BIOPSYCHOSOCIAL CHANGES IN THE HUMAN STRESS RESPONSE, WITH SPECIFIC REFERENCE TO STRESS MEASUREMENT AND CERTAIN MODERATING VARIABLES

by

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PREFACE

This study represents original work by the author and has not been submitted in any form to another University. Where use was made of the work of others it has been duly acknowledged in the text.

The research described in this thesis was carried out in the Department of Behavioual Medicine, School of Public and Family Health Medicine, Nelson R. Mandela School of Medicine, University of KwaZulu-Natal, under the supervision of Professor L Schlebusch.

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GLOSSARY

Active group:	Volunteer English-speaking South Africans who received micronutrients (mulitivitamin and mineral combination)
Placebo group:	Volunteer English-speaking South Africans who received a placebo
Total group:	Combination of Active and Placebo groups
Baseline or Pre-test:	Prior to receiving either micronutrients or placebo
Post-test:	After having received intervention
Placebo:	Look alike tablet with non-active ingredients
Micronutrients:	A combination of vitamins and minerals
DSM:	Diagnostic and Statistical Manual of Mental Disorders
WHO:	World Health Organisation
m =	mean
SPSS:	Statistical Package for Social Scientists

ABSTRACT

This empirical double-blind multi-centre empirical study assessed the sources of stress, stress-related symptoms, role of psychosocial moderating variables and the role of micronutrients (specifically the effect of intervention with micronutrient supplementation) on stress levels and symptoms in South Africans.

The sample consisted of 300 volunteer, English-speaking South Africans from two centres (KwaZulu-Natal and Gauteng) who had predetermined stress levels. The participants were evenly divided between the two centres (N=150 each). The Experimental Group (Active group) who comprised 151 participants received a multivitamin and mineral combination, while the Control Group (Placebo) group received a placebo.

The research dealt with perceived stressors, coping resources and outcomes in the general population (both at baseline and after intervention). Outcome was assessed using standardized self-report instruments which examined stress levels and symptoms, perception of stress levels, anxiety, psychological general well-being and neurocognitive functions (verbal and visual memory).

Univariate and multivariate correlational analyses were performed to inverstigate correlations and the predictive value of risk and rescue factors for the outcome variables.

The findings indicate that there were no significant differences in the number of stressors between the two groups at baseline, although they differed in respect of two particular stressors (A>P regarding concern over children's future; P>A regarding life decisions). An interaction of stressors and moderating variables (life orientation and perceived coping incapacity) have an important role in predicting stress and stress outcome, and outcomes themselves may function as stressors. The bidirectional, circular interactive effects of stressors, moderators and outcomes are important in the stress and coping process. The study failed to find any effect of stress on the neurocognitive functions assessed. No significant treatment effect for the micronutrient was found, but a number of trends in respect of efficacy were suggested by the findings. The findings also suggested particular patterns of interactions in this regard for predicting pre-post differences (delta). Strengths and limitations of the study are highlighted and implications for intervention in respect of a stress management programme are also discussed.

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CHAPTER ONE

INTRODUCTION

Stress can be conceptualised as following two pathways - a psychological and a physiological one and can be defined as a person's physiological, psychological and behavioural response when seeking to adapt to internal and/or external pressures associated with change (Schlebusch, 2000). The 'stress cascade' is produced by the close interaction of both these routes (Schlebusch, 2000).

Stress has been identified as a major problem in society at all levels of human interaction (Schlebusch, 2000). Stress levels of South Africans are particularly high, with some communities in KwaZulu-Natal and Gauteng appearing to experience even higher stress levels (Schlebusch & Bosch, 2002) and an average of 36.48% for the national population has been reported (Pharma Natura, 1999; Schlebusch 2004). Major risk factors for mortality rates in South Africa include life style diseases and health-risk behaviours, with many of these being stress related (Schlebusch, 1990; Schlebusch 1996; Schlebusch 1997a; Schlebusch, 1999; Rice, 1992).

Vitamin and/or mineral deficiencies, affecting overall well-being, have been said to afflict a significant number of the world's population (Lofti, Mannar, Merx, & Naber-van Den Heuvel, 1996). This is particularly true in developing societies, such as is found in South Africa, where a low dietary intake of specific micronutrients is common among most of the population, but particularly in rural and peri-urban populations (Labadarios, 1999). Psychophysiological symptoms resulting in a

generalised state of reduced resistance to stress can arise out of sub-clinical or marginal deficiencies of essential micronutrients, especially the B vitamins, but also magnesium (Schlebusch, 2000; Kirov, 1991; Pietrzik, 1985). Measurable diminished activity of vitamin-dependent enzymes characterize these deficiencies and, although immune response is reduced, specific clinical manifestations are still absent (Pietrzik, 1985). During this generalized state of reduced resistance to stress, which may be explained by the large number of enzymes in basic metabolism affected by the low status of these co-factors, unspecific symptoms of mood changes like increased irritability, tiredness, insomnia, loss of appetite and digestive disturbances (Pietrzik, 1985) are present.

Similarly, because of dietary inadequacy or increased demands for basic nutrients, certain essential nutrients are depleted during high stress with the nutrients most likely to suffer being vitamins and minerals which are not stored in the body in adequate quantities (Schlebusch, Bosch, Polgalse, Kleinschmidt, Pillay & Cassimjee, 2000).

Numerous roles for vitamins in stress-reactions as well as on the ability to manage potentially harmful consequences of diverse forms of acute and chronic stresses is indicated by the influence of stress on vitamin status and *vice versa* (Hanck, 1984). A reciprocal synergistic effect is experienced when stress and micronutrients overlap to affect body function and health (Glathaar, 1999). The negative effect of stress-related behaviours (excessive caffeine, nicotine, alcohol consumption, poor nutritional habits, etc.) and symptoms (e.g. digestive and other disturbances) can further compromise stress-management mechanisms (Schlebusch et al., 2000). The positive effects of vitamin-mineral combinations on patients' stress-related psychophysiological status

have been found by several studies (Popovic, 1993; Vein, Filatova, Selischchev, Ponomarenko, Bolkov, Mironov, Schmyrev, Ya Zaets & Bolotina, 1997; Willemsen, Petchot-Bacqué, Alleaume, Suter, Ring & Carroll, 1997; Bayer & Schmidt, 1991a; Bayer, & Schmidt, 1991b; Seelig, 1994; Selichev, Petchot-Bacqué, Volkov et al., 1998; and Carroll, Ring & Suter, 2000). Furthermore, the effect of chronic stress on the immune response could have implications for vulnerability to infection, whereas stress-related immunosuppression can be prevented by high-dose B-vitamin supplementation, indicating that patients treated with B-vitamins assimilate psychological stress more efficiently than placebo-treated controls (Schlebusch, 2000; Kiecolt-Glaser, Glaser, Gravenstein, Malarky & Sheridan, J., 1996; Lettko & Meuer, S, 1990).

Micronutrient deficiencies and psychological and medical problems can be the result of negative stress, and stress-related symptoms and reduced stress tolerance can follow on from the psychophysiological consequences of deficiencies in micronutrients (Schlebusch, 2000; Schiewner, 1995). Stress can be more adequately managed through restoring the nutritional balance in such patients. Stress depletes essential nutrients, either because of dietary inadequacy or as a result of increased demands for certain basic nutrients. Since vitamins and minerals are not stored in the body in sufficient quantities, they are some of the nutrients most likely to be depleted. An important part of adequate stress management is the restoration of nutritional balance.

Given the above, the present study was designed to evaluate the sources of stress, the biopsychosocial and select cognitive (neuropsychological) sequelae of stress, and the

effects of certain moderating variables including a multivitamin-mineral combination treatment on the psychological pathway of stress in a large sample of English-speaking South Africans with pre-determined high (negative) stress levels.

The following objectives were envisaged for the study:

1. to assess sources of stress for South Africans so that serviceable concepts for intervention can be derived;
2. to delineate the stress-related symptoms of South Africans so that serviceable concepts for intervention can be derived;
3. to delineate the role of psychosocial moderating variables so that serviceable concepts for intervention can be derived; and
4. to assess the role of micronutrients in stress management; specifically to assess the effect of intervention with micronutrient (vitamin and mineral combination) supplementation on the stress levels and symptoms of the patients studied as related to the benefits noted below:
   - 1.1 enhancing quality of life in the patient sample studied as related to general psychological well-being;
   - 1.2 reduction of stress/anxiety-related symptoms, including symptoms of tension, fears, insomnia, cognitive fallout (poor concentration / memory), fatigue, somatic complaints and depression; and
   - 1.3 improved social and occupational functioning, including increased productivity.

In order to achieve the aims in point 4 above, the following hypotheses will be tested in a representative sample of adult English-speaking South Africans drawn from the general population:

1. Stress related variables as measured by the psychometric assessments will improve significantly following the use of micronutrient supplementation. The improvement significance will be assessed as follows:

   A% change expected under placebo

   B% change expected with micronutrient supplementation

   HO=(B-A)% difference expected to be significant:

   A = 40%, B = 60% and HO = 20%

2. The patients' self-reported improvement regarding their experience of negative stress will be significant following the use of micronutrient supplementation.

In conclusion, a review of the literature indicated that there is a dearth of information on stress, and particularly stress in the general population, in South Africa. This is substantively linked to the fact that there is no adequate measure of stress, generally and specifically in South Africa. The present study therefore attempts to rectify this situation by developing a standardised stress symptom questionnaire, and by developing a profile of stress, coping and response to micronutrient supplementation in South Africans. A study of this kind has direct relevance for both the South African context and other developing, as well as developed, countries.

The remainder of this thesis has been organised in the following way. Chapter Two provides a basic review of the literature pertinent to the study. Chapter Three discusses the research methodology as well as providing a description of the sample, method of data collection, and a description of the psychometric battery. The results of the study are presented in Chapter Four: Part One reports on the results for the total sample, Part Two reports on the results for the comparative differences between the experimental (Active group which received the multivitamin and mineral combination supplement) and control (Placebo group) at baseline, and Part Three reports on the efficacy analysis and Part Four looks at the regression analysis of the Active, Placebo and total groups with a view towards providing a profile of stress. Chapter Five discusses the implications of the finding for stress theory in addition to stress measurement and management in South Africans.

CHAPTER TWO

CONCEPTUALIZING STRESS, COPING AND OUTCOMES

2.1 INTRODUCTION

The emergence of *Health Psychology*, which embraces any activity of psychology relating to any aspect of health , illness, health care system or health policy formation (Pillay, 1993), *Clinical health psychology*, which emphasises the significant relationship between clinical psychology and health psychology (Schlebusch, 1990) and a more recent interest in *health behaviour*, which accentuates the personal attributes, personality characteristics and affective states, and overt behaviour patterns relating to health maintenance, restoration and improvement Gochman (1982), has led to increased interest into the field of lifestyle diseases and health-risk behaviours, with a consequent re-emphasis on stress and stress-related phenomenon.

Given the numerous interpretations of the term stress amongst researchers, a single, agreed-upon definition of stress has eluded stress researchers (LoCastro & Schlebusch, 2006; de Bruin & Taylor, 2005). The literature is thus replete with definitions, conceptual frameworks, models and research around the area of "stress" in human functioning, and particular emphasis has been placed on the effects of stress on health outcome (both psychological and physical). Increasingly, stress has been identified as a major problem in society at all levels of human interaction (Schlebusch

& Bosch, 2002). In the local (South African) context, it has been suggested that stress levels in South Africans, particularly in the Provinces of KwaZulu-Natal and Gauteng, are high (Schlebusch, 1998a; Schlebusch & Bosch, 2002) with a national average stress level of 36.48% in the general population (Pharma Natura, 1999). Simultaneously, it has been suggested that lifestyle diseases and health-risk behaviours are major risk factors for mortality rates in South Africa (Schlebusch, 1997b; Schlebusch, 2004). Thus, stress has been linked to:

- physical illness (Feuerstein, Labbé & Kuczmierczyk, 1987; Selye, 1956; Selye, 1976; Steptoe, 1991).
- many lifestyle diseases (Steyn, Fourie & Bradeshaw, 1992) and health risk behaviours (Schlebusch, 1993), such as smoking and alcohol abuse (Schlebusch, 2000);
- other diseases and medical problems with a psychological and/or stress component (Schlebusch, 1990, 2000; Davidson, 1993) such as end stage renal disease (Schlebusch, 1998a);
- compromised immune response (Kaplan & Sadock, 1998) including colds and influenza (Bower, 1999; Glaser, 2000), cancer (Schlebusch & Van Oers, 1995; Noor Mohamed, Schlebusch & Bosch, 2003); and HIV-AIDS (Schlebusch & Cassidy 1995; Schlebusch, Scweitzer & Bosch, 1998); as well as
- psychological/psychiatric disorders (Kaplan & Sadock, 1995) including for example, anxiety (White 2000), suicide (Schlebusch, 2003), depression (White, 2000), and following exposure to indirect trauma resulting to trauma-producing behaviours (Schlebusch & Bosch, 2002).

This chapter aims to address the theoretical perspectives and scope of stress which underpin the conceptual background for the comparative analysis of the variables used in this study: *anxiety, stress, stressors (sources of stress), appraisal, subjective psychological well-being, perceived coping, optimism, and neurocognitive function (attention, memory, learning).* The current approaches to stress and coping are briefly discussed, as well as an explication of the stress response, with a view to developing an integrated bidirectional, circular, interactional, model or framework for stress in South Africans.

2.2 STRESS OVERVIEW: CONCEPT AND SCOPE OF STRESS

The origin of the term stress arises out of the physical sciences (engineering and architecture) where it was initially utilised to refer to the effects of (increasing) pressure or strain ("physical force"), in a mechanical sense, on a physical item (Schlebusch, 2000). The notion of stress has also been applied to the study of human functioning. However, research into stress in humans, although prolific, has not been holistic in that it has been defined, conceptualized and investigated by researchers from various disciplines and with different perspectives, which has led to conceptual confusion including different definitions, theories, models and approaches.

2.2.1 DEFINITION OF STRESS

The term "stress" rarely occurred in the scientific psychological or psychiatric literature before the end of World War II (Pollock, 1988). Various attempts have been made to provide a comprehensive definition of stress. Historically, stress has variably been defined in the literature, from different points of view, with such definitions ranging from a flight-or-fight reaction as a result of a disturbance of psychological or physical homeostasis in the face of changing environmental conditions (Cannon, 1939), to a range of bodily defences against environmental demands (Selye, 1956; 1980), to a collective, generic term encompassing all problem areas including the stimuli which produce stress reaction, the reactions themselves as well as the intervening processes (Lazarus, 1966).

For the purposes of this research, stress was seen as a multifactorial construct (Schlebusch, 2004) and defined as the bidirectional interaction between "a person's *physiological*, *psychological* and *behavioural* response when seeking to adapt and/or adjust to internal and/or external pressures associated with change" (Schlebusch et al., 2000, p 217) "and its perception" (Schlebusch, 2004, p 326).

2.2.2 CONCEPTUALISATIONS OF STRESS

Historically, several theoretical models have been proposed in an attempt to explain or account for stress. By 1983 there were over 120 000 publications dealing with

stress from behavioural and medical perspectives (Selye, 1983). It has been suggested that there are in excess of 300 definitions of stress (Allman, 1986, p 11).

Fischer (1986) reviewed the different approaches to the conceptualisation of stress, and indicted that they could be classified as falling into one of three categories:

1. Stimulus (independent) variables, which refer to stress variables found in the environment and which can be physical or psychosocial. When environmental factors threaten to disturb the homeostasis of the individual, causing stress, the individual will use resources (that is, physiological or behavioural responses) in an attempt to end the stress, thus restoring equilibrium.
2. Response (dependent) variables, which refer to the physiological or behavioural responses of the individual to stressors (such as sweating, or the presence of circulating hormones such as catecholamines and cortisol).
3. Internal (intervening) variables, which refer to the individual's mental structures which determine the degree to which stressors are perceived and/or experienced.

The above review indicates that interpretations of stress have ranged from a stimulus, to an inner state, to an observable response to a situation. Eisendorfer (1985, p 10) has attributed the conceptual confusion in the stress literature to the use of the term stress as referring to "independent, dependent and intervening variables indiscriminately", variably indicating sources of stress, reactions to stress, and mediating factors.

Fischer's (1986) variables have been more commonly conceptualised as the environmental, biomedical and psychological perspectives of stress. In contrast, Singer and Davidson (1986) suggest that in general, research on stress can be seen to fall into one of two broad categories, either as physiologically defined (essentially reactive in nature) or in contradistinction, as transactional (essentially the outcome of interactions between the organism and the environment).

A thorough review of all models therein are neither within the scope of this study or necessary for its objectives. The following section will briefly highlight some of the more common theories, locating them within these within these two frequently used conceptual frameworks.

2.2.2.1 PHYSIOLOGICAL DEFINITION/ BIOMEDICAL (STIMULUS RESPONSE PERSPECTIVE:

Stress is viewed as arising in reaction to (as a response to) disturbing stimuli (stressors) or an outside threat in this approach. Little cognition is involved and the organism is perceived as reactive. Research carried out within this conceptualization used physiological or physical stressors and physiological and endocrinological changes were measured as indications of stress.

As early as 1929 Walter Cannon was one of the first researchers to propose stress as a force, which when of sufficient magnitude, disrupts the normal internal environment (the homeostasis or balance) of the individual in respect of physical or psychological

parameters, thus resulting in a fight-or-flight response (Cannon, 1939; Cooper & Sutherland, 1990).

Hans Selye's (1956) pathogen reaction model focused on neuro-endocrine aspects, and went on to formulate stress as a General Adaptation Syndrome (GAS) in which stress is defined as a non-specific response to any demand placed on the body. The GAS (stress response) incorporates three stages: an immediate psycho-physiological response (alarm reaction stage of "fight or flight"); followed by an adaptation response or return to equilibrium (stage or resistance); and finally the third stage, which arises when the alarm reaction is elicited at high frequency and intensity over an extended period, leading to depletion of the bodily resources or energy needed for adaptation (stage of exhaustion), in which the individual loses their ability to resist further stress and which, when prolonged, results in collapse or death.

Seyle's focus was on stressors at a physical or environmental level, and the findings of his endocrinological animal experiments, which investigated the effect of extreme chemical stressors or electrical shock on biochemical reactions and subsequent physical effects, were later generalised to chronic human disorders (psychosomatic or stress disorders). It has been suggested (Singer & Davidson, 1986) that by non-specific, Selye meant that every stressor produces certain reactions specific to that stressor as well as nonspecific changes (in respect of steroid output) that result from all stressors. Subsequent theorists have criticized Selye's (1956) above formulation of the stress concept as being too simplistic (Sutherland & Cooper, 1990), that physical stressors fail to adequately explain psychosocial stress (Sutherland & Cooper, 1990), that it is not applicable over a cumulative period of time in that it has been suggested

(Lazarus, 1966) that stressors may pose little or no threat over a cumulative period of time, and that it fails to take cognisance of both the individual's perception of stress and/or his subjective experience of stress (Lazarus, 1966).

The above criticisms notwithstanding, Seyle's work is important in precipitating the focus on understanding how stress can lead to resistance to a stressor, to adaptation, and to potential damage to the individual. It is also important in that there are several implications of the notion of nonspecificity, perhaps the most relevant being that the effects of stress are cumulative (Singer & Davidson, 1986). This notion that stress accumulates over stressors has also been proposed by transactional theorists such as Lazarus and Cohen (1977), who indicated that daily hassles are chronic low-intensity threats that may accumulate over time, and that severe consequences may ensue if the stressor persists or if adaptive abilities are low (Singer & Davidson, 1986).

2.2.2.2 TRANSACTIONAL DEFINITION

Singer and Davidson's (1986) transactional category subsumes both the environmental and psychological perspectives. They argue that transactional models, rather than being in opposition to the physiologically defined (pathogen reactive) model, either address different issues or incorporate the reaction model as a special subclass. In the broadest sense of the transactional model, a stressor is any potential threat in the environment. This suggests that it is only when an individual's appraisal of an event and his own resources suggest that said event is threatening or disturbing that it is considered to be a stressor. This means that, for transactional models, it is only when physiological or physical stressors are appraised as threatening by the

individual that they will produce stress responses, and therefore, it is not assumed (as in the pathogen reaction model), that harm or life threat are inevitably stressful (Singer & Davidson, 1986). Research conducted within this framework has focused on humans and has used psychological measures for both how the individual evaluates the stress and in respect of the individual's reaction to it. Most research has therefore been on psychological (non-physical environmental) stimuli. The nuances herein are more clearly highlighted by considering the breakdown into the environmental perspective or the psychological perspective

2.2.2.2.1 Transactional Definition: Environmental (Stimulus) Perspective:

Stress is seen resulting from certain conditions in the external environment, and is perceived as the degree of demand placed on the individual which results in a specific stress response. The main focus of the environmental perspective is, therefore, on the identification of particular, potential sources of stress. This approach was popularized in 1967 by Holmes and Rahe (cf section 2.2.3.1).

2.2.2.2.2 Transactional Definition: Psychological Perspective

The psychological approach views stress and the outcome of the interaction between the individual and his environment. Cox (1978) regarded stress as an intervening variable, associated with the transaction between an individual and his environment. He proposed a five stage transactional model of stress. Stage 1 is seen to be

determined by both the individual's external environment as well as their internal physiological or psychological needs. Stage 2 is concerned with the congruence or incongruence between how the individual perceives the demand in relation to his perceived coping abilities, with incongruence between these two factors resulting in stress. Stage 3 pertains to the psychophysiological changes resulting from the individual's response to stress and their coping methods. Stage 4 is concerned with both the actual and perceived consequences of coping. Finally, Stage 5 considers feedback (from all previous stages) and impacts on outcome at each of these stages (in that failure at any stage influences the perception of demand, of capacity to cope and the damage caused by such failure).

This psychological approach is best encapsulated in the work of Lazarus and Folkman (1984) who propose a process-orientated transactional model of stress, which considers a number of variables, namely, the stressor(s), the individual's perception thereof (appraisal), consideration of the individual's resources to deal with the stressor(s) as adequate or exceeded, and various coping mechanisms. Lazarus and Folkman (1984, p 21) define stress as a particular *"relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being"*. The overriding emphasis of their psychological approach, then, is predominantly on two factors: individual perception (cognitive appraisal) of the stimulus (objective environmental experiences or person-environment transactions) as stressful or not, and if so, to what extent (that is, the personal meaning of stressors to the individual), as well as evaluation of adequacy of coping resources (the processes through which the demands of the person-environment relationship is managed and the emotions generated).

The transactional model therefore incorporates a number of key areas, the relative roles of which require consideration in the understanding of stress and coping, including the following:

1. stressors (sources of stress)
2. mediating variables - cognitive appraisal and coping resources (that is, physical, personal and environmental) including vulnerability
3. mediation of coping strategies
4. stress outcome (that is, the psychological, physical and/or social manifestations of stress responses)

However, before going on to consider the above key areas in more depth, there are some newer trends in stress research which have led to new perspectives that warrant discussion. These new trends essentially involve taking a more holistic, integrated approach to stress and stress research. There are two such approaches to the conceptualisation of stress namely, the integrated biobehavioural perspective and the disparity model, respectively.

2.2.2.3 INTEGRATED BIOBEHAVIOURAL PERSPECTIVE

More recently, rather than keeping the two different sets of variables separated (that is physiological endocrine measures dealt with primarily by the pathogen reactive model as compared to cognitive personality factors that have primarily been the domain of the transactional model), there has been a move among some stress researchers to consider stress as an integrated biosocial phenomenon. Their integrated biobehavioural approach has sought to look at stress from a transactional perspective

while also taking biological indicators/markers in order to see to what extent the neuroendocrine system correlates and covaries with the psychological cognitive system (Singer & Davidson, 1986). Such studies have shown that the two systems are really aspects of the same unitary process, and that an integrative approach provides the most information regarding increasing our understanding of the phenomena of stress.

Frankenhaeuser (1986) indicates that a reorientation of research in the stress field has been brought about by recent advances in neuroendocrinology pertinent to behaviour, in particular the view of coordinated functioning of the nervous and endocrine systems in the adaptation of the whole environment to environmental conditions, which replaced the earlier predominant view of the brain and endocrine system as separate entities, with the brain mediating the organism's relation to the external environment via behaviour in contrast to the endocrine system which was seen as orientated toward the internal somatic (body's) environment. She has proposed a psychobiological framework for research on human stress and coping, which is multidisciplinary in approach, focussing on the dynamics of stressful person-environment interactions, incorporating social, psychological and biological perspectives (Frankenhaeuser, 1986). One of her key notions is that "neuroendocrine responses to the psychosocial environment reflect its emotional impact on the individual" (p 101), which in turn is "determined by the person's cognitive appraisal of the severity of the demands in relation to his or her own coping resources" (p 101). Such research, over the past two decades, has shown that a number of pituitary and hypothalamic hormones, in addition to the adrenal-medullary and the adrenal-cortical hormones, are sensitive to psychological demands (Frankenhaeuser, 1986).

2.2.2.4 DISPARITY MODEL/APPROACH

Trumbull and Appley (1986) in their conceptualisation of stress, argue that any comprehensive stress theory should examine the dynamics of interaction of individuals and their environments, and that what should be taken into account is what happens before and during a stress experience, as well as the alteration of the individual after the stressor encounter.

The stress theory (Disparity Model) proffered by Trumbull and Appley (1986) involves the simultaneous consideration of physiological (biological), psychological and social systems, each with its own subsystems, all of which interface as a series of interlocking sheaths/wires. Each is capable of both conductance within its own sheath or subsets within that sheath, as well as of affecting each other via inductance from adjacent levels. Importantly, the psychological system is perceived as a "moderator, interpreter, transducer, or mediator between the social and physiological streams" (p 27) "as well as subsequent reaction" (p 41). Imbalance in any one system may result in stress symptom production in only that system, or by inductance through one or more of the other two systems. Furthermore, the capability of each system and/or subsystem to sustain itself over time is said to be affected by three factors:

1. the system and/or subsystem's own developmental history;
2. the dynamics of system interaction (including the readiness of each system in both its circadian and life cycles for impact or overflow from other systems); and
3. the nature of the demands placed on the individual.

Stress then is defined as occurring "when the functioning of one or more of these systems results in a discrepancy between any stressor and the carrying or resistance capacity available" (Trumbull & Appley, 1986, p 34). The demand (or stressor) may arise from eventful, chronic, or cumulative stressors or from change within the systems.

This model, therefore, not only concerns itself with the perception of disparity (similar to Lazarus and Folkman's appraisal concept), but also recognises the potential for stress arising from needs within the individual not being met by external sources (such as family, society or the outer world). These would include physiological needs such as nutrition, vitamins and minerals, water and exercise that have the capacity to produce predisposing as well as precipitating stress (Trumbull & Appley, 1986). Likewise, psychological needs (such as need for attention, affection etc.) or a variety of social needs (which may arise from psychological interactions) may have the same long-term role in stress. In such instances, the individual's failure to cope or possess adequate coping capacity does not depend on, or produce awareness of, the nature of the disparity (that is, appraisal).

Integral to this model are concepts of timeliness, recovery time, feedback and vulnerability (Trumbull & Appley, 1986), discussed in more depth below.

1. Timeliness:

   In brief, timeliness refers to the notion of each system having an optimum period within the individual's life cycle for development to ensure that the particular system will be healthy and ready and able to cope with the normal demand of a life event. Each individual system is therefore seen as having its

own history, optimal/appropriate period for development of various attributes, for the introduction and utilization of that system into the life cycle, and for its waning.

2. Recovery time:

A period of refraction (recovery) is required by all three systems when they have undergone stress. Failure of recovery can increase sensitivity and reactivity (susceptibility) to stress.

3. Feedback:

The continuing processes both within and between the three systems (the interplay between physiological, psychological and social systems) is defined as feedback. Feedback on one of the three systems can impact on a stressor already operative in another system or the same system, which would increase (compound the impact of) any stress already underway. Likewise such feedback, if it reinforces an adaptive response, could lessen the stress.

4. Vulnerability:

Stress is seen to exert an influence both at particular points in, as well as over, the life cycle. The level of stress experienced is perceived as being related to either the homeostatic balance or resistance of the system, as well as to the dynamic, ongoing process that could be triggered by summation of stimuli, sequence of stimuli, concurrence of stimuli as well as available resources for coping. Higher than normal ongoing stress at the time of the introduction of another stressor can predispose to stress (either through reduced coping/carrying capacity or through resulting in an exaggerated response beyond the level that might have been anticipated should only that stressor have been imposed, without any pre-existing, concurrent stress). Furthermore,

any predetermined weakness or lower resistance in any one of the three systems, even if not immediately evident, could exert its influence at some time in the future, thus predisposing to stress.

Their transactional model allows for the potential influence of three parallel systems which influence the individual either positively or negatively in respect of dealing with stressors, including: Physical (physiologic) factors such as genetic, prenatal or developmental factors; Psychological factors such as personality functioning, intellectual functioning, self-esteem, motivation and goals; and Social factors such as values, religious beliefs, social support, and financial resources (Appley & Trumbull, 1986).

In support of an integrated approach, Scheuch (1996) has argued that the origins of stress need to be regarded as "biological-centred, subject-centred, action-centred, social communication-centred, and emotion-centred" (p 118). He proposes that the psychological/social ('psychic") and psychophysiological levels both interact and have relative autonomy, and that stress is characterised by either of these or both. According to him, stress arises not only through the *psychic characteristics* of stress defined as the individual's "experience of threat to the satisfaction of essential needs" (p 119) with specific feeling qualities, and/or "ineffectiveness and destruction of the individual's action and behaviour" (p 119), but also from the *somatic characteristics* of stress, which he defines as lying in the "disturbance of the homeostasis of the organism's regulatory systems" (p 119). Stress then is seen as arising not out demands that lead to "responses within the organismic scope for homeostasis" (p 119) but as being linked to compensatory mechanisms which have both quantitative and

qualitative characteristics but lie "outside the compass of homeostasis"(p 119). Consequently stress thus seen as arising not only through the individual's appraisal (process of evaluation), but also when biological needs cannot be satisfied even in the absence of conscious evaluation.

2.2.3 STRESSORS (SOURCES OF STRESS)

In an attempt to gain some conceptual clarity in the area of stress research, it was necessary to differentiate between those stimuli thought to result in stress (stress stimuli) and the outcome thereof (stress response). The term "stressor" has been used in the literature to denote the original "stress stimuli" favoured by Cannon (1929), and is generally defined as objective exogenous or endogenous stimuli, which may be physical, psychological or psychosocial in origin (Schniederman & McCabe, 1985; Sutherland & Cooper, 1990). Such a definition demonstrates the expansion of the concept of stress stimuli from representing exclusively physical stressors (e.g. Selye) to the inclusion of psychosocial stimuli. Various formal taxonomies of stressors have been proposed in the literature. One of the most commonly accepted is that of Turner and Wheaton (1995), who suggest that stressors can be divided into three classes, based on severity. These three categories include extreme stressors, personal stressors or daily hassles.

2.2.3.1 EXTREME STRESSORS (CATACLYSMIC EVENTS)

These pertain to stressors which are unavoidable, with limited or minimal opportunities for response or control which can be exerted over them, and which are

unpredictable in respect of predicting their cessation (Weiner, 1985). Other researchers (Kahana, Kahana, Harel & Rozner, 1988) have suggested that mediating factors do play a role in the individual's capacity to survive extreme stressors. Essentially, in the face of such stressors, the demand is for survival. Weiner (1985) identifies such stressors as generating fear and frequently producing unavoidable injury. Examples of such stressors include catastrophic events or events of unusual magnitude, such as severe human violence (physical or sexual assault, terrorism), natural disasters (floods or earthquakes) etc (Weiner, 1985), that are usually treated as outside of any person's control and as universally stressful. This category of stressors can be subsumed under the sub-discipline of traumatic stress research and its immediate and long-term consequences, and has been researched and reported on in the literature in the substantial depth. It is generally agreed upon by researchers in the field to produce different physical and psychological symptoms from less severe stressors, and been linked with the development of Post-traumatic Stress Disorder (Van der Kolk & McFarlane, 1996; Van der Kolk, 1996a), Acute Stress Disorder (APA, 2000a), and Dissociative Disorders (APA, 2000a).

2.2.3.2 PERSONAL STRESSORS (LIFE EVENTS)

Caplan (1961) used the term life change events to describe situations or events which placed an additional demand on functioning as these were insurmountable through customary methods of problem solving. These refer to that class of stressors which encompass negative life events in a personal context, and include such events as death (of a spouse or relative), divorce or marital problems, illness or a disabling injury, occupational difficulties (job loss or promotion), or financial problems (Thoits,

1995). Contemporary researchers (Cohen et al, 1995) indicate that other factors need to be included in the consideration of this class of stressors such as the magnitude of the stressor, the particular context of the threat, individual personal control over the event, as well as time and duration of the stressor.

The earliest examples of this category of stressors is seen in the development of the Social Readjustment Rating Scale (Holmes & Rahe, 1967), and the later revised Recent Life Changes Questionnaire , a self-report schedule of life events, developed by Rahe (1977), which attempts to provide correlations between physical and/or mental disorders and stressful life events.

This approach has subsequently had various criticisms levelled at it in the literature, including:

- that correlations between illness and life events have been found to only be around r=0.30, which suggests that only about 10% of the variance is accounted for by life events (Cohen etc al.,1995);
- that confounding variables are introduced by the mixing of life events with physical/psychological symptoms (Thoits, 1995);
- that such scales may not be suitably representative of life events occurring in an individual's life and the list of life stressors in more than those used in Holmes and Rahe's Social Readjustment Scale (Cohen et al., 1995);
- that life events may have a different significance for particular individuals (Byrne & White, 1986; Moos & Billings, 1982);
- that the magnitude of the life change has been held as more important than the positivity or negativity of the event (Cohen et al., 1995);

- that there may be individual variance in the rating of the severity of stressors (Cohen et al., 1995);
- that negative life events may not necessarily lead to physical/mental health problems, but instead produce learning, active problem solving, and sustained self-worth (Thoits, 1995);
- that there is a differential potential for pathogenesis between negative and positive life events, with negative life events being more likely to be pathogenic (Cohen et al., 1995);
- that minor hassles are more important than life events (Cohen et al., 1995);
- that the potential role of personal coping resources (such as locus of control and self-esteem) or environmental coping resources (such as socio-economic status or level of social support), which may act as a buffer for the consequences of stress and thereby impact on stress outcome, has not been taken into consideration (Sutherland & Cooper, 1990);
- that research has demonstrated variations in ratings for different populations, suggesting cultural differences in the relevance of these events (Nash, Stoch & Harper, 1990).

Despite the above-noted shortcomings, some researchers (Prokop, Bradley, Burish, Anderson & Fox, 1991), have suggested that life event scales remain a useful research tool, and have potential for the measurement of stress in groups (Derogatis, 1982), especially since research has consistently shown a relationship between the

occurrence of undesirable events and onset of symptoms (Ormel & Sanderson, 1989). Such scales are best used in conjunction with the assessment of other stressors (stress stimuli).

2.2.3.3 DAILY HASSLES

These refer to low intensity, minor events and daily frustrations which arise from our roles in living and can irritate or distress people, are chronic, and include difficulties such as time pressure, delays, loss of items, etc., and have been published as a Daily Hassles Scale (DeLongis et al, 1988) and subsequently as the Combined Hassles and Uplifts Scale (Lazarus & Folkman, 1989). The impact of daily hassles on the individual is seen to be twofold: either diminishing individual problem solving capacity in the face of acute stressors or increasing psychological vulnerability to acute stressors by undermining usual coping resources (Cohen & Wills, 1985).

Research has shown a stronger correlation between daily hassles and physical health, that daily hassles are a better predictor of future health as compared to recent experiences (Lazarus, 1981; Kanner, Coyne, Schaefer & Lazarus, 1981), and that they may be even more important than major changes in life in adaptation and health (Kanner et al., 1981).

Laux (1986) has suggested another category of stressors, namely social stressors arising out of social stress situations, involving streams of cognitive and emotional experience, of which he focuses in particular on **psychological self-presentation** (referring to the evaluation of personal adequacy). He argues that whenever a person

anticipates that s/he will be unable to generate a particular type of image which would produce favourable reactions from a real or imagined audience, s/he will experience a threat to his/her identity which is usually appraised as a threat to self-esteem.

However, the above discussion of classes of stressors predominantly appears to be a taxonomy of *environmental (external) stressors*, and does not take into account the fact (as suggested by Trumbull & Appley, 1986 and Steuch, 1986) that stress could also be precipitated by, or the individual be predisposed to stress from, **internal** physiological, psychological or social needs within the individual not being met, without individual awareness of or perception of their role as "stressors" or by the interaction between these three aspects (cf section 2.2.2.4). Steuch (1986, p 120) has proposed that stress reactions are perceived as "individually caused, their dynamics influenced, their reactions specified, and their consequences" having a dual aetiology, that is being determined by:

1. the "objectively real or subjectively altered reflection of environmental demands in relation to needs and the individual's opportunities to meet them, by subsequent action, and by the individual and social interpretation of results" (p 120) which he terms *interpretation-specific causes*; as well as
2. the "differential responsiveness – either genetically determined or formed in the course of the individual's development – of organismic functional systems, by characteristics of impaired responsiveness in the form of disease, or by the demand-specific responsiveness of functional systems" (p 120) which he refers to as *somato-specific causes.*

In this context, stressors are thus seen as being **cognitively or biologically** determined, and are further described as being either acute (that is, developing in a concrete situation with the endangerment of the attainment of concrete goals) or chronic (resulting from frustrated satisfaction of essential needs over a long period and which does not require immediate action).

Cooper (1988) has also indicated that sources of stress can originate from within the individual, a fact which is either implicitly or explicitly generally ignored by most approaches to stress in their assumption that stress originates from some situation (event) in the individual's environment. Such internal sources of stress include worry about future events which have not yet occurred, imagined sources of stress (e.g. suspicions of infidelity in a spouse), or stress created by the individual's own behaviour (such as the urgency common in Type A individuals)

Finally, a discussion of stressors would be incomplete without noting that stressors have been found to be additive (cumulative or creating increased risk and vulnerability) by numerous researchers (Trumbull & Appley, 1986; Fischer, 1988; Schermerhorn et al., 1997; Robbins, 1996; Steuch, 1986).

2.2.3.4 BIOLOGICAL STRESSORS

Little attention appears to have been paid to **non-psychosocial** stressors in the stress and coping literature. More recently, a growing body of research has indicated the importance of vitamins/micronutrients in stress.

A significant number of the world's population suffers from vitamin and/or mineral (micronutrients) deficiencies, which affect overall well-being (Lofti et al., 1996). This is especially true in developing societies, such as also found in South Africa (Vorster, Oosthuizen, Jerling, Veldman & Burger, 1997; Schlebusch et al., 2000). At the same time, whenever a person is under stress certain essential nutrients are depleted, either because of dietary inadequacy, or because of increased demands for certain basic nutrients. Some nutrients most likely to suffer from this depletion are vitamins and minerals which are not stored in the body in adequate quantities (Schlebusch et al., 2000).

Micronutrients (specifically the b-complex vitamins, vitamin c and the minerals calcium and magnesium) play an essential role in human health (Popovic, 1993; Wurtman & Wurtman, 1990; Machlin, 1991).

The ***eight b vitamins*** often occur in the same foods and perform related functions in the body. For this reason, they are often grouped together under the term b-complex, although each is chemically different. B-complex vitamins play a vital role in the biochemical processes which converts food into energy, in that they function as co-enzymes which are involved in the breakdown of protein, carbohydrate and fat, in that they are responsible for the manufacture of some of the basic building bricks of the body, in that they affect the production of new red blood cells, in that they aid in the transmission of nerve impulses and are required for the synthesis of important neurotransmitters (e.g. epinephrine and serotonin) which are vital for efficient functioning of the central nervous system, in that they are important in cell formation and are required by the gastrointestinal tract for rapid turnover of cells, in that they are

required for efficient white cell function (e.g. neutrophils which fight infection), and in that b-complex vitamin deficiency is relatively frequent since they are easily lost/destroyed during cooking or other food processing (Machlin, 1991; Marcus & Coulson, 1990a, 1990b).

Vitamin c, also known as ascorbic acid, plays an important role in the healthy functioning of almost every system in the body, including antioxidant activity, protecting against the attacks of free radicals which initiate reactions which damage the cells and atoms of surrounding tissues and cells; maintaining healthy collagen, which is necessary for healthy cartilage, gums and skin as well as proper wound healing; maintaining efficient functioning of the gastrointestinal tract; promoting the immune system (e.g. promoting levels of leukocytes, the cells that engulf and kill bacteria); and improving absorption of iron, which is essential for healthy red blood cells (Marcus & Coulson, 1990a; 1990b; Machlin, 1991).

Calcium is known to be necessary for clotting blood and for the regulation of the activity of the neuromuscular system in response to the activity of neurohormones (chemicals which are released during periods of stress). Calcium deficiency may result in muscular twitching and spasms, muscle weakness and joint pain, and be accompanied by psychological problems such as sleeplessness, depression and anxiety. It is also necessary for efficient cardiac function (Machlin, 1991; Wurtman & Wurtman, 1990; Haynes Jr., 1990).

Magnesium is vital for optimal functioning of many enzymes, which are required for the normal functioning and development of the body (e.g. the maintenance of

electrical potentials of nerve muscle membranes and for the transmission of impulses across neuromuscular junctions). Magnesium is, therefore, important in preventing palpitations and irregular heartbeat during periods of stress. It is also necessary for assisting in regulating the sensitivity of muscles' response to the flow of nerve impulses since magnesium deficiency is associated with convulsions, muscle tiredness, cramps and tremors; and for controlling heart beat and the rate at which the heart contracts. (National Research Council, 1989; Mudge & Weiner, 1990; Popovic, 1993; Seelig, 1994).

Calcium and magnesium are interdependent and synergistic in the functioning of cellular metabolism, with both minerals working to maintain the electric potentials of nerve muscle membranes and to facilitate transmission of impulses to the musculature. Stress results in increased permeability of the muscle cell membranes, allowing a concentration of calcium causing muscles to contract. Under chronic stress conditions, magnesium flows out of the cell as calcium flows in, resulting in contracture of the vascular muscles and a rise in blood pressure. Adequate levels of both calcium and magnesium are required to regulate both the musculature and the activity of the nervous system during periods of stress (Seelig, 1994; Popovic, 1993; Flodin, 1988).

The body's response to stress has been long recognised and described. However, the biochemical explanations for the physical reactions (sweating, palpitations etc) and psychological reactions (e.g. anxiety) noted have only been relatively recently elucidated (Schlebusch, 2000). Confronted with stress, a cascade of biochemical events is stimulated (cf Section. 2.2.5.2). Initially, the main system to respond is the

sympathetic-adrenal-medullary system. The hypothalamus stimulates the release of norepinephrine (noradrenaline), which in turn activates the adrenal medulla to release further norepinephrine (associated with fight) and epinephrine (associated with flight). Blood is diverted to the major muscle groups. The liver releases its supply of glycogen to the musculature to provide the necessary energy. Heart rate and blood pressure rise so that glucose is rerouted from the organs to the extremities. Respiration accelerates in order to provide oxygen which is required to convert glucose into energy. Digestion slows, skin temperature increases and perspiration transports excess heat away from the body. The eyes dilate to improve visual acuity. Muscle tension increases, in order to prepare for fight or flight (i.e. release of rapidly accumulated energy). After the threat passes, the body gradually returns to normal. During persistent stress, the immune system is also stimulated by the pituitary adrenal cortical system. The production of adrenocortical stimulating hormone (ACTH) further stimulates the adrenal gland to produce cortisol (an important steroid in carbohydrate metabolism),which results in additional sources of energy being made available and the immune system being mobilised to deal with any injury. When there is no respite from stress over an extended period of time, the responses described may become harmful and increasing exhaustion sets in. Continuous stress also has nutritional consequences: nutritional reserves are drained and cannot easily be replenished. (Machlin, 1991). If initial energy stores were low because of sub-optimal nutritional status (and levels of key vitamins and minerals), the situation is further exacerbated (Machlin, 1991).

It is clear then that during stress, repeated surges of adrenaline and cortisol place the body's metabolism at a very high level of operation. Consequently, requirements for

micronutrients (b-complex and c vitamins, as well as calcium and magnesium) are high. (Popovic, 1993). Micronutrients are required for the synthesis of steroids, amines and norepinephrines which are released under conditions of stress, for effective transmission of electrical nerve impulses within the brain which regulate the production of hormones. They are also essential, in their capacity as co-enzymes, in the conversion of carbohydrates, fat and proteins into energy; this is vital during stress periods when energy demands peak. A lower level of these compounds results in the classic symptoms of stress (e.g. irritability, fatigue, muscle cramps, exhaustion and increased susceptibility to infection). These in turn contribute to further stress, creating a spiral of repeated cause and effect (Popovic, 1993; Seelig, 1994; Flodin, 1988).

Health is variably impacted upon by vitamin/mineral deficiency (Lofti et al., 1996; Schlebusch, 2000). Potentially life-threatening illnesses (e.g. Beriberi) may occur in severe cases. It is, however, now increasingly recognised that sub-optimal nutritional status exists even in wealthy industrialised societies, resulting in less clearly defined conditions such as increased susceptibility to infections such as colds and flu and symptoms such as fatigue and depression (Kiecolt-Glaser et al., 1996; Lofti et al., 1996). Vitamin A deficiency has been reported to be a global problem in 136 countries, and is seen as a significant public health problem (Goodman, 2002), particularly since recent studies have highlighted the importance of this vitamin in health (McLaren, 2002; Solomons, 2002). Despite being rarely discussed, the biochemical reactions resulting from stress are immediately recognisable. The widely recognised symptoms of stress (e.g. increased heart rate), which are the likely cause of serious syndromes such as hyperventilation and disturbed digestive function, which in

turn can lead to chronic 'stress' illnesses, are the result of these biochemical changes which increase nutritional demands.

Disturbances in the body's nutritional balance are, therefore, recognised as an important consequence of stress (Fawzy, 1995; Schlebusch, 2000). Stress leads to the depletion of essential nutrients, either as a result of dietary inadequacy, impaired absorption and activity of micronutrients, or because of increased demands for certain basic nutrients (Schiewner, 1995). Vitamins (b-complex, vitamin c) and minerals (calcium and magnesium) are some of the nutrients most likely to be depleted, since they are not stored in the body in sufficient quantities. Furthermore, changes in eating patterns, as a result of possible altered energy expenditure and intake, have also been suggested as occurring with stress (Rice, 1992; Schlebusch, 2000). These researchers have also argued that stress sensitivity could be increased by diet, such as ingestion of excessive amounts of sugar which depletes vitamins and minerals or ingesting of foods or beverages that contain preservatives and caffeine. The restoration of nutritional balance is an important part of adequate stress management (Bayer & Schmidt, 1991a, 1991b; Glathaar, 1999; Selishchev et al., 1998; Schlebusch et al., 2000).

2.2.3.5 INTERPERSONAL STRESSORS

Various authors have also suggested that social or interpersonal variables can function either positively or negatively (that is, as a buffer against stress or as a stressor in themselves), including:

- marital partners who could be a source of interpersonal stress rather than a key buffer or provider of support (Heller, 1986);
- lack of reciprocity in supportive interactions (Mills & Clark, 1982);
- Social information which is information given by others in the person's psychosocial environment (Cooper, 1988), if erroneous (e.g. not deterring ill-advised behaviour, promoting unhealthy behaviour etc.);
- Social comparison processes, which can cause stress by changing existing attitudes towards potential stressors / stressful situations (Buunk & Hoorens, 1992), such as when discussing potential problems in a shared situation where there is a predominantly negative view after such discussion (Hobfall & London, 1986), or where feelings of competence and control are undermined (Coates, Renzaglia & Embree, 1983);
- "contagion" of stress reactions, such as where a high degree of support fosters the development of burnout (Miller, Stiff & Ellis, 1988).

2.2.4 COPING MECHANISMS

It is generally accepted in the literature that stressors (in particular non-extreme stressors) alone do not appear to adequately account for the outcome of stress, a fact which becomes particularly evident when addressing the issue of variability of outcome in the human stress response (individual differences). Most researchers (Delongis, Folkman & Lazarus, 1988; Lazarus, 1966; Trumbull & Appley, 1986; Monroe & Kelly, 1995; Scheier, Carver & Bridges, 1994; Scheier, Weintraub & Carver, 1986) appear to agree that in order to objectively define stress, both

environmental conditions along with reference to the characteristics of the person are necessary. They therefore accept the existence of some or another mediating or moderating factors on stress outcome. Essentially, two processes have been identified, although variably by different researchers, as mediating stress outcome (the relationship between the person and the environment), namely subjective cognitive appraisal and coping.

2.2.4.1 COGNITIVE APPRAISAL

Lazarus and Folkman (1984, p 19) define cognitive appraisal as "an evaluative process that determines why and to what extent a particular transaction or series of transactions between the person and the environment is stressful". It is seen to be an evaluative process of categorizing an encounter and its various facets in respect of meaning or significance for well-being. Essentially, appraisal concerns the degree of threat imposed by a specific stressor on an individual, such that the threat is either less than, matches or exceeds the individual's ability to cope (Monroe & Kelly, 1995). In this way, appraisal is the "final common pathway" through which the diverse influences of coping strategies, personal and environmental resources, and the meaning of the encounter are synthesised and mediated (Monroe & Kelly, 1985).

Lazarus's (Lazaurs & Folkman, 1984; Lazarus, Averill & Opton, 1970) appraisal theory distinguishes between three types of appraisal: primary appraisal, secondary appraisal, and reappraisal.

Primary appraisal involves the individual's evaluative judgment of environmental demands in comparison to their ability to cope and maintain well-being. They conceptualise primary appraisal as comprising three types:

1. *irrelevant* (when the person-environment interaction carries no threat to well-being)
2. *benign-positive* (if the outcome of the encounter is construed as positive in respect of well-being), or
3. *stressful*, which may be one of three sub-types:
    - *Harm/loss* (which refers to some physical or psychological damage or injury which has already been sustained as a result of the impact of a stressor);
    - *Threat* (which concerns anticipated or potential future harm or loss); and
    - *Challenge* (which focuses on the potential for gain, growth, change or mastery inherent in the person-environment interaction).

Secondary appraisal becomes salient when a situation has been appraised as stressful. It is concerned with what might and can be done about an appraised stressful situation. According to Lazarus and Folkman (1984), it is the process whereby the individual makes a determination of

- what physical, social, psychological or material resources (Holroyd & Lazarus, 1979) are available to facilitate coping (coping options);
- the likelihood of a given coping option being successful and accomplishing what it is supposed to; and

- the likelihood that a particular strategy or set of strategies can be applied effectively.

Fawzy and Fawzy (1995) have suggested that the three factors that constitute secondary appraisal comprise: (a) perceived control/self-efficacy (over a particular situation), (b) control over emotions, and (c) compassion.

Reappraisal pertains to a changed/modified appraisal, based on new information from the environment and/or from the person (own reactions), following an earlier appraisal within the same person-environment interaction (encounter). As such, it is appraisal following feedback (Lazarus & Folkman, 1984).

Lazarus and Folkman (1984) argue that there is a pattern of research and observation that has clearly demonstrated that the "way a person appraises an encounter strongly influences the coping process and how the person reacts emotionally" (p 45) and is thus "central in mediating subsequent thought, feeling and action" (p 45).

Subsequent theorists have levelled criticisms at the concept of appraisal, which can be considered to fall into three categories:

- that it is confounded with other cognitive measures or aspects of a person's ongoing awareness or phenomenology, such as rumination, fear, worry and distress (Monroe & Kelly, 1995);
- that it may also occur, or be linked with processes outside of cognitive awareness (Monroe & Kelly, 1995), including need-centred judgements, motives, commitments and defensive based processes; or

- that it is a more complex concept than suggested by Lazarus and Folkman, in that appraisal also has to do with the context of the stressor, it's salience, the belief system of the individual as well as self-regulatory processes (Thoits, 1995).

Furthermore, perusal of the literature on research and theory on stress, coping and emotion which addresses the concept of appraisal in one form or another additionally seems to suggest that cognizance is not taken of possible "faulty appraisal", whereby the individual may incorrectly appraise an encounter as not stressful or be unaware of the (personal) stress valence of a particular stressor, or as potentially stressful but incorrectly as having the resources to cope (hence not stressful in respect of appraisal theory). This might be particularly salient in respect of the physiological/biological system (as per Trumbell & Appley, 1986) where, for example, vitamin deficiency (which the individual may not appraise as stressful) will act as a stressor on the biological system, with likely interactive effects on the psychological and/or social systems.

2.2.4.2 VULNERABILITY

The concept of vulnerability, frequently conceptualised as in respect of deficient coping resources in the literature, is closely related to cognitive appraisal. Lazarus and Folkman (1984) argue that inadequacy of resources, although a necessary condition is an insufficient condition for psychological vulnerability to stress, since in their view such a deficiency will precipitate psychological vulnerability only when the "deficit refers to something that matters" (p 51). Thus they conceptualise

psychological vulnerability in relational terms, and perceive it as being determined not just by a deficit in resources, but also by "the relationship between the individual's pattern of commitments and his or her resources for warding off threats to those commitments"(p 51). They draw parallels between vulnerability and their definition of threat (cf section 2.2.4.1) in that vulnerability can be seen as a potential threat which, when something of value is jeopardised in a particular transaction, is transformed into an active threat. They therefore also see vulnerability as a susceptibility to, or as being influenced by, various person factors, including commitments (motivation), beliefs and resources.

2.2.4.3 COPING

The literature on coping has been fairly prolific, and different ways of conceptualising coping have been proffered by various authors.

Traditionally, the literature on coping can be divided into two main approaches, derived from different theoretical/research literatures: the first being derived from the tradition of animal experimentation, the second from psychoanalytic ego psychology.

1. The animal model:

   In brief, focus here is on the concept of drive/arousal/activation, and coping is usually defined in terms of the lowering of drive or activation by acts that control aversive conditions. Consequently, the emphasis is on avoidance or escape behaviour.

2. The psychoanalytic ego psychology model:

   The central concern is with cognition (coping traits and styles) and the different processes used by people to manage troubled relationships, generally

conceived of as a hierarchy of strategies which progress from immature (primitive) mechanisms seen to distort reality to mature mechanisms. Coping is typically equated with adaptational success whereas less successful or unsuccessful attempts to deal with stress are termed defences.

Hobfall (1988) has ascribed all stress symptoms to "a mismatch between threat and demand, and coping capacity" (p 106), while Aguilera and Messick (1974) indicate that coping is what people do when they have a problem.

Roth and Cohen (1986) have suggested that the literature on coping can be summarised as falling into two styles of coping, in which cognitive activity is seen as being oriented either toward or away from threats, namely approach or avoidance, although the two styles are not seen as mutually exclusive. Their conceptualisation is an extension of the earlier model of Laux and Vossel's (1982) which described vigilant (being alert to threat) and avoidant (not admitting to threat) styles.

1. Approach Styles:

   These are characterised by behaviours which involve tackling, vigilant focusing and sensitizing, and tend to involve problem based strategies such as turning to others for health and information seeking in an attempt to change the nature of the stressor and bring it back under control. Increased anxiety, stress and worry are risk factors in this type of coping.

2. Avoidant Styles:

   These include behaviours which involve the reduction of anxiety by repression or denial, and tend to involve the use of any strategy which minimises the threat of the stressor, thus reducing or neutralising anxiety. Delays in proper

treatment, and thus less positive adaptational outcomes, as a result of not using appropriate problem solving is a risk factor in this type of coping.

Roth and Cohen (1986) have suggested that these two styles might be differentially suited to short- or long-term outcomes, with approach styles being more suited to positive long-term outcomes in contrast to avoidant styles, which have greater efficacy for short-term outcomes.

Folkman and Lazarus (1988) have proposed that coping styles consist of a wide range of cognitive and behavioural strategies involving both problem solving (instrumental) and affect regulation (palliative) functions, and not simply avoidance or approach strategies or defensive processes. Coping is defined as "constantly changing cognitive and behavioural efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person" (Lazarus & Folkman, 1984,p 141). Coping is thus a process "through which the individual manages the demands of the person-environment relationship that are appraised as stressful and the emotions they generate" (Lazarus & Folkman, 1984, p 19). They differentiate between coping strategies which are said to act as mediators of the stress process and psychosocial resources which are seen to act as moderators of the stress process. Mediators are defined as variables that are generated within encounters which change the relationship between the stressor and outcome variable, while moderators are antecedent conditions that interact with other conditions in producing outcome, such as gender, personality traits or socio-economic status (Folkman & Lazarus, 1988).

However, other authors have, where cognitive behavioural and social factors contribute to effective coping and adaptational outcome (including well-being, efficacious social functioning, physical health etc.) used other terms, including: buffering (Antonovsky, 1974; Cobb, 1976); protecting (Tapp, 1985); mediating (Eisendorfer, 1985; Hobfoll, 1988; Rabkin, 1982); modifiers (Kiecolt-Glaser et al., 1984); and moderators (Skodal et al., 1990).

2.2.4.3.1 COPING STRATEGIES

Folkman and Lazarus (1984, 1985) use the term coping strategies to refer to both constantly changing cognitive and behavioural efforts, both intrapsychic and action oriented, to manage, master, tolerate, reduce or minimize the specific environmental (external) or personal (internal) demands that tax or exceed an individual's coping resources, as appraised by the individual. The outcome of coping may have different results, including mastery, resilience, resolution or crisis and may therefore either enhance or disturb psychological functioning (Miller, 1992b).

In their approach to stress and coping, Lazarus and Folkman (1984) distinguish between three main types of coping: appraisal type coping, problem focused coping and emotional focused coping. Appraisal type coping attempts to define the meaning of the situation. Problem focused coping attempts to modify or eliminate the source of stress, and used strategies such as active confrontation, as well as help and information seeking. This strategy is generally used when an individual feels he has some degree of control over the environmental situation and that it can be changed. Emotion focused coping attempts to regulate affective responses to the stressor, and

utilizes strategies such as minimization, wishful thinking, engaging in self-blame and seeking emotional support. This strategy is generally used when environmental situations are appraised as being either harmful, threatening or challenging and not able to be changed, and thus functions to manage somatic or emotional distress without necessarily changing or controlling the situation. The Ways of Coping Checklist (Folkman & Lazarus, 1985) was an attempt to formalize and categorise coping styles, and comprises the following eight factors: confrontative coping, distancing, self-control, social support seeking, acceptance, avoidance, problem solving and positive re-appraisal. Carver, Scheier & Weintraub (1989) subsequently developed the COPE Scale, which is purported to measure fourteen "relatively" distinct, clearly focused coping strategies characterised into either adaptive or maladaptive strategies, as a way of studying the diversity of potential coping responses.

The research literature raises a number of different concerns or criticisms with regard to the area of coping strategies and the measures used therein:

- Thoits (1995) has pointed to the fact that there is a lack of consensus or consistency in the literature as to which strategies are most effective in reducing psychological distress or ill health;
- Coping strategies may have a differential response on long or short-term outcome, such as the reported findings regarding the beneficial effect of emotion focused coping (such as drug and alcohol use) in the short term in contrast to their deleterious consequences in the long term (Miller, 1992b);
- Individuals do not use one single strategy when coping with stress, but rather tend to use multiple strategies, and flexibility in adjusting

behavioural or emotional repertoires to changing demands has been found to result in most successful coping (Cohen et al., 1995);

- A combination of problem and emotion focused strategies may result in such individuals being less susceptible to negative health outcomes than persons who rely on a singular coping style exclusively (Cohen et al., 1995);
- Approach (engagement) strategies have been considered to be more likely to modify stressful situations and therefore be associated with more adaptive outcomes than avoidant (disengagement) strategies, despite the argument that no coping strategy in itself can be considered adaptive or maladaptive (Mosely et al., 1994);
- Concern about the validity of the measures used in coping research have been expressed by researchers (Stone, Greenberg, Kennedy-Moor & Newman, 1991);
- It has been argued that the distinction between problem focused coping and emotion focused coping in the Ways of Coping Checklist is too simplistic (Carver, Sheier & Weintraub, 1989);
- The Cope has been criticised as confounding coping efforts with emotional outcome, particularly distress on some items (Stanton, Danoff-Burg, Cameron & Ellis, 1994);
- Coping measures do not adequately discriminate between cognitive, emotional and behavioural coping styles (Stone et al., 1991);

- Concern as to whether respondents can reliably report upon emotion focused coping such as defence mechanisms which are considered to be unconscious has been expressed (Stone et al., 1991);
- Concern as to the way in which measures are completed have been raised, such as whether or not respondents are rating various coping strategies on the basis of outcome or the effectiveness of the strategy (Stone et al., 1991);
- Differing research designs and measurement schemes make it difficult for cross study comparisons and findings are thus less cumulative (Thoits, 1995).

From the above, it would seem that underlying themes of such criticisms appear to be that coping style, behavioural style, cognitive style, personality style, emotional distress and outcome are being confounded, thus producing instruments that are unreliable (Stone et al., 1991).

2.2.4.3.2 COPING RESOURCES

It is widely accepted (Miller, 1992a; Thoits, 1995; Sutherland & Cooper, 1990; Folkman & Lazarus, 1984) that the way people cope is affected by, or even dependent upon, the resources available to them, and that the relationship between stress and outcome will vary based on pre-existing vulnerability factors or individual differences (psychosocial coping resources). Some individuals may, therefore, be rendered more vulnerable or susceptible to the negative effects of stress than others as s result of such differences in psychosocial coping resources. Thoits (1995) defines

vulnerability as a particular weakness associated with personal or environmental coping resources. Sutherland and Cooper (1990, p 64) define vulnerability as "factors that protect or predispose". Folkman and Lazarus (1984) define vulnerability as being determined by the relationship between the individual's pattern of commitments and his ability to ward off threats to those commitments (cf section 2.2.4.2).

The personal characteristics, which includes both personal and environmental variables, which individuals draw upon when dealing with stressors, is what traditionally defines coping resources (Thoits, 1995; Cohen et al., 1995).

2.2.4.3.2.1 Personal resources

While widely researched, three personal coping resources appear to have been most frequently studied, namely, personal control (mastery), optimism and self-esteem. It is presumed that these coping resources influence both the choice and efficacy of coping strategies used by individuals when faced with stressors (Folkman, 1984; Thoits, 1995; Lazarus and Folkman, 1984). Various research, which has attempted to isolate particular idiosyncratic styles, has included constructs such as extroversion-introversion, neuroticism, Type A behaviour (Sutherland & Cooper, 1990), but there is little consensus in the literature and some of these constructs have been criticised as being too vague or for producing confounding between variables. The environmental and/or situational variables which individuals can draw upon have tended to include demographic factors, such as gender, or age in addition to social support and spirituality. Of these, Thoits (1995) has indicated that age, gender and social support have yielded indicators for vulnerability to stress.

2.2.4.3.2.1.1 Control

Thoits (1995) has indicated that the literature has examined the variable of personal control (mastery) most frequently in the literature, and various points of view have been cited, including the following:

- that all behaviour is mediated through changes in personal control (Bandura, 1982);
- that locus of control is a possible important moderator of responses to stressful situations (Sutherland & Cooper, 1990);
- there is an association between the benefits of control and Type A personality, in that when in control of a situation, Type A persons are able to set high standards and cope with a self-selected heavy load without mobilising excessive physiological resources (Frankenhaeuser, 1986);
- that positive outcomes (e.g. health, optimism, persistence, motivation, achievement, self-esteem, success, coping, personal adjustment, etc.) is linked to personal control (Skinner, 1996);
- that control is associated with an aspect of belief about self, including: self-efficacy (Bandura, 1982; O'Leary, 1985) as well as constructs which denote lack of control, such as powerlessness (Bauman & Urdy, 1972), and learned helplessness (Seligman, 1975).

Rotter (1966) devised the Locus of Control Scale, in which control was perceived as being of internal or external locus. Internal locus of control referred to an individual who perceived himself as having control over himself and his world and was therefore able to act and engage in problem solving. In contrast, external locus of control

referred to an individual who was less focused on success and achievement and more prone to anxiety and depression. Sutherland and Cooper (1990) have extended Rotter's view, and use the construct locus of control to refer to the extent to which the individual perceives he has control over a given situation. Thus, an individual with an internal locus of control will believe that he plays a role in determining events that impinge upon him, that he has control over what happens, and that decisions made and actions taken will exert an influence on personal outcome. This belief is viewed as an important factor in the expectation of coping when faced with stressful situations, and results in the person suffering less threat and adverse consequences. In contrast, the individual with an external locus of control believes that he has little influence upon situations and thus outcomes, tends to believe in luck or fate, and thus suffers more threat and greater adverse consequences in stressful situations.

Seligman (1975) is well known for his theory of Learned Helplessness, which arose out of his focus on the effects of lack of control over important events, and was originally conceptualised as a motivational deficiency arising out of an uncontrollable event (Abramson, Seligman & Teasdale, 1978). He postulated that when an individual learned that reinforcements are independent of personal responses, motivation to initiate further instrumental responses is undermined, which further interferes with learning that other outcomes are controllable and results in a depression of mood. Thus individuals with learned helplessness were more likely to feel frustration, lack of control and depression. Two modifications of this concept have been proposed:

1. Abramson, Seligman and Teasdale (1978) revised the concept of learned helplessness and proposed that it occurred when control of the environment was attributed to a lack of personal competence by an individual.
2. Cohen, Evans, Stokol and Krantz (1986) have suggested that when an individual lacks a requisite controlling response available to others (termed personal helplessness) and when helplessness is attributed to long-lived, stable, recurrent causes or causes important for a range of outcomes, then the impact of helplessness on such an individual is increased.

Badura's (1977) Social Learning Theory purports that persistence in mastering coping tasks is determined by personal efficacy expectations, so that, the stronger the sense of self-efficacy, the more active efforts will be in coping with obstacles. He states that self-competence cannot be assessed without consideration of both contextual factors and learned skills, but considers it to be an important mediator on coping ability. Bandura (1982) initially used the term self-efficacy to denote perceptions about behavioural capacities (control), but subsequently expanded this construct to include perceptions about the capacity to cope with emotions (Bandura, 1989).

Kobasa (1979) proposed that differences in personality structure separated individuals who fell ill under stress from those who did not fall ill. From this proposition, the notion of hardiness arose, and was seen to be a function of three personal dimensions, namely; (a) control versus powerlessness, (b) commitment versus alienation, and (c) challenge versus threat, which were in turn perceived as affecting an individual's coping capacity to stressor loads (Kobasa, Maddi & Khan, 1982). Kobasa et al. (1982) suggested that hardiness facilitated a form of coping that includes: (a) the

ability to keep specific stressors in perspective, (b) knowledge that one has the resources with which to respond, and (c) seeing stressful situations (even undesirable events) as opportunities for change or possibilities rather than threats.

Rhodewalt and Zone (1979) have extended the concept of hardiness, and indicate that hardy persons possess three general characteristics, namely: (a) the belief in their ability to influence or control their experience, (b) an ability to feel commitment to or deeply involved in their life activities, and (c) anticipation of change as an exciting challenge to further development.

The concept of hardiness has been variably criticised, such as:

- Kobasa's theory has been criticised as confounding research efforts by combining all three factors into a single factor (Wallston, 1989), as hardiness is not a unitary phenomenon (Hull, van Treunen & Virnelli, 1987);
- Kobasa's theory has been criticised as being not dissimilar to Bandura's (1977) social learning theory (Wallston, 1989);
- The sample and generalizability of Kobaba's theory has been criticised (Sutherland & Cooper, 1990);
- It has been argued that only commitment and control (that is, two components of Kobasa's hardiness construct) are systematically related to health outcomes (Hull et al., 1987), or improved mental heath through mediation of appraisal and coping (Florian, Mikulincer & Taubman, 1995).

The move away from locus of control (LOC)/hardiness to the construct of control in the literature is further reflected in The Life Orientation Scale (LOT) developed by

Scheier and Carver (1985), which measures optimism (or pessimism), which replaced LOC in stress studies (cf section 2.2.4.5.1.2.).

Tapp (1985) highlights the extremes of effective and ineffective coping, by using Kobasa's (1979, 1982) concept of hardiness and Seligman's (1975) theory of learned helplessness as dichotomies. He characterises ineffective coping comprising a lack of control, helplessness and/or pessimism, while effective coping is characterised as hardiness, manifesting as beliefs about control of the environment, optimism and potential for success.

Litt (1988) has differentiated between two aspects of control, namely: perceived control (seen as the individual's perception of the availability of a response) as compared to self-efficacy (defined as competence).

In contrast, Skinner (1996) conceptualises control as having three aspects: namely perceived control, potential control and actual control.

Hinton's (1991) more recently developed construct and measure of self-efficacy, defined as perceived coping incapacity (PCI), embodies inferences about the discrepancy between perceived demands and perceived capability (Cox, 1978). Hinton indicates that although the factor of perceived coping incapacity should be considered a mediating (intervening) variable between "stress generation factors and stress responses" (p 68), it also could be considered as inherently stress-inducing. Hinton (1991) demonstrated a significant relationship between perceived coping incapacity and the level of psychosomatic illness among university students and staff.

Criticisms of the value of the construct of control encompass construct validity, such as:

- There is a lack of clarity and rigour in the application of this construct (Steptoe & Apples, 1989; Syme, 1989);
- The varying interpretations of whether the term refers to perceived, potential or actual control (Mineska & Kelly, 1989);
- The issue of inadequate delineation of the dynamics of both the cognitive and behavioural aspects of the construct (Taylor & Brown, 1988).

It appears that the construct of control is more complex than postulated by early researchers, and criticisms of the construct have encompassed the various interpretations researchers have applied to the concept as seen above. The concept of control seems to be implicit in many of the cognitive factors employed in stress research, including those reflecting beliefs about the self as well as those reflecting existential beliefs about the controllability of the environment. Nevertheless, the general consensus appears to be that personal control impacts upon the way in which the individual appraises an event. It therefore appears to have a significant effect on well-being (including physical, social and psychological aspects of well-being), in that the amount of stress experienced by an individual will be determined by his willingness to attribute causality to controllable events, to infer predictability, or to be in circumstances that confer either of these (predictability or controllability) on them (Singer & Davidson, 1986). Perceived control (referring to the individual's perception that he can modify a stressor) has been shown to be a potent moderator of stressor response (Baron & Rodin, 1978; Glass & Singer, 1972) and many contemporary local studies (Schlebusch, 2000; Schlebusch, 1999; Lo Castro, 1996; Alberts, 1993) have

also demonstrated that individual's with a strong sense of personal control tend to have better psychological adjustment that those with little sense of personal control.

Psychoendocrinological studies (Frankenhaeuser, 1986) have suggested that personal control:

- is likely to change the balance between sympathetic-adrenal and pituitary-adrenal activity (in so far as it is associated with reducing negative emotions and stimulating effort);
- activates the sympathetic adrenal system but puts the pituitary-adrenal system to rest (as indicated by an adrenaline increase which accompanies the effort invested in performance in high control tasks, whereas in low control tasks (which induce both distress and effort) increases in adrenaline as well as cortisol are found;
- may act as a buffer (exert a positive influence on health outcomes) between stress and outcome through the fact that cortisol tends to be low in highly controllable situations;
- may act as a buffer in that being able to exercise control facilitates the process of unwinding (that is, the speed at which neuroendocrine and physiological baselines return to "normal") which reduces the after effects of short-term stress.

2.2.4.3.2.1.2 Optimism

Optimism, defined by Scheier and Carver (1985) as a tendency to believe that one will generally experience good rather than bad outcomes in life, has been proposed

(Scheier, Weintraub & Carver, 1986) as a mediator of how people respond to the demands of a stressor and has thus been purported to be a mediator of outcome. These authors (Scheier et al., 1986; Scheier & Carver, 1992) have argued that optimism is a stable characteristic of personality, that it is the process which underlies the self-regulation of behaviour, that it influences behaviour and thus contributes to coping potentially benefiting psychological and physical well-being.

Scheier et al. (1994) have suggested that it is the different way in which optimists and pessimists cope with life challenges that underlies differential outcome. In order to measure this construct, they developed the Life Orientation Scale (Scheier & Carver, 1992; Scheier et al., 1994), which came under repeated criticism along with their theory, in respect of the integrity of the construct (that optimism is indistinguishable variables such as neuroticism, trait anxiety, self-mastery and self- esteem.

Their revised scale, the Life Orientation Test or LOT (Scheier et al., 1994) attempted to address these criticisms and argued that many of the criticisms levelled were as a result of shared variance since, as there is a significant conceptual overlap between constructs, some form of correlation and a certain amount of shared variance is to be expected. In support of this they argue that:

- neuroticism is a multifaceted construct, consisting of pessimism which is the absence of optimism, thus providing a conceptual link between neuroticism and optimism;
- optimism taps a sense of personal responsibility for the positive expectancy for the future which is incorporated by the construct of personal control. Optimism can therefore be seen as an existential form of self-efficacy or, more specifically, as an existential belief concerning the controllability of the

environment. Bandura (1989) has attested to research findings of links between well-being and an optimistic sense of personal efficacy;

- self-esteem, by virtue of the fact that an individual with high self-esteem would also likely have a positive outcome to life contingencies, is linked to optimism; and
- optimism correlated positively with four of the eight coping mechanisms outlined in the Ways of Coping Checklisst (Folkman & Lazarus, 1985), including problem solving, positive re-interpretation, acceptance and resignation while there was an inverse relationship with both denial and distancing. Bandura (1989) and Beck (1976) have theorised that normal people distort reality in a positive direction resulting in self-enhancing biases producing more positive outcomes, which is in accordance with these findings.

The impact of the construct, optimism, on psychological and behavioural outcome in the face of adversity, has been both widely researched as well as having been found to have a significant impact on behavioural and psychological outcome (Scheier & Carver, 1992).

2.2.4.3.2.1.3 Self-Esteem

The psychological resource, self-esteem, has been variably defined in the literature, including as:

- a psychological resource influencing the stress and coping process by preventing individuals from becoming overwhelmed by stressful events (Delongis, Folkman & Lazarus, 1988);

- the total positive and negative thoughts of an individual about themselves that exhibits stability over time (Rosenberg, 1965) ;
- a fluctuating attribute with baseline changes according to the roles and expectations of both self and others (Fleming & Courtney, 1984; Marsh, 1986);
- a global self-construct that concerns self appraisal or self evaluation (Coopersmith, 1967);
- a multidimensional and multi-faceted concept (Fleming & Courtney, 1984), that includes other factors such as moral self, physical attractiveness, ideal self, self regard and self expectations (Marsh, 1986);
- as related to the regulation of feelings of self worth, which fluctuate in response to both internal and environmental events (Brown & Dutton, 1995);

Research has shown a link between physical illness and stress and self-esteem. Kobasa (1979) found that "alienation from self" was a strong discriminator between individuals who manifested high illness under stress and those who did not fall ill. This led to him combining two constructs, lack of control over environmental stressors with learned helplessness, to arrive at the concept of demoralization (Kobasa et al., 1982).

Delongis, Folkman and Lazarus (1988) and Thoits (1995) have suggested that self-esteem functions as a buffer between the appraisal of stressors and stress outcome.

However, the construct of self-esteem has been criticised around construct validity, such as whether it should be considered a personal or impact variable (Thoits, 1995), or a stressor (Miller, 1992b) since it represents an everyday experience of devaluation.

2.2.4.3.2.2 Environmental Resources

The most frequently researched environmental resources which have been considered to have an important role as moderators of stress outcome include two classes of factors: firstly, situational (demographic) factors, such as age, socio-economic status etc., and secondly social support (Sutherland & Cooper, 1990).

2.2.4.3.2.2.1 Situational (Demographic) Factors

It has long been considered in the theoretical and research literature that both demographic and situational factors are moderators of stress outcome. A diverse range of such factors have been investigated, including: age, gender, marital status, ethnicity, socio-economic status, level of education achieved (Cohen et al., 1995; Turner & Marino, 1994), as discussed below:

1. Age

    - Age may affect stress in respect of past experience and biological wear and tear (Fisher, 1988);

2. Gender

    Findings have shown that:

- Women tend to experience more psychological distress than men (Turner & Marino, 1994);
- Men are more susceptible to job-related or financial stressors, in contrast to women who are more vulnerable to disturbances in their social support network (Turner & Marino, 1994);

3. Marital Status

- A higher risk of physical illness, suicide and accidents has been associated with divorced individuals as compared to married or unmarried individuals (Fisher, 1988);

4. Ethnicity

- Ethnicity and being a member of a minority group can be both a source of stress in itself, as well as affecting the individual's response to stress (Sutherland & Cooper, 1990);
- Inequality perceptions are considered a source of demoralization (Cattell, 2001) and hence may affect stress outcome;
- Racial prejudice has been found to be promote feelings of inadequacy, and thus impact on coping style (Sutherland & Cooper, 1990);

5. Socio-economic Status

- It has been suggested that individuals of lower socio-economic status manifest those factors which account for demoralization, such as few skills, lower education, low personal control and diminished self-efficacy (Kutash & Schlesinger, 1980);

- That the relationship between social status, life change and distress is frequently dependent on both the nature and type of event being experienced (Turner & Marino, 1994).

In summary, the research literature variably demonstrates support for female gender, increased age (elderly), being divorced or of lower socio-economic status as being more vulnerable to, and experiencing high(er) levels of psychological distress (Thoits, 1995; Turner & Marino, 1994).

2.2.4.3.2.2.2 Social Support

Of all the psychosocial resources researched in the stress and coping literature, social support can be considered to be the most frequently studied of these (Thoits, 1995), but it has become a somewhat catchall concept in that there are as many definitions as there are studies engendered by the term (Hobfall, 1988). Researchers have used the term social support in different semantic contexts, including as an environmental resource, a personal resource or as restriction of movement, lack of social contact, or perceived emotional isolation (Lakey, McCabe, Fisicaro & Drew, 1996).

A number of different proposals have been put forward in the literature regarding making a differentiation between types of social support, including for example:

- between perceived support, which refers to an impression that support would be available if needed, such as love and affection and enacted social support, referring to specific assistance such as advice giving (Lakey et al., 1996);

- between emotional support (which includes ventilation, self-esteem support and intimacy support), instrumental support (the provision of material resources and financial aid which could directly resolve a problem for an individual), informational support (used in defining, understanding and coping with problematic events) as proposed by Cohen & Wills (1985);

The research and findings in the area of social support in the literature can be broadly divided as falling into two overall approaches, namely, either highlighting gains from social connectivity or focusing on interactions in which socially meaningful support occur.

Studies of social support have suggested various findings, including that:

- there are positive effects of social support on health and health behaviour, as demonstrated by an abundance of research findings (Cohen & Syme, 1985; Cutrona & Russel, 1990);
- positive mental and physical health is increased by the provision of social support from significant others across cultures (Fawzy & Fawzy, 1995);
- social support acts as a buffer between stressful life events and health (Östergren, 1991; Turner, 1981; Billings and Moos, 1981), even in extreme stressful situation (Dawes, 1990);
- relationships between social support and aspects of autonomic endocrine and immune function have been demonstrated (Kiecolt-Glaser et al., 1995);
- supportive interactions provide emotional concern, instrumental aid in kind, appraisal and information (House, 1981);

- social interactions provide both support and challenge (Pines, 1982);
- social interactions contribute to social integration and connectedness which in turn assists to embed the individual within a social system that provides him with love, caring, and a sense of attachment to a valued group (Hobfall, 1988);
- connection to social support provides a buffer against the effects of social stressors (Antonovsky, 1974; Brown, 1978; Cobb, 1976);
- a relationship between social support and health or ill-health, as well as an association between lack of support and a variety of physical, mental and social symptoms has been found in two major reviews (Cutler & Madore, 1980; Leavy, 1983) of social support studies, as well as by more recent studies (Cohen & Wills, 1985; Turner & Marino, 1994; Emmons & Colby, 1995; Östergren, et al., 1991; Kessler & McLeod, 1985);
- social support provides security, assistance and predictability (Thoit, 1995);
- social support can be considered as a social "fund" from which individuals may draw upon when handling stressors (Thoits, 1995) since it concerns helpful functions performed by significant others;
- the quality of interpersonal relationships is related to overall happiness (Emmons & Colby, 1995);
- that stress is reduced by the mere perception that one can turn to someone for help (Sarason & Sarason, 1986).

Although it has been suggested that the mechanisms underlying social support have yet to be clarified adequately (Lakey et al., 1996), it has been purported that social support protects people through the mediation of appraisal and coping process, thus

buffering the individual from seeing a situation as helpless and threatening to self-esteem (Lazarus & Folkman, 1984). Other suggested possible mechanisms underlying social support are social support as coping assistance, as a bolster for self-esteem, as supportive feedback and as encouraging a sense of mastery and competence (Cohen & Wills, 1985).

Criticisms and/or recommendations regarding the study of social support have included that:

- it is not only the extent of social support that should be investigated, but also the nature and adequacy of such support (Cutler & Madore, 1980);
- both the quantity and quality of supportive relationships are important, as well as the context and type of stressor, and type of support (Schwarzer & Leppin, 1989);
- the evidence for social support as either a moderating or mediating factor in stress is confusing at best, and that it is the perception of social support when needed that is the major contributor (Singer & Davidson, 1986);
- the findings on the role of support in alleviating stress are contradictory and sometimes difficult to interpret (Buunk & Hoorens, 1992); and that
- the negative direct effects of social support on stress need clarification (Buunk & Hoorens, 1992) since research has also shown that support can aggravate rather than alleviate stress and increase, rather than reduce, the impact of stress on well-being (Buunk & Hoorens, 1991).

Consequently the focus of social support was directed onto factors that influence relationships within support systems. Two factors that have received considerable

attention in the literature, namely loneliness (intimacy) and self-disclosure, as both have been considered relevant to the quality of social relationships and hence social support:

1. Loneliness (Intimacy)

   The construct of loneliness has been widely researched. Loneliness has been found to be inversely related to measures of self-esteem (Jones, Freeman & Gaswick, 1981), strongly associated with anxiety and depression as well as related to suicide, substance abuse and vulnerability to health problems (Jones et al., 1990). Having a confidant (intimacy) has been found to protect against the development of mental symptoms following stressful life events in women (Brown, Bhrolchain & Harris, 1975), and to buffer the stressful effects of unemployment on self-esteem (Pearlin & Schooler, 1978). Conversely, studies on loneliness (the absence of intimacy) have linked social isolation to addiction, suicide, physical illness and antisocial behaviours (Russel, Peplum & Cutrona, 1980), to inappropriate confiding of intimate details too soon in a relationship (Klienke, 1991), to feelings of alienation from others (Schlebusch, 2000); to cancer (Newby-Fraser & Schlebusch, 1997), and coronary heart disease and natural killer T cell activity (Locke & Colligan, 1986).

2. Self-disclosure

   Immune enhancing effects have been demonstrated among students (Pennebaker, Kiecolt-Glaser & Glaser, 1988); inappropriate self-disclosure has been linked to loneliness (Klienke, 1991), to low self-esteem, shyness, introversion, and lack of assertiveness and hence inhibited support-seeking, relational failure and deficient social skills (Hobfall, 1988; Klienke, 1991).

In summary, stress studies have established a relationship between mental and physical functioning and the utilization and adequacy of social support (Brown, 1978; Cobb, 1976), with social support generally being measured by evaluation of the perception of, as well as presence or absence (loneliness) of, support networks.

There is a burgeoning literature on social support as an important protection against the impact of stress on physical and mental health (Winnubst, Marcelissen & Kleber, 1982).

2.2.5 THE STRESS RESPONSE

Schlebusch (2000) has argued that health should be understood as an integrated state of mind-body well-being on physical, psychological and social levels, and not just as an absence of disease. Similarly, the stress response should be conceptualised as a complex process involving both the body (physical/physiological/biological parameters) as well as the mind (psychological processes, emotions, cognitions etc).

2.2.5.1 FUNCTIONAL OR DYSFUNCTIONAL STRESS

Most authors in the stress literature tend to agree that stress is not automatically negative, but may, at low to moderate levels, be positive (Schlebusch, 2000; Robbins, 1996). The pioneering work of Hans Selye (1956, 1976) has led to the concept of positive stress or "eustress", which is used to delineate stress which is functional, and which provides the energy and/or motivation to optimal achievement (Schlebusch,

2000; Robbins, 1996). The benefits of positive stress have included, amongst others: general wellness, increased optimism, high motivation, good concentration, elevated productivity and enhanced achievement, effective problem solving, and better coping skills (Schlebusch, 2000; Robbins, 1996).

Various authors (Schlebusch, 2000; Adams, 1980) in delineating the parameters of stress have further indicated that both over-stress (over-stimulation) and under-stress (lack of stimulation) can be unhealthy. However, different individuals are likely to have different notions as to what constitutes an acceptable level of stress (Schlebusch, 2000; Robbins, 1996; Schermerhorn et al., 1997). The "stress curve' (Schlebusch, 2000) illustrates how increasing stress may initially lead to an increase in an individual's level of performance up to a particular point (B, on the stress curve), where after either prolonged stress at a high level or any further increase in stress will result in negative performance and impaired health (as reflected in Figure 1).

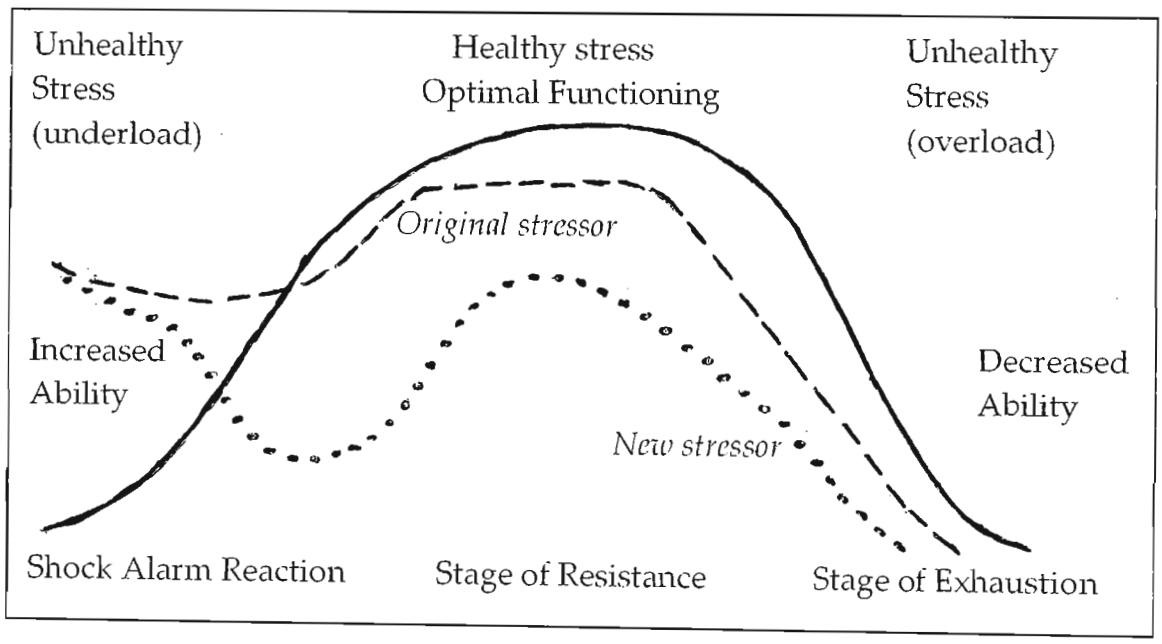

Figure 1: The Stress Curve

Adapted from: Schlebusch, L. (2000). Mind Shift Stress Management and your Health. Pietermaritzburg, South Africa: University of Natal Press. (pages 22 and 27)

Dysfunctional stress, then, is stress which is damaging and which can exact high costs in terms of individual's adaptive resources, wear and tear on the system, and their health and can lead to severe emotional and physical deterioration and even death (Schlebusch, 2000). The outcomes of such stress can manifest singly, or in combination, in the physical (e.g. tiredness, apathy, illness, etc.), psychological (e.g. depression, low self-esteem, etc., or behavioural (e.g. forgetfulness, increase in use of substances such as alcohol or nicotine, etc,) arenas (cf section 2.2.6).

2.2.5.2. THE ROUTE OF STRESS

Schlebusch (1998a, 1998b) has conceptualized the stress response as following two pathways, a *psychological* and a *physiological* one (Schlebusch, 1998a, 1998b).

2.2.5.2.1 The Physiological Route

Both pre-clinical studies of animal models of stress as well as the study of biological variables of clinical populations underpin the understanding of the ***physiological route*** of stress. Many neurotransmitter systems have been implicated by research, which has also tended to support the hypotheses that, in many individuals with high stress levels who develop psychological or physical disorders, the noradrenergic and endogenous opiate systems together with the hypothalamic-pituitary-adrenal-axis, are hyperactive (Davidson, 1993; Schlebusch, 1990).

2.2.5.2.2 The Psychological Route

The *psychological route* is underpinned by a cognitive model, in which perception of, appraisal of, and the emotional response of the individual to the stressor are paramount. It is the reaction to the stressor, influenced by appraisal and coping abilities, which produces a physiological response. This model therefore posits that when individuals are unable to process or rationalise stressors, or avoid the consequences of the stress by employing avoidance and other techniques (coping strategies or behaviours), a stress response/disorder is precipitated. Psychological stress is described (Schlebusch, 2000; Kaplan & Sadock, 1998) as operating through the brain and the automatic nervous system to influence the sympathetic and parasympathetic subsystems, thus influencing the immune and hormonal systems, which can result in adverse health effects.

2.2.5.2.3 The Stress Cascade

The "stress cascade" is produced by the close interaction of both these routes (Schlebusch, 2000). Any perceived (by the individual) threat or challenge in the environment, triggers a chain or complex series of neuroendocrine events (both biochemical and physiological) as part of the automatic reaction of the body during the stress response. Messages are sent from the brain to the adrenal medulla via the sympathetic nervous system. The adrenal medulla then secretes two catecholamines (adrenaline and noradrenaline). A second more complex route takes messages to the adrenal cortex, which secretes corticosteroids such as cortisol. This route involves

secretion of the adrenal corticotropic hormone (ACTH) from the pituitary gland and corticotrophin releasing factor (CRF) from the hypothalamus (as diagrammatised in Figure 2 and discussed in greater detail in the following paragraph).

THE STRESS CASCADE

STRESSOR
↓
STRESS (INFLUENCED BY PERCEPTION
↓
STRESS
↓
LIMBIC SYSTEM (EMOTIONAL CONTROL CENTRE)
AMYGDALA IN MIDBRAIN ACTIVATED
↓
NEURONAL RESPONSE
(NERVE CELL MESSENGERS)
↓
AUTONOMIC NERVOUS SYSTEM
↓
HYPOTHALAMUS TRIGGERED
↓
HORMONAL RESPONSE
(CHEMICAL MESSENGERS)
↓
RELEASE OF CORTICOTROPIN-RELEASEING FACTOR
(CRF HORMONAL RESPONSE)
↓
PITUITARY TRIGGERED
↓
HORMONAL RESPONSE
↓
RELEASES ADRENOCORTICOTROPIC HORMONE
(ACTH HORMONAL RESPONSE)
↓
STIMULATION OF ADRENAL GLANDS

↓	↓
ADRENAL MEDULLA	ADRENAL CORTEX
↓	↓
HORMONAL SECRETION	HORMONAL SECRETION
↓	↓
RELEASE OF HORMONES *epinephrine (adrenaline)* *norepinephrine (noradrenaline)*	RELEASE OF HORMONES *cortisol* *aldosterone*
↓	↓
Increases heart rate, metabolic rate, and strength of muscle contractions, and reroutes blood to organs that need more in times of stress	mobilises fat, converts other nutrients to glucose, and raises blood sugar level

Figure 2: The Stress Cascade

Adapted from: Schlebusch, L. (2000). Mind Shift Stress Management and your Health. Pietermaritzburg, South Africa: University of Natal Press (page 28.)

The amygdala, which is part of the limbic system (associated with emotions) and situated in the mid-brain, is activated by stress, producing an emotional response which is then moderated by additional input from the frontal lobes (higher cognitive centres of the brain). A hormonal response from the hypothalamus to release the hormone CRF (corticotropin-releasing factor) is activated by the amygdala's neuronal response. The pituitary gland is stimulated, releasing the hormone ACTH (adrenocorticotropic hormone), which in turn stimulates the adrenal glands to secrete adrenalin (epinephrine) and noradrenalin (norepinephrine) and further along the cascade, both corticosteroids (aldosterone) and glucocorticoids (cortisol). Simultaneously, the hypothalamus acts directly on the autonomic nervous system (which includes the sympathetic and parasympathetic sub-systems), thus inducing an immediate stress response. This places the individual in a state of arousal thereby readying them for the so-called 'fight or flight' response. The 'fight or flight' response occurs via a dual pathway, namely, a nervous response (which is relatively short-lived) and an endocrine [hormonal] response (which can last for much longer). The parasympathetic sub-system functions as a counterbalance for the sympathetic sub-system, and by conserving and restoring energy prepares the body of the "rest and digest phase" (Schlebusch, 2000).

Current psychoendocrinological research has attempted to address the issue of whether the adrenal medullary system (with the secretion of catecholamines) and the pituitary-adrenal-cortical system (with the secretion of corticosterois) respond selectively to different emotional and behavioural demands, and if so, which activators are critical for the activation of each system (Frankenhaeuser, 1986).

Experiments regarding the activation of these two system's responses (Frankenhaeuser, 1986) have shown that:

1. Adrenal-Medullary Response Activation:

   Increased catecholamine output in individuals exposed to a variety of psychosocial stressors (including for example noise, electrical shock, parachute jumping, crowded trains, performance tasks involving cognitive conflict or time pressure etc.). This catecholamine increase is evoked by these different situations by the emotional experience, regardless of whether it is pleasant or unpleasant. The adrenal-medullary response is determined by the psychological characteristics of the situation rather than the physical conditions (overload or underload) per se. Of adrenaline and noradrenaline, the former is more sensitive to mental stress, although noradrenaline may also increase under intense stress. Noradrenaline is more sensitive to physical stressors (e.g. exercise).

2. Pituitary – Adrenal (Corticosteroid Response) Activation:

   Human subjects exposed to novel and unfamiliar situations, which evoke uncertainty and anxiety, manifest cortisol increases generally. Unpredictability activates the pituitary adrenal system, with the change from predictable to unpredictable being sufficient to activate corticosteroid secretion. Anticipation is a very provocative stimulus for cortisol release. Corticosteroid secretion can be suppressed by environmental circumstances characterised by predictability and controllability. Pituitary-adrenal activity is suppressed when situations are predictable and expectancies are fulfilled. Recent studies have demonstrated a principally similar bidirectional pituitary-adrenal response in the face of high-control versus low-control situations.

Psychoendocrinological research has further suggested that the balance between sympathetic-adrenal and pituitary-adrenal activity will vary predictably according to the different emotions evoked by different environmental demands. Studies (Frankenhaeuser, 1986) comparing effort (elements of interest, engagement and determination) which can thus be conceptualised as an active way of coping or striving to gain and maintain control, in comparison to distress (elements of dissatisfaction, boredom, uncertainty and anxiety) which can thus be conceptualised as a passive attitude with feelings of helplessness, have indicated that:

- a combination of effort and distress is accompanied by an increase in both catecholamine and cortisol secretion;
- effort without distress is accompanied by increased catecholamine secretion, while cortisol secretion may be suppressed;
- distress without effort is accompanied by increased cortisol secretion, but catecholamines may be elevated too.

The above endocrine profiles are associated with different states (Frankenhaeuser, 1986):

- effort and distress is the state typical of daily hassles and also with repetitious, machine paced employment (assembly lines) or highly routinized work (computer terminals);
- effort without distress is the state of joyousness (a high degree of personal control);
- distress without effort is typical of depressed patients, and other states characterized by helplessness and passivity.

2.2.6 STRESS OUTCOME

There appears to be no less ambiguity in the delineation and measurement of the stress response than other aspects of stress theory, since the literature contains references to consequences (Eisendorfer, 1985) as well as outcomes (Lazarus & Folkman, 1984), and encompasses particular physical or emotional symptoms such as pain (Litt, 1988), diabetes (Turk & Speers, 1983), depression (Blaney, 1985), anxiety (White, 2000), post-traumatic stress disorder (Davidson & Baum, 1986) as well as the newer focus on so-called stress-related syndromes such as burn-out (Pines & Aaronson, 1988) or chronic fatigue syndrome (Kreusi, Dale & Strauss, 1989). The literature is also replete with more generalized constructs of dysfunction which use global measures of mental, physical and social functioning in a variety of disorders or their prodromal manifestations, including stress (Cohen & Wills, 1985) or psychological distress (Kessler & McLeod, 1985).

Historically, stress outcome measurement was the domain of psychosomatic research but has more recently been incorporated into behavioural medicine , including areas such as well-being, adjustment to extreme stressors, somatic health, social relationships (Thoits, 1995), early detection and prevention of illness/disease, aetiology of disease, predictors of prognosis, outcome, adjustment to illness and thereafter, and quality of life (Baum & Posluszny, 1999).

The introduction of the bio-psycho-social model (Engel, 1980) has resulted in the study of stress outcome in modern times incorporating physical

(biological/physiological), psychological (emotional), and social (interpersonal) levels of both well-being and distress (Sutherland & Cooper, 1990), which are conceived of as being interrelated, with failure at any one level likely increasing individual vulnerability to stress on other levels within and/or between levels (Trumbull & Appley,1986, cf section 2.2.2.4).

2.2.6.1 BIOLOGICAL (PHYSICAL/PHYSIOLOGICAL) OUTCOME

General as well as specific psycho-physiological effects on health outcome and well-being as a result of stress have been well-described in the psychophysiological research literature (Cohen et al., 1995; Sutherland & Cooper, 1990), with the sympathetic adrenal medulla system (SAM) and the hypothalamic pituitary adrenal cortical axis (HPA) receiving the most attention. (Cohen et al., 1995).

When SAM activation is either excessive, persistent, occurs often or is repeated over a long period, a sequence of responses resulting in ill health may occur. This involves the secretion of catecholamines epinephrine (adrenaline) and norepinephrine (noradrenalin), which results in various effects including:

- Haemodynamic changes such as additional production of blood platelets to assist with clotting in the face of injury (Schlebusch, 2000);
- Increased heart rate or blood pressure (Schlebusch, 2000);
- Production of endorphins, which block out the immediate effects of pain (Schlebusch, 2000);
- Increased suppression of immune functioning, such as long term suppression of immune activity until the stressful situation is over

(Schlebusch, 2000), the effects of cortisone in infection and auto-immune diseases (Solomon, 1985), suppressed natural killer cell activity including T cell proliferation which has been used to determine stress response (Jermott & Locke, 1984; O'Leary, 1990) and cancer;

- Production of neurochemical imbalances, which have been linked to psychiatric and physical disorders (Cohen et al., 1995).

The Hypothalamic Pituitary Adrenocortical axis (HPA) is the second important system in the biological outcome of stress. Selye (1956, 1976) suggested that the HPA system loses its autopituitary and adrenal cortical ability to secrete hormones under severe stress (when the stressor is severe), with the result that the individual is unable to successfully adapt to stress. The breakdown of vulnerable organs (determined by genetic and environmental factors) in the face of continued stress results in the manifestation of symptoms (illness and ultimately death) in Selye's (1956, 1976) model. Subsequent researchers have proposed that both specific and generalized biochemical reactions occur throughout all stages of the stress response in reaction to stressors (Eisendorfer, 1985). There is, for example, a growing body of research evidence (Van der Pompe et al., 1996) supporting the importance of the HPA system activity in, for example: various physical diseases (through increased secretion of cortisol); systemic illness; depression; as well as its potential involvement in neoplastic disease; that it may participate in the process of growth and differentiation of breast cancer; andthat it may induce immune impairments.

Still others (Everly, 1989; Schlebusch, 2000) have indicated that both these systems actually overlap, providing constant feedback loops to co-ordinate numerous complex

activities continuously taking place in the body through activation or inhibition of other systems, including neurochemical areas of the brain and cognitive and affective domains).

An area of growing interest and research has been the psychoneuroimmunology (the interactions between the brain, behaviour and the immune system (Alberts, 1993), including the effects of stress on the immune system. Whilst a comprehensive discussion of this field is outside of the scope of this thesis, the main findings in relation to stress and the immune system will be highlighted. Felton & Felton (1991) have described the mechanism of brain–immune system connections, and have proposed that this occurs through two process: (a) The brain connects with and controls both peripheral organs and processes through the peripheral nervous system (the autonomic nervous systems comprising both the sympathetic and parasympathetic branches) which, in turn, innervates the visceral organs (such as the heart and stomach). The sympathetic nervous system, which releases catecholamine and norephinephrine, innervates immune organs such as lymph nodes, bone marrow, spleen and thymus, which said organs through late cholamine receptors, have synaptic contacts with lymphocytes thus physically connecting the brain and the immune system, and (b) the brain releases factors which cause the endocrine glands to release hormones which when they reach various organs, bind to hormone receptors on the organs, thus allowing the brain to communicate with peripheral organs.

In the case of stress, it is the glucocorticoids, released from the cortical aspects of the adrenal glands that produce many of the bodily effects of stress (Schlebusch, 2000). Figure 2 which provided a diagrammatic representation of the stress response, could

be modified (as reflected in Figure 3) to illustrate the pathway of stress that has effect on immune cell function (Maier et al., 1994). Physical and psychological stressors provoke cells in the paraventricular nucleus of the hypothalamus to synthesise and release corticotrophin releasing hormone into the portal blood system at the base of the brain (Maier et al., 1994) which when it reaches the pituitary gland, leads to the synthesis and release of adrenocoricotrophic hormone into the blood, and when it arrives at the adrenal gland, activates the release of glucocorticoids. The T and B cells have receptors for the stress hormones (corticotropin, adrenocorticotrophic hormone and glucocorticoids). Simultanousely, the parasympathetic nervous system is activated, by stressors, and the inner portion of the adrenal gland releases catecholamines (norephinephrine and epinephrine) into the blood, to which receptors on the lymphocytes respond. The immune system functioning is therefore altered from both these processes.

The diagram overleaf also illustrates how psychological stressors as well as other psychological factors including: mood states such as depression (Maier et al., 1994), cognitive processes (Jordaan & Jordaan, 1998), or other psychological events such as bereavement, loss, divorce (Fawzy & Fawzy, 1995) impact on and are capable of altering immunity, in that they modulate autonomic function (activate both the sympathetic nervous system and the HPA) and the release of peripheral hormones (the plasma catecholamines released by the sympathetic terminals and the adrenal medulla in addition to the hormones released by the adrenal cortex and the pituitary), which modulate immunity (since these hormones participate in the regulation of the immune system). Fawzy and Fawzy (1995) argue that different stressors in addition to other psychological events (as described above) have a differential impact on immunity and

therefore will produce different outcomes, highlighting the complex relationship between behaviour which they, and Schlebusch (2000), indicate encompasses cognitive appraisal, coping, mediators, as well as psychological and physical responses). Most authors suggest that both physical as well as psychosocial stressors can affect immunity (Schlebusch, 1999; Schlebusch, 2000; Fawzy & Fawzy, 1995; Maier et al., 1995; Alberts, 1993.

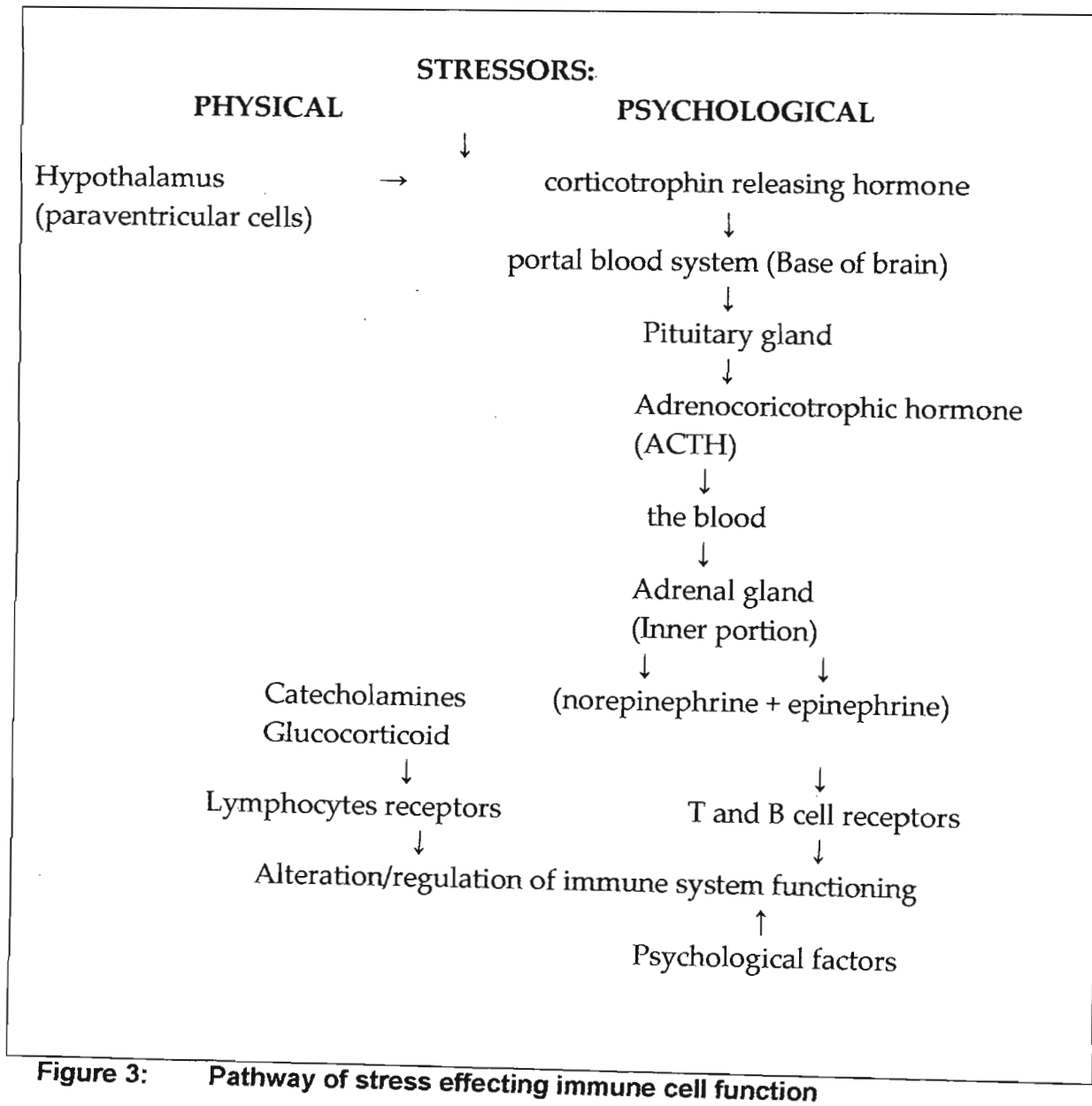

Figure 3: Pathway of stress effecting immune cell function

The stress literature (Everly, 1989; Sutherland & Cooper, 1990) points towards a general consensus that prolonged activation of certain systems results in negative outcomes, which manifest as physical and psychological/psychiatric disorders. Various such areas have been researched, including:

1. Physical arena:

   - illnesses and diseases, such as peptic ulcer, hypertension, hyperthyroidism, rheumatoid arthritis, nerodermatitis, asthma and ulcerative colitis (Locke & Colligan, 1986) and upper respiratory tract infections, the common cold, and diabetes mellitus (Cohen et al., 1995);
   - cancer (Cohen et al, 1995; Fawzy & Fawzy, 1995; Schlebusch, 1999);
   - cardiac disease (Rosenman & Chesney, 1985);
   - almost all aspects of immunity (Maier et al., 1994); and
   - autoimmune diseases including multiple sclerosis, HIV/AIDS, and rheumatoid arthritis (Cohen et al., 1995);
   - wound repair has been found to be delayed by stress (Marucha, Kiecolt-Glaser & Favagehi, 1998; Kiecolt et al., 1995).

2. Psychological arena:

   (a) Personality:

   - type A personality has been well-researched and linked to coronary heart disease (Rosenman & Chesney, 1985), increased reactivity to stress (Freidman & Rosenman, 1974),

- type C personality has been linked to certain diseases such as cancer (Smith, 1993);
- correlations have been shown between personality types and stress factors (Schlebusch, 1999);
- personality variables, through their influences on stress, mood and coping, have been suggested as moderators of post-surgical outcomes (Mathews & Ridgeway, 1981).

(b) Emotions:

- emotion has been linked to disease, and it is thought that the primary biological pathway linking these two factors is hormonal, predominantly the adrenal hormones, catecholamines and corticoids (Stone, 1995); in this way, stressors have been found to influence pathogenic states, through causing negative affective states such as depression and anxiety, which impact on biological and behavioural coping patterns (Stone, 1995);
- other authors (Cohen et al., 1995) have argued that disease processes develop independently of emotional processes since the effort involved in actively coping with stress can alter many of the same biological processes involved in emotional response and hormonal secretion;
- evidence of increased secretion of cortisol has been found in depression (Van der Pompe et al., 1996), with blood plasma levels of cortisol being found to be elevated in 50-70% of seriously depressed individual (Stokes & Sikes, 1987);

- psychosocial stressors have been found to cause long term changes in brain functioning, which may play a role in the development of mood disorders (Akisal, 1979)

(c) Behaviour:

- behaviour can affect health in various ways, either independently from other factors, or by mitigating, modifying or improving or exacerbating the effects of stress while at the same time, stress has been known to alter behaviour (Schlebusch, 2000);
- a positive correlation between avoidance behaviours (including avoiding people, denial and escape) with psychological distress has been noted (Fawzy & Fawzy, 1995);
- smoking, alcohol use, changed eating/nutrition, exercise and sleep duration are known to either reduce or exacerbate stress, but when habitual are risk factors associated with long term negative effects on health and well-being, have indirect effects on mood and behaviour (Baum & Posluzny, 1999) and are risk factors for surgery (Kiecolt-Glaser et al., 1995) ;
- tobacco use has been linked to cardiac disease, stroke and hypertension, cancer and other respiratory illnesses (Baum & Posluzny, 1999).

(d) Psychosomatic Disturbances:

- the Diagnostic and Statistical Manual of Mental Disorders IV-TR (APA, 2000a) can be said to recognise the importance of mind-body relationships (thoughts, feelings and behaviours) on health and well-

being by the inclusion of Somatoform and Somatic Disorders as specific diagnostic categories;

- numerous measures of psychosomatic functions have been utilized to measure stress outcome, including physical measures (e.g. blood pressure/flow, skin conductance, muscle tension, digestion, etc.), and biochemical measures (e.g. cortisol level, immune functioning, killer T cell activity);
- physical symptoms have also been used to measure psychosomatic function, including irritability, excitability, headaches (Cohen et al., 1995);
- individuals susceptible to psychosomatic illness have different perceptive patterns than those who are not vulnerable to such illness, which Wrzeniewski (1986) suggests may be one of the risk factors for actual onset of disease;
- researchers have reported good correlations between psychosomatic symptoms and physical measures, suggesting that the former are viable alternatives to physical tests (Scheuch, 1986).

(e) Nutritional Outcome

The positive health effects of vitamin supplementation have been well-demonstrated (Fawzy, 1995; Morgan & Morgan, 1986; Christensen, 1996). A recent study, for example showed a positive association between higher Vitamin E intake and its potential for reducing the risk of coronary heart disease (Machlin, 1998), while other studies showed the importance of Vitamin A in health (McLaren, 2002; Solomons, 2002). The deleterious consequences of a deficiency of vitamin B

complex and of ascorbic acid are well-known. Furthermore, calcium is essential for bone and teeth growth and development in pregnancy and lactation and the dependency of calcium on the vitamin B complex and ascorbic acid is also well-known. It has also been established that magnesium is essential for the activity of many enzyme systems and that it plays an important role in muscular excitability as well as in neurochemical transmission. Along with other factors such as adequate sleep and light, a balanced diet (which affects neurotransmitter function, and thus mental health), is a key protective factor in mental well-being (Wasserman, 2001).

The particular micronutrient supplementation used in this current study has been developed as a combination which provides an optimal amount of the water soluble B-complex vitamins and vitamin C with the minerals calcium and magnesium, in order to provide nutritional support in individuals coping with high stress levels. It supplements the body's stores of B-complex vitamins, vitamin C and the minerals calcium and magnesium at times when daily dietary intake is sub-optimal or these nutrients are depleted following exposure to such high stress levels. The clinical value of this micronutrient combination in stress management has been evaluated in four previous studies.

The first study (Popovic, 1993) comprised a four week, open, multicentre Swiss study (N =136) in which the clinical value of micronutrients in stress management was evaluated. Patients studied

complained of repeated stress and presented with symptoms such as fatigue, poor concentration and depression which were accompanied in some cases by physical symptoms such as muscle spasm and poor concentration. All of these symptoms are consistent with the biochemical effects of stress. Pre-treatment (with micronutrients) evaluation parameters included: global health status, psychological status, self rating of the frequency of muscle cramps and muscle spasms. At the end of a 4 week period of taking micronutrients, subjects were evaluated on the following parameters: psychological status, self rating of the frequency of muscle cramps and muscle spasms, overall efficacy of the trial medication, as well as any averse effects. Results of the study demonstrated that the above psychological and physical symptoms (stress-related symptoms), as assessed by the physicians, improved considerably, as well as subject's own evaluation of their attention span and degree of irritability. In addition, 85% of the subjects reported that they were satisfied with the efficacy of the trial medication and that it was well tolerated. Conclusions were that the recommended use of the multivitamin and mineral combination provided improvement of both psychological and physical symptoms of stress.

The second study (Willemsen et al., 1997) assessed the effects of multiple dose treatment with a multivitamin combination on cardiovascular reactions to psychological stress and psychological well-being in a group of 24 healthy males in a double-blind,

randomized, parallel group, placebo controlled exploratory pilot study during 28 days. Total peripheral resistance and diastolic blood pressure reactions to a cold pressor test were significantly attenuated following administration of the multivitamin combination. These effects may be clinically important as they describe an association between these experimental changes and the incidence of coronary heart disease and/or future hypertension. In addition, ratings of depression and psychological morbidity scores, as assessed by self-report and standard questionnaire, also improved in the treatment group, but not with placebo, although these effects were not statistically significant, possibly as a result of low power.

The third, Russian open non-comparative multicentre study (Vein et al., 1997) of individuals permanently exposed to occupational stress-predisposing factors such as intensive work, frequent business trips or lunches, conflicts, reported the following psychological and/or somatic symptom: weakness, irritability, difficulty in concentration, headache, vertigo, insommnia, restlessness, tremor, etc. This study found that a specific multivitamin combination improved mood, activity, fitness which was confirmed by statistically significant ($p<0.001$) increase both in the total SAN (Self-impression of Health, Activity and Mood test) score and scores of SAN subscales characterizing mood, fitness and activity ($p<0.001$ for all subgroups). The treatment was equally effective in both age groups tested, i.e. 18-34 and 35-50 years old and between-group analysis also demonstrated it to be effective in both

females and males, while females showed statistically stronger pronounced changes in the fitness SAN subscales scores than males. The multivitamin combination was reported as effective in stress management, and recommended as prophylactic treatment for people who are subject to the prolonged effects of stress.

The fourth study (Carroll et al., 2000) evaluated the effects of a multivitamin and mineral supplement on psychological well-being in a double-blind, randomized-control trial of 80 health male volunteers. Measurements included blood sample to determine plasma zinc concentrate pre- and post-treatment in addition to questionnaires measuring psychological state. The multivitamin and mineral combination was reported as statistically significantly reducing anxiety and perceived stress, tiredness and concentration as well as somatic symptoms.

2.2.6.2 PSYCHOLOGICAL (EMOTIONAL) OUTCOME

The literature encompassing psychological stress has posited a broad range of outcomes as stress indicators (Cohen et al., 1995), with measures of psychological stress, which usually are in the form of self-report checklists of either psychiatric/psychological or a combination of physical, mental and behavioural symptoms (Sutherland & Cooper, 1990), being utilized by researchers in the field as "prima facia evidence of the presence of stress" (Derogatis, 1982, p 276).

Support for the use of such measures has included that:

- they have been considered to be the most useful and flexible way of measuring stress outcomes (Derogatis & Melisaratos, 1982);
- studies have indicated a high correlation between physiological measures of autonomic responses and self-report measures (Laux & Vossel, 1982);
- there are similar correlations between physical measures and a checklists of psychosomatic symptoms with both environmental stressors and mediating factors including cognitive measures, such as the Perceived Coping Incapacity (Hinton, 1991);
- there is a negative correlation between killer T-cell activity and self-reported levels of stress and loneliness in students (Kiecolt-Glaser et al., 1984).

Criticisms against the use of self-report checklist of psychological symptoms have typically included that:

- events may be over-reported or exaggerated as a result of "effort after meaning" leading to bias in recall (Paykel & Dowlatshahi, 1988);
- ambiguity of terminology and/or definitions might lead to bias in recall (Paykel & Dowlatshahi, 1988);
- because multidimensional measures, such as personality measures, do not allow for the adequate identification of mediating factors as the latter require specifically designed measures, they can confound variables (Derogatis, 1982)

A perusal of the literature indicates that such measures have generally included six main areas of study, namely psychopathology and/or symptoms of psychiatric

disorders, cognitive impairments, emotional disequilibrium, quality of life and life satisfaction, and disturbed social relationships.

2.2.6.2.1 Psychopathology or Psychiatric Disorders

Historically, the area of psychopathology and psychiatric illness has probably been one of the main areas of distress measurement (Thoits, 1995; Rabkin, 1982). "Official" recognition of the link between psychopathology with stress research is reflected in the incorporation of the concepts of somatization and somatoform disorders in the DSM-III (APA, 1980) , revised thereafter as the DSM-III-R (APA, 1987) and DSM-IV (APA, 1994) and has become firmly entrenched in the psychiatric nomenclature as seen in the DSM-IV-TR (APA, 2000a) providing implicit recognition of the role of stress in many psychological/psychiatric illnesses, reflected in the identification of particular mental disorders as the direct sequelae of specific stressors, different onset periods and duration (such as somatoform disorders, acute stress disorder, post-traumatic stress disorder, brief psychotic disorder and adjustment disorders); and having included stressor identification (such as extreme stressors including for example warfare, abuse, etc) in psychodiagnostics (APA, 1994; APA,2000a).

2.2.6.2.1.1 Somatoform Disorders

Extreme stressors, such as warfare, have been included in the DSM-IV (APA, 1994) as a life change event which may predispose to conversions disorder, while physical trauma has been associated with somatoform pain disorder. In a review of numerous

studies of somatoform disorders (Bass, 1990), stress paradigms have been utilized to investigate conditions such as psychogenic/functional pain and conversion disorder.

2.2.6.2.1.2 Acute Stress Disorder and Post-traumatic Stress Disorder

Post-traumatic Stress Disorder (PTSD) and to a lesser extent Acute Stress Disorder (ASD) has an abundance of research and clinical literature. Various authors (Mc Manus, 1991; Weiner, 1985) have suggested that post-traumatic stress disorder and acute stress disorder represent a distinct stress phenomenon which is associated mainly with various forms of extreme stressors or stressors typically outside the range of normal human experience, including for example, warfare, severe assault, severe accidents, traumatic physical disability, natural disasters etc. Symptomatic presentation of these disorders include dissociative symptoms, anxiety, intrusive symptoms/thoughts, avoidance symptoms/behaviours and emotional arousal or numbing (Van der Kolk & McFarlane, 1996; APA,1994; APA, 2000a; Horowitz, 1986) as well as impairment in social, occupational and other areas of functioning with an acute (within 6 months of the stressor), chronic or delayed onset for PTSD (APA,1994; APA, 2000a), and within one month for ASD (APA,1994; APA, 2000a).

There are currently two main models of PTSD, namely a Biological Model (Van der Kolk, 1996a) and a Dynamic Information Processing Model (Horowitz, 1986).

1. Biological Model

   This model conceptualises PTSD as a manifestation of the individual's inability to inhibit intrusive experiences of the trauma, accompanied by over-usage of avoidance in an attempt to escape from the experience. Intrusive

symptoms and avoidance behaviours together with panic attacks, increased arousal and depressive symptoms have been considered as highly specific and reliable indicators of PTSD (Van der Kolk, 1996a; McFarlane, 1988). McFarlane (1988) has argued that although intrusive thoughts are very sensitive indicators (89%) of PTSD, they have less sensitivity while the converse is true for the symptoms of re-experiencing and avoidance which have a 97% specificity, but diminished sensitivity.

2. Dynamic Information Processing Model

This model posits that serious life events result in changes to an individual's inner models. A fundamental concept is the tendency of an individual to integrate his inner models and reality, termed "Completion Tendency". In the face of trauma, the information from and the reactions to the traumatic experience are stored in active memory before completion (integration) has taken place, thus resulting in intrusive thoughts and re-experiencing.

2.2.6.2.1.3 Brief Psychotic Disorder

The DSM-IV (APA, 1994, p 302) indicates that a Brief Psychotic Disorder will manifest shortly after one or more events which in the singular or together would be "markedly stressful to almost anyone in similar circumstances in that person's culture". Duration varies from one day up to 30 days maximum.

2.2.6.2.1.4 Adjustment Disorders

Adjustment Disorders are associated with stressors varying in severity, such as life change events (job change, divorce) to extreme stressors (natural disasters). Symptomatic presentation includes relationship disturbances, impaired role functioning, and mood variations, and they are temporary. Onset is within three months of the events.

2.2.6.2.2 Emotional Equilibrium

Emotional equilibrium, that is, the measure of emotional states ranging from normal to clinical populations, has long been another measure of stress outcome. Measurement of emotion has its rationale in two principles, namely, the central position of emotion in the understanding of the effects of stress on somatic outcomes, and the importance of the construct of emotion as an outcome measure in its own right. Stone (1995) has defined emotion as referring to a broad class of phenomena which encompass four components: cognitive, behavioural, physiological and subjective feelings. He argued that emotions can be categorised on the basis of three factors: (a) positive or negative valence, (b) level of associated arousal, and (c) emotional states (such as depression, anxiety or anger).

Cohen et al. (1995) suggest that appraisal and coping are antecedents of emotional (affective) responses to stressors, which in turn precede physiological or behavioural responses. Similarly, Lazarus and Folkman (1984) suggest that mood (positive or

negative) as a feeling occurs as an immediate effect of a stressor, with morale and/or demoralization occurring as a long term effect. By implication, they suggest in their model of stress that without appraisal of a demand in addition to an inability to cope, subsequent affect will be absent and hence there would be no physiological or behavioural responses which could lead to negative outcomes. There is some support in the literature for this position (Cohen et al., 1995, Schlebusch 2000), in that research has shown a high correlation between emotional distress/dysphoric emotionality and depression, anxiety, dysfunctional attitudes, embarrassment as well as non-assertive behaviour.

2.2.6.2.3 General Well-being, Quality of Life and Life Satisfaction

Health has been defined (WHO, 1980) as a state of physical, mental and social well-being, and not just as an absence of disease of infirmity. Yet another outcome measure that has received considerable attention in the literature is a cognitive judgemental process variably termed general well-being, subjective well-being, quality of life, or life satisfaction. Researchers have suggested that:

- life satisfaction is determined by each individual according to individual criteria (Shin & Johnson, 1978);
- individuals with a high index of life satisfaction should have high levels of well-being (Blau, 1977);
- judgements of life satisfaction are more highly correlated with personal resources than is affect (Diener & Fujita, 1995);

- recent life events can influence subjective well-being, unlike life events occurring a long time ago (Suh, Diener & Fujita, 1995);

In the local context, a greater number of South Africans as compared to most other nationalities, rate themselves as below neutral in respect of life satisfaction, in respect of both males and females (Diener & Diener, 1995).

Criticisms of well-being /life satisfaction measures have included that:

- they are generally symptom scales and therefore define well-being as an absence of either a clinical diagnosis or problems (Thoits, 1995);
- there are cultural differences which influence how individuals will rate themselves on such measures (Diener & Diener, 1995);
- predictors of happiness vary both amongst individuals and between societies (Diener & Fujita, 1995);
- self-report well-being measures are incomplete (Sandvik et al., 1993).

Satisfaction with life (of subjective well-being) is usually measured by self-report questionnaires, and research (Sandvik, Diener & Selditz, 1993) has shown that the well-being (life satisfaction) construct is validly measured by such conventional self-report measures.

The Psychological General Well-Being Schedule (Bech, 1993), a multiple item self-report measure was used in this study.

2.2.6.3 COGNITIVE OUTCOME

Given the inextricable links between brain, body and mind, it is not surprising that alterations in any one of these three systems, intimately affect the other two. Likewise, emotions and perceptions (psychological functions) form part of the neural mechanisms for biological regulation , and thus maintenance of internal homeostasis.

The circuits of the brainstem and hypothalamus comprise the innate neural patterns necessary for internal homeostasis along with their interaction with the endocrine glands (the pituitary, thyroid, and adrenal glands) as well as via action on the immune system (Van der Kolk, 1996b). These structures working in concert maintain elemental functions such as regulating temperature, maintaining blood sugar levels and fighting off alien micro-organisms.

The regulation of the limbic system complements the biological regulation mediated by the hypothalamus and brainstem. The neocortex and limbic system partially control the production of hormones in the thyroid and adrenal glands, which are controlled by activity of the pituitary gland. Over and above the oral and genital functions of the limbic system, it also has been reported to be involved in parental care, play and audiovocal behaviour (MacLean, 1985). The neocortex (assisted by the septo-hippocampal system) being primarily orientated toward the external world, is involved in complex discriminatory functions/activities such as problem solving, learning, mediating the transcription of subjective states into communicable language, reasoning strategies, weighing action options, predicting action outcomes and deciding on relevance or irrelevance of sensory stimuli (van der Kolk, B, 1996b).

The stress literature (Schlebusch, 2000; Warren & Toll, 1993; Popovic, 1993; Vein et al., 1997; Carroll et al., 2000) has also indicated that various cognitive functions are affected by stress, including most commonly: attention, concentration, memory, as well as to a lesser extent problem solving. For example, Newcomer, Selke, Melson et al. (1999) in an experimental study evaluating the connections between stress, stress hormones and memory, demonstrated that healthy subjects treated with cortisone (which the body rapidly converts to cortisol), had difficulty in memorizing verbal material. However, there appears to be a dearth of literature, both internationally and nationally, of studies using neuropsychological measures to evaluate such complaints from individuals rather than self-report only. The present study therefore aims to address this lack by investigating specific neurocognitive functions in non-pathological stress using particular neuropsychological measures.

In contrast to the lack of neuropsychological investigation of non-pathological stress (as associated with non-pathological anxiety), the psychopathological stress and anxiety continuum has been examined with neurophysiological, neuropsychological and other measures, including Post-traumatic Stress Disorder (PTSD), Depression, Suicide and Anxiety.

2.2.6.3.1 Post-traumatic stress Disorder (PTSD)

Extreme (intense) stress reactions, of which PTSD is one, has received great attention in the stress (and trauma) literature. Van der Kolk has been one of the most prolific

researchers into the psychobiological aspects of PTSD, and his research has indicated that:

- imaging studies in PTSD have shown significant limbic system involvement including both decreased hippocampal volume along with excessive activation of the amygdale and related structures, abnormal lateratlizaton and decreased Broca's area activity with symptom provocation (Van der Kolk , 1996c);
- symptom provocation neuroimaging studies have shown a decrease in Broca's area (the area of the brain most centrally involved in the transformation of subjective experience into speech) with simultaneous significantly increased activation of the areas in the right hemisphere in areas most involved in emotional arousal (the paralimbic belt, parts of the limbic system most intimately associated with the amygdala and thought to process intense emotions and visual images) during provocation of traumatic memories. The amygdale itself was most active, accompanied by the insular cortex, the posterior orbito-frontal cortex, the anterior cingulated cortex, and the anterior temporal cortex. An accompanying heightened activity in the right visual cortex was noted. These findings lend support to clinical observation of the organisation of traumatic memories on a personal level without accompanying narrative about what happened as well as that actual changes in brain activity underlie these individual's difficulties in putting feelings into words (Van der Kolk , 1996b, 1996c);
- contemporary research has shown persistent and profound alterations in stress hormone secretion in PTSD (Van der Kolk, 1996b);
- when under stress, individuals secrete endogenous stress hormones that affect the strength of memory consolidation and flight-or-fight behaviours, in

particular the role of norepinephrine (NE) input to the amygdale which has been shown to determine how strongly a memory trace is laid down, with NE having an inverted-U shaped function in memory consolidation, and extreme levels (very low or very high) of NE interfering with memory storage (Van der Kolk, 1996c);

- these areas, called the "worry circuit" are central sites for the experience of anxiety (Van der Kolk, 1996c).

2.2.6.3.1 Depression, Suicide and Anxiety

The neurobiological approach to depression and suicide has focussed on two main areas: (a) hyper-reactivity of the stress system with the stress hormone cortisol having been shown to have cytotoxic effects on the serotonergic system and (b) impaired function of the serotonin neurotransmission system showing decreased binding of 5-HT2a (serotonin) receptors (in the prefrontal area). Several studies have indicated overactivity of the noradrenaline system with hyperactive stress response in suicidal individuals (Wasserman, 2001).

Neuroanatomical studies (e.g. *Audenaert et al*, 2002 in Van Heeringen, 2002) have indicated that the prefrontal cortex has been implicated in suicidality (as well as depression), and shown blunted activation of the prefrontal cortex. The results of perfusion SPECT studies in patients who attempted suicide who do not have Major Depressive Disorder versus Controls are reflected in Figure 4 below.

LEFT		RIGHT	
Prefrontal	AS<CO	**Prefrontal**	AS<CO
	AS=CO		AS<CO
• *Orbitofrontal*	AS<CO	• *Orbitofrontal*	AS<CO
• *Dorsolateral*	AS<CO	• *Dorsolateral*	AS<CO
Medial Temporal	AS<CO		
Thalamus	AS>CO		

Figure 4: SPECT results of patients who attempted suicide (AS) but do not have Major Depressive Disorder versus Controls (CO)

One study (*Audenaert et al*, 2002 in Van Heeringen, 2002)) comparing patients who had attempted suicide with healthy volunteers, found:

- Blunted prefrontal activation in AS patients – in category not letter fluency;
- Blunted prefrontal activation in both letter and category fluency compared to normals.

Assessment of neuropsychological functions in depressed suicide patients has shown the following: impaired attention (assessed on modified Stroop), impaired memory (working memory – AMT) and impaired fluency (assessed on a modified fluency task). The above have been found to be related to impaired strategic planning (Van Heeringen, 2002).

There is empirical evidence regarding the effects of depression and/or anxiety on neuropsychological performance in a number of ways and contexts. Various studies and clinical neuropsychology texts and articles (Lezak, 1995; Spreen & Strauss, 1998;

Kizilbach, Vanderploeg, & Curtiss, 2002) report on the effects of depression and/or anxiety (without suicide) on cognitive function have variably suggested the following:

- that depression effects short-term recall and visual and visiospatial functions, showing up as defective retrieval on free recall;
- that depression effects performance on the Stroop and Çancellation tests, and that periodically depressed person suffer from a chronic attentional deficit event between depressive episodes;
- that inter-episode chronic impairment on memory tasks as measured by the Wechsler Memory Scales (WMS) Immediate and Delayed Visual Memory, Delayed Logical Memory, Paired Associate Learning, and Block Design) has been hypothesized to indicate that problems in complex attention underlie apparent deficits memory deficits in chronically depressed persons between episodes;
- that even depressed patients who do not show global cognitive impairment on Mental State Examination perform worse on selected measures of attention, concentration, language and memory than controls;
- that depressed patients with primarily vegetative symptoms performed worse than controls on Wechsler Adult Intelligence Scale-Revised (WAIS-R) Full Scale and Performance IQ, Wechsler Memory Scales – Revised (WMS-R) Immediate Visual Reproduction, Rey Complex Figure (RCF) recall, Facial Recognition and Wisconsin Card Sort both categories and perseverations;
- that depression without anxiety had an adverse effect on immediate recall of new information (T1), on the total amount of acquisition (sum T1-T5) while retrieval and retention were unaffected. The significance of the effect is

around 0.5SD. Other studies have found an effect size (on California Verbal Learning Test) of 0.5-1SD for depression alone; that **depression, somatic preoccupation and anxiety** can effect mental efficiency by either compromising intact cognitive functions or worsening organic based dysfunction;

- Co-morbid depression and anxiety had an adverse effect on immediate recall, amount recalled, and on retrieval of newly learned information. The effect size is 0.5 SD;
- That the weight of evidence suggests that caution is needed in interpreting the Rey Auditory Verbal Learning Test performance in patients with both a past history or clinical suspicion of depression, PTSD and anxiety.

2.2.6.4 SOCIAL OUTCOME

It is not only the biological and psychological functioning of the individual upon which stress impacts; social and interpersonal functioning is also affected when a person has stress. Various researchers (Sutherland & Cooper, 1990) have proposed that the social outcome of stress should be considered a multi-dimensional concept incorporating various spheres, including family, work, interpersonal relations, as well as the socio-cultural or support groups and organizations of the individual.

Problems in social outcome arise from the impact of stressors on both the number and quality of available resources. Research has found that:

- Dependency increased by chronic illness (Thoits, 1995);

- Changes in role interaction between both spouses and family members/systems occurs in chronic illness (Thoits, 1995);
- Such increased dependency or altered relational dynamics can result in isolation and avoidance of further social support, with resultant further negative effects or outcomes (Thoits, 1995); including loneliness (Jones et al., 1990);
- Loneliness has been strongly associated with depression, anxiety, substance abuse, vulnerability to health problems and suicide (Jones et al., 1990).

Two views have been put forward on how social support operates to improve health, namely: The first view holds that support acts as a *buffer* which protects the individual from the harmful effects of stress or stressful situations. (Cohen & Mckay, 1984; Dawes, 1990). It is proposed that support may intervene between the stressful event (or expectation of it) and the stress experience in two ways: (a) by reducing or preventing a stress response, or (b) by influencing responsible illness behaviours or physiological processes via the elimination of the stress experience (Cohen & Syme, 1985). The second view, the *direct effect* hypothesis, holds that support enhances health and wellbeing regardless of the level of stress. It is argued that an individual's perception that others are willing to help could result in (a) increased overall positive feelings, and (b) enhanced self-esteem, stability and control over one's environment. These in turn indirectly strengthen the immune system via their influence on susceptibility to illness (Zimet et al., 1988).

Although both these views may have validity, it must be noted that there is still debate in the stress research literature as to where social support is a mediator (buffer) in respect of stress, or whether it should be considered as an outcome of stress. Thoits (1995) has argued that there is some evidence that social support should be considered as both of these, that is, as both a buffer and as an outcome variable, and that social support acts in both a circuitous and dialectical fashion.

2.3 SUMMARY AND CONCLUDING REMARKS

Various perspectives on stress, coping behaviour and health outcome have been discussed in this chapter to provide a meta-perspective of stress, since an overview of the various perspectives in the literature would seem to indicate that the complexity of stress can be explained only at an interdisciplinary and multidisciplinary level. Hence an examination of models from the stress and coping literature, the biopsychosocial/transactional perspective (including the disparity model), and the psychophysiological perspective have been included.

A perusal of the multi- and interdisciplinary as well as psychological stress literature suggests that virtually all stress investigators, while not agreeing in detail, appear to:

1. accept a relational, interactional, or transactional view of stress;
2. describe stress is a process (in contrast to a state of outcome);
3. to acknowledge the multilevel, multitemporal nature of stress;
4. to recognise that need for multidisciplinary and interdisciplinary approaches to the study of stress; and

5. to recognise a three system function, namely biological (psychophysiological), psychological and social (Appley & Trumbull, 1986).

The present study aims to make use of these insights into the multivariate nature of stress to study the concept of stress, coping behaviour (that is, the effect of micronutrient supplementation) and health outcomes in a sample of English-speaking South Africans.

2.4 STATEMENT OF THE PROBLEM

In South Africa, there is an absence of systematic research on stress in the general population. There is also a dearth of literature on the effects of micronutrients on stress, both internationally and locally.

The present study therefore attempts to address this issue. A multifactorial research design was developed, with the purpose of (a) evaluating the sources of stress, (b) the biopsychosocial and select cognitive (neuropsychological) sequelae of stress, and (c) the effects of certain personal, environmental and biological variables (including a multivitamin-mineral combination treatment) on the psychological pathway of stress (on outcome), in a large sample of South Africans with pre-determined high (negative) stress levels.

2.5 CONCEPTUAL MODEL

A unified model of stress and coping was developed, based on Engels' (1980) biopsychosocial model, on Lazarus and Folkman's (1984) Transactional stress and coping Model, and on Trumbull and Appley's (1986) Disparity Model as well as various psychophysiological perspectives (cf Section 2.3) .

This unified model of stress, coping and outcome has been diagrammatised and is presented in Figure 5. A review of the multidisciplinary literature indicated that an integrated, unified perspective of stress should necessarily acknowledge the following:

1. that stress begins with what an individual brings to the situation (biological, psychological and social variables operative at stressor onset or exposure) rather than with the demand characteristics of the situation alone. Appley and Trumbull (1986) use the term predispositions to refer to this aspect, which they define as "the state or degree of susceptibility (to a potential stressor) that exists in the individual at any given time as a function of prior determinants" (p 311);

2. in this context, the individual's reactions to single or sequential stress situations are seen as determined by a complex matrix of factors that interact both with each other and with environmental events. These factors include:

   a) *Predispositions:*

   - *physiological (biological) predispositions* which derive from the

genetic, prenatal, developmental and nutritional history of the individual, acquired deficiencies of a temporary or permanent nature, such as vitamin deficiency, illness, or injury, as well as inherent strengths and weaknesses, etc.;

- *psychological predispositions* which can be found in motivational propensities, personality patterns, response styles, intelligence, past success or failure from previous stress exposure etc.; and
- *sociocultural predispositions* which include social support (nature and strength), values and norms, and various demographic factors (e.g. social class) etc.

Predisposing factors, although present over time, may only become operative when there is discrepancy between demand characteristic and capacity (such as excessive demand in the face of normal coping capacity, or conversely lowered coping capacity in the face of normal demand), or if there is a trigger such as congruence between a precipitating stressor and the source of a predisposed, stress-related response.

b) *Situational Factors*:

- *Situational context* which is defined not only by real time and place, but also by the location of the event in the individual's life in respect of personal individual socio-cultural and developmental history, social situation, etc. This is also true for the biological environment of the individual.

c) *Feedback:*

- The psychological, physiological and social systems are maintained and activated by feedback;
- Feedback refers not only to psychological (e.g. personal control, optimism, etc.) or social interactive feedback (such as for example where low self-esteem results in loss of social support, which may produce or reduce stress), but also in physiological processes (e.g. vitamin/micronutrient status, effect of control on endocrinological processes etc);
- Feedback is also an important element of the coping process, since the results of coping behaviours may not always be favourable in respect of reducing stress;
- Continual feedback in each of the three systems, and the interactions between them, may impact within and across systems, resulting in either conflict or mutual reinforcement, or to a reduction or exacerbation of stress.

d) Timing:

- Timing places a multifarious role in the development, maintenance and amelioration of stress;
- Duration of stress (acute, chronic or cumulative), as well as timing in respect of vulnerability at or over time is important in determining level of stressful of any situation;

- Recovery time (for both psychological and biological levels) plays an important role.

e) Appraisal

- Cognitive appraisal has been found to be a vital process in stress (transactional models);
- The issue of faulty appraisal (either of the stressfulness of the situation) in either direction (stressful or not stressful) and/or of coping capacity (adequate or inadequate) should also be taken cognisance of , not only in respect of situational stressors, but also in respect of potential biological stressors/vulnerabilities (e.g. nutritional status, sleep requirements etc). Furthermore, an individual may appraise himself as having the capacity to cope with a particular stressor, without taking into the account the potential deleterious effects of such coping (either in respect of strategy or other concomitant effects of such a strategy such as using up limited resources, becoming fatigued and reducing coping capacity etc.);
- Furthermore, stress can also arise in the absence of conscious evaluation (such as when biological needs for activity, optimal stimulus level, recovery etc are not satisfied) or with biochemical or nutritional deficiencies for example.

f) Mediating Factors:

- Pre-existing personal dispositions and their interaction with social conditions may mediate vulnerability (susceptibility) to stress;

- Several factors have consistently emerged as having protective (buffering) roles in the stress process, including social support, good health (including vitamin/mineral status), personal control, and optimism.

g) Coping

- Analysis of what factors are associated with "successful copers" suggests that various coping strategies (e.g. emotion-focussed and problem-focussed) as well as coping resources (both personal and environmental) play a significant role in stress outcome;
- More recently, the role of non-psychological coping mechanisms (e.g. vitamin and mineral status) on stress outcome has become an area of interest. Particular reference has been made to the role of vitamin/micronutrient deficiency/supplementation in stress.

The above meta-perspective on stress conceptualises stress as a dynamic process in which patterns of responses, and hence the degree of stressfulness of any situation, are determined by the interaction between predisposing (biological, social and psychological), situational and demand characteristics, and ultimately determine the effects on physical(somatic) health, psychological well-being and social functioning.

The model emphasises the bi-directionality, circularity and interactive pathways of the biological, psychological and social systems both in the precipitation, maintenance or reduction/amelioration of stress, and in the production of stress outcome including physical health and psychophysiological processes (endocrinological and

immunological), psychological well being and social functioning. Such a model requires a multidimensional, multifactorial assessment of various constructs within a personal (biospychosocial)-environment relationship.

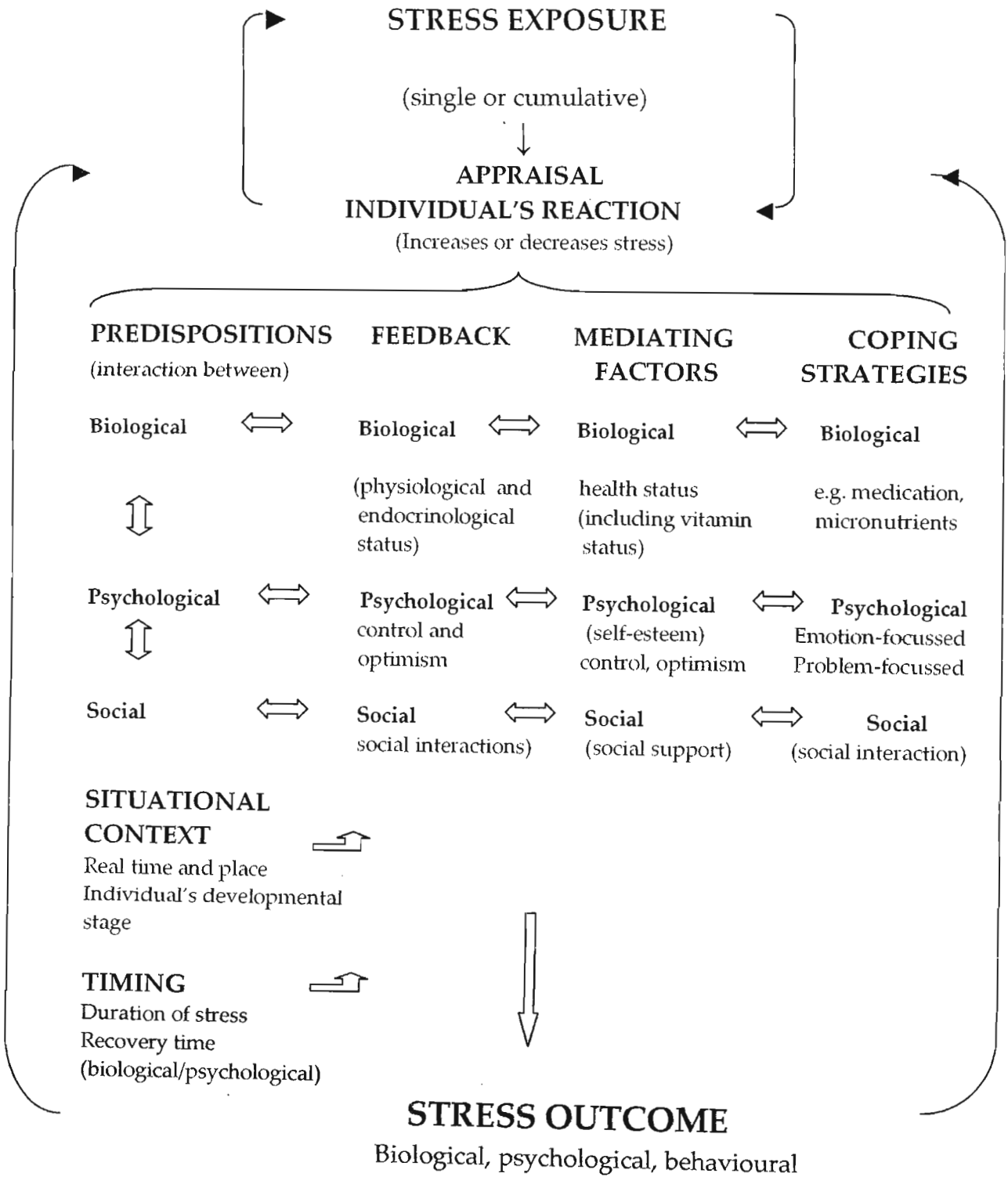

Figure 5: **Interactive, bidirectional, transactional model of stress**

2.6 RESEARCH QUESTIONS

RESEARCH QUESTION 1

WHAT ARE THE PERCEIVED SOURCES OF STRESS FOR SOUTH AFRICANS?

1.1 What recent life events do South Africans report as significantly occurring?

1.2 What daily hassles are reported as significant for South Africans?

1.3 What do South Africans report as the most stressful areas on self-report (open-ended questions)?

RESEARCH QUESTION 2

WHAT DOES THE PROFILE OF STRESS LOOK LIKE IN THE SAMPLE OF SOUTH AFRICANS STUDIED?

2.1 How does the sample present in respect of levels of stress, symptoms of stress, perceptions of their level of stress, anxiety and psychological well-being?

2.2 What subjective cognitive complaints do the sample report as occurring for them?

2.3 How do the sample score on neuropsychological parameters (test functioning)?

2.4 Is there a relationship between perceived stressors and outcome variables?

2.5 Is there a relationship between daily hassles and outcome variables?

2.6 Is there a relationship between the moderating variables and the outcome variables in the total sample?

2.7 What is the relationship of the environmental variable (daily uplifts) to outcome variables?

2.8 What are the relationships between the moderating variables?

2.9 What are the relationships between the outcome variables?

RESEACH QUESTION 3

IS THERE A DIFFERENCE IN THE TWO GROUPS WITH REGARDS TO DEMOGRAPHIC DATA AT BASELINE?

3.1 Is there a difference between the two groups at baseline with regards to sample size?

3.2 Is there a difference in demographic variables between the two groups at baseline?

RESEARCH QUESTION 4

IS THERE A DIFFERENCE IN PERCEIVED SOURCES OF STRESS (STRESSORS) BETWEEN THE TWO GROUPS (ACTIVE AND PLACEBO) AT BASELINE?

4.1 Is there a difference in recent life events (RLE) between the two groups at baseline?

4.2 Is there a difference between the two groups in sources of stress on (free) self-report at baseline?

4.3 Is there a difference in everyday environmental stressors (daily hassles) between the two groups at baseline?

4.4 Is there a difference in frequency of stress impact on functioning between the two groups at baseline?

RESEARCH QUESTION 5

IS THERE A DIFFERENCE IN MODERATING VARIABLES BETWEEN THE TWO GROUPS (ACTIVE AND PLACEBO) AT BASELINE?

5.1 Is there a difference between the two groups with regards to personal resources at baseline?

5.1.1 Is there a difference between the two groups with regard to environmental/situational variables at baseline?

RESEARCH QUESTION 6

IS THERE A DIFFERENCE IN OUTCOME VARIABLES BETWEEN THE TWO GROUPS (ACTIVE AND PLACEBO) AT BASELINE?

6.1 Is there a difference in level of stress as measured by the Stress Symptom Checklist (SSCL) between the two groups at baseline?

6.2 Is there a difference in subjective cognitive symptoms between the two groups at baseline?

6.3 Is there a difference between groups at baseline in perception of level of stress as measured by the visual analogue (VA)?

6.4 Is there a difference between the two groups with regards to level of anxiety as measured by the Hamilton Anxiety Scale (HARS) at baseline?

6.5 Is there a difference in psychological general well-being (PGWB) between the two groups at baseline?

6.6 Is there a difference between groups in performance on select memory functions (neuropsychological test data) at baseline?

RESEARCH QUESTION 7

WHAT EFFECT DOES MICRONUTRIENT (MULTIVITAMIN AND MINERAL COMBINATION) SUPPLEMENTATION HAVE ON ALL THE VARIABLES MEASURED (WHERE RELEVANT) FOR THE TWO GROUPS?

7.1 What is the effect of micronutrient supplementation on perception of everyday environmental stressors for the two groups (active and placebo)?

7.2 What is the effect of micronutrient supplementation on environmental moderating variables, that is, perception of everyday environmental uplifts (daily uplifts) the two groups (active and placebo)?

7.3 What is the effect of micronutrient supplementation on personal resources (moderating variables) for the two groups (active and placebo)?

7.4 What is the effect of micronutrient supplementation on health outcomes as measured by reported stress symptoms, perception of level of stress, anxiety, psychological general well-being and neurocognitive function for the two groups?

RESEARCH QUESTION 8

WHICH DELTAS OF STRESSOR AND MODERATING VARIABLES PREDICT THE DELTA OF OUTCOME VARIABLES IN THE TWO GROUPS?

RESEARCH QUESTION 9

WHAT STRESSOR AND MODERATING VARIABLES PREDICT THE DELTA (DEGREE OF PRE-POST DIFFERENCE) IN OUTCOME VARIABLES IN THE TOTAL SAMPLE?

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

The basis for the study was derived from the literature review and the stated objectives. Given that any investigation of stress is complex, a multifactorial research design was developed to take into account these complexities of examining the stress response and the effects of micronutrients (a multivitamin mineral combination) on stress in a sample of South Africans. To this end, the overall design consisted of a multiple dose, double-blind, placebo-controlled, double centre study, and included a pre- post-treatment psychological assessment and both experimental and naturalistic methods. This study comprises a comprehensive extension of a preliminary clinical trial (Schlebusch et al, 2000).

The research sample consisted of two groups of South Africans, from two centres, with predetermined levels of stress. Micronutrients (vitamin and mineral combination) were provided as treatment, to one group of patients (N=150). The comparator chosen as the control was a placebo, provided to the control group of patients (N=150). Each patient was randomly allocated with equal probability to one of the two groups in each of the two centres where the research was conducted.

Based on the literature review, research participants were hypothesized as having stressors which, mediated by personal and/or environmental variables determined their outcome. The introduction of a biological variable (micronutrient supplementation) was hypothesized to improve outcome. Various standardized questionnaires and psychological measures were gathered and formed the psychometric battery that operationalized the research model developed. In this way the research design implemented took into account the multifactorial nature the stress (and coping) process in a sample of South Africans in the general public. Furthermore, this study incorporated the validation of one of the measures, the Stress Symptom Checklist (Schlebusch, 1997).

3.2 NUMBER OF CENTRES AND SAMPLE SIZE

3.2.1 CENTRES

This was a double centred study. Two centres, the Durban Metropolitan Area (in the province of KwaZulu Natal, South Africa) and Johannesburg Metropolitan Area (in the province of Gauteng, South Africa) were used, because of the reported high stress levels in these areas (as explicated by Schlebusch et al, 2000).

3.2.2 SAMPLE SIZE

Each centre included at least N =150 patients, 75 of which were in the Micronutient and Placebo groups respectively. A total study population of N=300 was required,

and to arrive at the desired sample size of N=300, at least 1000 patients were initially screened from adult volunteers.

3.3 PATIENT SELECTION FOR STUDY ENTRY

3.3.1 POPULATION BASE

Adult patients were selected from various occupations/professions. The composition of the final sample was dictated by the fact that the study involved a random selection of adult volunteers who had to be English-literate. This was done in accordance with advice from the biostatistician.

3.3.2 INCLUSION CRITERIA

a) Since the study materials were provided in English, patients who volunteered had to be English-literate, able to understand the study and give written informed consent on the appropriate form, prior to being included in the study.

b) Patients had to be willing to comply with the study conditions (e.g. filling in the patient diary in a proper way, etc.).

c) The sample group was mixed, including both male and female patients from all ethnic groups. The age stratification was from 18 to 65 years.

d) Patients with pre-determined stress threshold scores as measured by a ***Stress Symptom Checklist*** (incorporating a *VAS* and the relevant stress-related symptom index of the ***Diagnostic and Statistical Manual of Mental Disorders - DSM IV*** (APA, 1994) were included.

3.3.3 EXCLUSION CRITERIA

a) Patients who failed to meet any of the inclusion criteria.

b) Patients who had participated in a clinical trial within 30 days of entering this study or who were currently enrolled in another trial or who were previously enrolled in this trial.

c) Patients who had concurrent or recent history of severe disease (including psychological/psychiatric disorders) which in the *investigators'* judgement were incompatible with the protocol or might have negatively impacted on it.

d) Females who were pregnant or who were breast feeding, or those within one month after post-partum.

e) The following treatments were forbidden at inclusion and during the course of the study: current treatment with psychotropic medication or other vitamin or mineral supplements (patients had to be prepared to discontinue other supplements for the duration of the study).

f) Trainees in stress management.

g) Patients who acquired an acute illness within seven days of entry into the study.

h) Patients who had surgery within seven days of entry into the study.

i) Patients outside the range of 18 to 65 years.

3.4 METHOD OF DATA COLLECTION AND INTERVIEWING PROCEDURES

The period of data collection was 12 months, and involved the completion of a psychometric battery compiled by the author, as well as the micronutrient intervention (vitamin and mineral combination) taken daily for one month. The research assistants were recruited by the author, and trained in interviewing and research methods by the author prior to commencement of the research project.

The investigation consisted of ***three phases*** and ***four visits*** conducted over ± ***one year***.

3.4.1 PHASE 1: PATIENT SCREENING

This phase included the ***first*** visit. Patients were evaluated for entry criteria during a pre-test screening using a ***Stress Symptom Checklist*** (incorporating a ***VAS*** and the relevant stress-related symptom index of the ***Diagnostic and Statistical Manual of Mental Disorders - DSM IV*** (APA, 1994) and the other inclusion criteria (cf 3.2). Approximately 1000 patients were initially screened at various business premises during pre-screening, from whom the study population of N=300 was identified for entry into the study. When found eligible for the study, they were given a randomized patient number on the first day.

The following procedures were completed for each patient prior to commencement of the study.

a) Informed consent which was obtained before any procedures were carried out.

b) Stress performance scores.

A screening log was kept by the *investigator*, in which the eligibility status of every patient screened was recorded, regardless of whether or not they entered the study and took the study medication. To maintain confidentiality, patients were identified only by their initials and date of birth. This screening log was kept for the duration of study.

3.4.2 PHASE 2: PSYCHOLOGICAL ASSESSMENTS

This phase included ***two*** visits (i.e. visits ***two*** and ***three***). During visit ***two*** all potential patients (N=300) included in the study were informed about the aims and procedures of the trial, and an informed consent was signed. Inclusion/exclusion criteria were checked.

Patients included were then subjected to an individual in-depth psychological assessment. The assessment included:

a) The administration of a semi-structured biographical questionnaire.

b) The Hamilton Anxiety Rating Scale (Bech, 1993; McDowell & Newell, 1996).

c) The Psychological General Well-Being Schedule (Bech, 1993; McDowell & Newell, 1996).

d) Visual Analogue Scales (Bech, 1993; McDowell & Newell, 1996).

e) Stress Symptom Checklist (Schlebusch, 1997).

f) A neuropsychological battery including the Rey Complex Figure, the Rey Auditory Verbal Learning Test and Story Recall (Wood, 1997).

h) The Life Orientation Test – Revised Version (Scheier, Carver & Bridges, 1994).

i) The Perceived Coping Incapacity Test (Hinton, 1991).

j) The Combined Hassles and Uplifts Scale (Lazarus & Folkman, 1989).

k) Recent Life Changes Questionnaire (Rahe, 1977).

l) Collateral information was obtained from interviews with close relatives where necessary, and which was used to supplement data for the assessments.

m) The sources of stress were additionally explored by using an open-ended questionnaire.

The psychological screening instruments were chosen because they were considered to be appropriate for measuring the various components of the stress response as discussed under 2.2.5, because they are well-known in health measurement research, because there is considerable evidence of their reliability and validity, and because they were thought to be suitable for discriminating most validly between pre- and post-treatment assessments (Bech 1993; McDowell & Newell, 1996).

Patients who met all inclusion criteria were then randomised. They were attributed a trial number in increasing order, corresponding to a randomly assigned study medication. Patients were instructed to take one tablet daily, dissolved in a glass of water (as per package insert). They were provided with the study medication and a patient's diary with an explanation on how to use the diary.

During visit ***three*** (one week after commencement of the patients' intake of the study medication) the following events/examinations were performed:

a) Diary progress was checked.

b) Patients were asked to report whether there were any adverse health events. These were recorded.

c) Patients were requested to complete a ***Visual Analogue Scale*** in order to measure any early changes in stress levels.

If patients decided to prematurely withdraw from the study, additional visits were accommodated to replace them in the study.

3.4.3 PHASE 3: PSYCHOLOGICAL RE-ASSESSMENTS

This consisted of the ***final*** visit (visit ***four***) which took place at the latest seven days after the last planned study medication intake. The patient diary was returned and reviewed with the patient. Any adverse events or concomitant medication change were recorded.

Procedures b) to i) under Phase Two (i.e. the psychological assessments) were then repeated at this juncture for purposes of pre- and post-psychological response comparison.

All study medication was returned and the accountability form (in respect of study medication dispensed and returned) completed. The study medication safety was evaluated by ongoing recording of adverse events.

3.5. STUDY PROCEDURES

3.5.1 TREATMENT

One effervescent micronutrient (vitamin and mineral combination) tablet/placebo.

3.5.1.1 TREATMENT PLAN

One tablet daily for one month, oral route.

3.5.1.1.1 Dosage Regimen and Rationale for Selection

Study medication was provided in standard pre-filled, single-use containers and was self-administered by daily oral intake. Each dose was separated by at least one day as per recommendation on the package insert. Patients were instructed by the responsible *investigator* on the correct usage technique.

3.5.1.1.2 Route of Administration and Duration

The route of administration was oral. For each patient the study continued for a total of thirty days (one month).

3.5.1.1.3 Dispensing and Accountability of Trial Medication Supplies

The study medication was dispensed under the supervision of a medically qualified person. Only patients who met all the protocol criteria for entry into this study, including the written informed consent on the appropriate form, were given a trial medication set.

A pre-printed medication dispensing log was kept current and identified the patient by initials and trial number, and the amount of medication dispensed to and returned by each patient at each visit, with the corresponding dates.

All study medication supplies (empty containers, as well as partly used and unused medication) were available for inspection, at every visit of the on site monitor in charge of the centre. ***All Study Medication Supplies (Unused, Partly Used And Empty Containers) Were Returned by the subjects to the investigator At The End Of The Trial.***

3.5.1.2 ASSIGNMENT TO TREATMENT GROUPS

A blocked randomization was generated prior to the start of the study. Study medication was packaged in sealed containers which were identified by a number. After inclusion in the study, patients were attributed a trial medication number, with numbers being assigned in increasing order, and they were identified by this number.

The *investigator* had a sealed coded envelope for each patient in the trial, for use in emergencies. Each envelope contained the identification of a patient's treatment. The coded envelopes WERE ONLY TO BE OPENED IN THE CASE OF AN EMERGENCY (SUCH AS AN IMMEDIATELY REPORTABLE ADVERSE EVENT) THAT REQUIRED KNOWLEDGE OF THE IDENTITY OF THE TRIAL MEDICATION IN ORDER TO MANAGE THE PATIENT'S CONDITION. If opened, the time, date and reason for opening the coded envelope were written on the envelope and signed by the *investigator*.

At the end of the study, ***all*** envelopes (opened and unopened) were returned, along with the completed case report forms. The envelopes were then checked to ensure that the seals were either unbroken, or that breakages were adequately accounted for.

3.5.1.3 ASSESSMENT OF COMPLIANCE

In order to ensure that the patients had complied adequately with their medication regime, at each visit to a patient, the returned medication was checked and counted by the *investigator*, and the returned amount recorded in the medication dispensing log. If the records showed that the patient was taking less than one tablet a day, then the patient was warned about his/her compliance. If the patient was taking less than the prescribed weekly dose, then the patient was re-assessed and if necessary was withdrawn from the trial.

3.5.1.4 CONCOMITANT TREATMENT

Any medications which a patient was using at the time of study entry was reported at the initial visit on the medication history form. Any modification of these medications during the trial were also reported. During the course of the study, the use of any other medication or stress management techniques specifically designed for stress which in the opinion of the *investigator* might interfere with the performance or interpretation of the study end points evaluations specified in this protocol were prohibited, unless the patient elected to withdraw from the study. The data of the patients who violated these medication exclusions were excluded from efficacy analysis.

3.5.2 ASSESSMENT OF EFFICACY

3.5.2.1 PRIMARY EFFICACY PARAMETER

The effect of micronutrient (vitamin and mineral combination) supplementation on the patients' stress levels.

3.5.2.2 SECONDARY EFFICACY PARAMETER

The effect on (a) quality of life and psychological well-being; (b) reduction of stress/anxiety-related symptoms, including symptoms of tension, fear, insomnia, cognitive fall-out, fatigue (poor concentration/memory), somatic complaints and depression; and (c) improved social and occupational functioning, including increased productivity.

3.5.2.3 EVALUATIONS AND TIMES OF EVALUATIONS

a) Baseline evaluations:

Phase 1

This phase included the ***first*** visit. During ***visit one*** a ***Stress Symptom Checklist*** (incorporating a ***VAS*** and the relevant stress-related symptom index of the ***Diagnostic and Statistical Manual of Mental Disorders - DSM IV*** (APA, 1994) was used to screen for patients suffering from stress who were willing to take part in the trial. This was the initial screening procedure to identify patients with sufficiently high stress levels for inclusion in the study.

To arrive at the desired sample size of N=300, at least 1000 patients were initially screened.

b) ***At each visit:***

Phase 2

This phase included ***two visits*** (i.e. visits ***two*** and ***three***). During visit two all potential patients included in the study (N=300) were informed about the aims and procedures of the trial, and an informed consent was signed. Inclusion/exclusion criteria were checked. Patients were then subjected to an individual in-depth psychological assessment. During ***visit three*** (one week after commencement of the patients' intake of the study medication) the following events/examinations were performed:

- Diary progress was checked.
- Patients were asked to report whether there were any adverse health events.
- Patients were requested to complete a ***Visual Analogue Scale*** in order to measure any early changes in stress levels.
- If patients decided to prematurely withdraw, additional visits were implemented to replace them in the study.

c) ***At final visit:***

Phase 3

This consisted of the ***final*** visit (***visit four***) which took place at the latest seven days after the last planned study medication intake. The diary was returned

and reviewed with the patient. Any adverse events or concomitant medication change were recorded. Procedures b) to f) under **Phase 2** (i.e. the psychological assessment) were repeated at this juncture for purposes of pre- and post-psychological response comparison. All study medication was returned and the accountability form completed.

Study medication safety was evaluated by ongoing recording of adverse events if present.

3.5.3 ASSESSMENT OF SAFETY

3.5.3.1 SAFETY PARAMETERS

Allergy to one or more of the ingredients or in the presence of hypercalcaemia, urinary calculi, or renal failure.

3.5.3.2 ADVERSE EVENTS

All adverse events (Appendix: Annexure A) encountered during the clinical trial were reported in the case report form. Although none were anticipated, there were minor events which did occur. These are reported in Table 2, section 4.1.2.

3.6 PREMATURE WITHDRAWAL

Results of this are reported under 4.1.2.

3.6.1 CONDITIONS FOR WITHDRAWAL

The withdrawal, or premature discontinuation of treatment, of the patient from the trial may have been due to any reason, including:

1. Failure of the patient to attend the specified number of scheduled visits.
2. Failure of, or lack of efficacy of treatment.
3. Adverse events (including inter-current illnesses).
4. Violations of, and deviations from the protocol.
5. Patient withdraws consent.
6. Patient lost to follow-up.
7. Administrative/other difficulties.

Patients may have withdrawn from the trial at any time and for any reason, without affecting their right to treatment by the *investigator*. The *investigator* had the right to withdraw a patient for any reason which was in the best interests of the patient, including inter-current illness, adverse events, or treatment failure, protocol violation, administrative, or any other valid and ethical reason.

Although withdrawals were avoided if at all possible, it was understood that withdrawals may occur during a trial. Whenever a patient was withdrawn from the trial, FOR WHATEVER REASON, a final trial evaluation was completed for that patient, stating the reason for withdrawal. All documentation concerning the patient was as complete as possible. Withdrawals due to non-attendance were followed up by the *investigator* to obtain the reason for non-attendance. WITHDRAWALS DUE TO INTER-CURRENT ILLNESS OR ADVERSE EVENTS WERE FULLY DOCUMENTED IN THE

CASE RECORD FORM, WITH SUPPLEMENTARY INFORMATION WHERE AVAILABLE AND/OR APPROPRIATE.

3.6.2 REPLACEMENT POLICY

The results of patient replacements (drop-outs) are reported section 4.1.2.

3.6.2.1 FOR PATIENTS

A patient was replaced after the reasons were well documented. The patient was replaced by randomly drawing a substitute from the original high scoring group of patients selected following the initial screening for stress.

3.7 ETHICS

3.7.1 DECLARATION OF HELSINKI AND GOOD CLINICAL PRACTICE

The *investigator* ensured that this trial was conducted in full conformity with the principles of the *Declaration of Helsinki* (as amended in Tokyo, Venice and Hong Kong), in accordance with Good Clinical Practices, and with all local laws and regulations concerning clinical trials.

3.7.2 INFORMED CONSENT

The *investigator* obtained written informed consent from each patient participating in the trial, after explanation of the aims, methods, benefits and potential hazards of the trial. This consent was obtained BEFORE any trial-specific procedures were performed on the patient. For those patients who were unable, for whatever reason, to give legal consent, consent was obtained from the legal parent, guardian or custodian (including legal authorities).

It was made completely and unambiguously clear to each patient that they were free to refuse to participate in the trial, or withdraw their consent at any time and for any reason, without incurring any penalty or withholding of treatment on the part of the *investigator*.

Signed informed consent forms were kept on file by the *investigator*, and documented in the case report form and the patient's medical records.

3.7.3 ETHICS COMMITTEE APPROVAL

Ethics Committee approval from the Ethics Committee, Nelson R. Mandela School of Medicine, University of KwaZulu-Natal, Durban, to conduct the trial was acquired in writing BEFORE the study was started.

3.7.4 CONFIDENTIALITY AND DATA PROTECTION

The *investigator* ensured that the patients' anonymity was maintained. On all documents (including case report forms) patients were ONLY identified by an identification code - not by their names or any other number or procedure. The *investigator* kept a separate confidential enrollment log which matched identifying codes with the patients' names and addresses, maintained by the *investigator* in strict confidence.

3.8 ADMINISTRATIVE PRACTICALITIES

3.8.1 MONITORING AND INVESTIGATING RESPONSIBILITIES

A monitor was appointed who had the responsibility of reviewing the ongoing trial with the *investigator*, to verify adherence to the protocol and to deal with any problems if and when they were to arise. At all times, confidentiality of trial documents was maintained.

3.8.2 INVESTIGATORS' RESPONSIBILITIES

The *investigator* conducted the trial in accordance with the procedures and requirements laid out in this protocol, in particular in accordance with Good Clinical Practice and strict ethical principles (see section 3.7 of this protocol).

In the event of an expected or unexpected serious adverse event (IRAE) they were reported within one working day, whether or not they were considered related to the treatment.

In addition to the case report form, the *investigator* maintained adequate records that fully documented the progress of the trial. ALL DOCUMENTATION AND MATERIAL FOR THIS STUDY (CASE REPORT FORMS, PROTOCOL, ETC.) WERE RETAINED IN A SECURE PLACE AND TREATED AS CONFIDENTIAL MATERIAL.

3.9 PATIENT ANALYSIS POPULATIONS

All cases were checked for accuracy, completeness and compliance with the protocol. Demographic variables and baseline values of clinical parameters were analyzed to assess the degree to which randomization achieved comparability among the treatment groups. To ensure the accuracy and reliability of data the following steps were to be taken:

1. The selection of trained research assistants and appropriate study centres.
2. Review of protocol procedures with the research assistants prior to the commencement of the study.
3. Provision of instruction for completion of case report forms will be provided and reviewed prior to the start of the study.
4. Case report forms were reviewed for accuracy and completeness during on-site monitoring visits and after their return, and any discrepancies were resolved with the research assistants.

5. All data was entered into a data base and verified.

6. Appropriate computer edit programmes were run to verify the accuracy of the data base.

7. Periodic monitoring visits/meetings by the investigator and monitor.

3.9.1 EFFICACY VARIABLES

All the validity judgements regarding data and the transformation of data were made. Then the database was locked. Finally, and only after, the code was broken.

3.9.1.1 VALIDITY JUDGEMENTS

Patients were considered invalid for the primary efficacy analysis if the following protocol violations occurred:

a) They do not meet inclusion criteria as discussed 3.3.2.

b) They meet with exclusion criteria as discussed under 3.3.3.

3.9.1.2 TRANSFORMATION OF DATA

Where non-compliance occurs data will be stored for reference, but in all cases where non-compliers are replaced, new data will be required.

3.9.2 SAFETY VARIABLES

All the patients who had taken the trial medication at least once will be included in the safety analysis.

All adverse events reported were listed, documenting course, outcome, severity, and possible relationship to study medication. Comparisons among treatment groups were made by tabulating the frequency of patients with one or more adverse events during the trial. Likelihood ration chi-square tests were used to compare the frequency of patients reporting adverse events among treatment groups. These results are reported under section 4.1.3.

3.10 DESCRIPTION OF THE PSYCHOMETRIC BATTERY

3.10.1 INTRODUCTION

The psychometric battery included in the study assessed 4 major categories of data, including: demographics, stressors, coping resources, and outcome variables. Previous research on outcome in stress has been criticized for using a single outcome measure (Cohen & Wills, 1985). For this reason, the present study included various outcome measures encompassing the interaction between physical, emotional, cognitive and behavioural factors.

The final range of variables selected for inclusion in the psychometric battery included the following:

1. STRESSOR VARIABLES

   Sources of Stress

   Recent Life Change Events

   Daily Hassles

2. COPING MECHANISMS

A. COPING RESOURCES

1. PERSONAL VARIABLES

Optimism

Personal Control Attributions

2. ENVIRONMENTAL VARIABLES

Daily Uplifts

B. COPING STRATEGY

1. Vitamin and Mineral combination

3. OUTCOME / RESPONSE VARIABLES

A. Stress-Specific

Psychological

Behavioural

Physical

B. Emotional Equilibrium (Psychological Distress)

Psychological general well-being

Anxiety

C. Cognitive

Memory and learning

3.10.2 INSTRUMENTS

The psychometric battery was designed to assess multiple areas, including stressors, coping mechanisms, and outcome variables. Essential demographic information was

obtained by a questionnaire specifically designed for that purpose. The psychological screening instruments were chosen because they were considered to be appropriate for measuring the various components of the stress response as discussed under Section 2.2, because they are well-known in health measurement research, because there is considerable evidence of their reliability and validity, and because they were thought to be suitable for discriminating most validly between pre- and post-treatment assessments (Bech, 1993; McDowell & Newell, 1996).

3.10.2.1 BIOGRAPHICAL QUESTIONNAIRE

The biographical questionnaire was developed by the author (in conjunction with her supervisor) in order to screen for demographic data, biographical data as well as to determine situational variables. Demographic data included in the questionnaire were: age, sex, marital status, ethnic group, gender, educational level, residential status, living arrangements, and income. Other factors included employment or profession, etc.

3.10.2.2 STRESS SYMPTOM CHECKLIST

The Stress Symptom Checklist (SSCL), developed by Schlebusch (1997), is a "dichotomous-scaled, 87-item checklist" (Schlebusch, 2004, p 335) which the author reports was "based on the appurtenant anxiety and stress-related indices" (p333) incorporated into the DSM-IV (APA, 1994, 2000a) and Kaplan and Sadock (1995). The items pertain to the general signs and symptoms of stress, divided into three categories, including physical reactions (items 1-18), psychological reactions (items

19-45) and behavioural reactions (items 46-87), and the complete version has been published (Schlebusch, 1998c, 2000). For the purposes of this study, a cognitive subscale derived from the 87 items was devised, which incorporated the 11 items, namely: memory loss or forgetfulness (item 46), poor long term planning (item 47), poor concentration (item 48), inability to meet deadlines (item 50), poor time management (item 51), the need to constantly take work home (item 53), poor problem solving (item 54), making unnecessary mistakes (item 64), need to take work home regularly (item 65), poor work quality (item 66),and difficulty in completing one task before rushing on to the next (item 67).

The entire checklist can be administered or self-scored, individually or in groups, and takes approximately 10 minutes to complete and score (Schlebusch, 2000). Each item is awarded a score of half a point if it occurs monthly or one point for a weekly frequency. Each category is totalled separately, with a score of three or more per category being indicative of elevated stress, or a cut-off score of 9 or more across all three categories being used to indicated elevated stress levels overall. Schlebusch (2002) suggests that the SSCL can further be interpreted as low stress (below 8), mild stress (9-15), moderate stress (16-30), severe stress (31-45) and profound stress (46 or more). Investigation of the (preliminary) reliability and validity of this scale formed part of the current study. The SSCL has been used on other sample populations within South Africa, including adults volunteers (Pharma Natura, 1999), cancer patients (Noor Mahommed, Schlebusch & Bosch, 2003; Lo Castro, 2003), hospital staff (Shadwell, 2003) and medical students (Vawda, 2004).

3.10.2.3 VISUAL ANALOGUE SCALE

As discussed in the literature for this type of scale (Bech, 1993; Schlebusch, 2000), a continuous visual analogue scale, in a horizontal linear format, was used to assess the individual's subjective estimate of stress experienced, with both a numerical scale and descriptive(semantic) cues (no stress =0 to profound stress = 10) placed on either end. Severity of stress was measured using an 11 point scoring system (Schlebusch, 2000): 0=no stress, 1 to 3 = mild stress, 4-6 = moderate stress, 7-9 = severe strress, and 10 = profound stress. Bech (1993) has argued that Discretised Analogue Scales, particularly when based on repeated administrations, offer a high degree of sensitivity.

3.10.2.4 THE HAMILTON ANXIETY RATING SCALE (HARS)

The HARS scale devised by Hamilton (1959) is a 14-item scale that assessed anxious and depressed mood, tension, fear, insomnia, intellectual (cognitive) symptoms, somatic (sensory) symptoms, behaviour at interview, cardiovascular symptoms, genitourinary symptoms, gastrointestinal symptoms, autonomic symptoms, and somatic (muscular) symptoms (Hamilton, 2000). It is an overall measure of global anxiety, and includes both cognitive (psychic) and somatic symptoms. Each item is rated on a 5-point scale ranging from 0=no symptoms to 4=severe, grossly disabling symptoms. Total scores thus range from 0-56. Clinically significant anxiety is suggested by a cutoff score of ≥14 (Kobak, Reynolds & Greist, 1993; Hamilton, 2000).

The HARS is considered a reliable and valid scale. Cronbach's Alphas ranging from 0.79 to 0.86 shows good internal consistency, while correlations with other anxiety scales such as the Beck Anxiety Inventory (r=0.56) show good validity as a measure of overall anxiety (Hamilton, 2000).

3.10.2.5 THE PSYCHOLOGICAL GENERAL WELL-BEING INDEX (PGWB)

The PGWB Index (Bech, 1993, Mc Dowell & Newell, 1996) developed by Dupuy in 1977 (Dupuy, 1984) is a 22-item scale that reflects both positive and negative feelings in six dimensions, including anxiety, depression, general health positive well-being, self-control and vitality over the past month. The scale is interpreted as follows: a score of 73-100 indicates positive well-being, a score of 61-72 shows moderate distress, and scores of 0-60 show severe distress. Overall this scale is considered to have "outstanding reliability and validity" (Mc Dowell & Newell, 1996, p 213), with the available reliability and validity tests showing internal consistency higher than for other scales and with the PGWB showing agreement with other depression and anxiety scales. Internal consistency scores coefficients range from r=0.72 - 0.88 and there is considerable evidence for correlational validity with various depression scales (average correlation of r =0.69), anxiety scales (average correlation of r= 0.64) and reports of stress at home and at work (ranging from r= 0.17-0.59) being reported (McDowell & Newell, 1996).

3.10.2.6 RECENT LIFE CHANGE EVENTS QUESTIONNAIRE.

Modifications were made to Rahe's (1977) Recent Life Change Events Questionnaire (RLE) in order to make it more appropriate to the South African context. Additional

items that tapped areas of violence pertinent to South Africa were incorporated into the scale, including unrest in your area; boycotts, strikes, protests in your area or at your work; housebreaking or robbery in your area, at own house, at friends or family; attempted or actual hijacking of self, family, friends or in your area; and attempted or actual rape of self, family, friends or in your area.

3.10.2.7 THE COMBINED HASSLES AND UPLIFTS SCALE

The Combined Hassles and Uplifts Scale (Folkman & Lazarus, 1989; DeLongis, Folkman, and Lazarus, 1988) is a thoroughly revised version of the earlier Hassles and Uplifts Scale (Lazarus and Folkman, 1989; DeLongis, Coyne, Dakof, Folkman & Lazarus, 1982; Kanner et al, 1981), consisting of 53 items. Revisions included removal of terms that suggested psychological or somatic symptoms, as well as redundant items. Items are rated on a 4-point Likert scale ranging from 0=none or not applicable to 3= a great deal, in respect of how much of a hassle or uplift each item is on the particular day the scale is completed.

The scale has been reported to have high face validity (Lazarus & Folkman, 2000). Internal consistency (Cronbach's Alpha) of between 0.80 and 0.93 in young adults and 0.53 to 0.90 in older adults have been reported (Lazarus & Folkman, 2000) . Test-retest comparisons of daily hassles (suggested as a better parameter for evaluating the reliability of the scale, (Lazarus & Folkman, 2000) are high (mean r=0.77 for frequency and r=0.82 in consecutive months). Small to nonexistent correlations of daily hassles with other life event scales have been shown in various studies (Lazarus & Folkman, 2000).

3.10.2.8 PERCEIVED COPING INCAPACITY SCALE

The Percieved Coping Incapacity Scale (PCI) developed by Hinton (1991) is a 9 item revised version of the earlier Cognitive Appraisal Stress Test (CAST: Hinton, 1988). It is scored on a 5-point Likert scale ranging from Strongly Disagree = 1 to Strongly Agree =5. It taps areas linked to feeling out of control of oneself, including perceived cognitive incapability, perceived coping incapacity etc.

3.10.2.9 LIFE ORIENTATION TEST - REVISED VERSION

The Life Orientation Test – Revised Version (LOT-R) is a scale, developed by (Scheier, Carver, and Bridges, 1994) which measures the personal disposition of optimism (personal expectancy of good outcomes), and comprises 10 items, scored on a 5-point Likert scale (ranging from strongly disagree = 0 to strongly agree = 4). It is a revision of the earlier 13 point scale (Scheier & Carver, 1985). Good predictive and discriminant validity has been reported (Scheier et al., 1994; Brisette, Scheier & Carver, 2002) with a Cronbach's alpha of 0.87 being reported in various studies, and the authors have reported a high internal consistency and test-retest reliability (Scheier, Carver & Bridges, 1994). The shared variance problems were minimal (which the previous version of the test had been criticised for). Norms for different population groups (e.g. students and cardiac bypass patients) have been shown to yield remarkably similar results, suggesting that this scale is reliable across different groups of subjects.

3.10.2.10 NEUROPSYCHOLOGICAL ASSESSMENT BATTERY, INCLUDING:

3.10.2.10.1 Rey Auditory Verbal Learning Test (RAVLT)

The RAVLT assesses immediate memory span, new (verbal) learning, susceptibility to interference, immediate as well as delayed recall, and recognition memory (Mitrushina, Boone & D'Elia, 1999). The original French version of the test was developed by Andre Rey in 1958, and subsequently altered and adapted for use with English-speaking individuals by Lezak (1976, 1983, 1995) amongst others.

There are many variants of the RAVLT, but most commonly the test consists of 15 nouns, read aloud at one second intervals in a fixed order of presentation, for five consecutive trials each of which is followed by a test of free recall. Thereafter, a second interference list of 15 words is presented with a free recall trial of that list, immediately followed by recall of the first list without presentation of the words. After 20 (or 30) minutes delay, free recall of the first list is examined. Finally recognition is assessed by the individual identifying the words on the first list from a list of words (which usually includes 30-50 words, some of which are semantically or phonemically familiar to words in both lists, as well as words from the second list).

The test has been reported to have moderate test-retest reliability, with small but significant improvements/practise effects (1-2 words per trial on average) with successive administration of the same list of words. In view of the noted practise effects, this study used two alternate parallel versions of the RAVLT for pre- and post-testing: the list of words used in the pre-test condition of this study included

those words suggested by Lezak (1995), while an alternative parallel list of words (Woods, 1997) were used in the post-test assessment. Lezak's (1995) suggestion of an average score of 10-12 was used, as were norms by Woods (1997).

3.10.2.10.2 Rey Complex Figure (RCF)

The RCF (developed by Rey in 1941) is used to assess visuospatial constructional ability and visual memory, but also evaluates planning, organisational skills, and problem solving strategies (Spreen & Strauss, 1998). Administration procedures vary greatly. For this study, the administration of the test involved a copy trial, followed by an immediate recall (3 minutes) and delayed recall (30 minutes) trial respectively.

Various version of the test are available. Internal consistency of the Rey figure has shown both split-half and coefficient alpha reliabilities of above 0.60 for copy and above 0.80 for both recall trials and reliability coefficients in the moderate range are reported with alternate versions of the figure (Spreen & Strauss, 1998; Mitrushina et al., 1999). Since practise effects have been shown in normal adults with repeated administration of the same figure reaching about 10% of the original score on 1 month retesting and since it has been suggested that the Rey figure is harder than the Taylor version by about 5 points difference (Spreen & Strauss, 1998; Mitrushina et al., 1999), this study utilised two alternate versions of the test for pre- and post-test conditions: the Rey-Ostereith Form A figure was utilised on the pre-test administration and the Woods-Taylor figure (Woods, 1997) was used on the post-test administration.

Scoring based on accuracy of the reproduction, with 0-2 points being assigned on placement and presence of distortion for each of the 18 design elements was used in this study. Qualitative analysis of the drawing strategy as suggested by Kaplan (1988) and Lezak (1995) was also carried out. Norms by Woods (1997) were used.

3.10.2.10.3 Story Recall

Recall of stories provides a measure of main aspects of verbal memory, namely (a) the amount of information retained when more is presented than the individual can recall on one hearing (overloading of data), and (b) the contribution of meaning to retention and recall (Lezak, 1995).

Various versions of story recall, as well as different scoring systems, are available. Again, to minimise practice effects, two alternate stories, namely " a farmer from Transkei" and "a lion called Sultan" (Woods, 1997) were used in this study for the pre- to post-test conditions. Scoring involves crediting content ideas per designated units. Lezak (1999) has suggested that average recall of at least a 22-30 unit story is between 10-12 units, which was used as the scoring system and norm in this study.

3.10.2.11 THE SOURCES OF STRESS WILL BE EXPLORED BY USING AN OPEN-ENDED QUESTIONNAIRE OF (FREE) SELF-REPORT

Respondents were asked (a) to list their five main stressors, and to then indicate how much their stress interferes with their activities in relation to work, leisure, and family respectively, on an 8-point scale ranging from continuously to never.

3.10.3 STATISTICAL STATEMENT

3.10.3.1 STATISTICAL HYPOTHESIS AND SAMPLE SIZE CALCULATION

The calculation of the sample size was based on statistical advice from the Institute for Biostatistics of the Medical Research Council, Durban, South Africa.

The sample size was set at N=300. To achieve this at least N = 1000 patients were screened and allowance was made for possible drop-outs during the study. Provision was made to replace the patients who leave the study (cf. section 4.1.2).

3.10.3.2 STRATEGY FOR STATISTICAL ANALYSES OF PRE-POST TEST RESULTS

The statistical analysis included:

1. A description of all the patients included in the trial.
2. An analysis of demographic variables and baseline values and clinical parameters, to allow for an evaluation of the comparability between the groups.
3. An analysis of efficacy. The primary analysis was performed on all the patients declared valid for this analysis.

In the analyses the ***Intervention-group*** = the active group (patients who took micronutrient supplementation), and the ***Placebo-group*** = those patients who were on the ***placebo***.

Descriptive statistics consisted of the calculation of means and standard deviations for continuous data and frequencies and percentages for categorical data. Differences between the two study groups were assessed with relation to baseline parameters and pre- to post difference scores.

Statistical analysis included: paired t-tests (because there was no reason to think that the treatment could not be one-directional only - that is towards improvement), unpaired t-tests including one-and two-tailed tests, Levene's test for equality of means, Chi-Square tests (Fischer's Exact Test), Pearson's Coefficient correlations, univariate analysis of variance, multivariate analysis and regression analysis.

The significance level was set at 0.05. 95% confidence intervals were calculated where appropriate.

The two study arms did not show baseline differences in the measured stress levels of the two groups on pre-screening for entry into the study, nor differences with relation to demographic parameters, which were, therefore, not adjusted for in the statistical analysis.

3.10.3.3 RESPONSIBILITY FOR STATISTICAL ANALYSES

The statistical analysis was done by the Department of Medical Bioethics, Nelson R. Mandela School of Medicine, University of KwaZulu-Natal, the Institute for Biostatistics of the Medical Research Council, Durban, South Africa, and Information Technology Department, University of KwaZulu-Natal, using the SPSS package.

CHAPTER FOUR

RESULTS

4.0 INTRODUCTION

This study was designed as a multifactorial exploration of the relative effect of specific external stressors, as well as of biological (multivitamin-mineral combination supplementation), and psychosocial mediating variables on stress outcomes (namely, physical, psychological and cognitive levels) in a sample of English-speaking South Africans.

Part One presents the results for the total sample in respect of demographic variables and sources of stress and a stress profile for South Africans. Part Two presents the results for the comparison of differences in the Experimental (Active) group which received micronutrient supplementation) and Control (Placebo) group at baseline. Part Three presents the results of the efficacy analysis, that is, the comparative analysis of the Experimental (Active) and Control (Placebo) groups following intervention (multivitamin and mineral combination supplementation). Part Four presents the stress profile for the Active and Placebo Groups as well as the total sample. The results are presented in terms of descriptive as well as inferential data.

PART ONE

RESULTS FOR TOTAL SAMPLE

4.1 DESCRIPTIVE DATA

There were a total of 333 volunteer participants who entered into this study. However, because of drop-outs and replacement policy (cf section 4.1.3. for a more detailed discussion) the final overall (total) sample used in the study (as shown in Table 1 below) comprised a total of 300 volunteer participants, of which 32.0% were male and 68.0% were female.

The majority of the participants were White South Africans (85.3%), with only 2.3 % being Black, 2.0% being Coloured and 3.0% being Asian South Africans.

The age range of participants was set from 18 to 65 years. As indicated in Table 1, 17.3 % of the sample were between 50 and 65 years of age. Most of the sample fell between 25 to 40 years of age (25-29 years having 15.7%, 30-34 years comprising 16%, 35-40 years having 14.3% and 40-44 years comprising 16.3% of the sample respectively). 9.7% (age 21-24 years) and 3.0% (age 18-20 years) of the sample were below 25 years of age, while 7.7% fell in the 45-49 years of age group.

As reflected in Table 1, most participants were married (57.0%) or remarried (2.7%), the remainder either being single (26.7%) or divorced (9.7%), while only a small percentage were separated (1.3%) or widowed (2.7%).

Given the results on marital status, not surprisingly, most participants lived with their family of creation (65.7%). A total of 13.3% and 12.7% respectively either lived with their parents or alone, while only 3.7 % resided with a partner. The remainder of the sample either lived with friends (1.3%), with relatives (1.7%) or boarded (1.0%) while a small percentage (0.7%) had alternative living arrangements.

Nearly four fifths (79.66%) of the entire sample studied were in full-time employment whereas the next highest percentage was in part-time employment (12.0%). A relatively small percentage of the sample was either retired (3.0%) or unemployed, either because they were unable to find employment on the open labour market (3.67%) or as a result of them being homemakers (1.67%).

Most of the sample were employed in an administrative (54.7%) or professional (27.7%) capacity. A total of 8.0 % and 1.7% respectively worked in a skilled or unskilled capacity. A small proportion (1.7%) were housewives, with 0.7% being employed in some other capacity. Students comprised 5.7 % of the sample.

Table 1: Demographic data for total sample

Variable category	Variable	Frequency	Percent	Total
Sex	Male	96	32.0	
	Female	204	68.0	300
Race	White (Caucasian)	256	85.3	
	Black	7	2.3	
	Coloured	7	2.0	
	Asian	30	3.0	300
Age Group	18-20 years	9	3.0	
	21-24 years	29	9.7	
	25-29 years	47	15.7	
	30-34 years	48	16	
	35-39 years	43	14.3	
	40-44 years	49	16.3	
	45-49 years	23	7.7	
	50-65 years	52	17.3	300
Marital Status	Married	171	57.0	
	Remarried	8	2.7	
	Single	80	26.7	
	Divorced	29	9.7	
	Separated	4	1.3	
	Widowed	8	2.7	300
Live With	Family of Creation	197	65.7	
	Parents	40	13.3	
	Alone	38	12.7	
	Friends	4	1.3	
	Partner	11	3.7	
	Boarding	3	1.0	
	Relatives	5	1.7	
	Other	2	0.7	300
Employment Status	Fulltime	239	79.66	
	Part-time	36	12.0	
	Retired	9	3.0	
	Homemaker	5	1.67	
	Unemployed	11	3.67	300
Occupational Category	Professional	83	27.7	
	Administrative	164	54.7	
	Skilled	24	8.0	
	Unskilled	5	1.7	
	Student	17	5.7	
	Housewife	5	1.7	
	Other	2	0.7	300

4.1.1 CENTRES

Participants were selected from two centres, each of which included 150 participants, that is, the sample is equally distributed (50%) between the two provinces. A total

population of 300 participants was required and to arrive at the desire sample size of N=300, at least 1000 participants were initially screened.

4.1.2. DROP OUTS/REPLACEMENTS

Replacement policy stated that participants could be randomly replaced by drawing substitutes from the originally selected high scoring pre-screened group. A total of 9.90% (33 out of 333 participants) dropped out of the study. Percentages are calculated in terms of 33 out of 333 participants, because the protocol required that all drop-outs be replaced (not only real drop-outs/protocol violations) in order to achieve the total size sample of N=300.

The reasons for the above drop-outs from the study (9.90 %) are summarised in Table 2. From this it can be seen that 18 (54.54%) of participants who dropped out were safety-analysis related, and 15 (45.45%) were real drop-outs (i.e. as a result of protocol violations). Regarding this latter group, 27.27% of the participants replaced due to protocol violations were as a result of them being lost to the study, either as a result of going on vacation (24.24%) or permanently moving away without a forwarding address (3.03%) during the duration of the study. Non-compliance with the research protocol accounted for 9.09% of replacements, such non-compliance either being due to refusal to complete the protocol (3.03%) or incorrectly using the study medication (6.06%).

Of the participants who were replaced because of safety reasons, 21.21% had adverse reactions, including headaches (0.09%), gout (3.03%), or developed a rash (3.03%), puffy eyes (3.03%) or spastic colon (3.03%). A further 12.12% became ill (developed influenza) during the study, while 15.15% commenced using psychotropic medication for pre-existing problems during the course of the study, and 6.06% were admitted into hospital for medical conditions (unrelated to the study medication).

Table 2: Distribution of reasons for patient drop outs (33 out of N=333)

Number of observations		
Drop-out safety analysis	**NO**	**%**
ADVERSE REACTIONS	7	21.21
Headaches	3	9.09
Gout	1	3.03
Rash	1	3.03
Puffy eyes	1	3.03
Spastic colon	1	3.03
HOSPITAL ADMISSIONS	2	6.06
Stroke	1	3.03
Cholecystectomy	1	3.03
BECAME ILL	4	12.12
Developed Influenza	4	12.12
PSYCHOTROPIC DRUG USERS	5	15.15
For pre-existing Anxiety/Stress	5	15.15
TOTAL	18	54.54
Real drop-outs (protocol violations)		
UNKNOWN	3	9.09
LOST TO FOLLOW-UP	9	27.27
Temporary (vacation)	8	24.24
Permanent (moved)	1	3.03
NON-COMPLIANT	3	9.09
Incorrect use of trial medication	2	6.06
Refusal to Complete Test Protocol	1	3.03
TOTAL	15	45.45

4.2 INFERENTIAL STATISTICS

4.2.1 RESEARCH QUESTION 1

WHAT ARE THE PERCEIVED SOURCES OF STRESS FOR THIS SAMPLE OF SOUTH AFRICANS?

The relative impact of the different stressors (demands) on a sample of South Africans (total group n=300) as measured by three different questionnaires are presented in this section.

4.2.1.1 WHAT RECENT LIFE EVENTS DO THESE SOUTH AFRICANS REPORT AS SIGNIFICANTLY OCCURRING?

The top six most common recent life events (*in total over a two-year period*) experienced by the sample over a two year period in order of frequency were as follows (as indicated in Table 3):

1. Violence: boycotts, strikes etc. in their area (89%)
2. Personal and Social: a change in religious beliefs (79%)
3. Work: other work troubles (66%)
4. Personal and Social: being held in jail such as for driving under the influence, etc. (66%)
5. Work: change in work hours or conditions (65.9%)
6. Home and Family: a change in family get-togethers (64.3%)

In contrast, Table 3 reveals that the top six most common recent life events *over the 6-month period directly prior to the assessment* (in rank order) included:

1. Violence: boycotts, strikes, protests in their area (37.3%)
2. Work: a change in responsibilities at work or more work responsibilities (38.3%)
3. Work: a change in work hours or conditions (29.3%)
4. Violence: a personal housebreaking or robbery (29%)
5. Personal and Social: a change in religious beliefs (29%)
6. Work: other work troubles (28.7%)

Table 3: Recent life events of total sample

	Recent life events	1-6 months		6-12 months		13-18 months		19-24 months		Total	
		Count	%	Count	%	Count	%	Count	%	Count	%
1	An illness/ injury which kept you in bed a week or more/sent you to the hospital?	49	16.3	25	8.3	24	8.0	28	9.3	126	41.9
2	Was less serious than above?	75	25.0	38	12.7	35	11.7	28	9.3	176	58.7
3	Major dental work?	30	10.0	21	7.0	8	2.7	13	4.3	72	24
4	A major change in eating habits?	43	14.3	13	4.3	7	2.3	14	4.7	77	25.6
5	A major change in sleeping habits?	50	16.7	35	11.7	24	8.0	27	9.0	136	45.4
6	A major change in your usual type and/or amount of recreation?	46	15.3	36	12.0	21	7.0	26	8.7	129	43
7	A change to a new type of work?	66	22.0	44	14.7	25	8.3	38	12.7	173	57.7
8	A change in your work hours or conditions?	88	29.3	51	17.0	25	8.3	34	11.3	198	65.9
9	A change in your responsibilities at work/more responsibilities?	115	38.3	66	22.0	41	13.7	34	11.3	256	85.3
10	Less responsibilities?	17	5.7	13	4.3	9	3.0	9	3.0	48	16
11	Promotion?	19	6.3	23	7.7	4	1.3	5	1.7	51	17
12	Demotion?	3	1.0	1	0.3	1	0.3	2	0.7	7	2.3
13	Transfer?	17	5.7	14	4.7	8	2.7	11	3.7	50	16.8
14	Troubles at work: with your boss?	55	18.3	27	9.0	25	8.3	21	7.0	128	42.6
15	With your co-workers?	69	23.0	36	12.0	23	7.7	13	4.3	141	47
16	With persons under your supervision?	60	20.0	40	13.3	21	7.0	15	5.0	136	45.3
17	Other work troubles?	86	28.7	56	18.7	30	10.0	27	9.0	199	66.4
18	A major business readjustment?	25	8.3	26	8.7	7	2.3	9	3.0	67	22.3

	Recent life events	1-6 months		6-12 months		13-18 months		19-24 months		Total	
		Count	%	Count	%	Count	%	Count	%	Count	%
19	A retirement?	5	1.7	1	0.3	0	0.0	3	1.0	9	3
20	A loss of job laid off work?	5	1.7	2	0.7	2	0.7	2	0.7	11	3.8
21	Fired from work?	2	0.7	0	0.0	0	0.0	1	0.3	3	1
22	A correspondence course to help you in your work?	17	5.7	19	6.3	14	4.7	12	4.0	62	20.7
23	A major change in your living conditions (home improvements	72	24.0	46	15.3	23	7.7	37	12.3	178	59.3
21	Fired from work?	2	0.7	0	0.0	0	0.0	1	0.3	3	1
22	A correspondence course to help you in your work?	17	5.7	19	6.3	14	4.7	12	4.0	62	20.7
23	A major change in your living conditions (home improvements)	72	24.0	46	15.3	23	7.7	37	12.3	178	59.3
24	A decline in your home or neighbourhood?	29	9.7	21	7.0	12	4.0	26	8.7	88	29.4
25	A change in residence: move within the same town or city?	17	5.7	12	4.0	5	1.7	17	5.7	51	17.1
26	Move to a different town, city or province?	39	13.0	49	16.3	16	5.3	34	11.3	138	45.9
27	A change in family get-togethers?	79	26.3	57	19.0	25	8.3	32	10.7	193	64.3
28	A major change in the health or behaviour of a family member	24	8.0	15	5.0	11	3.7	19	6.3	69	23
29	Illness, accidents, drug or disciplinary problems, etc?	9	3.0	6	2.0	6	2.0	6	2.0	27	9
30	Marriage?	4	1.3	1	0.3	3	1.0	3	1.0	11	3.6
31	A pregnancy?	10	3.3	11	3.7	8	2.7	11	3.7	40	13.4
32	A miscarriage or abortion?	1	0.3	0	0.0	0	0.0	2	0.7	3	1
33	A gain of a new family member birth of a child?	16	5.3	7	2.3	4	1.3	7	2.3	34	11.2
34	Adoption of a child?	26	8.7	13	4.3	10	3.3	9	3.0	58	19.3
35	A relative moving in with you?	4	1.3	2	0.7	2	0.7	2	0.7	10	3.4
36	A spouse beginning or ending work outside the home?	3	1.0	2	0.7	5	1.7	4	1.3	14	4.7
37	A child leaving home to attend college?	14	4.7	6	2.0	4	1.3	2	0.7	26	8.7
38	Due to marriage?	48	16.0	32	10.7	16	5.3	23	7.7	119	39.7
39	For other reasons?	24	8.0	19	6.3	11	3.7	13	4.3	67	22.3
40	A change in arguements with your spouse?	3	1.0	2	0.7	0	0.0	4	1.3	9	3
41	In-law problems?	1	0.3	1	0.3	3	1.0	0	0.0	5	1.6
42	A change in the marital status of your parents: divorce?	8	2.7	4	1.3	3	1.0	2	0.7	17	5.7
43	Remarriage?	5	1.7	7	2.3	5	1.7	4	1.3	21	7
44	A separation from your spouse: due to work?	5	1.7	1	0.3	1	0.3	1	0.3	8	2.6
45	Marital problems?	3	1.0	5	1.7	3	1.0	2	0.7	13	4.4
46	A divorce?	1	0.3	0	0.0	2	0.7	2	0.7	5	1.7
47	The birth of a grandchild?	1	0.3	0	0.0	0	0.0	1	0.3	2	0.6
48	The death of a spouse?	2	0.7	1	0.3	0	0.0	1	0.3	4	1.3

	Recent life events	1-6 months		6-12 months		13-18 months		19-24 months		Total	
		Count	%	Count	%	Count	%	Count	%	Count	%
49	Rhe death of another family member:child?	17	5.7	9	3.0	4	1.3	7	2.3	37	12.3
50	Brother or sister?	62	20.7	48	16.0	21	7.0	32	10.7	163	54.4
51	Parent?	19	6.3	9	3.0	4	1.3	11	3.7	43	14.3
52	A change in personal habits (your dress, friends, lifestyle etc)?	2	0.7	0	0.0	2	0.7	4	1.3	8	2.7
53	Beginning or ending school or college?	11	3.7	13	4.3	10	3.3	11	3.7	45	15
54	A change of school or college?	10	3.3	6	2.0	2	0.7	9	3.0	27	9
55	A change in political beliefs?	64	21.3	48	16.0	16	5.3	26	8.7	154	51.3
56	A change in religious beliefs?	87	29.0	69	23.0	42	14.0	39	13.0	237	79
57	A change in social activities (clubs, movies, visiting etc)?	33	11.0	27	9.0	12	4.0	14	4.7	86	28.7
58	A vacation?	13	4.3	7	2.3	7	2.3	6	2.0	33	10.9
59	A new, close, personal relationship?	22	7.3	13	4.3	4	1.3	5	1.7	44	14.6
60	An engagement to marry?	23	7.7	23	7.7	11	3.7	12	4.0	69	23.1
61	Girlfriend or boyfriend problems?	44	14.7	23	7.7	9	3.0	11	3.7	87	29.1
62	Sexual difficulties?	13	4.3	14	4.7	7	2.3	7	2.3	41	13.6
63	A falling out of a close personal relationship?	42	14.0	24	8.0	16	5.3	17	5.7	99	33
64	An accident?	3	1.0	0	0.0	0	0.0	0	0.0	3	1
65	A minor violation of the law (traffic ticket etc)?	19	6.3	15	5.0	19	6.3	20	6.7	73	24.3
66	Being held in jail (DUI, felony etc)?	99	33.0	59	19.7	19	6.3	21	7.0	198	66
67	The death of a close friend?	57	19.0	41	13.7	14	4.7	17	5.7	129	43.1
68	A major decision regarding your immediate future?	66	22.0	40	13.3	19	6.3	14	4.7	139	46.3
69	A major personal achievement?	43	14.3	21	7.0	10	3.3	17	5.7	91	30.3
70	A major change in finances: increased income?	46	15.3	32	10.7	12	4.0	11	3.7	101	33.7
71	Decreased income?	37	12.3	25	8.3	15	5.0	16	5.3	93	30.9
72	Investment and/or credit difficulties?	54	18.0	25	8.3	14	4.7	29	9.7	122	40.7
73	A loss or damage to personal property?	15	5.0	9	3.0	6	2.0	16	5.3	46	15.3
74	A moderate purchase (such as an automobile)?	4	1.3	4	1.3	1	0.3	1	0.3	10	3.2
75	A major purchase (such as a home)?	51	17.0	32	10.7	16	5.3	19	6.3	118	39.3
76	A foreclosure of a mortgage or loan?	28	9.3	17	5.7	11	3.7	11	3.7	67	22.4
77	Unrest in your area?	41	13.7	23	7.7	17	5.7	10	3.3	91	30.4
78	Boycotts, strikes, protests: in your area?	112	37.3	71	23.7	43	14.3	41	13.7	267	89
79	At your work?	26	8.7	19	6.3	11	3.7	25	8.3	81	27

	Recent life events	1-6 months		6-12 months		13-18 months		19-24 months		Total	
		Count	%	Count	%	Count	%	Count	%	Count	%
80	Housebreaking or robbery: in your area?	37	12.3	27	9.0	9	3.0	14	4.7	87	29
81	Your own house?	87	29.0	42	14.0	22	7.3	20	6.7	171	57
82	Your family?	4	1.3	3	1.0	1	0.3	5	1.7	13	4.3
83	Your friends?	16	5.3	9	3.0	5	1.7	7	2.3	37	12.3
84	Attempted or actual hijacking:yourself?	40	13.3	34	11.3	13	4.3	12	4.0	99	32.9
85	Your family?	70	23.3	39	13.0	29	9.7	26	8.7	164	54.7
86	Your friends?	2	0.7	0	0.0	0	0.0	0	0.0	2	0.7
87	In your area?	4	1.3	0	0.0	1	0.3	0	0.0	5	1.6
88	Attempted or actual rape:yourself?	5	1.7	5	1.7	2	0.7	4	1.3	16	5.4
89	Your family, friends or in your area?	29	9.7	26	8.7	12	4.0	15	5.0	82	27.4

The sample of South Africans studied had an the following sample average scores in the respective periods covered : an average of 9.49 events in the 0-6 month period, an average of 6.16 events in the 7-12 month period, an average of only 3.4 events in the 13-18 month period and 4.06 events in the 19-24 month period. The overall average over the 2 year period was 23.14.life events (Table 4).

Table 4: Total and average number of life events for total sample

Period	Total Number of Recent Life Events	Sample average
0-6	2847	9.49
7-12	1858	6.16
13-18	1020	3.4
19-24	1218	4.06
Sum 2 years	6943	23.14

4.2.1.2 WHAT DAILY HASSLES ARE REPORTED AS SIGNIFICANT FOR SOUTH AFRICANS?

Table 5 reflects the data for the experience of daily hassles for the total sample, with column five (combined experienced) indicating the summed data for columns titled "Somewhat" to "A great deal". The top five areas of everyday encounters with the following environmental stressors reported by the total sample as being experienced as *hassling them a great deal* included:

1. **financial problems** such as having enough money for extras such as entertainment or relaxation activities (21.7%), for necessities (20.0%) such as food, housing etc. or for emergencies (19.0%), enough money for education (13.0%);
2. every-day **work related hassles** including: workload (24.3%), meeting goals or deadlines at work (16.0%), the nature of their work (13.0%), being bothered by clients, customers, patients etc. (11.3%), job security (10.7%);
3. **home related hassles**, predominantly amount of free time (20.3%); taking care of paper work at home such as bills (18.0%); housework (12.7%), car maintenance (11.0%), being organised (10.0%);
4. **political or social issues** (16.3%);
5. the **health or well-being** of family member (11.0%).

The six most frequently reported daily hassles that occurred on a *continuous basis*, in rank order were: workload (24.3%), having enough money for extras (21.7%), amount of free time (20.3%), having enough money for necessities (20.0%), having enough

money for emergencies (19.0%), and taking care of paperwork and home or at work (18.0%).

However, the data for whether or not a particular area of daily functioning was experienced as a hassle or not by the sample at all (column 5 which constitutes the combined data for columns 2-4 in Table 5) presents a somewhat different picture regarding the most common everyday experiences that the sample experienced as stressful.

Table 5: Daily hassles of total sample

Daily Hassles	None or N/A		Somewhat		Quite a bit		A great deal		Combined	
	Count	Table %	Count	Table %	Count	Table %	Count	Table %	Count	Tabl %
Your child	186	62.0%	59	19.7%	114	38.0%	39	13.0%	16	5.3%
Your parents of parents-in-law	182	60.7%	61	20.3%	118	39.3%	36	12.0%	21	7.0%
Other relative(s)	201	67.0%	51	17.0%	99	33.0%	31	10.3%	17	5.7%
Your spouse	192	64.0%	64	21.3%	108	36.0%	26	8.7%	18	6.0%
Time spent with family	183	61.0%	76	25.3%	117	38.9%	31	10.3%	10	3.3%
Health or well-being of a family member	170	56.7%	55	18.3%	130	43.3%	42	14.0%	33	11.0%
Sex	240	80.0%	27	9.0%	60	20.0%	19	6.3%	14	4.7%
Intimacy	210	70.0%	52	17.3%	90	30.0%	23	7.7%	15	5.0%
Family-related obligations	128	42.7%	84	28.0%	172	57.3%	60	20.0%	28	9.3%
Your friend(s)	199	66.3%	79	26.3%	101	33.6%	19	6.3%	3	1.0%
Fellow workers	143	47.7%	71	23.7%	157	52.3%	58	19.3%	28	9.3%
Clients, customers, patients etc.	156	52.0%	65	21.7%	144	48.0%	45	15.0%	34	11.3%
Your supervisor or employer	180	60.0%	61	20.3%	120	40.0%	30	10.0%	29	9.7%
The nature of your work	114	38.0%	83	27.7%	186	62.0%	64	21.3%	39	13.0%
Your work load	111	37.0%	53	17.7%	189	63.0%	63	21.0%	73	24.3%
Your job security	208	69.3%	36	12.0%	92	30.7%	24	8.0%	32	10.7%
Meeting deadlines or goals on the job	129	43.0%	70	23.3%	171	57.0%	53	17.7%	48	16.0%
Enough money for necessities (e.g. food, clothing, housing, health care, taxes, insurance	124	41.3%	64	21.3%	176	58.6%	52	17.3%	60	20.0%

Daily Hassles	None or N/A		Somewhat		Quite a bit		A great deal		Combined	
	Count	Table %	Count	Table %	Count	Table %	Count	Table %	Count	Tab %
Enough money for education	198	66.0%	32	10.7%	102	34.0%	31	10.3%	39	13.0
Enough money for emergencies	136	45.3%	65	21.7%	164	54.7%	42	14.0%	57	19.0
Enough money for extras (eg. Entertainment, recreation, vacation	114	38.0%	75	25.0%	186	62.0%	46	15.3%	65	21.7
Financial care for a person who doesn't live with you	236	78.7%	25	8.3%	64	21.3%	19	6.3%	20	6.7
Investments	206	68.7%	48	16.0%	94	31.3%	21	7.0%	25	8.3
Your smoking	237	79.0%	26	8.7%	63	21.0%	9	3.0%	28	9.3
Your drinking	268	89.3%	21	7.0%	32	10.7%	6	2.0%	5	1.7
Mood-altering drugs	293	97.7%	4	1.3%	7	2.3%	3	1.0%	0	.0%
Your physical appearance	133	44.3%	95	31.7%	167	55.7%	48	16.0%	24	8.0
Contraception	258	86.0%	22	7.3%	42	14.0%	12	4.0%	8	2.7
Exercise(s)	171	57.0%	63	21.0%	129	43.0%	38	12.7%	28	9.3
Your medical care	196	65.3%	59	19.7%	104	34.7%	25	8.3%	20	6.7
Your health	143	47.7%	90	30.0%	157	52.4%	44	14.7%	23	7.7
Your physical abilities	178	59.3%	81	27.0%	122	40.6%	31	10.3%	10	3.3
The weather	198	66.0%	66	22.0%	102	34.0%	20	6.7%	16	5.3
News events	139	46.3%	80	26.7%	161	53.7%	52	17.3%	29	9.7
Your environment (eg. quality of air, noise level)	154	51.3%	82	27.3%	146	48.6%	43	14.3%	21	7.0
Political or social issues	137	45.7%	59	19.7%	163	54.3%	55	18.3%	49	16.3
Your neighbourhood (eg. neighbours, setting)	196	65.3%	72	24.0%	104	34.6%	22	7.3%	10	3.3
Conserving (gas, electricity, water, petrol)	196	65.3%	76	25.3%	104	34.6%	22	7.3%	6	2.0
Pets	206	68.7%	59	19.7%	94	31.4%	23	7.7%	12	4.0
Cooking	163	54.3%	77	25.7%	137	45.7%	33	11.0%	27	9.0
Housework	147	49.0%	73	24.3%	153	51.0%	42	14.0%	38	12.7
Home repairs	167	55.7%	76	25.3%	133	44.3%	28	9.3%	29	9.7
Yard work	191	63.7%	62	20.7%	109	36.3%	22	7.3%	25	8.3
Car maintenance	166	55.3%	60	20.0%	134	44.7%	41	13.7%	33	11.0
Taking care of paperwork (eg. Paying bills, ETC)	109	36.3%	72	24.0%	191	63.7%	65	21.7%	54	18.0
Home entertainment (eg. TV, music, reading)	229	76.3%	54	18.0%	71	23.6%	10	3.3%	7	2.3%
Amount of free time	132	44.0%	63	21.0%	168	56.0%	44	14.7%	61	20.3
Recreation and entertainment outside the home	202	67.3%	46	15.3%	98	32.7%	26	8.7%	26	8.7%
Eating (at home)	202	67.3%	61	20.3%	98	32.6%	22	7.3%	15	5.0%
Church or community organizations	254	84.7%	36	12.0%	46	15.3%	7	2.3%	3	1.0%
Legal matters	218	72.7%	35	11.7%	82	27.4%	29	9.7%	18	6.0%
Being organized	136	45.3%	87	29.0%	164	54.7%	47	15.7%	30	10.0%
Social commitments	164	54.7%	84	28.0%	136	45.3%	37	12.3%	15	5.0%

The top 16 daily hassles overall for the total sample, in order of frequency, are presented in Table 6. Taking care of paperwork, either at home or in their occupation, was ranked as the most common daily hassle overall (63.7%). This was closely followed by various work related activities such as work load (63%) and nature of work (62%) and, to a lesser extent, meeting deadlines and goals on the job (57%). Financial concerns were also ranked highly by the sample, including having enough money for extra's (62%) or for necessities (58.6%), and to a lesser extent for emergencies (54.70%).

Table 6: Order of frequency of overall daily hassles experienced by total sample

Daily hassles	Experienced as a hassle	
	Count	Table %
Taking care of paperwork (eg. Paying bills, filling out forms)	191	63.70%
Your work load	189	63.00%
The nature of your work	186	62.00%
Enough money for extras (eg. Entertainment, recreation, vacation)	186	62.00%
Enough money for necessities (e.g. food, clothing, housing, health care, taxes, insurance)	176	58.60%
Family-related obligations	172	57.30%
Meeting deadlines or goals on the job	171	57.00%
Amount of free time	168	56.00%
Your physical appearance	167	55.70%
Enough money for emergencies	164	54.70%
Being organized	164	54.70%
Political or social issues	163	54.30%
News events	161	53.70%
Your health	157	52.40%
Fellow workers	157	52.30%
Housework	153	51.00%

4.2.1.3 WHAT DO SOUTH AFRICANS REPORT AS THE MOST STRESSFUL AREAS ON SELF-REPORT?

The 5 most stressful areas reported by the total sample on (free) self-report report, in order of frequency of percentage, included the following (as indicated in Table 7). Work was rated as the highest stressor (73.7%) by the sample. Financial concerns (50.7%) and family responsibilities were also major stressors, as was time management (37.3%). Relationships, both personal (23.7%) and work (23.7%) were equally stressful for the total sample.

Table 7: Sources of stress for total sample

Area/stressor	No		Yes		Total	
	Count	Table %	Count	Table %	Count	Table %
Finance	148	49.3%	152	50.7%	300	100.0%
Work	79	26.3%	221	73.7%	300	100.0%
Health-self	263	87.7%	37	12.3%	300	100.0%
Health family of creation	267	89.0%	33	11.0%	300	100.0%
Health family of origin	269	89.7%	31	10.3%	300	100.0%
Health other	291	97.0%	9	3.0%	300	100.0%
Time Management	188	62.7%	112	37.3%	300	100.0%
Personal Relationships	229	76.3%	71	23.7%	300	100.0%
Work Relationships	229	76.3%	71	23.7%	300	100.0%
Crime – self	266	88.7%	34	11.3%	300	100.0%
Crime –general	262	87.3%	38	12.7%	300	100.0%
Partner work	279	93.0%	21	7.0%	300	100.0%
Family Responsibilites	165	55.0%	135	45.0%	300	100.0%
Study	270	90.0%	30	10.0%	300	100.0%
Pets	291	97.0%	9	3.0%	300	100.0%
Behaviour of children	239	79.7%	61	20.3%	300	100.0%
Travel	259	86.3%	41	13.7%	300	100.0%
Housework	290	96.7%	10	3.3%	300	100.0%
Loneliness	287	95.7%	13	4.3%	300	100.0%
Kids future	274	91.3%	26	8.7%	300	100.0%
Life decisions	291	97.0%	9	3.0%	300	100.0%
Relocation	290	96.7%	10	3.3%	300	100.0%
Sleep Disturbance	288	96.0%	12	4.0%	300	100.0%
Death	294	98.0%	6	2.0%	300	100.0%
Own future	257	85.7%	43	14.3%	300	100.0%
With self	257	85.7%	43	14.3%	300	100.0%

4.2.1.4 HOW MUCH DOES STRESS IMPACT ON FUNCTIONING IN RESPECT OF WORK, FAMILY CHORES AND RELAXATION FOR SOUTH AFRICANS?

The degree to which stress impacted on different areas of functioning is reported in Table 8. Family chores was the area that South Africans reported was most impacted upon on a daily basis overall (24.3%) by stress, followed by relaxation (22.0%) and work (18.3%).

Overall, the greatest degree of impact overall was on family chores (87.0%), followed by work (76,3%) and lastly relaxation (74.3%). More people reported no impact on relaxation (25.7%) and work (23.7%) than on family chores (13.0%).

Table 8: Impact of stress on functioning for total sample

Frequency of impact of stress	Impact of stress					
	Work		Family chores		Relaxation	
	N	%	N	%	N	%
Continuously	25	8.3%	33	11.0%	20	6.7%
with Several times a day	17	5.7%	30	10.0%	24	8.0%
Once a day	13	4.3%	10	3.3%	22	7.3%
Daily Combined Total	55	18.3%	73	24.3%	66	22.0%
Several times a week	34	11.3%	52	17.3%	50	16.7%
Several times a month	41	13.7%	53	17.7%	45	15.0%
Once monthly	24	8.0%	35	11.7%	28	9.3%
Monthly combined total	65	21.7%	88	29.3%	73	24.3%
Less than once monthly	75	25.0%	48	16.0%	34	11.3%
Some impact overall total	229	76.3%	261	87,0%	223	74.3%
Never	71	23.7%	39	13.0%	77	25.7%
Total	300	100%	300	100%	300	100%

Overall, across rating measures for stressors, the top two stressors were finance and work.

4.2.2 RESEARCH QUESTION 2

WHAT DOES THE PROFILE OF STRESS LOOK LIKE IN THE SAMPLE OF SOUTH AFRICANS STUDIED?

This section reports the findings regarding the four main outcome variables, namely stress, anxiety, psychological well-being and perception of level of stress for the total sample. Neuropsychological test data is reported on separately in section 4.2.3.2.

4.2.2.1 HOW DO THE SAMPLE PRESENT IN RESPECT OF LEVELS OF STRESS, SYMPTOMS OF STRESS, PERCEPTIONS OF THEIR LEVEL OF STRESS, ANXIETY AND PSYCHOLOGICAL WELL-BEING?

As indicated in Table 9, the mean level of stress reported by the sample was 24.62 (SD 15.77) while for anxiety the mean was 15.37 (SD 8.60). The sample of South Africans have a mean of 62.98 (SD 16.65) in respect of psychological well-being and a mean of 5.40 (SD 2.14) in respect of how stressed they perceived themselves to be at the time of the study.

Table 9: Means and SD of outcome variables for total sample

		Stress (SSC total)	Anxiety (HARS)	Psychological well-being (PGWB)	Perception of stress level (VA)
N	Valid	300	300	300	297
	Missing	0	0	0	3
Mean		24.6217	15.3667	62.9800	5.4040
Std. Deviation		15.76689	8.60304	16.64823	2.14312

4.2.2.2 WHAT SUBJECTIVE COGNITIVE COMPLAINTS DO THE SAMPLE REPORT AS OCCURRING FOR THEM?

The results in Table 10 indicate that 65% of the sample reported one or another combination of subjective cognitive complaints.

The five most frequent subjective cognitive complaints were, in order of frequency: memory loss/forgetfulness (11.8%); poor concentration (9.7%); poor long-term planning (7.8%); poor time management (7.6%); and poor work quality (7.3).

These were followed by, in order of frequency: making unnecessary mistakes and inability to meet deadlines (4.6%); poor decision making (4.0%); poor problem solving skills (3.2%); need to work late regularly (2.3%); and difficulty in completing one task before moving on to the next (2.0%). Table 10 reflects the subjective neurocognitive complaints of South Africans.

Table 10: Subjective neurocognitive complaints

Neurocognitive symptoms	% of responses
Memory loss or forgetfulness	11.8
Poor concentration	9.7
Poor long term planning	7.8
Poor time management	7.6
Poor work quality	7.3
Making unnecessary Mistakes	4.6
Inability to meet deadlines	4.6
Poor decision making	4.0
Poor problem solving skills	3.2
Need to work late regularly	2.3
Difficulty in completing 1 task before moving on to the next	2.0
TOTAL	65.0

4.2.2.3 HOW DO THE SAMPLE SCORE ON NEUROPSYCHOLOGICAL PARAMETERS (TEST FUNCTIONING)?

4.2.2.3.1 How do they perform on a test of discrete items/ unrelated word list learning (RAVLT)?

The mean scores (as shown in Table 11) for all trials of the RAVLT (computed using raw scores) were essentially within normal limits for the total sample, suggesting that as a whole, there was no significant impairment in functioning with regards to learning and recall of discrete items (unrelated word lists). Qualitative analysis of the number of repetitions per trial (shown in Table 11) indicated that the sample made the most repetitions on the last two trials of the first list presented to them (Trial 4 m 1.09, SD 1.51; Trial 5 m 1.14, SD 1.46). Again, the most errors of commission (words given that were not on the list) were found to occur on the initial trial (m 0.29; SD 0.60) of the first list presented, and on the second list presented (m 0.4, SD 0.69) as reflected in Table 11.

Table 11: RAVLT performance

Trial	RAVLT performance (raw scores)		Number of repetitions per trial		Number of errors (commission) per trial	
	MEAN	SD	MEAN	SD	MEAN	SD
Trial 1	6.70	2.065	0.37	0.82	0.29	0.60
Trial 2	9.22	2.318	0.66	1.14	0.19	0.48
Trial 3	10.76	2.297	0.93	1.18	0.15	0.37
Trial 4	11.60	2.255	1.09	1.51	0.17	0.44
Trial 5	12.30	1.963	1.14	1.46	0.17	0.43
Total	50.58	9.052				
List B	5.76	2.075	0.30	0.67	0.40	0.69
Recall	10.81	2.822	0.70	1.25	0.21	0.44
Recognition	14.30	1.055				

4.2.2.3.2 How do they perform on a test of meaningful verbal material in context (Story Recall)?

Table 12 indicates that most of the sample (85.00%) performed within normal limits according to their age norms on immediate recall, with only 15.00% of participants having had a below average (impaired) performance. Likewise, the majority of participants (75.67%) were average as compared to their age norms on delayed recall, with just under one quarter (24.33%) falling in the below average range of performance.

Table 12: Performance on story recall (relative to norm scores)

Trial condition	Performance		Performance rating
Immediate Recall	AVERAGE	Number	255
		%	85.00
	BELOW AVERAGE	Number	45
		%	15.00
Delayed Recall	AVERAGE	Number	227
		%	75.67
	BELOW AVERAGE	Number	73
		%	24.33

The mean scores for the total sample's ability to recall meaningful verbal material in context (story recall) under two conditions (immediate recall and delayed recall) are shown in Table 13. The mean score for immediate recall (m 13.47) is average, whilst the sample performed in the lower range of average on delayed recall (m 11.95).

Table 13: Story recall (raw scores)

Recall condition	Mean	SD
Immediate recall	13.47	4.22
Delayed recall	11.95	3.90

A qualitative analysis of performance for the sample in respect of percentage forgotten and number of errors of commission (as shown in Table 14) reveals that a greater number of errors of commission (m 1.670, SD 0.14) were made as compared to units forgotten (m 0.134, SD 0.14).

Table 14: Error analysis of story recall performance

Error	Mean	SD
% forgotten	0.134	0.14
Errors of commission	1.670	1.53

4.2.2.3.3. How do they perform on a task of visual recall of a complex configurational design (RCF)?

Table 15 indicates that most of the sample (64.33%) performed within normal limits according to their age norms, although approximately one-third (35.67%) of participants had a below average (impaired) performance on the Copy trial of the RCF – this was predominantly due to carelessness, untidiness, poorly executed intersections, etc. (possible reduced self-monitoring ability) and not actual visual-perceptual deficits per se. Immediate Recall (96%) and Delayed Recall (96.67%) were essentially within normal limits for the majority of the sample.

Table 15: Performance on RCF (relative to norm score)

Trial condition	Performance		Performance rating
Copy	AVERAGE	Number	193
		%	64.33
	BELOW AVERAGE	Number	107
		%	35.67
Immediate Recall	AVERAGE	Number	288
		%	96.00
	BELOW AVERAGE	Number	12
		%	4.00
Delayed Recall	AVERAGE	Number	290
		%	96.47
	BELOW AVERAGE	Number	10
		%	3.33

When results regarding the three conditions of performance on the RCF are computed using raw scores (as presented in Table 16), overall South Africans performed essentially within normal limits on copy (m 30.62, SD 2.6), immediate recall (m 19.94 SD 5.3) and delayed recall (m 17.90, SD 2.6).

Table 16: Performance on RCF (raw scores)

Task condition	Mean	SD
Copy	30.62	2.6
Immediate Recall	19.94	5.3
Delayed Recall	17.90	2.6

Overall, the results for the neuropsychological test data indicated overall average performance for the majority of the sample for tasks involving recall of discrete items (unrelated word lists), meaningful verbal material in context (story recall) and visual recall (complex configurational design) for both immediate and delayed recall conditions. A slight trend for poorer performance on story recall was found.

4.2.2.4 IS THERE A RELATIONSHIP BETWEEN PERCEIVED STRESSORS AND OUTCOME VARIABLES?

This section presents the results on the relationship between the perceived stressors as measured in three ways, namely recent life events, daily hassles and sources of stress on (free) self-report report to outcome variables. Outcome variables included for analysis comprised level (SSCL total) and symptoms (SSCL physical, SSCL psychological, SSCL behavioural) of stress, perception of level of stress (VA total), anxiety (HARS) and psychological general well-being (PGWB). Given that there were essentially no positive findings with regard to neuropsychological data (cf section 4.2.3.2) this variable was not included in any further analysis.

4.2.2.4.1 Is there a relationship between recent life events (RLE) and outcome variables?

The results presented in Table 17 shows that there is no significant relationship between total number of recent life events and physical symptoms of stress (P= 0.786), psychological symptoms of stress (P= 0.679), behavioural symptoms of stress (P= 0.211) or total stress level (P= 0.516). Nor was there a significant relationship (P=0.172) between total number of recent life events and perception of level of stress (Table 17). In contrast, there is a statistically significant relationship (P= 0.035) between total number of recent life events and anxiety as indicated in Table 17. No statistically significant relationship (P= 0.974) was found between total number of recent life events and psychological general well-being (Table 17).

Table 17: Relationship between RLE and outcome variables

Source	Outcome Variable		Type III Sum of squares	DF	Mean Square	F	Sig.
Recent Life Events	Symptom of Stress	SSCL PHYSICAL	.859	1	0.859	0.074	0.786
		SSCL PSYCHOLOGICAL	5.506	1	5.506	0.172	0.679
		SSCL BEHAVIOURAL	77.590	1	77.590	1.570	0.211
		SSCL TOTAL	91.953	1	91.953	0.423	0.516
Recent Life Events	Perception of Level of Stress	VA TOTAL	8.194	1	8.194	1.872	0.172
Recent Life Events	Anxiety	HARS	293.355	1	293.355	4.495	0.035
Recent Life Events	Psychological General Well-being	PGWB	0.237	1	0.237	0.001	0.974

$p<0.05$

4.2.2.5 IS THERE A RELATIONSHIP BETWEEN SOURCES OF STRESS REPORTED ON (FREE) SELF-REPORT REPORT AND OUTCOME VARIABLES?

4.2.2.5.1 Is there a relationship between financial stress and outcome?

There is a significant positive relationship between financial stress and physical (P=0.003) and psychological (P=0.015) behavioural (P= 0.056), stress symptoms, total level of stress (P=0.014), anxiety (P=0.030) and psychological general well-being (P=0.010) as indicated in Table 18.

Table 18: Relationship between financial stress and outcome

Outcome Variables	Finance	N	Mean	Std. Deviation	Std. Error Mean	Levene's Test	2-Tailed P-Value
SSCL Phys	No	148	5.2466	3.17328	0.26084		0.003
	Yes	152	6.4704	3.89525	0.31595	0.009	0.003
SSCL Psych	No	148	6.6250	5.36678	0.44115		0.015
	Yes	152	8.2829	6.35346	0.51533	0.003	0.015
SSCL Beh	No	148	10.4811	7.16591	0.58903		0.056
	Yes	152	12.1414	7.80673	0.63321	0.260	0.056
SSCL Total	No	148	22.3716	14.43377	1.18645		0.014
	Yes	152	26.8125	16.72249	1.35637	0.019	0.014
HARS	No	148	14.2770	8.28393	0.68093		0.030
	Yes	152	16.4276	8.80066	0.71383	0.365	0.030
PGWB	No	148	65.4797	15.87214	1.30468		0.010
	Yes	152	60.5461	17.07282	1.38479	0.594	0.010
VA	No	147	5.3537	2.09632	0.17290		0.690
	Yes	150	5.4533	2.19391	0.17913	0.299	0.689

$p<0.05$

4.2.2.5.2 Is there a relationship between work as a stressor and outcome?

The results as presented in Table 19 indicate that there is a significant relationship between work stress psychological general well-being ($P= 0.034$).

Table 19: Relationship between work stress and outcome

Outcome Variables	Finance	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	79	5.3038	3.83842	0.43186		0.106
	Yes	221	6.0679	3.50356	0.23567	0.338	0.123
SSCL Psych	No	79	7.0886	5.75112	0.64705		0.512
	Yes	221	7.5995	6.00769	0.40412	0.552	0.504
SSCL Beh	No	79	11.3354	7.40959	0.83364		0.986
	Yes	221	11.3176	7.59053	0.51059	0.895	0.986
SSCL Total	No	79	23.6013	15.20129	1.71028		0.504
	Yes	221	24.9864	15.98209	1.07507	0.622	0.494
HARS	No	79	14.1772	8.18654	0.92106		0.153
	Yes	221	15.7919	8.72573	0.58696	0.136	0.141
PGWB	No	79	66.3797	17.08148	1.92182		0.034
	Yes	221	61.7647	16.35873	1.10041	0.310	0.039
VA	No	79	5.0759	2.14698	0.24155		0.112
	Yes	218	5.5229	2.13419	0.14455	0.813	0.115

$p<0.05$

4.2.2.5.3 Is there a relationship between concerns about one's own health and outcome?

A statistically significant positive relationship was found between concerns about one's own health and perception of level of stress (P=0.022) as reflected in Table 20.

Table 20: Relationship between concerns about own health and outcome

Outcome variables	Health- self	N	Mean	Std. Deviation	Std. Error mean	Levene's	2-tailed p-value
SSCL Phys	No	263	5.8593	3.56900	.22007		0.925
	Yes	37	5.9189	3.89536	.64039	0.359	0.930
SSCL Psych	No	263	7.5152	6.02157	.37131		0.697
	Yes	37	7.1081	5.34911	.87939	0.237	0.672
SSCL Beh	No	263	11.5198	7.74265	.47743		0.227
	Yes	37	9.9189	5.69663	.93652	0.053	0.133
SSCL Total	No	263	24.8612	16.08063	.99157		0.484
	Yes	37	22.9189	13.39336	2.20186	0.350	0.425
HARS	No	263	15.3270	8.72084	.53775		0.832
	Yes	37	15.6486	7.81813	1.28529	0.510	0.818
PGWB	No	263	62.9392	16.57933	1.02233		0.910
	Yes	37	63.2703	17.36159	2.85423	0.624	0.914
VA	No	260	5.5115	2.11171	.13096		0.022
	Yes	37	4.6486	2.23875	.36805	0.311	0.032

$p<0.05$

4.2.2.5.4 Is there a relationship between concerns about the health of family of creation and outcome?

Table 21 shows that no statistically significant positive relationships was found between concern over the health of family of creation and outcome variables.

Table 21: Relationship between concern over health of family of creation and outcome

Outcome Variables	Health-Family Of Creation	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	267	5.7884	3.57245	.21863		0.285
	Yes	33	6.5000	3.84870	.66997	0.412	0.319
SSCL Psych	No	267	7.4569	5.93218	.36304		0.947
	Yes	33	7.5303	6.05823	1.05460	0.525	0.948
SSCL Beh	No	267	11.3772	7.52992	.46082		0.721
	Yes	33	10.8788	7.64141	1.33020	0.820	0.725
SSCL Total	No	267	24.5861	15.70014	.96083		0.912
	Yes	33	24.9091	16.54466	2.88006	0.347	0.916
HARS	No	267	15.2135	8.38698	.51327		0.381
	Yes	33	16.6061	10.24982	1.78426	0.241	0.458
PGWB	No	267	62.9738	16.41643	1.00467		0.985
	Yes	33	63.0303	18.69573	3.25451	0.480	0.987
VA	No	264	5.4394	2.11012	.12987		0.422
	Yes	33	5.1212	2.40777	.41914	0.244	0.473

$p<0.05$

4.2.2.5.5 Is there a relationship between concern over the health of family of origin and outcome?

A significant positive relationship was found between concern over the health of members of one's family of origin and perception of level of stress (P=0.042), anxiety (P=0.043) and psychological general well-being (P=0.008). Results are indicated in Table 22.

Table 22: Relationship between concern over health of family of origin and outcome

Outcome Variables	Health – Family Of Origin	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	269	5.8030	3.57831	.21817		0.368
	Yes	31	6.4194	3.83644	.68905	0.724	0.399
SSCL Psych	No	269	7.3773	5.92756	.36141		0.452
	Yes	31	8.2258	6.05233	1.08703	0.627	0.464
SSCL Beh	No	269	11.1041	7.39329	.45078		0.140
	Yes	31	13.2161	8.53394	1.53274	0.116	0.195
SSCL Total	No	269	24.2268	15.57285	.94949		0.202
	Yes	31	28.0484	17.25319	3.09876	0.169	0.246
HARS	No	269	14.9405	8.26362	.50384		0.011
	Yes	31	19.0645	10.57650	1.89960	0.030	0.043
PGWB	No	269	63.8439	16.37110	.99816		0.008
	Yes	31	55.4839	17.41813	3.12839	0.511	0.015
VA	No	268	5.3209	2.11682	.12931		0.042
	Yes	29	6.1724	2.26887	.42132	0.499	0.062

$p<0.05$

4.2.2.5.6 Is there a relationship between concern over the health of others (excluding family or self) and outcome?

Table 23 shows that there is a significant positive relationship between feeling stressed about the health of others (excluding family or self) and behavioural symptoms of stress (P=0.005) and total stress (P=0.086) as indicted in Table 26.

Table 23: Relationship between concern over health of others and outcome

Outcome Variables	Health Of Others (Non-Family)	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	291	5.9175	3.61845	.21212		0.165
	Yes	9	4.2222	2.77389	.92463	0.267	0.108
SSCL Psych	No	291	7.5395	5.97417	.35021		0.217
	Yes	9	5.0556	4.05003	1.35001	0.056	0.108
SSCL Beh	No	291	11.4759	7.56474	.44345		0.044
	Yes	9	6.3556	4.08813	1.36271	0.075	0.005
SSCL Total	No	291	24.8969	15.83981	.92855		0.086
	Yes	9	15.7222	10.21063	3.40354	0.111	0.028
HARS	No	291	15.4330	8.65138	.50715		0.449
	Yes	9	13.2222	6.90612	2.30204	0.605	0.373
PGWB	No	291	62.9313	16.72708	.98056		0.774
	Yes	9	64.5556	14.61259	4.87086	0.479	0.751
VA	No	288	5.4201	2.14798	.12657		0.465
	Yes	9	4.8889	2.02759	.67586	0.455	0.461

$p<0.05$

4.2.2.5.7 Is there a relationship between time management and outcome?

The results in Table 24 indicate that there is a significant positive relationship between problems with time management and total level of stress (P=0.067), and both behavioural (P=0.037) and physical (P=0.030) symptoms of stress.

Table 24: Relationship between time management and outcome

Outcome Variables	Time Management	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	188	5.5027	3.32327	0.24237		0.023
	Yes	112	6.4777	3.97253	0.37537	0.035	0.030
SSCL Psych	No	188	7.2207	5.55434	0.40509		0.357
	Yes	112	7.8750	6.53215	0.61723	0.033	0.377
SSCL Beh	No	188	10.5809	6.77279	0.49396		0.027
	Yes	112	12.5670	8.54413	0.80734	0.020	0.037
SSCL Total	No	188	23.2527	14.11427	1.02939		0.051
	Yes	112	26.9196	18.04231	1.70484	0.007	0.067
HARS	No	188	15.1383	8.43674	0.61531		0.552
	Yes	112	15.7500	8.90035	0.84100	0.419	0.558
PGWB	No	188	63.8723	16.75092	1.22169		0.230
	Yes	112	61.4821	16.43989	1.55342	0.623	0.228
VA	No	185	5.3459	2.12881	0.15651		0.549
	Yes	112	5.5000	2.17272	0.20530	0.743	0.551

$p<0.05$

4.2.2.5.8 Is there a relationship between personal relationships as a stressor and outcome?

Stressful personal relationships was positively significantly (P=0.065) related to psychological general well-being as shown in Table 25.

Table 25: Relationship between stressful personal relationships and outcome

Outcome Variables	Personal Relationships	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	229	5.8297	3.48578	0.23035		0.750
	Yes	71	5.9859	3.98566	0.47301	0.213	0.767
SSCL Psych	No	229	7.3472	5.77831	0.38184		0.538
	Yes	71	7.8451	6.44681	0.76510	0.174	0.562
SSCL Beh	No	229	10.9769	7.33666	0.48482		0.154
	Yes	71	12.4366	8.07993	0.95891	0.315	0.177
SSCL Total	No	229	24.1201	15.30895	1.01164		0.323
	Yes	71	26.2394	17.17616	2.03843	0.381	0.354
HARS	No	229	15.4061	8.94359	0.59101		0.887
	Yes	71	15.2394	7.45552	0.88481	0.026	0.876
PGWB	No	229	63.9127	17.02813	1.12525		0.081
	Yes	71	59.9718	15.08071	1.78975	0.032	0.065
VA	No	227	5.2952	2.18323	0.14491		0.115
	Yes	70	5.7571	1.98133	0.23681	0.108	0.099

$p<0.05$

4.2.2.5.9 Is there a relationship between work relationships as a stressor and outcome?

Stressful work relationships were not found to be statistically significantly related to any outcome variables (Table 26).

Table 26: Relationship between stressful work relationships and outcome variables

Outcome Variables	Work Relationships	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	229	5.6921	3.52127	0.23269		0.132
	Yes	71	6.4296	3.83061	0.45461	0.338	0.152
SSCL Psych	No	229	7.2096	5.65702	0.37383		0.181
	Yes	71	8.2887	6.73565	0.79937	0.133	0.224
SSCL Beh	No	229	11.1231	7.28022	0.48109		0.412
	Yes	71	11.9648	8.31106	0.98634	0.175	0.445
SSCL Total	No	229	23.9869	15.02636	0.99297		0.211
	Yes	71	26.6690	17.91228	2.12580	0.093	0.256
HARS	No	229	14.9825	8.13912	0.53785		0.165
	Yes	71	16.6056	9.91605	1.17682	0.004	0.213
PGWB	No	229	63.2707	16.60073	1.09701		0.588
	Yes	71	62.0423	16.88485	2.00386	0.832	0.592
VA	No	227	5.3480	2.14260	0.14221		0.418
	Yes	70	5.5857	2.15011	0.25699	0.999	0.420

$p<0.05$

4.2.2.5.10 Is there a relationship between crime against oneself and outcome?

No significant relationships between having experienced a crime against oneself and outcome variable were found as indicated in Table 27.

Table 27: Relationship between crime against self and outcome variables

Outcome Variables	Crime Against Self	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	266	5.9267	3.64527	0.22351		0.421
	Yes	34	5.3971	3.27474	0.56161	0.441	0.386
SSCL Psych	No	266	7.5714	6.06090	0.37162		0.386
	Yes	34	6.6324	4.84347	0.83065	0.154	0.307
SSCL Beh	No	266	11.3917	7.49466	0.45953		0.656
	Yes	34	10.7794	7.90396	1.35552	0.960	0.671
SSCL Total	No	266	24.8440	15.85033	0.97185		0.495
	Yes	34	22.8824	15.21266	2.60895	0.626	0.485
HARS	No	266	15.5075	8.64968	0.53035		0.429
	Yes	34	14.2647	8.26936	1.41818	0.424	0.416
PGWB	No	266	62.9211	16.57975	1.01657		0.864
	Yes	34	63.4412	17.42376	2.98815	0.641	0.870
VA	No	264	5.3939	2.11012	0.12987		0.819
	Yes	33	5.4848	2.42540	0.42221	0.172	0.838

$p<0.05$

4.2.2.5.11 Is there a relationship between general crime and outcome?

Table 28 shows that a statistically significant relationship (P=0.082) was found between general crime and psychological symptoms of stress.

Table 28: Relationship between general crime and outcome variables

Outcome Variables	General Crime	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	262	5.9141	3.62559	0.22399		0.550
	Yes	38	5.5395	3.48041	0.56460	0.727	0.540
SSCL Psych	No	262	7.6489	6.10279	0.37703		0.159
	Yes	38	6.1974	4.48653	0.72781	0.022	0.082
SSCL Beh	No	262	11.4321	7.56768	0.46753		0.508
	Yes	38	10.5658	7.32560	1.18837	0.441	0.501
SSCL Total	No	262	24.9504	15.98309	0.98744		0.344
	Yes	38	22.3553	14.17216	2.29903	0.239	0.304
HARS	No	262	15.5038	8.61290	0.53211		0.469
	Yes	38	14.4211	8.58859	1.39325	0.740	0.471
PGWB	No	262	62.7290	16.36553	1.01107		0.494
	Yes	38	64.7105	18.62708	3.02171	0.106	0.537
VA	No	260	5.4192	2.06394	0.12800		0.747
	Yes	37	5.2973	2.66526	0.43817	0.002	0.791

$p<0.05$

4.2.2.5.12 Is there a relationship between experiencing one's partner's work as a stressor and outcome?

No significant relationships were found between any of the outcome variables and the experience of one's partner's work as a stressor (Table 29).

Table 29: Relationship between partner's work as a stressor and outcome variables

OUTCOME VARIABLES	PARTNER'S WORK	N	MEAN	STD. DEVIATION	STD. ERROR MEAN	LEVENE'S	2-TAILED P-VALUE
SSCL Phys	No	279	5.7993	3.55823	0.21303		0.238
	Yes	21	6.7619	4.15818	0.90739	0.207	0.313
SSCL Psych	No	279	7.3925	5.91130	0.35390		0.441
	Yes	21	8.4286	6.32512	1.38025	0.602	0.475
SSCL Beh	No	279	11.2480	7.40981	0.44361		0.534
	Yes	21	12.3095	9.14395	1.99537	0.183	0.609
SSCL Total	No	279	24.4050	15.51934	0.92912		0.387
	Yes	21	27.5000	18.95587	4.13651	0.152	0.473
HARS	No	279	15.2760	8.55615	0.51224		0.507
	Yes	21	16.5714	9.34115	2.03841	0.529	0.544
PGWB	No	279	63.2652	16.57839	0.99252		0.280
	Yes	21	59.1905	17.52318	3.82387	0.849	0.313
VA	No	277	5.3682	2.11657	0.12717		0.285
	Yes	20	5.9000	2.48998	0.55678	0.505	0.362

$p<0.05$

4.2.2.5.13 Is there a relationship between family responsibilities as a stressor and outcome?

The results as reflected in Table 30 indicate that the family responsibilities are significantly positively related (P=0.024) to psychological general well-being.

TABLE 30: Relationship between family responsibilities and outcome variables

Outcome Variables	Family Responsibilities	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	165	5.7182	3.60229	0.28044		0.431
	Yes	135	6.0481	3.61117	0.31080	0.894	0.431
SSCL Psych	No	165	6.9909	5.85560	0.45586		0.126
	Yes	135	8.0444	6.00356	0.51670	0.436	0.127
SSCL Beh	No	165	10.7194	7.39978	0.57607		0.125
	Yes	135	12.0593	7.65122	0.65851	0.747	0.127
SSCL Total	No	165	23.3606	15.69552	1.22189		0.126
	Yes	135	26.1630	15.77487	1.35768	0.904	0.126
HARS	No	165	15.0727	8.80795	0.68570		0.514
	Yes	135	15.7259	8.36431	0.71988	0.593	0.512
PGWB	No	165	64.9394	16.93809	1.31863		0.024
	Yes	135	60.5852	16.02535	1.37924	0.631	0.023
VA	No	164	5.3963	2.18926	0.17095		0.945
	Yes	133	5.4135	2.09302	0.18149	0.236	0.945

$p<0.05$

4.2.2.5.14 Is there a relationship between study and outcome?

Study was found to be significantly positively related (P= 0.048) to physical symptoms of stress as indicated in Table 31.

Table 31: Relationship between study and outcome

Outcome Variables	Study	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	270	5.7296	3.56134	0.21674		0.048
	Yes	30	7.1000	3.81105	0.69580	0.374	0.068
SSCL Psych	No	270	7.2352	5.82707	0.35462		0.044
	Yes	30	9.5333	6.58883	1.20295	0.155	0.076
SSCL Beh	No	270	10.8444	7.40013	0.45036		0.001
	Yes	30	15.6233	7.45176	1.36050	0.679	0.002
SSCL Total	No	270	23.7667	15.51840	0.94442		0.005
	Yes	30	32.3167	16.16215	2.95079	0.548	0.009
HARS	No	270	15.3148	8.76293	0.53330		0.755
	Yes	30	15.8333	7.11038	1.29817	0.226	0.714
PGWB	No	270	63.1852	16.67587	1.01486		0.523
	Yes	30	61.1333	16.56072	3.02356	0.707	0.524
VA	No	267	5.3820	2.14426	0.13123		0.598
	Yes	30	5.6000	2.15918	0.39421	0.927	0.603

$p<0.05$

4.2.2.5.15 Is there a relationship between pets and outcome?

No statistically significant relationship was found between pets as a stressor and any outcome variables as indicated in Table 32.

Table 32: Relationship between pets and outcome

Outcome Variables	Pets	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	291	5.8625	3.61152	0.21171		0.910
	Yes	9	6.0000	3.55317	1.18439	0.806	0.912
SSCL Psych	No	291	7.4467	5.94832	0.34870		0.762
	Yes	9	8.0556	5.82261	1.94087	0.804	0.765
SSCL Beh	No	291	11.3058	7.56735	0.44361		0.830
	Yes	9	11.8556	6.60021	2.20007	0.360	0.812
SSCL Total	No	291	24.5756	15.81322	0.92699		0.774
	Yes	9	26.1111	14.96825	4.98942	0.869	0.769
HARS	No	291	15.2887	8.49132	0.49777		0.373
	Yes	9	17.8889	12.04621	4.01540	0.154	0.538
PGWB	No	291	63.0378	16.56529	0.97107		0.733
	Yes	9	61.1111	20.18938	6.72979	0.354	0.784
VA	No	288	5.3681	2.11761	0.12478		0.102
	Yes	9	6.5556	2.74368	0.91456	0.504	0.233

$p<0.05$

4.2.2.5.16 Is there a relationship between behaviour of one's children and outcome?

A statistically significant relationship (P=0.064) between children's behaviour as a stressor and perception of level of stress was found, as indicated in Table 33.

Table 33: Relationship between children's behaviour and outcome variables

Outcome Variables	Behaviour Of Children	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	239	5.9770	3.68743	0.23852		0.295
	Yes	61	5.4344	3.24869	0.41595	0.228	0.260
SSCL Psych	No	239	7.5167	6.10773	0.39508		0.766
	Yes	61	7.2623	5.25008	0.67220	0.300	0.745
SSCL Beh	No	239	11.3084	7.61436	0.49253		0.949
	Yes	61	11.3770	7.25583	0.92901	0.894	0.948
SSCL Total	No	239	24.7469	16.13825	1.04390		0.786
	Yes	61	24.1311	14.33292	1.83514	0.419	0.771
HARS	No	239	15.3096	8.51620	0.55087		0.821
	Yes	61	15.5902	9.00440	1.15290	0.613	0.827
PGWB	No	239	62.6318	16.38451	1.05983		0.474
	Yes	61	64.3443	17.71900	2.26869	0.424	0.496
VA	No	236	5.5212	2.14664	0.13973		0.064
	Yes	61	4.9508	2.08508	0.26697	0.728	0.061

$p<0.05$

4.2.2.5.17 Is there a relationship between travel and outcome?

There was no significant relationship between travel and any of the outcome variables (Table 34)

Table 34: Relationship between travel and outcome

Outcome Variables	Travel	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	259	5.9112	3.57666	0.22224		0.592
	Yes	41	5.5854	3.80608	0.59441	0.988	0.610
SSCL Psych	No	259	7.5560	5.89555	0.36633		0.506
	Yes	41	6.8902	6.22948	0.97288	0.917	0.525
SSCL Beh	No	259	11.4236	7.51874	0.46719		0.559
	Yes	41	10.6829	7.67036	1.19791	0.408	0.567
SSCL Total	No	259	24.8591	15.65298	0.97263		0.513
	Yes	41	23.1220	16.58982	2.59090	0.446	0.533
HARS	No	259	15.6795	8.68359	0.53957		0.114
	Yes	41	13.3902	7.88948	1.23213	0.301	0.094
PGWB	No	259	62.9228	16.56096	1.02905		0.881
	Yes	41	63.3415	17.39628	2.71684	0.853	0.886
VA	No	257	5.4358	2.11319	0.13182		0.518
	Yes	40	5.2000	2.34466	0.37072	0.541	0.552

$p<0.05$

4.2.2.5.18 Is there a relationship between housework and outcome?

The results did not indicate any significant relationship between housework and any outcome variables (Table 35)

Table 35: Relationship between housework and outcome

Outcome Variables	Housework	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	290	5.8603	3.58346	0.21043		0.870
	Yes	10	6.0500	4.37448	1.38333	0.432	0.895
SSCL Psych	No	290	7.4379	5.96222	0.35011		0.671
	Yes	10	8.2500	5.32943	1.68531	0.415	0.647
SSCL Beh	No	290	11.2955	7.51464	0.44127		0.740
	Yes	10	12.1000	8.37921	2.64974	0.869	0.771
SSCL Total	No	290	24.5603	15.74936	0.92483		0.717
	Yes	10	26.4000	17.03884	5.38816	0.621	0.744
HARS	No	290	15.2724	8.52464	0.50058		0.308
	Yes	10	18.1000	10.80586	3.41711	0.397	0.433
PGWB	No	290	63.2000	16.58369	0.97383		0.218
	Yes	10	56.6000	18.16713	5.74495	0.735	0.285
VA	No	287	5.4042	2.14273	0.12648		0.995
	Yes	10	5.4000	2.27058	0.71802	0.785	0.996

$p<0.05$

4.2.2.5.19 Is there a relationship between loneliness and outcome?

A statistically significant positive relationship was found between loneliness and perception of level of stress (P=0.000), psychological general well-being (P=0.002), level of stress (P=00.041) and psychological symptoms of stress (P=0.003). Results are presented in Table 36.

Table 36: Relationship between loneliness and outcome

Outcome Variables	Loneliness	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	287	5.8240	3.60888	0.21303		0.337
	Yes	13	6.8077	3.49725	0.96996	0.950	0.340
SSCL Psych	No	287	7.2456	5.81652	0.34334		0.003
	Yes	13	12.3077	6.71298	1.86185	0.280	0.019
SSCL Beh	No	287	11.1906	7.50272	0.44287		0.155
	Yes	13	14.2308	7.87299	2.18357	0.545	0.196
SSCL Total	No	287	24.2265	15.63753	0.92305		0.041
	Yes	13	33.3462	16.73119	4.64040	0.586	0.076
HARS	No	287	15.3693	8.68663	0.51276		0.980
	Yes	13	15.3077	6.76245	1.87557	0.390	0.975
PGWB	No	287	63.3310	16.87444	0.99607		0.086
	Yes	13	55.2308	7.17814	1.99086	0.009	0.002
VA	No	284	5.3415	2.16286	0.12834		0.019
	Yes	13	6.7692	.92681	0.25705	0.002	0.000

$p<0.05$

4.2.2.5.20 Is there a relationship between concern over one's children's future and outcome?

No statistically significant relationships were found between concern over the future of one's children and outcome variables (Table 37).

Table 37: Relationship between concern over children's future and outcome

Outcome Variables	Children's Future	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	274	5.8741	3.62577	0.21904		0.908
	Yes	26	5.7885	3.43270	0.67321	0.631	0.905
SSCL Psych	No	274	7.5493	5.99163	0.36197		0.426
	Yes	26	6.5769	5.33796	1.04686	0.187	0.387
SSCL Beh	No	274	11.4679	7.60238	0.45928		0.278
	Yes	26	9.7885	6.67109	1.30831	0.246	0.235
SSCL Total	No	274	24.8942	16.00663	0.96700		0.332
	Yes	26	21.7500	12.88274	2.52651	0.135	0.254
HARS	No	274	15.3358	8.60256	0.51970		0.840
	Yes	26	15.6923	8.77163	1.72026	0.970	0.844
PGWB	No	274	62.9526	16.38774	0.99002		0.926
	Yes	26	63.2692	19.54801	3.83368	0.141	0.937
VA	No	271	5.3985	2.10375	0.12779		0.886
	Yes	26	5.4615	2.56485	0.50301	0.046	0.904

$p < 0.05$

4.2.2.5.21 Is there a relationship between life decisions and outcome?

No statistically significant relationships were found between life decisions and outcome variables (Table 38).

Table 38: Relationship between life decisions and outcome

Outcome Variables	Life Decisions	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	291	5.9089	3.62645	0.21259		0.249
	Yes	9	4.5000	2.56174	0.85391	0.287	0.144
SSCL Psych	No	291	7.5086	5.96996	0.34997		0.470
	Yes	9	6.0556	4.75949	1.58650	0.290	0.395
SSCL Beh	No	291	11.3976	7.56935	0.44372		0.326
	Yes	9	8.8889	5.99363	1.99788	0.430	0.252
SSCL Total	No	291	24.7852	15.84024	0.92857		0.308
	Yes	9	19.3333	12.77449	4.25816	0.365	0.243
HARS	No	291	15.4158	8.68266	0.50899		0.575
	Yes	9	13.7778	5.51765	1.83922	0.187	0.412
PGWB	No	291	63.1890	16.55822	0.97066		0.217
	Yes	9	56.2222	19.16232	6.38744	0.881	0.311
VA	No	288	5.3958	2.14693	0.12651		0.710
	Yes	9	5.6667	2.12132	0.70711	0.849	0.715

$p<0.05$

4.2.2.5.22 Is there a relationship between relocation and outcome?

Table 39 shows that there is a statistically significant relationship between relocation and psychological general well-being (P=0.006), perception of level of stress (P=0.007), total level of stress (P=0.087 SSCL) and physical symptoms of stress (P=0.077).

Table 39: Relationship between relocation and outcome

Outcome Variables	Relocation	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	290	5.7983	3.56038	0.20907		0.077
	Yes	10	7.8500	4.46623	1.41235	0.112	0.183
SSCL Psych	No	290	7.3638	5.90536	0.34677		0.112
	Yes	10	10.4000	6.39357	2.02183	0.545	0.171
SSCL Beh	No	290	11.2041	7.52706	0.44200		0.144
	Yes	10	14.7500	7.16957	2.26722	0.832	0.157
SSCL Total	No	290	24.3328	15.70072	0.92198		0.087
	Yes	10	33.0000	16.19842	5.12239	0.579	0.128
HARS	No	290	15.2759	8.63924	0.50731		0.326
	Yes	10	18.0000	7.36357	2.32857	0.521	0.280
PGWB	No	290	63.4724	16.58138	0.97369		0.006
	Yes	10	48.7000	12.03744	3.80657	0.212	0.004
VA	No	287	5.3415	2.13409	0.12597		0.007
	Yes	10	7.2000	1.61933	0.51208	0.157	0.005

$p<0.05$

4.2.2.5.23 Is there a relationship between sleep disturbance and outcome?

No statistically significant relationships were found between the outcome variables and sleep disturbance (Table 40).

Table 40: Relationship between sleep disturbance and outcome

Outcome Variables	Sleep Disturbane	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	288	5.8663	3.61910	0.21326		0.993
	Yes	12	5.8750	3.36509	0.97142	0.742	0.993
SSCL Psych	No	288	7.4601	5.96470	0.35147		0.944
	Yes	12	7.5833	5.43069	1.56771	0.690	0.940
SSCL Beh	No	288	11.3549	7.61110	0.44849		0.715
	Yes	12	10.5417	5.43331	1.56846	0.172	0.627
SSCL Total	No	288	24.6476	15.90181	0.93702		0.889
	Yes	12	24.0000	12.62033	3.64318	0.529	0.866
HARS	No	288	15.3576	8.65002	0.50971		0.929
	Yes	12	15.5833	7.71608	2.22744	0.885	0.923
PGWB	No	288	63.1563	16.56998	0.97640		0.370
	Yes	12	58.7500	18.70403	5.39939	0.363	0.438
VA	No	285	5.3930	2.15915	0.12790		0.666
	Yes	12	5.6667	1.77525	0.51247	0.327	0.613

$p<0.05$

4.2.2.5.24 Is there a relationship between experiencing a death and outcome?

There were no statistically significant relationships between experiencing a death and outcome variables (Table 41).

Table 41: Relationship between experiencing a death and outcome

Outcome Variables	Experiencing A Death	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	294	5.8588	3.61425	0.21079		0.793
	Yes	6	6.2500	3.32791	1.35861	0.466	0.787
SSCL Psych	No	294	7.4473	5.95344	0.34721		0.718
	Yes	6	8.3333	5.40062	2.20479	0.739	0.707
SSCL Beh	No	294	11.2422	7.49883	0.43734		0.197
	Yes	6	15.2500	8.80199	3.59340	0.530	0.317
SSCL Total	No	294	24.5153	15.76969	0.91971		0.414
	Yes	6	29.8333	16.12038	6.58112	0.916	0.459
HARS	No	294	15.3605	8.67930	0.50619		0.931
	Yes	6	15.6667	3.38625	1.38243	0.062	0.842
PGWB	No	294	63.1395	16.63206	0.97000		0.246
	Yes	6	55.1667	17.01078	6.94462	0.959	0.305
VA	No	291	5.4055	2.13360	0.12507		0.935
	Yes	6	5.3333	2.80476	1.14504	0.358	0.952

$p<0.05$

4.2.2.5.25 Is there a relationship between concerns about one's own future and outcome?

There were no significant relationships between concerns regarding one's own future and any of the outcome variables (Table 42).

Table 42: Relationship between concern over own future and outcome

Outcome Variables	Own Future	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	257	5.9825	3.66927	0.22888		0.174
	Yes	43	5.1744	3.13559	0.47817	0.207	0.132
SSCL Psych	No	257	7.5078	5.99641	0.37405		0.761
	Yes	43	7.2093	5.62121	0.85723	0.627	0.751
SSCL Beh	No	257	11.3704	7.62937	0.47591		0.787
	Yes	43	11.0349	6.99098	1.06611	0.701	0.775
SSCL Total	No	257	24.8268	15.92242	0.99321		0.582
	Yes	43	23.3953	14.92224	2.27562	0.532	0.566
HARS	No	257	15.6459	8.74258	0.54535		0.170
	Yes	43	13.6977	7.59553	1.15831	0.332	0.133
PGWB	No	257	62.4319	16.62724	1.03718		0.164
	Yes	43	66.2558	16.58900	2.52980	0.922	0.167
VA	No	255	5.4196	2.13344	0.13360		0.758
	Yes	42	5.3095	2.22500	0.34333	0.613	0.766

$p<0.05$

4.2.2.5.26 Is there a relationship between feeling stressed over some aspect regarding the self and outcome?

A statistically significant relationship was found between concern over the self and perception of level of stress (P=0.085) as indicated in Table 43.

Table 43: Relationship between concern over self and outcome

Outcome Variables	With Self	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
SSCL Phys	No	257	5.8249	3.52952	0.22017		0.624
	Yes	43	6.1163	4.05738	0.61874	0.123	0.659
SSCL Psych	No	257	7.2704	5.80391	0.36204		0.166
	Yes	43	8.6279	6.62615	1.01048	0.158	0.211
SSCL Beh	No	257	11.2518	7.39716	0.46142		0.692
	Yes	43	11.7442	8.36829	1.27615	0.267	0.718
SSCL Total	No	257	24.3132	15.43080	0.96255		0.408
	Yes	43	26.4651	17.73025	2.70384	0.124	0.457
HARS	No	257	15.5019	8.54452	0.53299		0.506
	Yes	43	14.5581	9.00609	1.37342	0.706	0.524
PGWB	No	257	62.9922	16.22450	1.01206		0.975
	Yes	43	62.9070	19.20046	2.92804	0.173	0.978
VA	No	254	5.4921	2.13153	0.13374		0.085
	Yes	43	4.8837	2.16255	0.32979	0.832	0.093

$p<0.05$

4.2.2.6 IS THERE A RELATIONSHIP BETWEEN DAILY HASSLES AND OUTCOME VARIABLES?

Pearson's correlation coefficient was undertaken to assess the relationship of daily hassles (as measured by the Combined Hassles and Uplifts Scale) and outcome variables. Outcome measures included the SSCL (level of stress), VA (perception of level of stress), HARS (anxiety) and PGWB (psychological general well-being).

Table 44 shows a significant positive relationship between daily hassles and physical symptoms of stress (r =0.344; p<0.000), psychological symptoms of stress (r =0.309, p<0.000), behavioural symptoms of stress (r = 0.340, p< 0.000), total level of stress (r =0.356, p< 0.000), anxiety (r =0.367, p<0.000), and perception of level of stress (r =0.163, p<0.005). A significant negative relationship (r = -.0426, p<0.000) was found with psychological general well-being.

Table 44: Relationship between daily hassles and outcome variables

		SSCL Physical	SSCL Psych	SSCL Beh	SSCL Total	HARS	PGWB	VA
Daily Hassles	Pearson Correlation	0.344**	0.309**	0.340**	0.356**	0.367**	-0.426**	0.163**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.005
	N	300	300	300	300	300	300	297

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

4.2.2.7 IS THERE A RELATIONSHIP BETWEEN THE MODERATING VARIABLES AND THE OUTCOME VARIABLES IN THE TOTAL SAMPLE?

4.2.2.7.1 What is the relationship of the personal resources to outcome variables?

Personal resource variables included optimism (LOT) and perceived coping incapacity reflective of lack of perceived control and coping (PCI). Outcome variables included for analysis comprised level (SSCL total) and symptoms (SSCL physical, SSCL psychological, SSCL behavioural) of stress, perception of level of stress (VA total), anxiety (HARS) and psychological general well-being (PGWB). Given that there were essentially no positive findings with regard to neuropsychological data (cf section 4.2.3.2) this variable was not included in any further analysis.

Statistical analysis included Pearson's correlation co-efficient and/or univariate analysis of variance. Results are presented in Table 45.

Findings indicate that there was a significant positive correlation between perceived coping incapacity (PCI) and psychological well-being, but significant negative correlations between perceived coping incapacity and psychological stress symptoms (r=-.0.196, p<0.004), total level of stress (r= -0,173, p<0.003) and perception of level of stress (r= -.129, p<0.027).

The results also showed a significant positive correlation between optimism (LOT) and psychological general well-being (r=0.223, p<0.000) in contrast to a significant negative correlation between optimism and anxiety (r=-0.132, p<0.022) and perception of level of stress (r = -.0.182, p<0.002).

Table 45: Relationship of personal resources to outcome variables

		SSCL Physical	SSCL Pysch	SSCL Beh	SSCL Total	HARS	PGWB	VA
PCI	Pearson Correlation	-0.089	-0.196**	-0.164**	-0.173**	-0.240**	0.333**	-0.129*
	Sig. (2-tailed)	0.125	0.001	0.004	0.003	0.000	0.000	0.027
	N	300	300	300	300	300	300	297
LOT	Pearson Correlation	-0.053	-0.004	0.008	-0.009	-0.132*	0.223**	-0.182**
	Sig. (2-tailed)	0.356	0.943	0.892	0.872	.022	0.000	.002
	N	300	300	300	300	300	300	297
	N	300	300	300	300	300	300	297

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

4.2.2.8 WHAT IS THE RELATIONSHIP OF THE ENVIRONMENTAL VARIABLE (DAILY UPLIFTS) TO OUTCOME VARIABLES?

A measure of everyday positive events (Daily Uplifts) was included as the environmental variable in the study. Outcome variables included for analysis comprised level (SSCL total) and symptoms (SSCL physical, SSCL psychological, SSCL behavioural) of stress, perception of level of stress (VA total), anxiety (HARS) and psychological general well-being (PGWB). Given that there were essentially no positive findings with regard to neuropsychological data (cf section 4.2.3.2) this variable was not included in any further analysis.

Findings (as reflected in Table 46) indicated a significant negative relationship (r=-0.192, p=0.001) between daily uplifts and perception of level of stress. There were no significant findings (p>0.05, p>0.01) in respect of all other outcome variables.

Table 46: Relationship of daily uplifts to outcome variables

		SSCL Physical	SSCL Pysch	SSCL Beh	SSCL Total	HARS	PGWB	VA
Daily Uplifts	Pearson Correlation	-0.021	-0.010	-0.012	-0.012	-0.019	0.112	-0.192**
	Sig. (2-tailed)	0.716	0.870	0.843	0.843	0.743	0.054	0.001
	N	299	299	299	299	299	299	0296

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

4.2.2.9 WHAT ARE THE RELATIONSHIPS BETWEEN THE MODERATING VARIABLES?

The results as presented in Table 47 indicate that there is a significant positive correlation between perceived coping incapacity and optimism (r=0.119, p=0.000), and inversely between optimism and perceived coping incapacity (r=0.239, p=0.000).

No other significant correlations were found between any of the moderating variables.

Table 47: Relationships between moderating variables

		PCI	LOT	Daily Uplifts
PCI	Pearson Correlation	1	.239(**)	0.090
	Sig. (2-tailed)	.	0.000	0.119
	N	300	300	299
LOT	Pearson Correlation	0.239(**)	1	0.111
	Sig. (2-tailed)	0.000	.	0.055
	N	300	300	299
Daily Uplifts	Pearson Correlation	0.090	0.111	1
	Sig. (2-tailed)	0.119	0.055	.
	N	300	300	299

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

4.2.2.10 WHAT ARE THE RELATIONSHIPS BETWEEN THE OUTCOME VARIABLES?

The results presented in detail in Table 48 indicate that level of stress, physical, psychological and behavioural symptoms of stress, anxiety, and perception of level of stress are significantly positively correlated ($p<0.01$) with each other, while there are significant negative correlations ($p<0.01$) between all these variables and psychological general well being.

Table 48: Relationships between outcome variables

		SSCL Physical	SSCL Pysch	SSCL Beh	SSCL Total	HARS	PGWB	VA
SSCL Physical	Pearson Correlation	1	0.771**	0.713**	0.856**	0.603**	-0.566**	0.432**
	Sig. (2-tailed)	.	0.000	0.000	0.000	0.000	0.000	0.000
	N	300	300	300	300	300	300	297
SSCL Psych	Pearson Correlation	0.771**	1	0.822**	0.942**	0.437**	-0.506**	0.359**
	Sig. (2-tailed)	0.000	.	0.000	0.000	0.000	0.000	0.000
	N	300	300	300	300	300	300	297
SSCL Beh	Pearson Correlation	0.713**	0.822**	1	0.946**	0.449**	-0.485**	0.330**
	Sig. (2-tailed)	0.000	0.000	.	0.000	0.000	0.000	0.000
	N	300	300	300	300	300	300	297
SSCL Total	Pearson Correlation	0.856**	0.942**	0.946**	1	0.519**	-0.551**	0.394**
	Sig. (2-tailed)	0.000	0.000	0.000	.	0.000	0.000	0.000
	N	300	300	300	300	300	300	297
HARS	Pearson Correlation	0.603**	0.437**	0.449**	0.519**	1	-0.657**	0.484**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	.	0.000	0.000
	N	300	300	300	300	300	300	297
PGWB	Pearson Correlation	-0.566**	-0.506**	-0.485**	-0.551**	-0.657**	1	-0.601**
	Sig. (2-tailed)	0.000	0.000	0.000	.000	0.000	.	0.000
	N	300	300	300	300	300	300	297
VA	Pearson Correlation	0.43**)	0.359**	0.330**	0.394**	0.484**	-0.601**	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	.
	N	297	297	297	297	297	297	297

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

PART TWO

RESULTS FOR EXPERIMENTAL (ACTIVE) AND CONTROL (PLACEBO) GROUPS AT BASELINE

4.3DESCRIPTIVE DATA

RESEACH QUESTION 3

IS THERE A DIFFERENCE IN THE TWO GROUPS WITH REGARDS TO DEMOGRAPHIC DATA AT BASELINE?

4.3.1 IS THERE A DIFFERENCE BETWEEN THE TWO GROUPS AT BASELINE WITH REGARDS TO SAMPLE SIZE?

The original protocol called for 150 participants in each of the Active and Placebo groups respectively. However, because of the drop-outs and replacement policy (cf section 4.1.3), and since these participants were replaced during the trial, it resulted in the Active (intervention) group ultimately consisting of 151 participants and the Placebo group ultimately consisting of 149 participants.

This did not affect the validity of the statistical calculations. Because randomisation was done in blocks of ten, there was no way to identify whether drop-outs were taking the active substance or placebo, nor was there any way to identify which of these were received by replacements. It was, therefore, not possible to ensure that the final countdowns of the Active and the Placebo-Groups were equal.

4.3.2 IS THERE A DIFFERENCE IN DEMOGRAPHIC VARIABLES BETWEEN THE TWO GROUPS AT BASELINE?

The demographic variables were recorded on a questionnaire designed for the study to elicit the relevant information. The differences in demographic variables between the two groups are discussed in sections 4.3.2.1 – 4.2.3.5.

4.3.2.1 IS THERE A DIFFERENCE BETWEEN THE TWO GROUPS AT BASELINE IN AGE DISTRIBUTION?

The mean age for the Active-group was 36.99 years and the mean age for the Placebo-group was 38.78 years, as reflected in Table 49. The difference between the two groups with regard to mean age was statistically not significant (P= 0.1915) as shown in Table 49.

Table 49: Group by age at baseline

Variable	Group	Number	Mean	SD	P-Value
AGE	Active	151	36.99	11.22	0.1915
	Placebo	149	38.78.	12.46	

$p<0.05$

There was a relatively even age spread for both groups between the various age categories. This ranged from 2.65% in the age group lower than 20 years to 15.23 % in the age group older than 50 years for Active-group, and 3.36% in the age group under 20 years through to 19.46 % in the age group older than 50 years for Placebo-group (Table 50). There were no statistically significant differences (P=0.0850) in age groupings for the active versus placebo groups (Table 50).

Table 50: Group by age category (X^2) at baseline

Frequency	18-20	21-24	25-29	30-34	35-39	40-44	45-49	50-65	Total	P-Value
Active	4 2.65	16 10.60	23 15.23	29 19.21	19 12.58	31 20.53	6 3.97	23 15.23	151	
Placebo	5 3.36	13 8.72	24 16.11	19 12.75	24 16.11	18 12.08	17 11.41	29 19.46	149	
Total	9	29	47	48	43	49	23	52	300	0.0850

$p<0.05$

4.3.2.2 IS THERE A DIFFERENCE BETWEEN THE TWO GROUPS IN RESPECT OF GENDER AT BASELINE?

Both groups were relatively evenly spread with regards to gender. The Placebo group comprised of 45 (15.0%) males as compared to 51 (17.0%) in the Placebo group. Likewise, 35.3 % (n=106) participants in the Active group were females as compared to 32.7% (n=98) in the Placebo Group. There were no statistically significant differences (P=0.4110) between the two groups with regard to gender as indicated in Table 51).

Table 51: Group by gender at baseline

Frequency	Male	Female	Total	P-Value
Active	45 269.80	106 70.20	151	
Placebo	51 34.23	98 65.77	149	
Total	96	204	300	0.4110

$p<0.05$

4.3.2.3 IS THERE A DIFFERENCE BETWEEN THE TWO GROUPS IN MARITAL STATUS AT BASELINE?

The groups also did not differ statistically significantly (P=0.6610) in respect of marital status (Table 52). Most of the participants in both groups were married (56.95% in the Active group and 57.05% in the Placebo group) or remarried (3.31% of the Active group as compared to 2.01% of the Placebo group). Around a quarter of the participants were singe in both groups (28.48% in the Active group and 24.83% in the Placebo group). A small percentage in both groups were divorced, separated or widowed.

Table 52: Group by marital status at baseline

Frequency	Married	Re-Married	Single	Divorced	Separated	Widowed	Total	P-Value
Active	86 56.95	5 3.31	43 28.48	13 8.61	2 1.32	2 1.32	151	
Placebo	85 57.05	3 2.01	37 24.83	16 10.74	2 1.34	6 4.03	149	
Total	171	8	80	29	4	8	300	0.6610

$p<0.05$

4.3.2.4 IS THERE A DIFFERENCE BETWEEN THE TWO GROUPS IN RESPECT OF ETHNICITY AT BASELINE?

The groups did not differ statistically (P=0.4130) in terms of ethnic distribution (Table 53). Most of the sample in both groups were White (Active group 82.12%; Placebo group 88.59%). A smaller percentage in both groups were of other ethnic status.

Table 53: Group by ethnicity at baseline

Frequency	White	Black	Coloured	Asian	Total	P-Value
Active	124 82.12	4 2.65	5 3.31	18 11.92	151	
Placebo	132 88.59	3 2.01	2 1.34	12 8.05	149	0.4130
Total	256	7	7	30	300	

$p<0.05$

4.3.2.5. IS THERE A DIFFERENCE IN LIVING ARRANGEMENTS BETWEEN THE TWO GROUPS AT BASELINE?

As indicated in Table 54, 45.0% of the Active group lived with someone else (either family of creation, parents, friends etc.) in contrast to 5.3% living alone. In the Placebo group the majority of participants lived with someone else (42.3%) with fewer of them (7.3%) living alone. There were no statistically significant differences (P=0.2780) between the two groups with regards to living arrangements.

Table 54: Living arrangements by group at baseline

Living Arrangements	Group		P-Value
	Active	Placebo	
With others	135 (45.0%)	127 (42.3%)	
Alone	16 (5.3%)	22 (7.3%)	
Total	151 (50.5%)	149 (49.7%)	0.2780

$p<0.05$

Since no statistically significant differences between the two groups at baseline were found on any of the demographic variables measured as reflected in Tables 49-54, they were not adjusted when comparing stress levels.

4.4 INFERENTIAL STATISTICS

4.4.1 RESEARCH QUESTION 8

IS THERE A DIFFERENCE IN PERCEIVED SOURCES OF STRESS (STRESSORS) BETWEEN THE TWO GROUPS (ACTIVE AND PLACEBO) AT BASELINE?

The results reported in this section deal with the investigation of any differences in stressors, namely number of life events, daily hassles, sources of stress on free report or impact on functioning in respect of work, family chores and relaxation between the Active and Placebo groups.

4.4.1.1 IS THERE A DIFFERENCE IN RECENT LIFE EVENTS (RLE) BETWEEN THE TWO GROUPS AT BASELINE?

The experience of particular significant life events as having occurred during the two year period prior to the study was evaluated by the Recent Life Events Schedule. Apart from total number of life events, four time periods were investigated, namely 0-6 months, 7-12 months, 13-18 months and 19-24 months prior to the assessment.

T-tests were used to investigate any differences between groups at baseline, and the results for total number of life events and each time period respectively are presented in sections 4.4.1.1.1 – 4.4.1.1.5 below.

4.4.1.1.1 Is there a difference in total number of Recent Life Events experienced by the Active as compared to the Placebo group at baseline?

As indicated in Table 55, there was, however, no significantly different association (P= 0.0970) between groups (placebo/active) and total number of recent life events in the sample at baseline. However, there was a trend in that double the number of people in the Placebo group (12.0%) than the Active group (6.0%) had experienced a total of 1-10 life events overall in the two year period prior to the study. Most participants in both groups had experienced between 11-20 (Active group 16.7% and Placebo group 13.0%) and 21-30 (Active group 13.3% and Placebo group 12.3%) significant recent life events in this period.

Table 55: Total number of recent life events by group at baseline

Number of Life Events	Count	Group		Total	P-Value
		Active	Placebo		
0	Number	1	0	1	
	% of Total	0.3%	0.0%	0.3%	
1-10	Number	18	36	54	
	% of Total	6.0%	12.0%	18.0%	
11-20	Number	50	39	89	
	% of Total	16.7%	13.0%	29.7%	
21-30	Number	40	37	77	
	% of Total	13.3%	12.3%	25.7%	
31-40	Number	26	18	44	
	% of Total	8.7%	6.0%	14.7%	
41-50	Number	9	13	22	
	% of Total	3.0%	4.3%	7.3%	
50 or more	Number	7	6	13	
	% of Total	2.3%	2.0%	4.3%	
TOTAL		151	149	300	
		50.3%	19.7%	100.0%	0.0970

4.4.1.1.2 Is there a difference in number of Recent Life Events occurring in the 0-6 month period prior to the assessment between the Active and Placebo groups at baseline?

For both the groups (Active and Placebo) the greatest number of recent life events were experienced in the results of the comparison between the Active and Placebo groups over the 6 month period prior to commencement of this study indicated that there was no statistically significant different association (P=0.9250) between group and number of life events experienced as indicated in Table 56. The majority of participants in both groups had experienced between 1-10 recent life events during this time (Active group 28.0%, Placebo group 29.0%), followed by 19.7% (Active group) and 17.7% (Placebo group) who had experienced a total of 11-20 recent life events over the same period of time.

Table 56: Number of recent life events in 0-6 month period by group at baseline

Number of Life Events	Count	Group		Total	P-Value
		Active	Placebo		
0	Number	4	4	8	
	% of Total	1.3%	1.3%	2.7%	
1-10	Number	84	87	171	
	% of Total	28.0%	29.0%	57.0%	
11-20	Number	59	53	112	
	% of Total	19.7%	17.7%	37.3%	
21-30	Number	4	5	9	
	% of Total	1.3%	1.7%	3.0%	
TOTAL		151	149	300	0.9250
		50.3%	19.7%	100.0%	

$p<0.05$

4.4.1.1.3 Is there a difference in number of Recent Life Events occurring in the 7-12 month period prior to the assessment between the Active and Placebo groups at baseline?

The majority of participants in both the Active (36.7%) and Placebo (35.0%) groups reported having experienced between 1-10 significant recent life events in the 7-12 month period before the study started. No statistically significant different association (P=0.7710) was found between number of recent life events experienced and group during the 7-12 month period as reflected in Table 57.

Table 57: Recent life events 7-12 months by group at baseline

Number of Life Events	Count	Group		Total	P-Value
		Active	Placebo		
0	Number	11	15	26	
	% of Total	3.7%	5.0%	8.7%	
1-10	Number	110	105	215	
	% of Total	36.7%	35.0%	71.7%	
11-20	Number	29	27	56	
	% of Total	9.7%	9.0%	18.7%	
21-30	Number	1	2	3	
	% of Total	0.3%	0.7%	1.0%	
TOTAL		151	149	300	0.7710
		50.3%	19.7%	100.0%	

$p<0.05$

4.4.1.1.4 Is there a difference in number of Recent Life Events occurring in the 13-18 month period prior to the assessment between the Active and Placebo groups at baseline?

As seen above with regards to the 7-12 month period, the largest proportion of participants in both groups (Active group 35.0% and Placebo group 35.7%) reported having experienced 1-10 recent life events during the 13-18 months prior to entering the study. There was no statistically significant different association (P=0.8980) between the two groups in respect of number of recent life events during this period, as indicated in Table 58.

Table 58: Recent life events 13-18 months by group at baseline

Number of Life Events	Count	Group		Total	P-Value
		Active	Placebo		
0	Number	40	36	76	
	% of Total	13.3%	12.0%	25.3%	
1-10	Number	105	107	212	
	% of Total	35.0%	35.7%	70.7%	
11-20	Number	6	6	12	
	% of Total	2.0%	2.0%	4.0%	
TOTAL		151	149	300	
		50.3%	19.7%	100.0%	0.8980

$p<0.05$

4.4.1.1.5 Is there a difference in number of Recent Life Events occurring in the 19-24 month period prior to the assessment between the Active and Placebo groups at baseline?

The majority of participants reported between 1-10 recent life events during this period, as reported by 38.0% of the Active group and 34.7% of the Placebo group. No

significant different association (P=0.1730) was found between group and number of recent life events experienced during the 19-24 month period as reflected in Table 59.

Table 59: Recent life events 19-24 months by group at baseline

Number of Life Events	Count	Group		Total	P-Value
		Active	Placebo		
0	Number	24	32	56	0.1730
	% of Total	8.0%	10.7%	18.7%	
1-10	Number	114	104	218	
	% of Total	38.0%	34.7%	72.7%	
11-20	Number	13	10	23	
	% of Total	4.3%	3.3%	7.7%	
21-30	Number	1	3	3	
	% of Total	0.0%	1.0%	1.0%	
TOTAL		151	149	300	
		50.3%	19.7%	100.0%	

$P<0.05$

4.4.1.2 IS THERE A DIFFERENCE IN EVERYDAY ENVIRONMENTAL STRESSORS (DAILY HASSLES) BETWEEN THE TWO GROUPS AT BASELINE?

The experience of everyday life events as nocuous (a hassle) was measured using the Combined Hassles and Uplifts Scale.

Differences between groups at baseline were analysed using paired t-tests.

There was no significant difference (P=0.2990) between the two groups in respect of number of daily hassles reported at baseline, with the mean for the active group being 37.74 (SD 21.29) and for the Placebo group it was 35.24 (SD 20.33) as reflected in Table 60.

Table 60: Total daily hassles by group at baseline

Group	Number	Mean	SD	P-Value
Active	151	37.74	21.29	
Placebo	140	35.24	20.33	
TOTAL	300			0.2990

$p<0.05$

4.4.1.3 IS THERE A DIFFERENCE BETWEEN THE TWO GROUPS IN SOURCES OF STRESS (ON FREE REPORT) AT BASELINE?

Sources of stress on free report were elicited on the demographic questionnaire for each patient. Responses were then categorised. Results are presented as percentages, and t-tests were done to evaluate any differences between groups at baseline, the results of which are presented in section 4.4.1.3.1.

4.4.1.3.1 Is there a difference between the two groups, at baseline in respect of Sources of stress (on free report)?

Table 61 reports the percentage of patients in each group that endorsed a particular area of life as being experienced as a stressor. The five most frequently reported everyday events experienced as stressful by the Active group, in rank order, were: work (36.7%), family responsibilities (25.0%), finance (24.7%), time management (17.7%) and work relationships (12.0%). The Placebo group reported the following as the top stressors, in rank order: work (37.0%), finance (26.0%), family responsibilities (20.0%), time management (19.7%), and personal relationships (12.0%).

Although the rank order of the top four stressors reported differed between the two groups, the actual items endorsed were the same. For both groups relationships were

the fifth most common daily hassle, but they differed in that the Active group experienced stress regarding relationships at work in contrast to the Placebo group who experienced stress as a result of personal relationships.

Table 61: Self-reported sources of stress by group at baseline

	Active						Placebo					
	No		Yes		Total		No		Yes		Total	
	Count	Table %	Count	Table %	Count	Table %	Count	Table %	Count	Table %	Count	Table %
Finance	77	25.7%	74	24.7%	151	50.3%	71	23.7%	78	26.0%	149	49.7%
Work	41	13.7%	110	36.7%	151	50.3%	38	12.7%	111	37.0%	149	49.7%
Health-self	135	45.0%	16	5.3%	151	50.3%	128	42.7%	21	7.0%	149	49.7%
Health fam creation	135	45.0%	16	5.3%	151	50.3%	132	44.0%	17	5.7%	149	49.7%
Health fam origin	131	43.7%	20	6.7%	151	50.3%	138	46.0%	11	3.7%	149	49.7%
Health other	147	49.0%	4	1.3%	151	50.3%	144	48.0%	5	1.7%	149	49.7%
Time Mgt	98	32.7%	53	17.7%	151	50.3%	90	30.0%	59	19.7%	149	49.7%
Rels Pers	116	38.7%	35	11.7%	151	50.3%	113	37.7%	36	12.0%	149	49.7%
Rels Work	115	38.3%	36	12.0%	151	50.3%	114	38.0%	35	11.7%	149	49.7%
Crime self	131	43.7%	20	6.7%	151	50.3%	135	45.0%	14	4.7%	149	49.7%
Crime general	128	42.7%	23	7.7%	151	50.3%	134	44.7%	15	5.0%	149	49.7%
Partner work	143	47.7%	8	2.7%	151	50.3%	136	45.3%	13	4.3%	149	49.7%
Fam Resp/Rel/Exp	76	25.3%	75	25.0%	151	50.3%	89	29.7%	60	20.0%	149	49.7%
Study	137	45.7%	14	4.7%	151	50.3%	133	44.3%	16	5.3%	149	49.7%
Pets	144	48.0%	7	2.3%	151	50.3%	147	49.0%	2	.7%	149	49.7%
Beh kids	117	39.0%	34	11.3%	151	50.3%	122	40.7%	27	9.0%	149	49.7%
Travel	132	44.0%	19	6.3%	151	50.3%	127	42.3%	22	7.3%	149	49.7%
Housework	148	49.3%	3	1.0%	151	50.3%	142	47.3%	7	2.3%	149	49.7%
Loneliness	145	48.3%	6	2.0%	151	50.3%	142	47.3%	7	2.3%	149	49.7%
Kids future	133	44.3%	18	6.0%	151	50.3%	141	47.0%	8	2.7%	149	49.7%
Life decisions	150	50.0%	1	.3%	151	50.3%	141	47.0%	8	2.7%	149	49.7%
Relocation	145	48.3%	6	2.0%	151	50.3%	145	48.3%	4	1.3%	149	49.7%
Sleep Dist	146	48.7%	5	1.7%	151	50.3%	142	47.3%	7	2.3%	149	49.7%
Death	147	49.0%	4	1.3%	151	50.3%	147	49.0%	2	.7%	149	49.7%
Own future	131	43.7%	20	6.7%	151	50.3%	126	42.0%	23	7.7%	149	49.7%
With self	128	42.7%	23	7.7%	151	50.3%	129	43.0%	20	6.7%	149	49.7%

A more detailed statistical analysis of the differences in responses of the two groups on each item is presented below.

4.4.1.3.1.1 Is there a difference in the experience of individual stressors between the two groups at baseline?

There was no statistically significant difference (P=0.5660) between the two groups at baseline in respect of the experience of finance as a stressor, with 49.0% of the Active group and 50.7% of the Placebo group respectively endorsing finance as a stressor (as indicated in Table 62).

As reflected in Table 62, there was no statistically significant difference (P=0.7940) between the two groups at baseline in respect of the experience of work as a stressor, with 72.8% of the Active group and 74.5% of the Placebo group respectively positively endorsing work as a stressor.

There was no statistically significant difference (P=0.3840) at baseline between the two groups at in respect of the experience of their own health as a stressor, with most of the sample in both groups (Active group 89.4%, Placebo group 85.9%) reporting that their own health was not a stressor (as shown in Table 62).

Table 62 indicates that there was no statistically significant difference (P=0.8550) at baseline between the two groups at in respect of the experience of the health of their family of creation as a stressor, with most of the sample in both groups (Active group 89.4%, Placebo group 88.6%) reporting that the health of their family of creation was not a stressor.

Table 62 indicates that there was no statistically significant difference (P=0.1280) at baseline between the Active group (86.8%) and Placebo group (92.6%) in respect of the experience of the health of their family of origin as a stressor, with most of the sample in both groups reporting that this variable was not a stressor.

Table 62 indicates that there was no statistically significant difference (P=0.7490) at baseline between the Active group (86.8%) and the Placebo group (92.6%) in respect of the experience of the health of other individuals than family or self as a stressor, with most of the sample in both groups reporting that this variable was not a stressor.

There was no statistically significant difference (P=0.4740) between the two groups at baseline. Only 35.2% of the Active group and 39.6% of the Placebo group reported that time management was a stressor (as shown in Table 62).

Table 62 shows that there was no statistically significant difference (P=0.8920) between the two groups at baseline in respect of personal relationships as a stressor. Most participants in both the Active group (76.8%) and the Placebo group (75.8%) reported that personal relationships were not a stressor for them.

There was no statistically significant difference (P=1.000) between the two groups at baseline in respect of work relationships as a stressor (as shown in Table 62). Most participants in both groups (Active group 76.2%, Placebo group 76.5%) reported that work relationships were not a stressor for them.

Only a minority of the participants in both the Active group (13.2%) and Placebo group (9.4%) reported that crimes experienced by themselves was a stressor. No statistically significant difference (P=0.3630) between the two groups at baseline in respect of this variable was found (as indicated in Table 62).

Most of the participants in both the Active group (84.8%) and Placebo group (89.9%) reported that general crime was a stressor. There was no statistically significant difference (P=0.2240) between the two groups at baseline in respect of this variable as shown in Table 62.

Only 5.3% of the Active group and 8.7% of the Placebo group reported feeling stressed by their partner's work. There was no statistically significant difference (P=0. 2660) between the two groups at baseline in respect of partner's work as a stressor (reflected in Table 62).

There was no statistically significant difference (P=0.1060) between the two groups at baseline in respect of the experience of finance as a stressor, with 49.7% of the Active group and 40.3% of the Placebo group respectively endorsing family responsibilities as a stressor (as indicated in Table 62).

There was no statistically significant difference (P=0.7040) between the two groups at baseline in respect of the experience of study as a stressor as indicated in Table 62. Only a few of the participants in both the Active group (9.3%) and the Placebo group (10.7%) indicated that study was a stressor for them.

Most of the participants in both groups (Active group 495.4%, Placebo group 98.7%) did not report pets as a stressor for them. No statistically significant difference (P= 0.1730) between the two groups at baseline in this regard was found (Table 62).

Only a few of the Active group (22.5%) and the Placebo group (18.1%) reported that their children's behaviour was a stressor for them. There was no statistically significant difference (P=0.3900) between groups at baseline in respect of the behaviour of their children as a stressor as reflected in Table 62.

A minority of the Active group (12.6%) and the Placebo group (14.8%) reported that travel was a stressor for them. No statistically significant difference (P=0.6170) between groups in respect of this variable was found at baseline (Table 62).

Most of the participants in both groups (Active group 98.0%, Placebo group 95.7%) did not report housework as a stressor for them. There was no statistically significant difference (P=0.2160) between groups in this regard at baseline as indicated in Table 62.

There was no statistically significant difference (P=0.7850) between groups at baseline in respect of loneliness as a stressor. The majority of participants in the Active group (96.0%) and the Placebo group (95.3%) did not report loneliness as a stressor (Table 62).

Just over twice as many participants in the Active group (11.9%) as compared to the Placebo group (5.4%) reported that concern for their children's future was a stressor

for them. There was a statistically significant difference (P=0.0440) between the two groups at baseline in this regard as shown in Table 62. This difference between the two groups was further statistical analysed (Pearson's Chi Square) and confirmed a statistically significant difference (P=0.0440) between the two groups at baseline.

The difference between the two groups at baseline in respect of experiencing making life decisions as a stressor was found to be statistically significantly different (P= 0.0190) with the Placebo group (5.4%) endorsing this variable as a stressor to a greater degree than the Active group (0.7%) as shown in Table 62.

As indicated in Table 62, the difference at baseline between the Active (4.0%) and Placebo (2.7%) groups in respect of experiencing relocation as a stressor was not found to be statistically significantly different (P=0.7500).

The majority of participants in both the Active (96.7%) and Placebo (95.3%) did not experience disturbed sleep as a stressor, with there being no statistically significant difference (P=0.5710) between the two groups at baseline (Table 62).

There was no statistically significant difference (P=0.6840) between the two groups at baseline in respect of experiencing death as a stressor as indicated in Table 62. Only 2.6% of the Active group and 1.3% of the Placebo group reported that experiences of death were stressful to them.

Most participants in both the Active (86.8%) and Placebo (84.6%) did not report that concerns about their future were a significant stressor for them at baseline. No

statistically significant difference (P=0.6240) at baseline was found between the two groups (Table 62).

Only 15.2% of the Active group and 13.4% of the Placebo group experienced stress as a result of having concerns about themselves. There was no statistically significant difference (P= 0.7420) between the two groups at baseline (Table 62).

Table 62: Individual stressor by group at baseline

Stressor		Count	Group		Total	P-Value
			Active	Placebo		
Finance	No	% within Group	77	148	71	
			51.0%	49.3%	47.7%	
	Yes	% within Group	74	152	78	
			49.0%	50.7%	52.3%	0.5660
Work	No	% within Group	41	38	79	
			27.2%	25.5%	26.3%	
	Yes	% within Group	110	111	221	
			72.8%	74.5%	73.7%	0.7940
Own Health	No	% within Group	135	128	263	
			89.4%	85.9%	87.7%	
	Yes	% within Group	16	21	37	
			10.6%	14.1%	12.3%	0.3840
Health – Family of Creation	No	% within Group	135	132	267	
			89.4%	88.6%	89.0%	
	Yes	% within Group	16	17	34	
			10.6%	11.4%	11.3%	0.8550
Health – Family of Origin	No	% within Group	131	138	269	
			86.8%	92.6%	89.7%	
	Yes	% within Group	20	11	31	
			13.2%	7.4%	10.3%	0.1280
Health of Others	No	% within Group	147	144	291	
			97.4%	96.6%	97.0%	
	Yes	% within Group	4	5	9	
			2.6%	3.4%	3.0%	0.7490
Time Management	No	% within Group	98	90	188	
			64.9%	60.4%	62.7%	
	Yes	% within Group	53	59	112	
			35.1%	39.6%	37.3%	0.4740

Stressor		Count	Group		Total	P-Value
			Active	Placebo		
Personal Relationships	No	% within Group	116	113	229	
			76.8%	75.8%	76.3%	
	Yes	% within Group	35	36	71	
			23.2%	24.2%	23.7%	0.8920
Work Relationships	No	% within Group	115	114	229	
			76.2%	76.5%	76.3%	
	Yes	% within Group	36	35	71	
			23.8%	23.5%	23.7%	1.000
Crime - self	No	% within Group	131	135	266	
			86.8%	90.6%	88.7%	
	Yes	% within Group	20	14	34	
			13.2%	9.4%	11.3%	0.3630
General Crime	No	% within Group	128	134	262	
			84.8%	89.9%	87.3%	
	Yes	% within Group	23	15	38	
			15.2%	10.1%	12.7%	0.2240
Partner's Work	No	% within Group	143	136	279	
			94.7%	91.3%	93.0%	
	Yes	% within Group	8	13	21	
			5.3%	8.7%	7.0%	0.2660
Family Responsiblities	No	% within Group	76	89	165	
			50.3%	59.7%	55.0%	
	Yes	% within Group	75	60	135	
			49.7%	40.3%	45.0%	0.1060
Study	No	% within Group	137	133	270	
			90.7%	89.3%	90.0%	
	Yes	% within Group	14	16	30	
			9.3%	10.7%	10.0%	0.7040
Pets	No	% within Group	144	147	291	
			95.4%	98.7%	97.0%	
	Yes	% within Group	7	2	9	
			4.6%	1.3%	3.0%	0.1730
Children's Behaviour	No	% within Group	117	122	239	
			77.5%	81.9%	79.7%	
	Yes	% within Group	34	27	61	
			22.5%	18.1%	20.3%	0.3900
Travel	No	% within Group	132	127	259	
			87.4%	85.2%	86.3%	
	Yes	% within Group	19	22	41	
			12.6%	14.8%	13.7%	0.6170
Housework	No	% within Group	148	142	290	
			98.0%	95.3%	96.7%	
	Yes	% within Group	3	7	10	
			2.0%	4.7%	3.3%	0.2160

Stressor		Count	Group		Total	P-Value
			Active	Placebo		
Loneliness	No	% within Group	145	142	287	
			96.0%	95.3%	95.7%	
	Yes	% within Group	6	7	13	
			4.0%	4.7%	4.3%	0.7850
Children's Future	No	% within Group	133	141	274	
			88.1%	94.6%	91.3%	
	Yes	% within Group	18	8	26	
			11.9%	5.4%	8.7%	0.7850
Life Decisions	No	% within Group	150	141	291	
			99.3%	94.6%	97.0%	
	Yes	% within Group	1	8	9	
			0.7%	5.4%	3.0%	0.0190
Relocation	No	% within Group	145	145	290	
			96.0%	97.3%	96.7%	
	Yes	% within Group	6	4	10	
			4.0%	2.7%	3.3%	0.7500
Sleep disturbance	No	% within Group	146	142	288	
			96.7%	95.3%	96.0%	
	Yes	% within Group	5	7	12	
			3.3%	4.7%	4.0%	0.5710
Death	No	% within Group	147	147	294	
			97.4%	98.7%	98.0%	
	Yes	% within Group	4	2	6	
			2.6%	1.3%	2.0%	0.6840
Own future	No	% within Group	131	126	257	
			86.8%	84.6%	85.7%	
	Yes	% within Group	20	23	43	
			13.2%	15.4%	14.3%	0.6240
Concerns about self	No	% within Group	128	129	257	
			84.8%	86.6%	85.7%	
	Yes	% within Group	23	20	43	
			15.2%	13.4%	14.3%	0.7240

$p<0.05$

4.4.1.4 IS THERE A DIFFERENCE IN FREQUENCY OF STRESS IMPACT ON FUNCTIONING BETWEEN THE TWO GROUPS AT BASELINE?

The results of any differences between the two groups (Active and Placebo) with regards to reported frequency regarding impact of stress on work, family chores and relaxation was measured using a likert-type scale for frequency of impact, which ranged from never to continuously.

Differences between the two groups were assessed using t-tests, and are presented below in sections 4.4.1.3.2- 4.4.1.3.3

4.4.1.4.1 Is there a difference between the two groups regarding frequency of impact of stress on work at baseline?

Table 63 indicates that most participants in both groups reported some impact of stress in work functioning, with the highest percentage reporting an impact of less than once monthly (Active 15.0%, Placebo 10.0%) to no impact (Active 12.3%, Placebo 11.3%). Only 12.3% of the Active groups and 11.3% of the Placebo group reported that stress did not impact on work functioning at all. There was no statistically significant difference (P=0.2710) in respect of reported frequency of impact of stress on work between the two groups at baseline, although there was a trend for the Placebo group (5.7%) to report nearly double the number of times work was experienced as a stressor continuously as compared to the Active group (2.7%).

Table 63: Frequency of impact of stress on work by group at baseline

Frequency	Count	Group		Total	P-Value
		Active	Placebo		
Continuously	Number	8	17	25	
	% of Total	2.7%	5.7%	8.3%	
Several times a day	Number	8	9	17	
	% of Total	2.7%	3.0%	5.7%	
Once a day	Number	8	5	13	
	% of Total	2.7%	1.7%	4.3%	
Several times a week	Number	16	18	34	
	% of Total	5.3%	6.0%	11.3%	
Several times a month	Number	20	21	41	
	% of Total	6.7%	7.0%	13.7%	
Once monthly	Number	9	15	24	
	% of Total	3.0%	5.0%	8.0%	
Less than once monthly	Number	45	30	75	
	% of Total	15.0%	10.0%	25.0%	
Never	Number	37	34	71	
	% of Total	12.3%	11.3%	23.7%	
TOTAL		151	149	300	0.2710
		50.3%	49.7%	100%	

$p<0.05$

4.4.1.4.2 Is there a difference between the two groups regarding frequency of impact of stress on family chores at baseline?

Most participants reported some impact of stress on their ability to carry out family chores, ranging from 5.0% with continuous impact to 8.0% reporting an impact several times a week in the Active group, as compared to 6.0% of the Placebo group reported a continuous impact on family chores and 9.3% reporting an impact several times a week. There was a trend for the Placebo group (2.7%) to report three times more frequent impact of stress on family chores than the placebo group (0.7%). However, there was no statistically significant association (P=0.3480) between frequency of impact of stress on family chores and group (active and placebo) overall as indicated in Table 64.

Table 64: Frequency of impact of stress on family chores by group at baseline

Frequency	Count	Group		Total	P-Value
		Active	Placebo		
Continuously	Number	15	18	33	
	% of Total	5.0%	6.0%	11/0%	
Several times a day	Number	15	15	30	
	% of Total	5.0%	5.0%	10.05	
Once a day	Number	2	8	10	
	% of Total	0.7%	2.7%	3.3%	
Several times a week	Number	24	28	52	
	% of Total	8.3%	9.3%	17.3%	
Several times a month	Number	25	28	53	
	% of Total	8.3%	9.3%	17.7%	
Once monthly	Number	19	16	35	
	% of Total	6.3	5.3%	11.7%	
Less than once monthly	Number	30	18	48	
	% of Total	10.0%	6.0%	16.0%	
Never	Number	21	18	30	
	% of Total	7.0%	6.0%	13.0%	
TOTAL		151	149	300	0.3480
		50.3%	19.7%	100.0%	

$p<0.05$

4.4.1.4.3 Is there a difference between the two groups regarding frequency of impact of stress on relaxation at baseline?

Most of the participants in both groups reported some impact of stress on relaxation, while only 14.0% (Active group) and 11.7% (Placebo group) indicated that their stress had no impact on relaxation. There was no significant different association (P= 0.7710) between group and frequency of impact of stress on relaxation overall as indicated in Table 65, although there was a trend for the Placebo group (4.3%) to report nearly double the frequency of impact of stress on relaxation than the Placebo group (2.3%).

Table 65: Frequency of impact of stress on relaxation by group at baseline

Frequency	Count	Group		Total	P-Value
		Active	Placebo		
Continuously	Number	7	13	20	
	% of Total	2.3%	4.3%	6.7%	
Several times a day	Number	11	13	24	
	% of Total	3.7%	4.3%	8.0%	
Once a day	Number	10	12	22	
	% of Total	3.3%	4.0%	7.3%	
Several times a week	Number	25	25	50	
	% of Total	8.3%	8.3%	16.7%	
Several times a month	Number	22	23	45	
	% of Total	7.3%	7.7%	15.0%	
Once monthly	Number	17	11	28	
	% of Total	5.7%	3.7%	9.3%	
Less than once monthly	Number	17	17	34	
	% of Total	5.7%	5.7%	11.3%	
Never	Number	42	35	77	
	% of Total	14.0%	11.7%	25.7%	
TOTAL		151	149	300	0.7710
		50.3%	19.7%	100.0%	

$p<0.05$

Overall, there were no statistically significant differences with regards to total number of stressors between the two groups at baseline. In respect of the individual stressors, there were some statistically significant differences between the two groups, namely concern for children's future (Active greater than Placebo) and making life decisions (Placebo greater than Active).

4.4.2 RESEARCH QUESTION 5

IS THERE A DIFFERENCE IN MODERATING VARIABLES BETWEEN THE TWO GROUPS (ACTIVE AND PLACEBO) AT BASELINE?

The respective differences in personal and environmental moderating variables between the Active and Placebo groups at baseline were identified and are reported upon in this section.

4.4.2.1 IS THERE A DIFFERENCE BETWEEN THE TWO GROUPS WITH REGARDS TO PERSONAL RESOURCES AT BASELINE?

The personal resources investigated in this study included the variables of perceived personal control (PCI), optimism (LOT), and perception of acceptable percentage of stress to live by (%acceptable).

Differences between groups at baseline were measured using Levene's test for equality of means and paired 2-tail t-test. Results are reported in Table 66.

There were no significant differences at baseline for the variables of perceived personal control (P=0.103) or optimism (P=0.276) between the Active and Placebo groups. However, there was a significant difference (P=0.000) in how much stress it

was believed (cognitive) was acceptable to live with between the two groups, with the Active group (χ 38.65, SD 18.48), SD endorsing a higher level of stress being acceptable than the Placebo group (χ 28.64, SD 18.43) at baseline (Table 66).

Table 66: Personal resources (moderating variables) by group at baseline

Personal Resource	Group	N	Mean	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
PCI	Active	151	29.9338	4.62842	0.37666		0.103
	Placebo	149	30.7181	3.60570	0.29539	0.1050	0.102
LOT	Active	151	31.0331	3.48983	0.28400		0.276
	Placebo	149	31.4966	3.86184	0.31637	0.2840	0.276
% Acceptable	Active	151	38.6490	18.48214	1.50405		0.000
	Placebo	149	28.6443	18.42739	1.50963	0.9180	0.000

$p<0.05$

4.4.2.2 IS THERE A DIFFERENCE BETWEEN THE TWO GROUPS WITH REGARD TO ENVIRONMENTAL VARIABLE AT BASELINE?

A measure of everyday daily positive events/experiences (Daily Uplifts) comprised the environmental measure and is reported on in Table 67 below. The situational variables selected for the study included five demographic variables, namely age, gender, ethnicity, marital status and living arrangement.

Between group differences at baseline for the Daily Uplifts were investigated using Levene's test for equality of means and paired 2-tail t-test. Results are reported in section 4.4.2.2.2

4.4.2.2.1 Is there a difference in environmental variables between the two groups at baseline?

Table 67 indicates that there was no significant difference (P=0.9510) at baseline between the two groups with regard to the everyday experience of uplifting events (Daily Uplifts).

Table 67: Daily uplifts (environmental variable) by group at baseline

Environmental Variable	Group	N	Man	Std. Deviation	Std. Error Mean	Levene's	2-Tailed P-Value
Daily Uplifts	Active	151	41.9603	22.65182	1.84338		0.9510
	Placebo	148	42.1284	24.55572	2.01847	0.336	0.9510

$p<0.05$

4.4.3 RESEARCH QUESTION 6

IS THERE A DIFFERENCE IN OUTCOME VARIABLES BETWEEN THE TWO GROUPS (ACTIVE AND PLACEBO) AT BASELINE?

This section analyses differences between the active and placebo groups in respect of the outcome variables of level of stress (SSCL), perceived level of stress (VA), anxiety (HARS), psychological general well-being (PGWB), subjective cognitive complaints, and neuropsychological functioning.

Differences at baseline between the two groups in respect of these variables were investigated by means of t-tests and or univariate analysis of variance. Results are reported in sections 4.4.3.1 – 4.4.3.6.

4.4.3.1 IS THERE A DIFFERENCE IN LEVEL OF STRESS (SSCL) BETWEEN THE TWO GROUPS AT BASELINE?

The results as presented in Table 68 show that there was only a borderline statistically significant difference (P=0.0510) between the Active and the Placebo group at baseline with regards to behavioual symptoms on the SSCL, otherwise there were no other statistically significant differences.

Table 68: SSCL by group at baseline

SSCL	Group	N	Mean	Std. Deviation	P-Value
Physical	Active	151	5.9901	3.81378	0.5510
	Placebo	149	5.7416	3.38648	
Psychological	Active	151	7.7980	6.16392	0.3290
	Placebo	149	7.1275	5.69648	
Behavioural	Active	151	12.1636	7.89521	0.0510
	Placebo	149	10.4698	7.06754	
SSCL Total	Active	151	25.8974	16.34272	0.1590
	Placebo	149	23.3289	15.10602	

$p<0.05$

Further univariate analysis of variance (Univariate ANOVA presented in (Table 69) between the two groups with regards to performance on the SSCL confirmed that there is no statistically significant difference between Active and Placebo groups at baseline in respect of levels of stress reported for physical (P=0.2830), psychological (P=0.3050), and total stress (P=0.1320) on the SSCL at baseline. However, there is a borderline significant difference (P=0.0580) between the groups with regards to

behavioural symptoms at baseline, with the Active group reporting slightly more behavioural symptoms of stress than the Placebo group (Figure 6).

Table 69: SSCL by group at baseline on univariate anova

SSCL	Source	Type III Sum of Squares	DF	Mean Square	F	P-Value
SSCL Physical	Between groups (A/P)	14.801	1	14.801	1.157	0.2830
SSCL Psychological	Between groups (A/P)	36.144	1	36.144	1.058	0.3050
SSCL Behavioural	Between groups (A/P)	201.127	1	201.127	3.626	0.0580
SSCL Total	Between groups (A/P)	552.092	1	552.092	2.276	0.1320

$p<0.05$

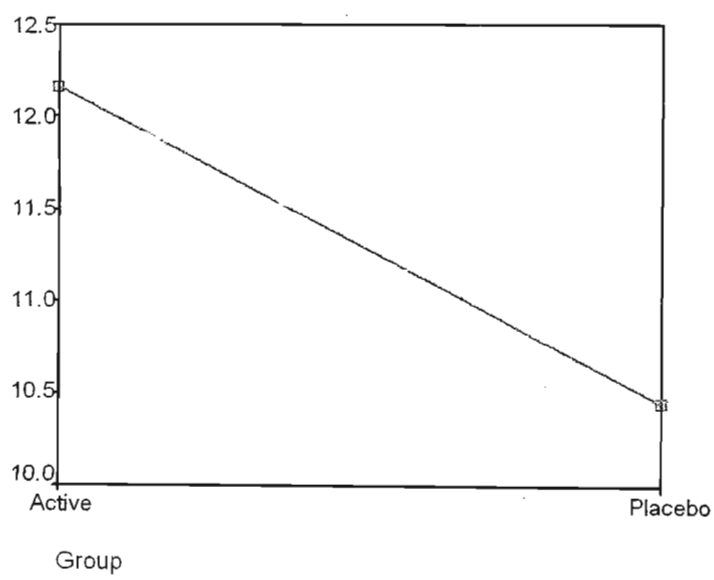

Figure 6: Profile Plots of Estimated Marginal Means between groups on SSCL Behaviour

4.4.3.2 IS THERE A DIFFERENCE IN SUBJECTIVE COGNITIVE SYMPTOMS BETWEEN THE TWO GROUPS AT BASELINE?

As indicated in Table 70, there was a statistically significant difference between the two groups in respect of the following subjective cognitive complaints at baseline, with the Active group reporting more complaints than the Placebo group: memory loss or forgetfulness (P= 0.057), poor long term planning (P=0.0055), and poor work quality (P=0.0066), with a borderline significant difference with regard to poor problem solving (P=0.0570).

Table 70: Subjective cognitive complaints by group at baseline

Cognitive Symptom	Group	Mean	SD	P-Value
Memory loss or forgetfulness	Active	0.7	0.5	0.0567
	Placebo	0.6	0.5	
Poor concentration	Active	0.4	0.5	0.8954
	Placebo	0.4	0.5	
Poor long term planning	Active	0.6	0.5	0.0055
	Placebo	0.5	0.5	
Poor time management	Active	0.3	0.5	0.1279
	Placebo	0.2	0.4	
Poor work quality	Active	0.5	0.5	0.0066
	Placebo	0.3	0.5	
Making unnecessary mistakes	Active	0.2	0.4	0.2524
	Placebo	0.2	0.4	
Inability to meet deadlines	Active	0.3	0.5	0.8488
	Placebo	0.3	0.4	
Poor decision making	Active	0.2	0.4	0.0652
	Placebo	0.1	0.3	
Poor problem solving skills	Active	0.5	0.5	0.0570
	Placebo	0.4	0.5	
Need to work late regularly	Active	0.1	0.3	0.8860
	Placebo	0.1	0.3	
Difficulty in completing one task before moving on to the next	Active	0.2	0.4	0.4401
	Placebo	0.2	0.4	

$p<0.05$

4.4.3.3 IS THERE A DIFFERENCE BETWEEN GROUPS AT BASELINE IN PERCEPTION OF LEVEL OF STRESS (VA)?

There was no statistically significant difference (P=0.4180) between the two groups (Active and Placebo) as to their perception on the Visual Analogue Scale (VA) as to overall level of stress at baseline, with the Active group having a mean of 6.4 (SD 1.5) and the Placebo group mean being 6.2 (SD 1.7) as indicated in Table 71.

Table 71: Group by VA at baseline

Group	Mean	SD	P-Value
Active	6.4	1.5	0.4180
Placebo	6.2	1.7	

$p<0.05$

Univariate ANOVA confirmed no statistically significant difference (0.6700) between the two groups at baseline with regards to perception of level of stress (VA) as shown in Table 72, and in Figure 7.

Table 72: Univariate anova of VA by group at baseline

VA	Source	Type III Sum of Squares	DF	Mean Square	F	P-Value
Perception of level of stress	Between groups (A/P)	0.786	1	0.786	0.182	0.6700

$p<0.05$

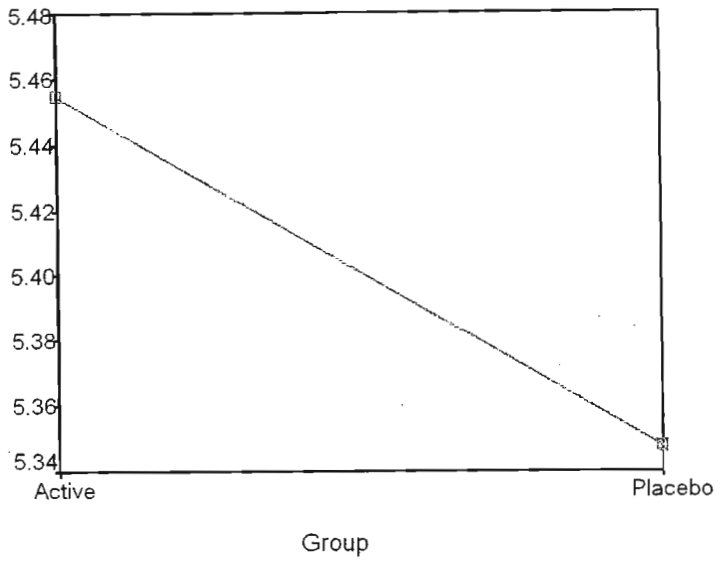

Figure 7: Profile Plots of Estimated Marginal Means between groups on the Visual Analogue scale

4.4.3.4 IS THERE A DIFFERENCE BETWEEN THE TWO GROUPS WITH REGARDS TO LEVEL OF ANXIETY (HARS) AT BASELINE?

As indicated in Table 73, there was a statistically significant difference (P=0.1148) in the overall level of anxiety (HARS) between the Active and Placebo groups at baseline as measured by the Hamilton Anxiety Rating Scale (HARS), with the Active group having a mean score of 16.2 (SD 8.1) as compared to a mean score of 14.6 (SD 9.1) for the Placebo group.

Table 73: group by HARS (TOTAL) at baseline

Group	Mean	SD	P-Value
Active	16.2	8.1	
Placebo	14.6	9.1	0.1148

$p<0.05$

Further statistical analysis (Univariate ANOVA) confirmed this statistically significant difference (P=0.0520) between the two groups (shown in Table 74), with the Active group reporting a higher level of anxiety at baseline than the Placebo group (Figure 8).

Table 74: Univariate anova of HARS by group at baseline

HARS	Source	Type III Sum of Squares	DF	Mean Square	F	P-Value
Anxiety	Between groups (A/P)	259.315	1	259.315	3.810	0.0520

$p<0.05$

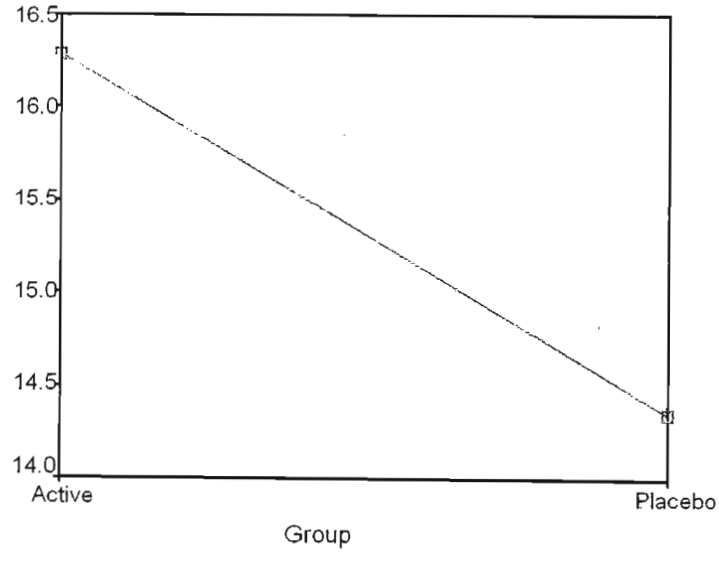

Figure 8: Profile Plots of Estimated Marginal Means between groups on HARS

A more detailed analysis of specific anxiety symptoms (items) endorsed by both groups (Table 75), indicates that there were statistically significant baseline differences between the two groups on the following items: fears (P=0.0003) and

depressed mood (P=0.0040) with marginally statistically significant differences for tension (P=0.0296) and being anxious (P=0.0530).

Table 75: Anxiety symptoms by group at baseline

HARS Synptom	Group	Mean	SD	P-Value
Anxious	Active	1.8	0.8	
	Placebo	1.6	0.9	0.0530
Tension	Active	2.0	1.9	
	Placebo	1.6	1.0	0.0296
Fears	Active	0.9	1.0	
	Placebo	0.8	0.1	0.0003
Insomnia	Active	1.4	1.1	
	Placebo	1.3	1.1	0.4029
Intellectual (Cognitive)	Active	1.6	0.9	
	Placebo	1.6	1.0	0.8054
Depressed Mood	Active	1.4	0.9	
	Placebo	1.1	1.0	0.0040
Somatic Muscular	Active	1.3	1.0	
	Placebo	1.2	1.1	0.3395
Somatic Sensory	Active	0.8	1.0	
	Placebo	0.8	1.1	0.6775
Cardiovascular Symptoms	Active	0.7	0.8	
	Placebo	0.7	0.9	0.8231
Respiratory Symptoms	Active	0.7	0.8	
	Placebo	0.7	0.9	0.9168
Gastrointestinal Symptoms	Active	1.0	0.9	
	Placebo	1.0	1.0	0.7241
Genitourinary Symptoms	Active	0.7	0.9	
	Placebo	0.6	0.9	0.3192
Autonomic Symptoms	Active	1.2	1.0	
	Placebo	1.1	1.2	0.5992
Bahavioural Symptoms	Active	0.8	0.8	
	Placebo	0.8	1.0	0.5153
Total	Active	16.2	8.1	
	Placebo	14.6	9.1	0.1148

$p<0.05$

4.4.3.5 IS THERE A DIFFERENCE IN PSYCHOLOGICAL GENERAL WELL-BEING (PGWB) BETWEEN THE TWO GROUPS AT BASELINE?

Table 76 indicates that there is a statistically significant difference (P=0. 0095) in total level of psychological well-being between the two groups at baseline as measured by the Psychological General Well-Being Scale (PGWB), with the Placebo

group (χ 60.5, SD 17.4) reporting a higher level of well-being than the Active group (χ 60.5, SD 15.4).

Table 76: Group by PGWB (TOTAL) at baseline

Group	Mean	SD	P-Value
Active	60.5	15.4	0.0095
Placebo	65.5	17.4	

$p<0.05$

Further statistical analysis (Univariate ANOVA) did not confirm that the Placebo group reported statistically higher (P=0.1110) levels of well-being at baseline than the Active group (as reflected in Table 77 and Figure 9).

Table 77: Univariate anova of PGWB by group at baseline

PGWB	Source	Type III Sum of Squares	DF	Mean Square	F	P-Value
Psychological general well-being	Between groups (A/P)	609.273	1	609.273	2.557	0.1110

$p<0.05$

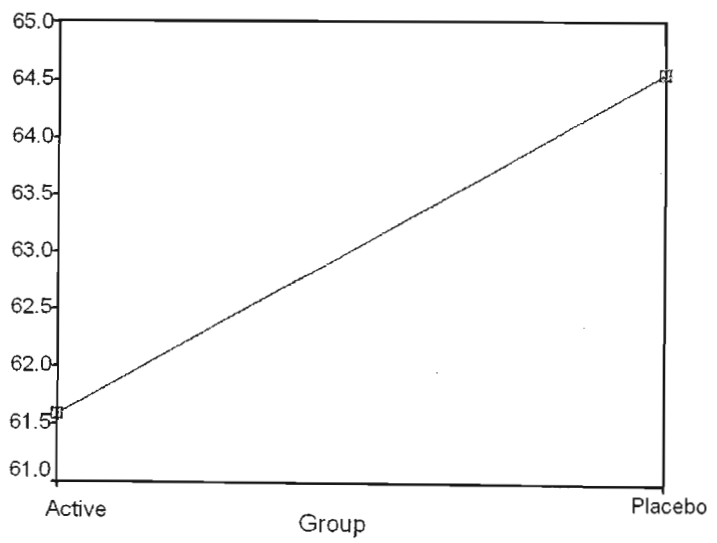

Figure 9: Profile Plots for Estimated Marginal means between groups on PGWB

A more detailed analysis of specific symptoms regarding psychological well-being endorsed by both groups (Table 78), indicates that there were statistically significant differences between the Active and Placebo groups at baseline, with the Placebo group reporting statistically significantly less negative symptoms on the following items: amount of energy (P=0.0004), feeling healthy enough to carry out things that had to be done or that the person liked to do (P=0.0330), having been concerned, worried, or had any fears about their health (P=0.0024), feeling tired, worn out, used up, or exhausted (P=0.0025) and marginally significant differences for: having any illness, bodily disorder, aches or pains (P=0.0560).

Table 78: Symptoms of psychological general well-being by group at baseline

Table 78: Symptoms of psychological general well-being by group at baseline

PGWB Symptom	Group	Mean	SD	P-Value
Feeling in general	Active	2.3	0.8	
	Placebo	2.5	1.0	0.0560
Any illness, bodily disorder, aches or pains	Active	2.8	1.2	
	Placebo	3.0	1.3	0.0887
Feel depressed	Active	3.6	0.9	
	Placebo	3.6	1.1	0.9473
In firm control of behaviour, thoughts, emotions, feelings	Active	3.1	1.0	
	Placebo	3.3	1.1	0.1646
Bothered by nervousness or your 'nerves'	Active	3.2	1.1	
	Placebo	3.4	1.3	0.0820
Amount of energy, pep, or vitality did you have or feel	Active	2.4	1.0	
	Placebo	2.9	1.1	0.0004
Felt downhearted or blue	Active	3.1	1.0	
	Placebo	3.3	1.0	0.1108
Generally tense or felt any tension	Active	2.1	1.0	
	Placebo	2.3	1.1	0.1107
Feel happy, satisfied or pleased with personal life	Active	2.6	1.1	
	Placebo	2.8	1.1	0.1102
Feel healthy enough to carry out the things you like to do or had to do	Active	3.9	0.8	
	Placebo	4.2	0.9	0.0330
Felt so sad, discouraged, hopeless, or had so many problems that you wondered if anything was worthwhile	Active	3.4	1.4	
	Placebo	3.7	1.3	0.1449
Woke feeling fresh and rested	Active	2.0	1.3	
	Placebo	2.2	1.4	0.2172
Been concerned, worried, or had any fears about your health	Active	3.0	1.2	
	Placebo	3.4	1.2	0.0024
Had any reason to wonder if you were losing your mind, or losing control over the way you act, talk, think, feel or of your memory	Active	3.5	1.5	
	Placebo	3.7	1.2	0.1038
My daily life was full of things that were interesting to me	Active	2.5	1.2	
	Placebo	2.6	1.2	0.8792
Feel active, vigorous, or dull, sluggish	Active	2.6	1.0	
	Placebo	2.8	0.9	0.0917
Been anxious, worried, or upset	Active	2.4	1.1	
	Placebo	2.7	1.3	0.0658
Emotionally stable and sure of myself	Active	3.0	1.1	
	Placebo	3.2	1.3	0.1171
Relaxed, at ease, or highly strung, tight, or keyed-up	Active	2.5	1.0	
	Placebo	2.7	1.2	0.0942
Felt cheerful, lighthearted	Active	2.4	1.1	
	Placebo	2.6	1.1	0.1431
Felt tired, worn out, used up, or exhausted	Active	2.4	1.1	
	Placebo	2.8	1.3	0.0025
Been under or felt you were under any strain, stress, or pressure	Active	1.9	1.1	
	Placebo	2.1	1.4	0.0563
Total	Active	60.5	15.4	
	Placebo	65.5	17.4	0.0095

$p<0.05$

4.4.3.6 IS THERE A DIFFERENCE BETWEEN GROUPS IN PERFORMANCE ON SELECT MEMORY FUNCTIONS (NEUROPSYCHOLOGICAL TEST DATA) AT BASELINE?

4.4.3.6.1 Is there a difference between groups in performance on a task of Discrete items/List Learning (RAVLT) at baseline?

Table 79 indicates that overall there was no significant difference on any of the trials on the RAVLT between the two groups at baseline, including immediate recall (P=0.3094), best learning (P=0.9161), total amount learned (P=0.6234), proactive learning (P=0.5142), delayed recall (P=0.6234) or recognition (P=0.5337).

Table 79: Comparison of RAVLT raw scores between groups at baseline

Trial	Group	Mean	SD	P-Value
Trial 1	Active	6.6	2.1	
	Placebo	6.8	2.1	0.3094
Trial 2	Active	9.1	2.2	
	Placebo	9.3	2.4	0.4056
Trial 3	Active	10.7	2.2	
	Placebo	10.8	2.4	0.8310
Trial 4	Active	11.6	2.2	
	Placebo	11.6	2.3	0.9024
Trial 5	Active	12.3	2.0	
	Placebo	12.3	2.0	0.9161
Sum 1-5	Active	50.3	8.7	
	Placebo	50.8	9.5	0.6234
List B	Active	5.8	2.1	
	Placebo	5.7	2.0	0.5143
Recall -	Active	10.8	2.7	
Delayed	Placebo	10.8	3.0	0.9939
Recognition	Active	14.3	1.0	
	Placebo	14.3	1.1	0.5337

$p<0.05$

4.4.3.6.2 Is there a difference between the two groups at baseline in respect of recall of Meaningful Verbal Material in Context (Story Recall)?

There was no significant difference (P=0.1370) between the active and placebo group on immediate recall at baseline. Likewise, the two groups did not differ significantly (P=0.1282) in respect of performance on delayed recall of a story at baseline. Results are indicated in Table 80.

Table 80: Comparison of active and placebo groups on Story Recall at baseline

Story Recall	Group	Mean	SD	P-Value
Immediate	Active	13.1	4.3	0.1370
	Placebo	13.8	4.1	
Delayed	Active	11.6	3.8	0.1282
	Placebo	12.3	4.0	

$p<0.05$

4.4.3.6.3 Is there a difference between group regarding performance on Visual Recall of a Complex Configurational Design (RCF) at baseline?

There was no significant difference between the Active and Placebo groups at baseline with regards to performance on the copy trial of the RCF (P=0.9337), on the immediate recall trial (P=0.7640) or on delayed recall trial (P=0.9499) at baseline, as reflected in Table 81. While the mean of 30.6 on the copy trial (both groups) is somewhat below average, with qualitative analysis of each drawing suggesting minor inaccuracies (e.g. poorer intersections, careless execution of lines etc.) rather than any

major distortions of the overall configuration of the design or design elements. The mean scores on immediate (Active χ19.9, SD 4.7; Placebo χ 20.3, SD 5.7) and delayed recall (Active χ 19.7, SD 4.4; Placebo 19.7, SD 5.5) for both groups are within normal limits.

Table 81: Comparison of RCG raw scores for active and placebo groups at baseline

RCF	Group	Mean	SD	P-Value
Copy	Active	30.6	2.9	
	Placebo	30.6	2.3	0.9337
Immediate	Active	19.9	4.7	
Recall	Placebo	20.3	5.7	0.7640
Delayed	Active	19.7	4.4	
Recall	Placebo	19.7	5.5	0.9499

$p<0.05$

PART THREE

RESULTS OF THE EFFICACY ANALYSIS

4.5 INFERENTIAL RESULTS

RESEARCH QUESTION 7

WHAT EFFECT DOES MICRONUTRIENT (MULTIVITAMIN AND MINERAL COMBINATION) SUPPLEMENTATION HAVE ON ALL THE VARIABLES MEASURED (WHERE RELEVANT) FOR THE TWO GROUPS?

4.5.1 WHAT IS THE EFFECT OF MICRONUTRIENT SUPPLEMENTATION ON PERCEPTION OF EVERYDAY ENVIRONMENTAL STRESSORS FOR THE TWO GROUPS (ACTIVE AND PLACEBO)?

The Daily Hassles Scale (DH) was used to assess the differences in perception of everyday events being stressful after micronutrient supplementation (pre- post-test) in English-speaking South Africans in the general public.

Repeated measures of analysis of variance (Repeated measures ANOVA; Wilks' Lambada) was undertaken for both the Active and Placebo groups and the results are presented below.

A statistically significant time effect (P=0.008) for perception of everyday events being stressful (daily hassles) was found, indicating an improvement from pre- to post-test following micronutrient supplementation (Table 82). However, there was no significant group effect (P=0.249), that is, no significant difference between the two groups with respect to improvement over time (presented in Table 83 and graphically in Figure 10). Likewise, there was no significant time by group interaction (treatment effect) for perceived daily hassles (P= 0.931) as indicated in Table 82.

Table 82: Within-subject contrasts for Daily Hassles

Source	Time	Type III Sum of Squares	DF	Mean Square	F	Sig.
TIME	Linear	7482.004	1	7482.004	46.355	0.008
TIME * AP	Linear	1.204	1	1.204	0.007	0.931
Error(TIME)	Linear	48098.695	298	161.405		

$p < 0.05$

Table 83: Between-subject effects for Daily Hassles

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
INTERCEPT	651536.130	1	651536.130	998.153	0
AP	871.623	1	871.623	1.335	0.249
ERROR	194516.995	298	652.742		

$p < 0.05$

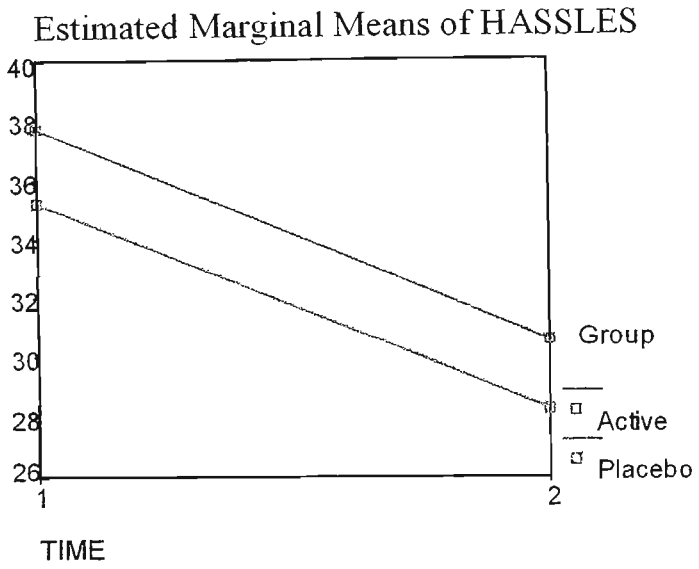

Figure 10 : Profile Plots for Estimated Marginal Means for Daily Hassles

4.5.2 WHAT IS THE EFFECT OF MICRONUTRIENT SUPPLEMENTATION ON ENVIRONMENTAL MODERATING VARIABLES, THAT IS, PERCEPTION OF EVERYDAY ENVIRONMENTAL UPLIFTS (DAILY UPLIFTS) THE TWO GROUPS (ACTIVE AND PLACEBO)?

The Daily Uplifts Scale (DUp) was used to assess the differences in perception of everyday events (environmental variable) being uplifting after micronutrient supplementation (pre- post-test) in English-speaking South Africans in the general public.

Repeated measures of analysis of variance (Repeated measures ANOVA; Wilks' Lambada) was undertaken for both the Active and Placebo groups and the results are presented below.

There was no statistically significant time effect (P=0.508), group effect (P=0.719) or time by group interaction (treatment effect) with regards to daily uplifting experiences (P=0.540) following micronutrient supplementation. Results are presented in Tables 84-85 and Figure 11. However, there was a trend for the Placebo group to report more everyday experiences as uplifting on post-test.

Table 84: Within-subject contrasts for Daily Uplifts

Source	Time	Type III Sum of Squares	DF	Mean Square	F	Sig.
TIME	Linear	94.881	1	94.881	0.439	0.508
TIME * AP	Linear	81.216	1	81.216	0.375	0.540
Error(TIME)	Linear	64239.647	297	216.295		

$p < 0.05$

Table 85: Between-subject effects for Daily Uplifts

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
INTERCEPT	1077116.848	1	1077116.848	1143.817	0
AP	122.487	1	122.487	.0130	0.719
ERROR	279680.724	297	941.686		

$p < 0.05$

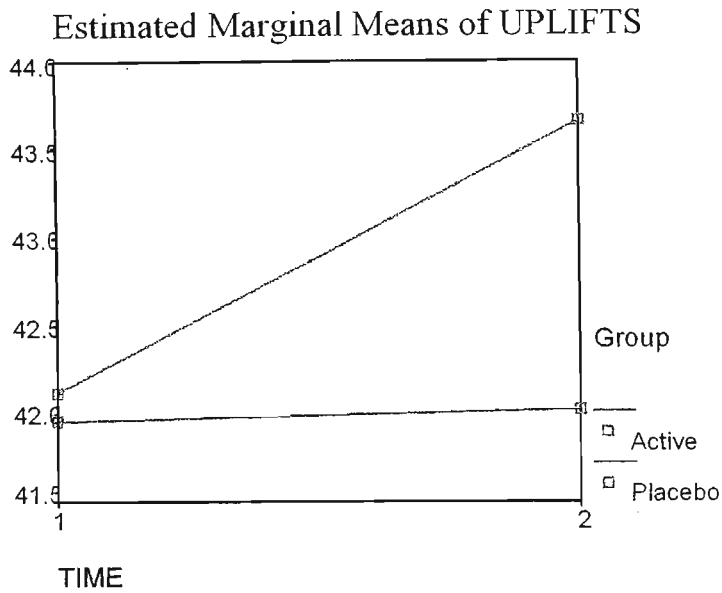

Figure 11: Profile Plots for Estimated Marginal Means for Daily Uplifts

4.5.3 WHAT IS THE EFFECT OF MICRONUTRIENT SUPPLEMENTATION ON PERSONAL RESOURCES (MODERATING VARIABLES) FOR THE TWO GROUPS (ACTIVE AND PLACEBO)?

The Life Orientation Test (LOT) was used to assess the differences in optimism , while the Perceived Coping Incapacity Scale (PCI) was used to measure differences in perceived coping incapacity (control), after micronutrient supplementation (pre- post-test) in this sample of English-speaking South Africans in the general public.

Repeated measures of analysis of variance (Repeated measures ANOVA; Wilks' Lambada) was undertaken for both the Active and Placebo groups and the results are presented below.

4.5.3.1 WHAT IS THE EFFECT OF MICRONUTRIENT SUPPLEMENTATION OF LIFE ORIENTATION (LOT)?

Table 86 shows that there was a statistically significant time effect (P=0.008) for life orientation (optimism), indicating an improvement from pre- to post-test following micronutrient supplementation. However, there was no significant group effect (P=0.282), that is, no significant difference between the two groups with respect to improvement over time (presented in Table 87 and graphically in Figure 12). Likewise, there was no significant time by group interaction (treatment effect) for perceived total level of stress (P=. 0.998) as indicated in Table 86.

Table 86: Within-subject contrasts for LOT

Source	Time	Type III Sum of Squares	DF	Mean Square	F	Sig.
TIME	Linear	110.933	1	110.933	7.044	0.008
TIME * AP	Linear	.000	1	0.000	0.000	0.998
Error(TIME)	Linear	4693.060	298	15.749		

p 0.05

Table 87: Between-subject effects for LOT

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
INTERCEPT	602712.285	1	602712.285	21809.095	0
AP	32.098	1	32.098	1.161	0.282
ERROR	8235.475	298	27.636		

p 0.05

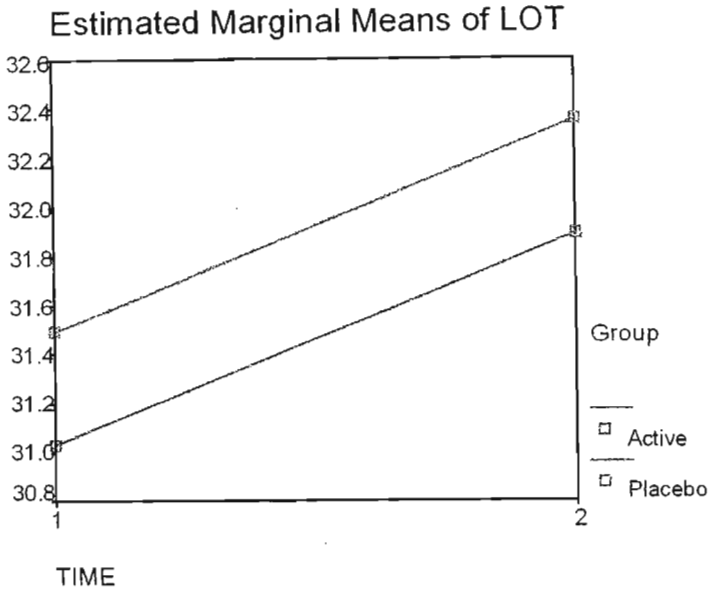

Figure 12: Profile Plots of Estimated Marginal Means for LOT

4.5.3.2 WHAT IS THE EFFECT OF MICRONUTRIENT SUPPLEMENTATION OF PERCEIVED COPING INCAPACITY (PCI)?

A statistically significant time effect (P=0.023) for life orientation (optimism) was found, indicating an improvement from pre- to post-test following micronutrient supplementation (Table 88). However, there was no significant group effect (P=0.131), that is, no significant difference between the two groups with respect to improvement over time (presented in Table 89 and graphically in Figure 13). Likewise, there was no significant time by group interaction (treatment effect) for perceived total level of stress (P=0.417) as indicated in Table 88. However, there was a trend for the Active group to improve more than the Placebo group as seen in Figure 13.

Table 88: Within-subject contrasts for PCI

Source	Time	Type III Sum of Squares	DF	Mean Square	F	Sig.
TIME	Linear	47.375	1	47.375	5.239	0.023
TIME * AP	Linear	5.975	1	5.975	0.661	0.417
Error(TIME)	Linear	2694.923	298	9.043		

$p < 0.05$

Table 89: Between-subject effects for PCI

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
INTERCEPT	562046.223	1	562046.223	25067.331	0
AP	51.289	1	51.289	2.288	0.131
ERROR	6681.596	298	22.421		

$p < 0.05$

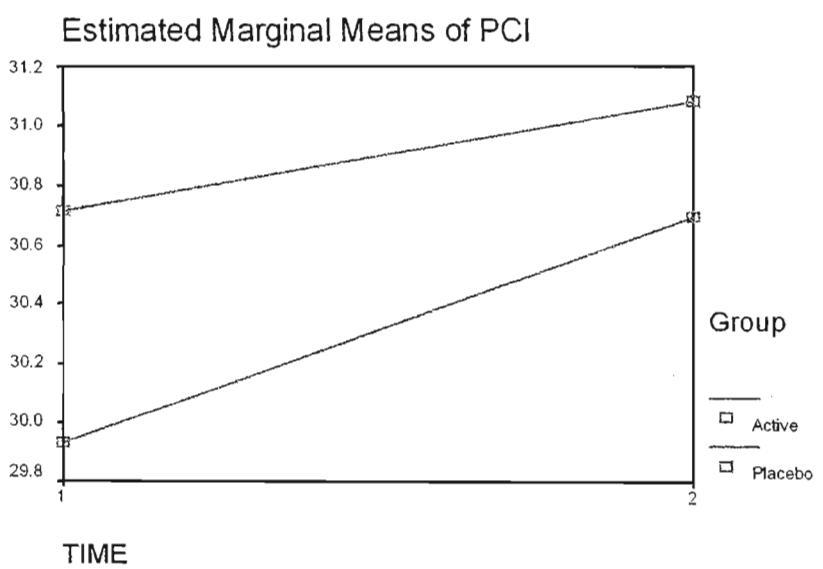

Figure13: Profile Plots of Estimated Marginal Means for PCI

4.5.4 WHAT IS THE EFFECT OF MICRONUTRIENT SUPPLEMENTATION ON HEALTH OUTCOMES AS MEASURED BY REPORTED STRESS SYMPTOMS, PERCEPTION OF LEVEL OF STRESS, ANXIETY, PSYCHOLOGICAL GENERAL WELL-BEING AND NEUROCOGNITIVE FUNCTION FOR THE TWO GROUPS?

4.5.4.1 WHAT IS THE EFFECT OF MICRONUTRIENT SUPPLEMENTATION ON REPORTED STRESS SYMPTOMS FOR THE TWO GROUPS?

The Stress Symptom Checklist (SSCL) was used to assess the differences in outcome after micronutrient supplementation (pre- post-test) in levels of stress and stress symptoms experienced by English-speaking South Africans in the general public.

Repeated measures of analysis of variance (Repeated measures ANOVA; Wilks' Lambada) was undertaken for both the Active and Placebo groups and the results are presented below.

4.5.4.1.1 What is the effect of micronutrient supplementation on physical stress symptoms (SSCL physical) for the two groups?

The results presented in Table 90 indicated that there was a statistically significant time effect (P=0.000), that is, that reported levels of physical stress improved with time

(from pre- to post-test) following micronutrient supplementation. However there was no significant group effect (P=0.757) indicating no significant difference between the two groups with respect to improvement over time (Table 91). Furthermore, there was no significant time by group interaction (treatment effect) for reported physical symptoms of stress (P=0.953) as indicated in Table 90, and shown graphically in Figure 14.

Table 90: Within-subject contrasts for SSCL PHYSICAL

Source	Time	Type III Sum of Squares	DF	Mean Square	F	Sig.
TIME	Linear	824.184	1	824.184	172.196	0
TIME * AP	Linear	.017	1	0.017	0.004	0.953
Error(TIME)	Linear	1249.231	261	4.786		

$p < 0.05$

Table 91: Between-subject effects for SSCL PHYSICAL

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
INTERCEPT	9736.577	1	9736.577	745.451	0
AP	1.254	1	1.254	0.096	0.757
ERROR	3409.006	261	13.061		

$p < 0.05$

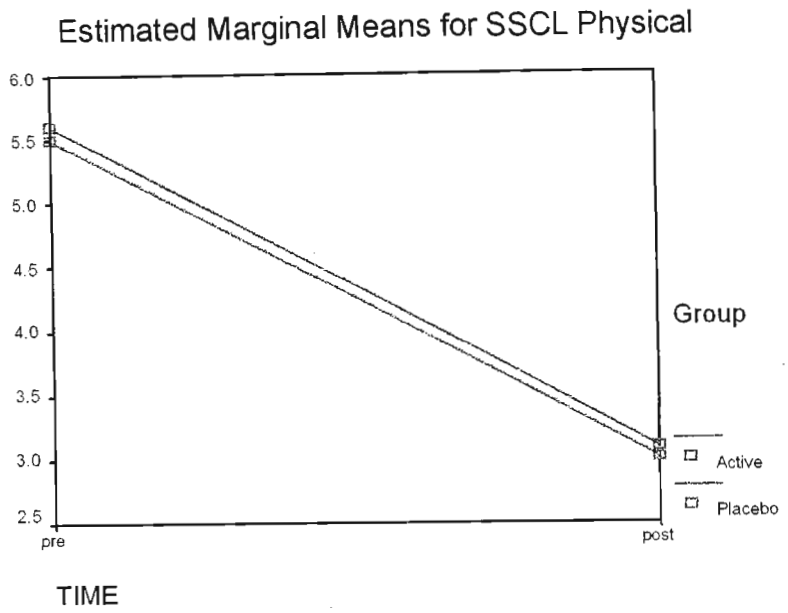

Figure 14: Profile Plots of Estimated Marginal Means for SSCL Physical

4.5.4.1.2 What is the effect of micronutrient supplementation on psychological stress symptoms (SSCL psychological) for the two groups?

A statistically significant time effect (P=0.000) was found for psychological symptoms of stress, indicating an improvement from pre- to post-test following micronutrient supplementation (Table 92). However, as shown in Table 93, there was no significant group effect (P=0.665) indicating no significant difference between the two groups with respect to improvement over time. Nor was there any significant time by group interaction (treatment effect) for reported psychological symptoms of stress (P=0.710) as indicated in Table 92, and shown graphically in Figure 15.

Table 92: Within-subject contrasts for SSCL PSYCHOLOGICAL

Source	Time	Type III Sum of Squares	DF	Mean Square	F	Sig.
TIME	Linear	1752.416	1	1752.416	137.035	0
TIME * AP	Linear	1.774	1	1.774	0.139	0.710
Error(TIME)	Linear	3337.684	261	12.788		

$p < 0.05$

Table 93: Between-subject effects for SSCL PSYCHOLOGICAL

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
INTERCEPT	14911.863	1	14911.863	430.581	0
AP	6.517	1	6.517	0.188	0.665
ERROR	9038.941	261	34.632		

$p < 0.05$

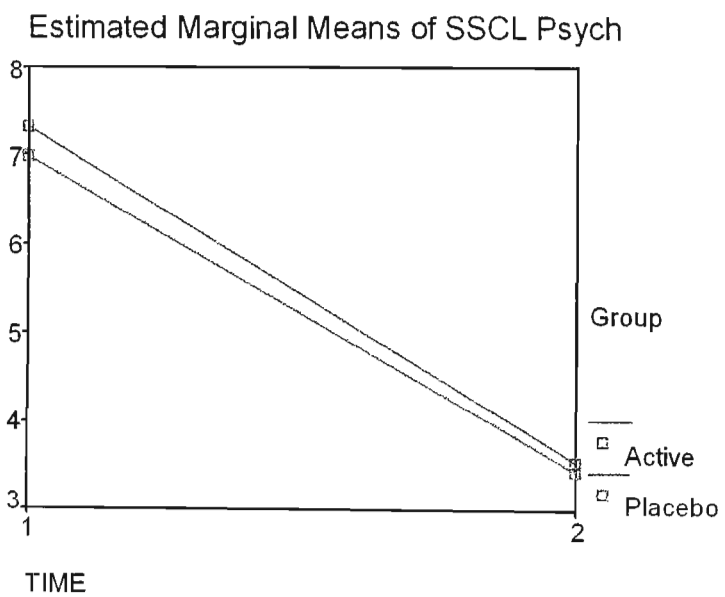

Figure 15: Profile Plots for Estimated Marginal Means for SSCL Psychological

4.5.4.1.3 What is the effect of micronutrient supplementation on behavioural stress symptoms (SSCL behavioural) for the two groups?

As indicated in Table 94, a statistically significant time effect (P=0.000) was found for behavioural symptoms of stress, indicating an improvement from pre- to post-test following micronutrient supplementation. The results, however, did not show a significant group effect (P=0.075), thus indicating no significant difference between the two groups with respect to improvement over time (Table 95). Similarly, there was no significant time by group interaction (treatment effect) for reported behavioural symptoms of stress (P=0.254) as indicated in Table 94, and shown graphically in Figure 16. However, there is a slight trend for the Active group to improve more quickly than the Placebo group (Figure 16).

Table 94: Within-subject contrasts for SSCL BEHAVIOURAL

Source	Time	Type III Sum of Squares	DF	Mean Square	F	Sig.
TIME	Linear	4260.725	1	4260.725	157.212	0
TIME * AP	Linear	35.481	1	35.481	1.309	0.254
Error(TIME)	Linear	7073.558	261	27.102		

$p < 0.05$

Table 95: Between-subject effects for SSCL BEHAVIOURAL

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
INTERCEPT	35564.151	1	35564.151	720.093	0
AP	158.063	1	158.063	3.200	0.075
ERROR	12890.335	261	49.388		

$p < 0.05$

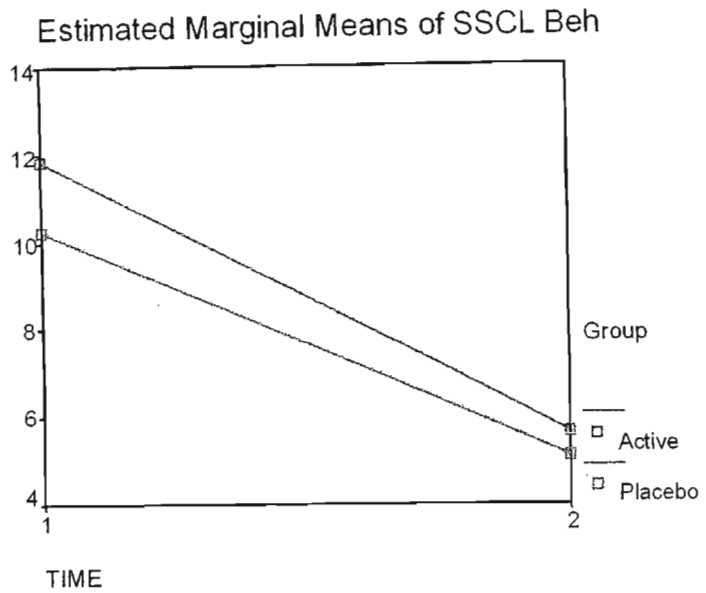

Figure16: Profile Plots for Estimated Marginal Means for SSCL Behavioural

4.5.4.1.4 What is the effect of micronutrient supplementation on total level of stress (SSCL total) for the two groups?

Again, a statistically significant time effect (P=0.000) was found for total number of symptoms of stress, indicating an improvement from pre- to post-test following micronutrient supplementation (Table 96). However, as shown in Table 97, there was no significant group effect (P=0.265), that is, no significant difference between the two groups with respect to improvement over time. Likewise, there was no significant time by group interaction (treatment effect) for reported total number of symptoms of stress (P=0.491) as indicated in Table 96, and shown graphically in Figure 17. There is, however, a slight trend for the Active group to improve more quickly than the Placebo group (Figure 17).

Table 96: Within-subject contrasts for SSCL TOTAL

Source	Time	Type III Sum of Squares	DF	Mean Square	F	Sig.
TIME	Linear	18559.569	1	18559.569	181.611	0
TIME * AP	Linear	48.576	1	48.576	0.475	0.491
Error(TIME)	Linear	26672.644	261	102.194		

$p < 0.05$

Table 97: Between-subject effects for SSCL TOTAL

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
INTERCEPT	167286.658	1	167286.658	723.818	0
AP	288.373	1	288.373	1.248	0.265
ERROR	60321.563	261	231.117		.

$p < 0.05$

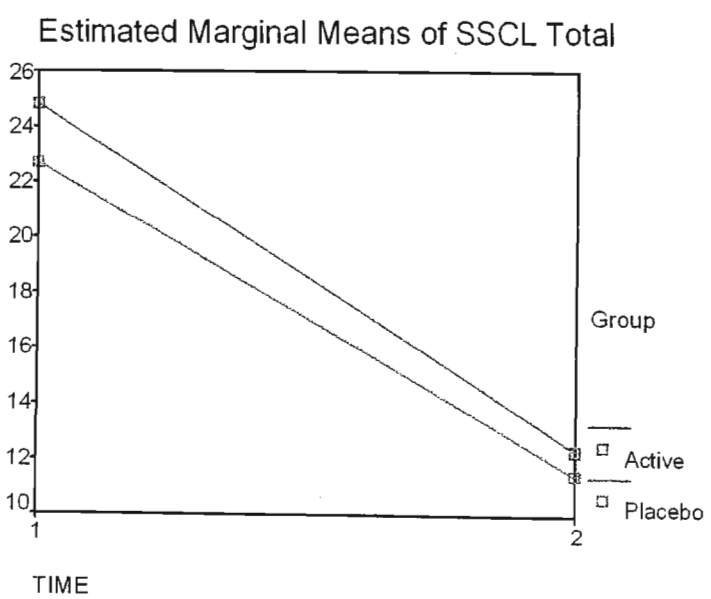

Figure 17: Profile Plots of Estimated Marginal Means for SSCL Total

4.5.4.2. WHAT IS THE EFFECT OF MICRONUTRIENT SUPPLEMENTATION ON PERCEPTION OF LEVEL OF STRESS (VA) FOR THE TWO GROUPS?

The Visual Analogue Scale (VA) was used to assess the differences in outcome after micronutrient supplementation (pre- post-test) in perception of total level of stress experienced by English-speaking South Africans in the general public.

Ratings were obtained in terms of six categories, that is, for a total score and for five different times of the day (morning, noon, afternoon, evening, and before going to sleep). There were no statistically differences between the two groups at the beginning of the study.

Repeated measures of analysis of variance (Repeated measures ANOVA; Wilks' Lambada) was undertaken for both the Active and Placebo groups and the results are presented in sections 4.5.4.2.1 to 4.5.4.2.6 respectively .

4.5.4.2.1 What is the effect of micronutrient supplementation of perceived total level of stress (VA total)

Table 98 shows that there was a statistically significant time effect (P=0.000) for perceived total level of stress, indicating an improvement from pre- to post-test following micronutrient supplementation. There was no significant group effect (P=0.845), that is, no significant difference between the two groups with respect to

improvement over time (presented in Table 99 and graphically in Figure 18). Likewise, there was no significant time by group interaction (treatment effect) for perceived total level of stress ($P = 0.696$) as indicated in Table 98.

Table 98: Within-subject contrasts for VA TOTAL

Source	Time	Type III Sum of Squares	DF	Mean Square	F	Sig.
TIME	Linear	275.259	1	275.259	94.083	0
TIME * AP	Linear	.005	1	0.005	0.002	0.969
Error(TIME)	Linear	857.226	293	2.926		

p 0.05

Table 99: Between-subject effects for VA TOTAL

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
INTERCEPT	13107.888	1	13107.888	2217.616	0
AP	.227	1	0.227	0.038	0.845
ERROR	1731.865	293	5.911		

p 0.05

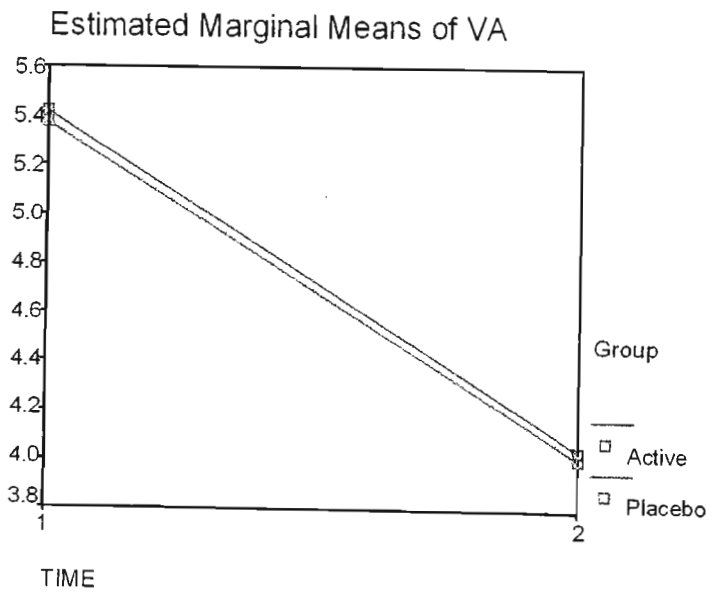

Figure18: Profile Plots of Estimated Marginal Means for VA Total

4.5.4.2.2 Is the effect of micronutrient supplementation on reported perceived levels of stress in the morning (VA morning)?

Again, a statistically significant time effect (P=0.000) was found for perceived level of stress in the morning, indicating an improvement from pre- to post-test following micronutrient supplementation (Table 100). However, as shown in Table 101, there was no significant group effect (P=0.338), that is, no significant difference between the two groups with respect to improvement over time, and reflected graphically in Figure 19. Likewise, there was no significant time by group interaction (treatment effect) for perceived level of stress in the morning (P=0.757) as indicated in Table 100.

Table 100: Within-subject contrasts for VA MORNING

Source	Time	Type III Sum of Squares	DF	Mean Square	F	Sig.
TIME	Linear	115.630	1	115.630	45.093	0
TIME * AP	Linear	.246	1	0.246	0.096	0.757
Error(TIME)	Linear	761.587	297	2.564		

$p < 0.05$

Table 101: Between-subject effects for VA MORNING

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
INTERCEPT	8441.519	1	8441.519	1228.974	0
AP	6.322	1	6.322	0.920	0.338
ERROR	2040.019	297	6.869		

$p < 0.05$

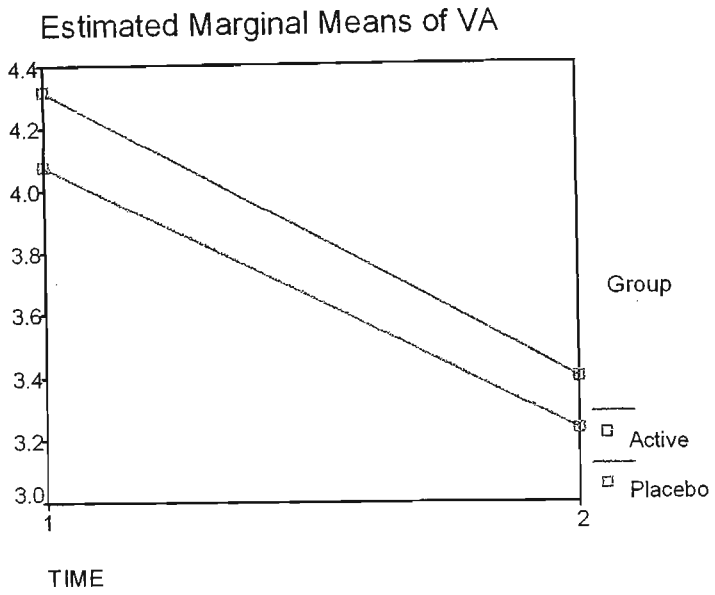

Figure 19: Profile Plots of Estimated Marginal Means for VA Morning

4.5.4.2.3 What is the effect of micronutrient supplementation on reported perceived levels of stress at noon (VA Noon)?

Table 102 shows that a statistically significant time effect (P=0.000) was found for perceived level of stress at noon, indicating an improvement from pre- to post-test following micronutrient supplementation. In contrast, there was no significant group effect (P=0.826), that is, no significant difference between the two groups with respect to improvement over time (Table 103 and Figure 20). Similarly, there was no significant time by group interaction (treatment effect) for perceived level of stress at noon (P=0.293) as indicated in Table 102. However, there was a trend for the Active group to improve more over time than the Placebo group (Figure 20).

Table`102: Within-subject contrasts for VA NOON

Source	Time	Type III Sum of Squares	DF	Mean Square	F	Sig.
TIME	Linear	98.650	1	98.650	56.042	0
TIME * AP	Linear	1.954	1	1.954	1.110	0.293
Error(TIME)	Linear	522.801	297	1.760		

p 0.05

Table 103: Between-subject effects for VA NOON

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
INTERCEPT	11104.751	1	11104.751	2103.372	0
AP	.256	1	.256	0.049	0.826
ERROR	1568.011	297	5.279		

p 0.05

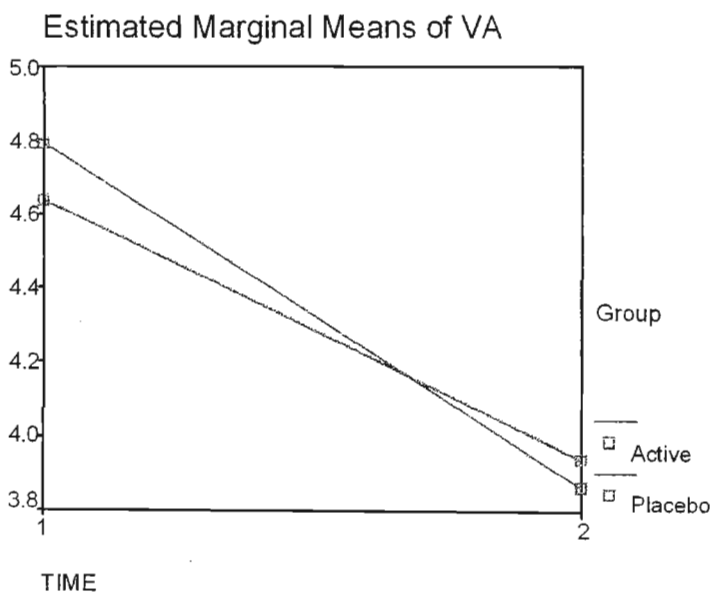

Figure 20: Profile Plots of Estimated Marginal Means for VA Noon

4.5.4.2.4 What is the effect of micronutrient supplementation on reported perceived levels of stress in the afternoon (VA Afternoon)?

As presented in Table 104, the results indicated a statistically significant time effect (P=0.000) for perceived level of stress in the afternoon, indicating an improvement from pre- to post-test following micronutrient supplementation. In contrast, there was no significant group effect (P=0.231), showing that there was no significant difference between the two groups with respect to improvement over time (Table 105 and shown graphically in Figure 21). Similarly, there was also no significant time by group interaction (treatment effect) for perceived level of stress in the afternoon (P=0.231) as indicated in Table 104. However, there was a trend for the Active group to improve slightly more than the Placebo group (Figure 21).

Table 104: Within-subject contrasts for VA AFTERNOON

Source	Time	Type III Sum of Squares	DF	Mean Square	F	Sig.
TIME	Linear	89.195	1	89.195	52.052	0
TIME * AP	Linear	0.338	1	0.338	0.198	0.657
Error(TIME)	Linear	508.929	297	1.714		

$p < 0.05$

Table 105: Between-subject effects for VA AFTERNOON

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
INTERCEPT	12935.150	1	12935.150	2131.087	0
AP	8.742	1	8.742	1.440	0.231
ERROR	1802.713	297	6.070		

$p < 0.05$

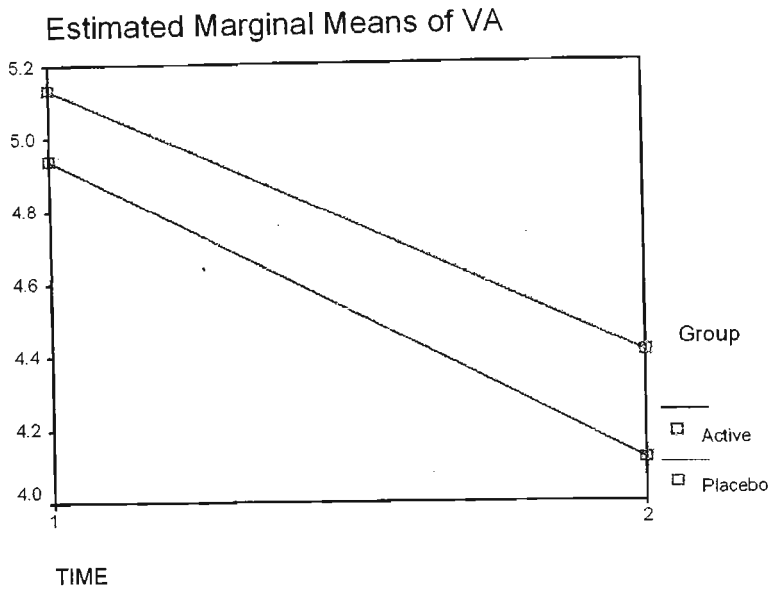

Figure 21: Profile Plots of Estimated Marginal Means for VA Afternoon

4.5.4.2.5 What is the effect of micronutrient supplementation on reported perceived levels of stress in the evening (VA Evening)?

There was a statistically significant time effect (P=0.000) for perceived level of stress in the evening (Table 106), indicating an improvement from pre- to post-test following micronutrient supplementation. There was no significant group effect (P=0.581), that is, no significant difference between the two groups with respect to improvement over time (Table 107 and shown graphically in Figure 22) or significant time by group interaction (treatment effect) for perceived level of stress in the evening (P=0.231) as indicated in Table 106. However, there was a trend for the Active group to improve

slightly faster than the Placebo group (Figure 22).

Table 106: within-subject contrasts for VA EVENING

Source	Time	Type III Sum of Squares	DF	Mean Square	F	Sig.
TIME	Linear	123.556	1	123.556	60.399	0
TIME * AP	Linear	4.713	1	4.713	2.304	0.130
Error(TIME)	Linear	607.568	297	2.046		

$p < 0.05$

Table 107: between-subject effects for VA EVENING

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
INTERCEPT	10400.287	1	10400.287	1494.760	0
AP	2.126	1	2.126	0.306	0.581
ERROR	2066.476	297	6.958		

$p < 0.05$

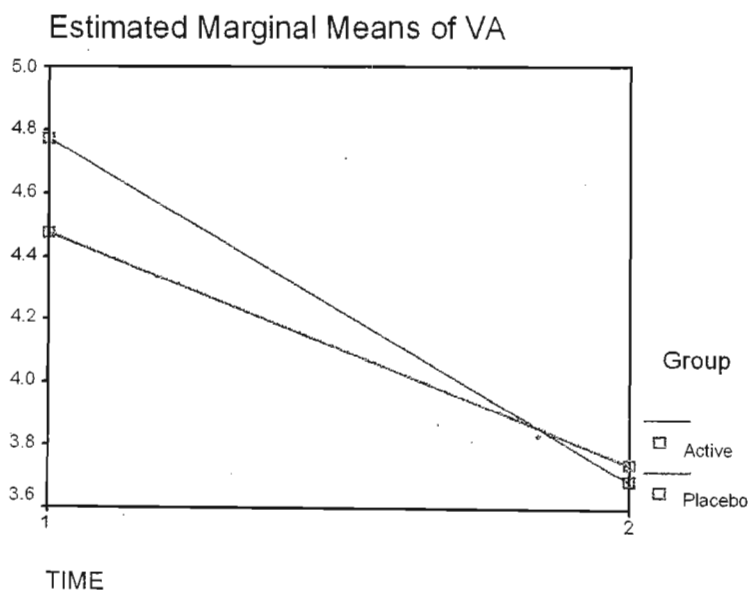

Figure 22: Profile Plots for Estimated Marginal Means for VA Evening

4.5.4.2.6 What is the effect of micronutrient supplementation on reported perceived levels of stress before going to sleep (VA Sleep)?

The results in Table 108 show a statistically significant time effect (P=0.000) for perceived level of stress before going to sleep, thus indicating an improvement from pre- to post-test following micronutrient supplementation. There was no significant group effect (P=0.204), indicating no significant difference between groups with respect to improvement over time (Table 109 and shown graphically in Figure 23). Likewise, there was no significant time by group interaction (treatment effect) for perceived level of stress in the evening (P=0.586) as reflected in Table 108.

Table 108: Within-subject contrasts for VA SLEEP

Source	Time	Type III Sum of Squares	DF	Mean Square	F	Sig.
TIME	Linear	134.814	1	134.814	66.016	0
TIME * AP	Linear	.607	1	0.607	.297	0.586
Error(TIME)	Linear	606.517	297	2.042		

$p < 0.05$

Table 109: Between-subject effects for VA SLEEP

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
INTERCEPT	6085.923	1	6085.923	885.549	0
AP	11.140	1	11.140	1.621	0.204
ERROR	2041.128	297	6.872		

$p < 0.05$

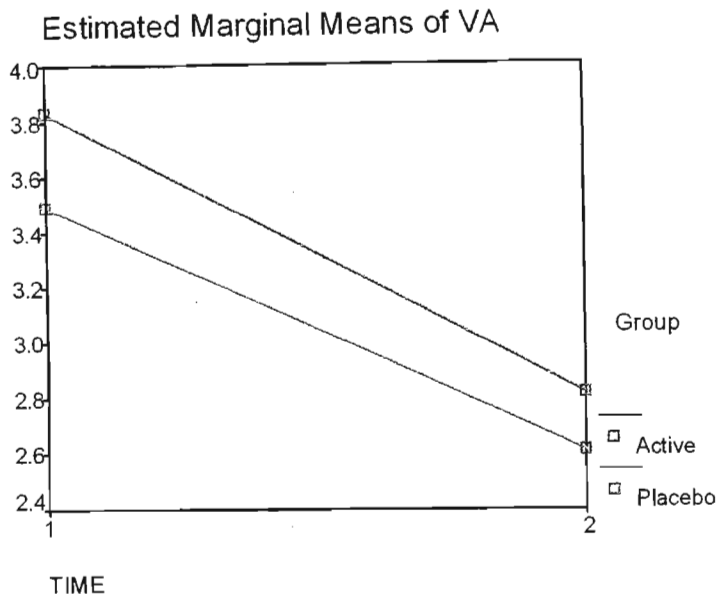

Figure 23: Profile Plots for Estimated Marginal Means for VA Sleep

In summary, on completion of the study there were significant time effects for both groups, but no statistically significant group or time by group (treatment) effect. However, there was a trend for the Active group to show more improvement in respect of their perception of stress measured at noon, in the afternoon and in the evening than the Placebo group. The VAS measurements were done at visits 1, 2, 3 and 4. At visit 1 to screen the patients and at visit 2 to capture immediate change after entry into the study. The differences measured, therefore, were between visit 2 and visit 4. The implications of this are further discussed in the discussion and overall conclusions.

4.5.4.3 WHAT IS THE EFFECT OF MICRONUTRIENT SUPPLEMENTATION ON ANXIETY FOR THE TWO GROUPS?

The Hamilton Anxiety Rating Scale (HARS) was used to assess the differences in outcome after micronutrient supplementation (pre- post-test) in levels of anxiety experienced by English-speaking South Africans in the general public.

Repeated measures of analysis of variance (Repeated measures ANOVA; Wilks' Lambada) was undertaken for both the Active and Placebo groups and the results are presented below.

As indicated in Table 110 a statistically significant time effect (P=0.000) was found for levels of anxiety, indicating an improvement from pre- to post-test following micronutrient supplementation. The results, however, did not show a significant group effect (P=0.196), thus indicating no significant difference between the two groups with respect to improvement over time (Table 111). Similarly, there was no significant time by group interaction (treatment effect) for reported anxiety levels (P=0.180) as indicated in Table 110, and shown graphically in Figure 24. However, there is a slight trend for the Active group to improve more quickly than the Placebo group (Figure 24).

Table 110: Within-subject contrasts for HARS

Source	Time	Type III Sum of Squares	DF	Mean Square	F	Sig.
TIME	Linear	4838.098	1	4838.098	166.237	0
TIME * AP	Linear	52.592	1	52.592	1.807	0.180
Error(TIME)	Linear	8672.867	298	29.104		

p 0.05

Table 111: Between-subject effects for HARS

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
INTERCEPT	94072.284	1	94072.284	1107.077	0
AP	142.990	1	142.990	1.683	0.196
ERROR	25322.135	298	84.974		

$p = 0.05$

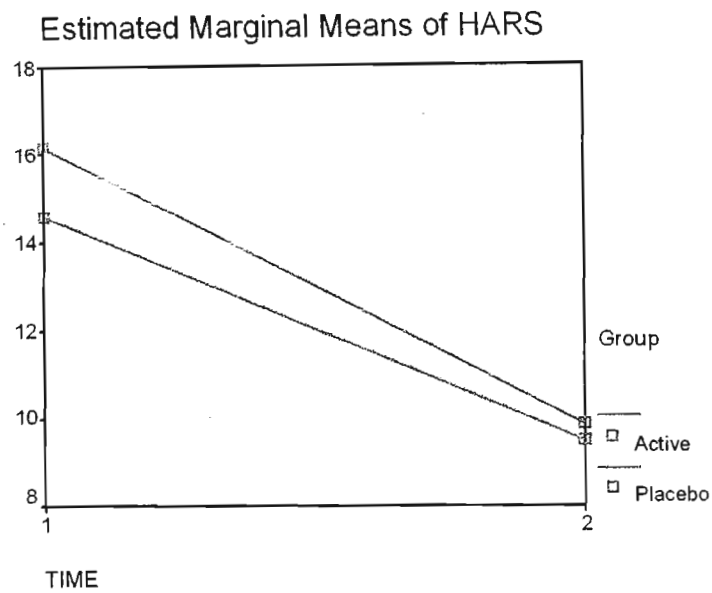

Figure 24: Profile Plots of Estimated Marginal Means of HARS

Table 112 presents a detailed analysis of the pre-post difference in specific anxiety symptoms as reported by both groups.

Table 112: Pre-post differences with time in specific anxiety symptoms on HARS

Symptom	Group	Difference Pre-Post		
		Mean	SD	p-value
Anxious	Active	0.6	1.0	0.1111
	Placebo	0.4	1.1	
Tension	Active	0.8	1.9	0.0412
	Placebo	0.4	1.1	
Fears	Active	0.5	0.9	0.0020
	Placebo	0.1	1.0	
Insomnia	Active	0.5	1.2	0.0682
	Placebo	0.2	1.1	
Intellectual (Cognitive)	Active	0.2	1.1	0.3112
	Placebo	0.3	0.9	
Depressed Mood	Active	0.6	1.0	0.0033
	Placebo	0.2	1.0	
Somatic Muscular	Active	0.6	0.9	0.0843
	Placebo	0.4	1.0	
Somatic Sensory	Active	0.4	1.0	0.3007
	Placebo	0.3	1.0	
Cardiovascular Symptoms	Active	0.4	0.8	0.5146
	Placebo	0.3	0.8	
Respiratory Symptoms	Active	0.4	0.8	0.3276
	Placebo	0.4	0.9	
Gastrointestinal Symptoms	Active	0.5	0.8	0.3276
	Placebo	0.4	0.9	
Genitourinary Symptoms	Active	0.4	0.8	0.0504
	Placebo	0.2	0.8	
Autonomic Symptoms	Active	0.6	0.9	0.2697
	Placebo	0.5	1.0	
Behavioural Symptoms	Active	0.4	0.8	0.8373
	Placebo	0.4	1.0	

$p<0.05$

4.5.4.4 WHAT IS THE EFFECT OF MICRONUTRIENT SUPPLEMENTATION ON PSYCHOLOGICAL GENERAL WELL-BEING FOR THE TWO GROUPS?

The Psychological General Well-Being Scale (PGWB) was used to assess the differences in outcome after micronutrient supplementation (pre- post-test) in levels of psychological general well-being experienced by English-speaking South Africans in the general public.

Repeated measures of analysis of variance (Repeated measures ANOVA; Wilks' Lambada) was undertaken for both the Active and Placebo groups and the results are presented below.

As indicated in Table 113 a statistically significant time effect (P=0.000) was found for levels of reported psychological general well-being, indicating an improvement from pre- to post-test following micronutrient supplementation. The results, however, did not show a significant group effect (P=0.170), thus indicating no significant difference between the two groups with respect to improvement over time (Table 114). Similarly, there was no significant time by group interaction (treatment effect) for reported levels of psychological general well-being (P=0.344) as indicated in Table 113, and shown graphically in Figure 25. However, there is a slight trend for the Active group to improve more quickly than the Placebo group (Figure 25).

Table 113: Within-subject contrasts for PGWB

Source	Time	Type III Sum of Squares	DF	Mean Square	F	Sig.
TIME	Linear	29653.483	1	29653.483	210.211	0
TIME * AP	Linear	126.843	1	126.843	0.899	0.344
Error(TIME)	Linear	42037.490	298	141.065		

$p < 0.05$

Table 114: Between-subject effects for PGWB

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
INTERCEPT	2941590.652	1	2941590.652	8042.773	0
AP	691.372	1	691.372	1.890	0.170
ERROR	108991.521	298	365.743		

$p < 0.05$

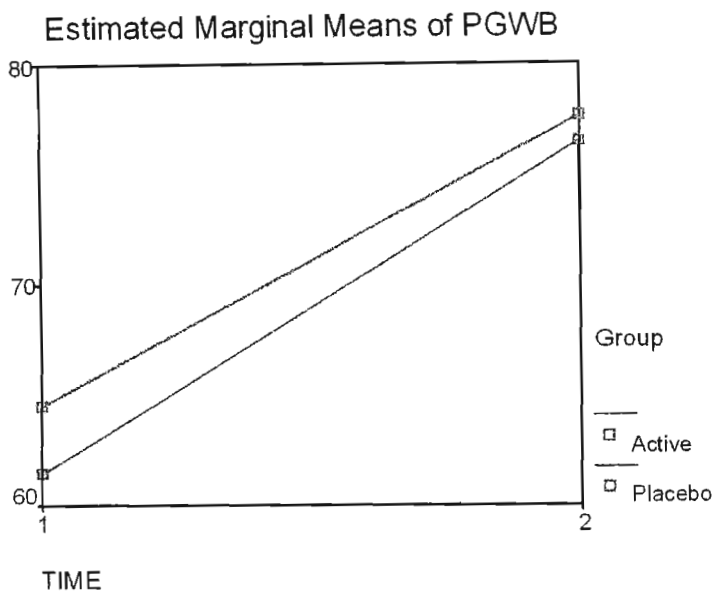

Figure 25: Profile Plots of Estimated Marginal Means for PGWB

Table 115 presents a more detailed analysis of the pre-post difference in specific symptoms of general psychological well-being as reported by both groups. (A detailed description of each symptom can be found in Appendix A).

Table 115: Pre-post differences on PGWB individual items by group

		Before			After			Before-After Difference		
		Mean	SD	P-value	Mean	SD	P-value	Mean	SD	P-value
1	Active	2.3	0.8	0.0560	2.9	0.9	0.6912	-0.7	1.0	0.1620
	Placebo	2.5	1.0		3.0	0.9		-0.5	1.0	
2	Active	2.8	1.2	0.0887	3.5	1.0	0.9142			
	Placebo	3.0	1.3		3.5	1.2				
3	Active	3.6	0.9	0.9473	4.0	0.8	0.7625	-0.4	0.9	0.7637
	Placebo	3.6	1.1		4.0	1.8		-0.4	1.2	
4	Active	3.1	1.0	0.1646	3.7	1.0	0.6295	-0.6	1.2	0.1070
	Placebo	3.3	1.1		3.6	0.9		-0.3	1.1	
5	Active	3.2	1.1	0.0820	4.0	1.0	0.1381	-0.8	1.1	0.0028
	Placebo	3.4	1.3		3.8	1.2		-0.4	1.4	
6	Active	2.4	1.0	0.0004	3.4	0.9	0.4769	-1.0	1.2	0.0047
	Placebo	2.9	1.1		3.5	0.8		-0.6	1.0	
7	Active	3.1	1.0	0.1108	3.9	0.9	0.7021	-0.8	1.0	0.-559
	Placebo	3.3	1.0		3.9	1.0		-0.5	1.0	
8	Active	2.1	1.0	0.1107	3.0	1.0	0.4546	-0.9	1.2	0.0447
	Placebo	2.3	1.1		2.9	1.0		-0.6	1.2	
9	Active	2.6	1.1	0.1102	3.1	1.1	0.4430	-0.5	1.1	0.3799
	Placebo	2.8	1.1		3.2	1.1		-0.4	1.0	
10	Active	3.9	0.8	0.0330	4.3	0.7	0.7692	-0.4	1.0	0.0752
	Placebo	4.2	0.9		4.4	0.7		-0.2	0.8	
11	Active	3.4	1.4	0.1449	4.2	1.1	0.4474	-0.8	1.3	0.4092
	Placebo	3.7	1.3		4.3	1.1		-0.6	1.4	
12	Active	2.0	1.3	0.2172	2.9	1.3	0.5900	-0.9	1.5	0.5232
	Placebo	2.2	1.4		3.0	1.3		-0.8	1.6	
13	Active	3.0	1.2	0.0024	3.8	1.0	0.9746	-0.8	1.2	0.0023
	Placebo	3.4	1.2		3.8	1.1		-0.4	1.2	
14	Active	3.5	1.5	0.1038	4.3	1.2	0.8995	-0.8	1.4	0.1241
	Placebo	3.7	1.2		4.3	1.2		-0.6	1.2	
15	Active	2.5	1.2	0.8792	3.2	2.7	0.4705	-0.7	2.8	0.4390
	Placebo	2.6	1.2		3.1	1.1		-0.5	1.2	
16	Active	2.6	1.0	0.0917	3.2	0.9	0.5770	-0.6	1.0	0.2859
	Placebo	2.8	0.9		3.2	0.9		-0.4	1.0	
17	Active	2.4	1.1	0.0658	3.5	0.9	0.4789	-1.1	1.3	0.0370
	Placebo	2.7	1.3		3.4	1.2		-0.7	1.5	
18	Active	3.0	1.1	0.1171	3.7	1.1	0.5983	-0.7	1.2	0.2895
	Placebo	3.2	1.3		3.7	1.0		-0.5	1.3	
19	Active	2.5	1.0	0.0942	3.3	1.0	0.8266	-0.8	1.2	0.1568
	Placebo	2.7	1.2		3.3	0.9		-0.6	1.1	
20	Active	2.4	1.1	0.1431	3.1	1.0	0.3900	-0.7	1.2	0.5359
	Placebo	2.6	1.1		3.2	1.0		-0.6	1.2	
21	Active	2.4	1.1	0.0025	3.4	1.0	0.2728	-0.9	1.3	0.0555
	Placebo	2.8	1.3		2.5	1.1		-0.7	1.3	
22	Active	1.9	1.1	0.0563	2.9	1.3	0.8010	-1.0	1.6	0.1854
	Placebo	2.1	1.4		2.9	1.3		-0.8	1.6	
TOTAL	Active	60.5	15.4	0.0095	77.0	15.3	0.9091	-16.4	17.4	0.0136
	Placebo	65.5	17.4		77.2	15.1		-11.7	15.9	

4.5.4.5 WHAT IS THE EFFECT OF MICRONUTRIENT SUPPLEMENTATION ON NEUROCOGNITIVE FUNCTION FOR THE TWO GROUPS?

4.5.4.5.1 What is the effect of micronutrient supplementation on subjectively reported cognitive symptoms?

There was no significant difference ($p>0.05$) between groups from pre- to post-test with regard to almost all subjective cognitive complaints, except poor work quality ($P=0.066$) with Active group reporting a greater improvement than the Placebo group. Results are indicated in Table 116.

Table 116: Pre to post difference 2-way Anova SSS COGNITIVE subtest

Subjective Cognitive Complaint	**A_P**		
	Pre-test	Post-test	Pre-post Difference
Memory loss/forgetfulness	0.0567	0.0536	0.9716
Poor long term planning	0.8833	0.3531	0.8856
Poor concentration	0.0050	0.0381	0.7177
Inability to meet deadlines	0.1227	0.3229	0.2842
Poor time management	0.0066	0.0163	0.2846
Poor problem solving skills	0.2435	0.2420	0.6478
Making unnecessary mistakes	0.8434	0.9978	0.7981
Need to work late regularly	0.0627	0.0231	0.9826
Poor work quality	0.0578	0.4399	0.0066
Difficulty in completing one task before moving on to the next	0.8791	0.3891	0.2709
Poor decision making	0.4377	0.4491	0.9175

$p<0.05$

4.5.4.5.2 Neuropsychological Tests

4.3.4.5.2.1 Discrete items/list learning (RAVLT)

There was no significant difference ($p>0.05$) from pre-to post test for either the Active or Placebo group with respect to raw scores on the RAVLT, as is indicated in Table 117.

Table 117: Pre-post difference on RAVLT raw scores performance for both groups (t-test)

RAVLT	Group	Comparison of Active and Placebo Groups								
		Before			After			Before-After Difference		
		Mean	SD	p-value	Mean	SD	p-value	Mean	SD	p-value
Trial 1	Active	6.6	2.1	0.3094	6.2	2.0	0.9221	0.4	2.1	0.3727
	Placebo	6.8	2.1		6.2	2.0		0.6	2.2	
Trial 2	Active	9.1	2.2	0.4056	8.5	2.3	0.7407	0.6	2.4	0.6041
	Placebo	9.3	2.4		8.6	2.3		0.7	2.1	
Trial 3	Active	10.7	2.2	0.8310	10.1	2.4	0.4268	0.7	2.4	0.5486
	Placebo	10.8	2.4		10.3	2.3		0.5	2.1	
Trial 4	Active	11.6	2.2	0.9024	11.1	2.3	0.4260	0.5	2.3	0.3293
	Placebo	11.6	2.3		11.3	2.1		0.3	1.8	
Trial 5	Active	12.3	2.0	0.9161	11.7	2.2	0.5203	0.6	2.2	0.5427
	Placebo	12.3	2.0		11.8	2.4		0.5	2.0	
Sum 1-5	Active	50.3	8.7	0.6234	47.5	9.4	0.5198	2.8	7.9	0.8258
	Placebo	50.8	9.5		48.2	9.4		2.6	6.5	
List B	Active	5.8	2.1	0.5143	55.8	2.1	0.6299	0.1	2.2	0.2625
	Placebo	5.7	2.0		5.9	2.2		-0.2	2.1	
Recall - Delayed	Active	10.8	2.7	0.9939	10.3	2.8	0.8449	0.5	2.5	0.8090
	Placebo	10.8	3.0		10.4	2.9		0.4	2.4	
Recognition	Active	14.3	1.0	0.5337	14.0	1.3	0.7466	0.3	1.3	0.8896
	Placebo	14.3	1.1		14.0	1.6		0.3	1.5	

These results were further confirmed by two-away analysis of variance (reported in Table 118).

Table 118: pre-post RAVLT RAW scores by group (2 way anova)

RAVLT	A_P		
	Before	**After**	**Difference**
Trial 1	0.3131	0.9325	0.3769
Trial 2	0.4030	0.7547	0.6112
Trial 3	0.8488	0.4294	0.5512
Trial 4	0.8806	0.4277	0.3342
Trial 5	0.9312	0.5274	0.5496
Sum 1-5	0.6338	0.5260	0.8264
List B	0.4956	0.6348	0.2542
Recall (delayed)	0.9793	0.8598	0.8127
Recognition	0.5280	0.7315	0.8986

$p<0.05$

4.3.4.5.2.2 Meaningful Verbal Material in Context (Story Recall)

Table 119 indicates that there was no significant difference from pre- to post-test between the Active and Placebo group on immediate recall ($P=0.0762$) or delayed recall ($p=0.4182$).

Table 119: Pre-post Story Recall raw scores by group (t-test)

STORY RECALL	Group	Comparison of Active and Placebo Groups								
		Before			After			Before-After Differrence		
		Mean	SD	p-value	Mean	SD	p-value	Mean	SD	p-value
Immediate	Active	13.1	4.3		16.2	5.9	0.5626	-3.1	6.2	
	Placebo	13.8	4.1	0.1370	15.8	4.6		-2.0	4.2	0.0762
Delayed	Active	11.6	3.8		14.2	4.4	0.5259	-2.6	4.2	
	Placebo	12.3	4.0	0.1282	14.6	4.9		-2.2	4.1	0.4182

$p<0.05$

Further analysis (2-way ANOVA) indicated, as reflected in Table 120, that there is no significant difference from pre-to post- test (after micronutrient supplementation) with regards to immediate or delayed recall of meaningful verbal material (Story Recall).

Table 120: Story Recall 2-way anova by group

	A_P		
STORY RECALL	Pre-test	Post-test	Pre-post Difference
Immediate	0.1389	0.5678	0.0776
Delayed	0.1303	0.5306	0.4231

$p<0.05$

4.3.4.5.2.3 Visual recall of a complex configurational design (RCF)

There was no significant pre-post test difference for either the Active or Placebo group on any of the three trials, namely copy (P=0.4145), immediate recall (P=0.3508) or delayed recall (P=-0.0721)) on the RCF, as indicated in Table 121.

Table 121: Pre-post difference on RCF raw scores between groups (t-test) by group

RCF	Group	Mean	SD	P-value	Mean	SD	P-value	Mean	SD	P-value
Copy	Active	30.6	2.9	0.9337	32.4	2.3	0.2793	-1.8	3.3	0.4145
	Placebo	30.6	2.3		32.1	2.6		-1.5	2.6	
Immediate Recall	Active	19.9	4.7	0.7640	26.0	5.0	0.7635	-6.1	4.9	0.3508
	Placebo	20.3	5.7		26.0	6.9		-5.4	6.2	
Delayed Recall	Active	19.7	4.4	0.9499	25.3	5.2	0.1663	-5.7	4.4	0.0721
	Placebo	19.7	5.5		24.4	6.0		-4.7	4.6	

$p<0.05$

These results were further confirmed by the results of two-way analysis of variance (2-way ANOVA) as reflected in Table 122.

Table 122: RCF performance 2-way anova by group

	Pre-test	Post-test	Pre-post Difference
Copy	0.9035	0.2705	0.4178
Immediate	0.5140	0.7677	0.3531
Delayed	0.9501	0.1691	0.0734

$p<0.05$

PART FOUR

TOWARDS A PROFILE OF STRESS IN SOUTH AFRICANS RESULTS OF REGRESSION ANALYSIS

4.5.5 RESEARCH QUESTION 8

WHAT FACTORS PREDICT THE DEGREE OF PRE-POST DIFFERENCE (DELTA) IN OUTCOME FOR THE TWO GROUPS?

A stepwise multiple regression was done separately for active and placebo groups, using the delta values to determine which variables predicted the outcome variables as shown in Tables 123-124. The predictors were Stress variables, Daily Hassles, PCI, LOT, and Daily Uplifts. The dependents were the SSCL variables (physical, psychological, behavioural and total stress level), perception of level of stress (VA total), anxiety (HARS) and psychological general well-being.

4.5.5.1 WHAT ARE THE PREDICTORS FOR THE ACTIVE GROUP?

For the active group (as shown in Table 123) the only variable that predicted the degree of change in physical stress symptoms was the degree of change in daily hassles (Adj R^2 = 0.114, $\underline{F}$=18.03, P=0.000). Psychological symptoms of stress degree of change was predicted by the degree of pre-post test improvement in both daily hassles (Adj R^2 = 0.137, $\underline{F}$=21.99, P=0.000) and studying (Adj R^2 = 0.168, $\underline{F}$=14.29, P=0.018). The degree of change from pre- to post-test in behavioural stress reactions was predicted by

the degree of change in daily hassles (Adj R^2 = 0.0,159, F=25.921, P=0.000), followed by studying (Adj R^2 = 0.199, F=17.418, P=0.005), and perceived coping incapacity (Adj R^2 = 0.217, F=13.229, P=0.047). The degree of improvement in daily hassles (Adj R^2 = 0.169, F=27.863, P=0.000) and studying (Adj R^2 = 0.209, F=18.391, P=0.007) appeared to account for the degree of improvement in total level of stress. Pre-to post-test degree of change in perception of level of stress experienced was predicted by the degree of change in both daily hassles (Adj R^2 = 0.022, F=4.360, P=0.007) and daily uplifts (Adj R^2 = 0.137, F=21.99, P=0.000). The degree of improvement in the outcome variable of anxiety was predicted by the degree of change daily hassles (Adj R^2 = 0.054, F=9.520, P=0.002), life orientation/optimism (Adj R^2 = 0.102, F=9.492, P=0.002), and recent life events in the 7-12 month period (Adj R^2 = 0.124, F=8.058, P=0.032) from pre- to post-test . The degree of improvement in perceived coping incapacity (Adj R^2 = 0.084, F=14.715, P=0.000), followed by the degree of improvement in daily hassles (Adj R^2 = 0.144, F=13.615, P=0.004) appeared to account for the degree of pre-post changes in psychological general well-being.

Table 123: Stepwise multiple regression analysis of stressors and moderating variables on outcome variables for active group

PREDICTOR VARIABLES	R SQUARE	ADJ R2	DF	F VALUE	BETA
PHYSICAL SYMPTOMS (SSCL physical)					
Daily Hassles	0.121	0.114	1	18.034***	0.348
PSYCHOLOGICAL SYMPTOMS (SSCL psychological)					
Daily Hassles	0.144	0.137	1	21.978***	0.379
Study	0.181	0.168	2	14.285**	0.203
BEHAVIOURAL SYMPTOMS (SSCL behavioural)					
Daily Hassles	0.165	0.159	1	25.921***	0.406
Studying	0.211	0.199	2	17.418**	0.234
Perceived coping incapacity	0.235	0.217	3	13.229*	0.155
TOTAL STRESS LEVEL (SSCL total)					
Daily hassles	0.175	0.169	1	27.863***	0.419
Studying	0.221	0.209	2	18.391**	0.226
STRESS PERCEPTION (VA)					
Daily hassles	0.029	0.022	1	4.360**	0.229
Daily Uplifts	0.062	0.049	2	4.826*	-0.192
ANXIETY (HARS)					
Daily hassles	0.060	0.054	1	9.520**	0.245
Life orientation (control)	0.114	0.102	2	9.492**	-0.246
Life events 7-12 months	0.141	0.124	3	8.058*	0.160
PSYCHOLOGICAL WELL-BEING (PBWB)					
Perceived coping incapacity	0.144	0.138	1	14.715	-0.300
Daily hassles	0.155	0.144	2	13.615	0.326
Daily uplifts	0.203	0.187	3	12.474	-0.229

*p<0.05 ** p<0.01 *** p<0.001

4.5.5.2 WHAT ARE THE PREDICTORS FOR THE PLACEBO GROUP?

Physical stress symptoms were predicted by both daily hassles (Adj R^2 = 0.080, F=12.205, P<0.001) and family responsibilities (Adj R^2 = 0.133, F=0.133, P<0.004). Both family responsibilities (Adj R^2 = 0.053, F=8.161, P=0.005) and concern over the health of one's family of creation (Adj R^2 = 0.087, F=7.115, P=0.018) predicted psychological symptoms of stress (Adj R^2 = 0.137, F=21.99, P=0.000) (Adj R^2 =

0.137, F=21.99, P=0.000) (Adj R^2 = 0.137, F=21.99, P=0.000). Recent life events occurring in the 13-18 month period (Adj R^2 = 0.031, F=0.924, P=0.045) appeared to predict behavioural reactions to stress). The degree of improvement in both family responsibilities (Adj R^2 = 0.033, F=5.362, P=0.019) and daily hassles (Adj R^2 = 0.066, F=5.526, P=0.021) appeared to account for the degree of improvement in total level of stress. Pre-to post-test degree of change in perception of level of stress experienced was predicted by the degree of change in the following four variables: concerns about oneself (Adj R^2 = 0.047, F=8.164, P=0.002), followed by daily hassles (Adj R^2 = 0.080, F=7.281, P=0.008), then by loneliness (Adj R^2 = 0.106, F=6.757, P=0.023), and concerns about one's own health (Adj R^2 = 0.126, F=6.204, P=0.045). The degree of improvement in the outcome variable of anxiety was predicted by the degree of change daily hassles (Adj R^2 = 0.138, F=24.486, P=0.000), perceived coping incapacity/control (Adj R^2 = 0.177, F=16.787, P=0.004), and finance (Adj R^2 = 0.196, F=12.949, P=0.036) from pre- to post-test. The degree of improvement in daily hassles (Adj R^2 = 0.123, F=21.701, P=0.000), then by perceived coping incapacity (Adj R^2 = 0.150, F=13.193, P=0.013), finance (Adj R^2 = 171, F=11.116, P=0.014), and finally in personal relationships (Adj R^2 = 0.192, F=9.711, P=0.033) appeared to account for the degree of change in psychological general well-being. Results are presented in Table 124.

Table 124: Stepwise multiple regression analysis of stressor and moderator variables on outcome for placebo group

PREDICTOR VARIABLES	R SQUARE	ADJ R2	DF	F VALUE	BETA
PHYSICAL SYMPTOMS (SSCL Physical)					
Daily Hassles	0.088	0.080	1	12.205***	0.298
Family Responsibilities	0.146	0.133	2	10.784**	0.242
PSYCHOLOGICAL SYMPTOMS (SSCL psychological)					
Family Responsibilities	0.060	0.053	1	8.161**	0.246
Health Family of Creation	0.101	0.087	2	7.115*	0.203
BEHAVIORAL SYMPTOMS (SSCL behavioural)					
Recent Life Events 13-18 months	0.031	0.024	1	4.108*	0.177
TOTAL LEVEL OF STRESS (SSCL total)					
Family Responsibilities	0.041	0.033	1	5.362*	0.203
Daily Hassles	0.081	0.066	2	5.526*	0.200
STRESS PERCEPTION (VA)					
Concerns with oneself	0.054	0.047	1	8.164**	0.002
Daily hassles	0.092	0.080	2	7.281**	0.008
Loneliness	0.125	0.106	3	6.757*	0.023
Concerns with own health	0.150	0.126	4	6.204*	0.045
ANXIETY (HARS)					
Daily hassles	0.144	0.138	1	24.486***	0.379
Perceived coping incapacity	0.188	0.177	2	16.787**	-0.219
Finance	0.212	0.196	3	12.949*	0.158
PSYCHOLOGICAL WELL-BEING (PGWB)					
Daily hassles	0.129	0.123	1	21.701***	0.360
Perceived coping incapacity	0.162	0.150	2	13.193*	-0.188
Finance	0.188	0.171	3	11.116*	0.183
Personal relationships	0.214	0.192	4	9.711*	0.161

*p<0.05 ** p<0.01 *** p<0.001

4.5.6 RESEARCH QUESTION 9

WHAT FACTORS PREDICT THE DELTA (DEGREE OF PRE-POST DIFFERENCE) IN OUTCOME FOR THE TOTAL GROUP?

For the total group (as shown in Table 125) the variables that predicted the degree of change in physical stress symptoms were the degree of change in daily hassles (Adj R^2

= 0.03, F=30.878, P=0.000), time management (Adj R^2 = 0.115, F=17.880, P=0.035) and concern over health of family of origin (Adj R^2 = 0.124, F=13.363, P=0.049). Psychological symptoms of stress degree of change was predicted by the degree of pre-post-test improvement in both daily hassles (Adj R^2 = 0.085, F=21.308, P=0.000) and relocation (Adj R^2 = 0.095, F=14.759, P=0.049). The degree of change from pre- to post-test in behavioural stress reactions was predicted by the degree of change in daily hassles (Adj R^2 = 0.0,090, F=26.737, P=0.000), followed by studying (Adj R^2 = 0.106, F=16.401, P=0.014), and perceived coping incapacity (Adj R^2 = 0.118, F=12.621, P=0.033). The degree of improvement in daily hassles (Adj R^2 = 0.169, F=27.863, P=0.000) and time management (Adj R^2 = 0.121, F=19.046, P=0.021) appeared to account for the degree of improvement in total level of stress. Pre-to post-test degree of change in perception of level of stress experienced was predicted by the degree of change in both daily hassles (Adj R^2 = 0.030, F=9.973, P=0.000), daily uplifts (Adj R^2 = 0.052, F=9.029, P=0.008), concern over self (Adj R^2 = 0.064, F=7.694, P=0.029), and life orientation (Adj R^2 = 0.075, F=6.976, P=0.034). The degree of improvement in the outcome variable of anxiety was predicted by the degree of change daily hassles (Adj R^2 = 0.087, F=29.339, P=0.000) and perceived coping incapacity (Adj R^2 = 0.120, F=21.265, P=0.001) from pre- to post-test. The degree of improvement in daily hassles (Adj R^2 = 0.093, F=31.406, P=0.000), followed by the degree of improvement in perceived coping incapacity (Adj R^2 = 0.147, F=16.707, P=0.000) and then finance (Adj R^2 = 0.093, F=19.850, P=0.021) appeared to account for the degree of pre-post changes in psychological general well-being.

Table 125: Stepwise multiple regression analysis of stressors and moderating variables on outcome variables for total group

PREDICTOR VARIABLES	R SQUARE	ADJ R2	DF	F VALUE	BETA
PHYSICAL SYMPTOMS (SSCL physical)					
Daily hassles	0.106	0.103	1	30.878***	0.337
Time management	0.121	0.115	2	17.880*	0.124
Health of family of origin	0.134	0.124	3	13.362*	-.0.117
PSYCHOLOGICAL SYMPTOMS (SSCL psychological)					
Daily hassles	0.089	0.085	1	25.308***	0.298
Relocation	0.102	0.095	2	14.759*	-0.117
BEHAVIOURAL SYMPTOMS (SSCL behaviour)					
Daily hassles	0.093	0.090	1	26.737***	0.305
Studying	0.112	0.106	2	16.401*	0.148
Perceived coping incapacity	0.128	0.118	3	12.621*	-0.126
TOTAL STRESS LEVEL (SSCL total)					
Daily hassles	0.110	0.107	1	32.144***	0.332
Time management	0.128	0.121	2	19.046*	0.135
STRESS PERCEPTION (VA)					
Daily hassles	0.033	0.030	1	9.973***	0.222
Daily uplifts	0.058	0.052	2	9.029**	-0.164
Concern over self	0.074	0.064	3	7.694*	-0.124
Life orientation	0.088	0.075	4	6.976*	-0.120
ANXIETY (HARS)					
Daily hassles	0.090	0.087	1	29.339***	0.300
Perceived coping incapacity	0.126	0.120	2	21.265**	-0.190
PSYCHOLOGICAL GENERAL WELL – BEING (PGWB)					
Daily hassles	0.096	0.093	1	31.406***	0.309
Perceived coping incapacity	0.153	0.147	2	26.707***	-0.253
Finance	0.168	0.159	3	19.850*	0.124

*p<0.05 ** p<0.01 *** p<0.001

4.6 SUMMARY OF MAIN FINDINGS

4.6.1 RESEARCH QUESTION 1

WHAT ARE THE PERCEIVED SOURCES IF STRESS FOR SOUTH AFRICANS AS EMBODIED IN THIS STUDY?

An important finding in this study was that overall for the whole sample, both within the two year period as well as the 6-month period preceding the study, the most frequently occurring stressful life event was exposure to violence (such as boycotts, strikes, etc.) in the participants area of work or residence. The other most frequent stressful events that occurred in both time periods included a change in work hours or conditions, other work troubles, and changes in religious beliefs. The period most recent to the assessment (0-6 months) also saw an increase in frequency in exposure to forms of violence personally experienced by the participants (such as robbery or housebreaking) as well as a change in work responsibilities. Other stressful life events frequently reported during the two time periods included changes in religious beliefs, being held in jail for driving under the influence of alcohol, and a change in family get-togethers.

The everyday experiences that were reported as being a significant stress (either continuously or a great deal on a daily basis) included work-related factors (predominantly workload), financial concerns (enough money for necessities, emergencies and extras), amount of free time available, and taking care of paperwork (both at home and at work). Other significant daily stressors included political or social

issues, job security and the nature of the job, and other routine home related activities (such as housework, car maintenance etc.).

On (free) self-report the most frequent stressor related to work, followed by financial concerns and family responsibilities. Time management and relationships (both personal and work-related) were also reported as significant stressors.

Overall, the areas of life that were perceived as most stress-inducing related to financial concerns, various work-related problems or concerns and violence.

Most of the sample reported that their stress impacted to the greatest extent on their capacity to carry out family chores (both on a daily basis and overall). Work and relaxation were also reported as affected by stress, but to a lesser extent.

4.6.2 RESEARCH QUESTION 2

WHAT DOES THE PROFILE OF STRESS LOOK LIKE IN THE SAMPLE OF SOUTH AFRICANS STUDIED?

4.6.2.1 HOW DOES THE SAMPLE PRESENT IN RESPECT OF LEVELS OF STRESS, SYMPTOMS OF STRESS, PERCEPTIONS OF THEIR LEVEL OF STRESS, ANXIETY AND PSYCHOLOGICAL WELL-BEING?

The most significant findings were that the South African sample of the general public studied presented with overall high levels of stress and clinically significant anxiety.

Furthermore, they perceive themselves as having moderately high stress, and lower levels of general psychological well-being.

4.6.2.2. WHAT SUBJECTIVE COGNITIVE COMPLAINTS DO THEY REPORT AS OCCURING?

The findings indicated that almost three-quarters of the sample reported a significant number of cognitive complaints, most prominently memory loss or forgetfulness, poor concentration, poor long-term planning, poor time management and poor work quality.

4.6.2.3 HOW DOES THE SAMPLE PRESENT IN RESPECT OF NEUROCOGNITIVE FUNCTION (MEMORY AND LEARNING) ON NEUROPSYCHOLOGICAL TESTING?

An important finding of this study was that there was no impairment in verbal or visual memory (recall) as measured, regardless of the nature of the task.

Learning and memory functions with regard to discrete items (unrelated list of words) was average on all parameters, including immediate recall, supraspan memory, amount of information learned and amount of information recalled after interference and after a delay of 30 minutes. From a qualitative perspective, the greatest number of repetitions (of words already stated) occurred on the last two trials for the first list presented. In contrast, the greatest number of errors of commission (including words that were not on the list presented) occurred on the first trial of the list (for each list).

Most of the sample were at least average in their ability to recall a story, under both immediate and delayed conditions of recall. Error analysis indicated that more errors of commission (that is, adding in details that were not in the original story) were made than leaving out details of the story (errors of omission).

The findings further indicated that, despite an overall average ability to copy a complex configurational design, most of the participants tended to produce poorer quality of drawings, predominantly due to carelessness, untidiness, poorly executed intersections, etc. and not actual visual-perceptual deficits per se, which is consistent with complaints of poorer quality of work, and may reflect a subtle residual deficit with regards to attention to detail, self-monitoring or planning. However, most of the sample were essentially within normal limits with regards to both immediate and delayed recall of the design.

4.6.2.4 IS THERE A RELATIONSHIP BETWEEN PERCEIVED STRESSORS AND OUTCOME VARIABLES?

4.6.2.4.1 Is there a relationship between recent life events and outcome variables?

The most important findings were that the total number of life events experienced was significantly related to anxiety, but not overall level of stress, symptoms of stress, perception of level of stress or psychological general well-being.

4.6.2.4.2 Is there a relationship between daily hassles and outcome variables?

There was a positive correlation between total number of unpleasant everyday events (daily hassles) physical, psychological and behavioural symptoms of stress as well as total level of stress, anxiety, and perception of level of stress. A negative correlation between daily hassles and psychological general well-being was found.

4.6.2.4.3 Is there a relationship between sources of stress on (free) self-report and outcome?

A number of different statistically significant relationships and / or positive associations were established between individual external stressors (sources of stress) and the various outcome variables were found in the study.

Those stressors found to be positively related to **physical** symptoms of stress (SSCL physical) included: financial stress, time management, studying, and relocation.

The following stressors were identified as having a significant relationship to **psychological** stress symptoms (SSCL psychological): financial stress, general crime and loneliness.

A few significant relationships were found to exist between stressors and **behavioural** manifestations of stress (SSCL behaviour). These included: financial stress, stressed about the health of others (excluding family or self), and time management.

Significant relationships between the following stressors and **total level** of stress (SSCL total) were identified in the study, namely, financial stress, stressed about the health of others (excluding family or self), time management, loneliness, and relocation.

The findings of the study indicated that the second highest number of particular individual stressors were significantly related to **perception** of level of stress (VA), including: concerns about one's own health, concern over the health of members of one's family of origin, children's behaviour, loneliness, relocation and concern over the self.

There were two stressors that were identified in the study as having a significant relationship with anxiety (HARS), including: financial stress and concern over the health of members of one's family of origin.

The largest number of stressors were found to have significant relationships with **psychological general well-being** (PGWB). These included: financial stress, work stress, concern over the health of members of one's family of origin, personal relationships, family responsibilities, loneliness and relocation.

4.6.2.5 IS THERE A RELATIONSHIP BETWEEN THE MODERATING VARIABLES AND THE OUTCOME VARIABLES IN THE TOTAL SAMPLE?

The only statistically significant positive correlations found were between perceived coping incapacity (PCI) and life orientation (LOT) and psychological well-being.

Statistically significant negative correlations were found between perceived coping incapacity and psychological stress symptoms, total level of stress, and perception of level of stress. In contrast there were significant negative correlations between optimism and anxiety and perception of level of stress.

4.6.2.6 WHAT IS THE RELATIONSHIP OF THE ENVIRONMENTAL VARIABLE (DAILY UPLIFTS) TO OUTCOME VARIABLES?

With regard to the relationship between everyday positive experiences (daily uplifts) and outcome variables, a positive correlation between daily uplifts and perception of level of stress was found.

4.6.2.7 WHAT ARE THE RELATIONSHIPS BETWEEN THE MODERATING VARIABLES?

Only life orientation (LOT) and perceived coping incapacity (PCI) were positively

correlated with each other. There were no significant correlations between daily uplifts and the other moderating variables.

4.6.2.8 WHAT ARE THE RELATIONSHIPS BETWEEN THE OUTCOME VARIABLES?

The findings indicated that level of stress, physical, psychological and behavioural symptoms of stress, anxiety, and perception of level of stress are significantly positively correlated with each other, while there are significant negative correlations between all these variables and psychological general well being.

4.6.3 RESEACH QUESTION 3

IS THERE A DIFFERENCE IN THE TWO GROUPS WITH REGARDS TO DEMOGRAPHIC DATA AT BASELINE?

4.6.3.1 IS THERE A DIFFERENCE BETWEEN THE TWO GROUPS AT BASELINE WITH REGARDS TO SAMPLE SIZE?

Ultimately there were 151 participants in the Active group and 149 in the Placebo group because of the drop-outs and replacement policy (cf section 4.1.3). However, this did not affect the validity of the statistical calculations.

4.6.3.2 IS THERE A DIFFERENCE IN DEMOGRAPHIC VARIABLES BETWEEN THE TWO GROUPS AT BASELINE?

The findings indicated that there were no differences between the Active and Placebo group at baseline in respect of any of the demographic variables. Regarding age distribution, most participants were in the younger age groups (aged 18-44 years). Both groups had more females than males. More participants were married than single (never married, divorced, separated or widowed) in both of the groups. Regarding ethnicity, most participants were White, with a smaller percentage being non-Caucasian (Asian, Coloured and Black South Africans). The majority of participant in both groups lived with someone else (partner, family, friends or others) with only a small percentage living alone.

4.6.4 RESEARCH QUESTION 4

IS THERE A DIFFERENCE IN PERCEIVED SOURCES OF STRESS (STRESSORS) BETWEEN THE TWO GROUPS (ACTIVE AND PLACEBO) AT BASELINE?

4.6.4.1 IS THERE A DIFFERENCE IN RECENT LIFE EVENTS (RLE) BETWEEN THE TWO GROUPS AT BASELINE?

The findings indicated that there was no significant difference between the two groups at baseline in respect of any of the four time periods measured, namely 0-6 months, 7-12 months, 13-18 months and 19-24 months prior to assessment. Neither was there any difference between them as to total number of life events experienced overall. In respect of the individual stressors, there were statistically significant differences

between the two groups in respect of two stressors, namely concern for children's future (Active greater than Placebo) and making life decisions (Placebo greater than Active).

Some interesting trends were noted. During the two year period prior to the study, most of the participants in both groups had experienced between 21-30 followed by 1-10 significant recent life events in this period. Double the number of people in the Placebo group as compared to the Active group had experienced a total of 1-10 life events in the same period. During the 0-6 months prior to entering the study, the majority of participants in both groups had experienced between 1-10 recent life, followed by 11-20 recent life events over the same period of time. Most participants reported having experienced between 1-10 significant recent life events in the remaining three time periods (7-12 months, 13-18 months and for 19-24 months prior to the assessment).

4.6.4.2 IS THERE A DIFFERENCE IN EVERYDAY ENVIRONMENTAL STRESSORS (DAILY HASSLES) BETWEEN THE TWO GROUPS AT BASELINE?

The Active and the Placebo groups did not differ at baseline in respect of total number of daily hassles experienced.

4.6.4.3 IS THERE A DIFFERENCE BETWEEN THE TWO GROUPS IN SOURCES OF STRESS (ON FREE REPORT) AT BASELINE?

The findings indicated that although the order of frequency (based on table percentage of yes responses) in respect of the top four stressors reported differed between the

Active and Placebo groups, they listed the same stressors, namely, work, family responsibilities, finance and time management. For both groups, relationships were the fifth most common stressor. However the Active group favoured work relationships as a stressor as compared to the Placebo group who reported higher stress as a result of personal relationships.

There were no statistically significant differences between the two groups (at baseline) in respect of all of the stressors. Statistical analysis (yes and no answers in respect of each variable being a stressor) indicated that around 70% of both groups positively endorsed work as a stressor, with around 50% (half) of both groups positively endorsing both finance and family responsibilities as stressors.

4.6.4.4 IS THERE A DIFFERENCE IN FREQUENCY OF STRESS IMPACT ON FUNCTIONING BETWEEN THE TWO GROUPS AT BASELINE?

There was no statistically significant difference between the two groups in respect of impact of stress on work, family chores, or relaxation.

Regarding impact of stress on work, most participants in both groups reported some impact of stress in work functioning, with the highest percentage reporting an impact of less than once monthly. A trend for the Placebo group to report nearly double the number of times stress impacted upon work.

Most participants reported some impact of stress on their ability to carry out family chores. There was a trend for the Placebo group to report three times more frequent impact of stress on family chores than the placebo group

The majority of both groups reported some impact of stress on relaxation. There was a trend for the Placebo group to report nearly double the impact of stress on relaxation than the Active Group.

4.6.5 RESEARCH QUESTION 5

IS THERE A DIFFERENCE IN MODERATING VARIABLES BETWEEN THE TWO GROUPS (ACTIVE AND PLACEBO) AT BASELINE?

4.6.5.1 IS THERE A DIFFERENCE BETWEEN THE TWO GROUPS WITH REGARDS TO PERSONAL RESOURCES AT BASELINE?

No significant differences at baseline were found between the two groups in respect of perceived coping incapacity (control) and life orientation (optimism).

4.6.5.2 IS THERE A DIFFERENCE BETWEEN THE TWO GROUPS WITH REGARD TO ENVIRONMENTAL/SITUATIONAL VARIABLES AT BASELINE?

The findings indicated that there were no significant differences between the active and

the Placebo group at baseline in respect of daily positive uplifting events as measured by the Daily Uplifts Scale (environmental variable).

4.6.6. RESEARCH QUESTION 6

IS THERE A DIFFERENCE IN OUTCOME VARIABLES BETWEEN THE TWO GROUPS (ACTIVE AND PLACEBO) AT BASELINE?

4.6.6.1 IS THERE A DIFFERENCE IN LEVEL OF STRESS (SSCL) AND STRESS SYMPTOMS BETWEEN THE TWO GROUPS AT BASELINE?

There were no significant differences between groups at baseline in respect of levels of stress. The results showed that there is a borderline significant difference between the groups with regards to behavioural symptoms at baseline, with the Active group reporting slightly more behavioural symptoms of stress than the Placebo group. For other symptoms of stress (physical and psychological), the two groups did not differ.

4.6.6.2 IS THERE A DIFFERENCE IN SUBJECTIVE COGNITIVE SYMPTOMS BETWEEN THE TWO GROUPS AT BASELINE?

There was a statistically significant difference between the two groups in respect of a few of the subjective cognitive complaints at baseline, with the Active group reporting more complaints of memory loss or forgetfulness, poor long term planning, and poor work quality than the Placebo group. The results also indicated a borderline significant

difference between the two groups with regard to poor problem solving, in the same direction as the other subjective cognitive complaints.

4.6.6.3 IS THERE A DIFFERENCE BETWEEN GROUPS AT BASELINE IN PERCEPTION OF LEVEL OF STRESS (VA)?

The results indicated that there was no significant difference between the Active and Placebo groups in respect of perception of level of stress at baseline.

4.6.6.4 IS THERE A DIFFERENCE BETWEEN THE TWO GROUPS WITH REGARDS TO LEVEL OF ANXIETY (HARS) AT BASELINE

An important finding was that there was a significant baseline difference between the two groups in respect of level of anxiety, with the Active group endorsing higher levels of anxiety than the Placebo group. Statistical analysis of the individual items on the HARS indicated that there were significant differences between the groups with the Active group reporting more symptoms of fears and depressed mood, and marginally statistically significantly more tension and anxiousness.

4.6.6.5 IS THERE A DIFFERENCE IN PSYCHOLOGICAL GENERAL WELL-BEING (PGWB) BETWEEN THE TWO GROUPS AT BASELINE?

The results with regards to psychological general well-being were equivocal. T-tests indicated that there is a statistically significant difference in total level of psychological

well-being between the two groups at baseline, with the Placebo group reporting a higher level of well-being than the Active group.

In contrast, univariate analysis of variance did not reveal any significant baseline group differences in respect of psychological general well-being.

When each item was subjected to statistical analysis, analysed, significant differences between the Active and Placebo groups were found. The Placebo group reported less negative symptoms in respect of amount of energy, feeling healthy enough to carry out things that had to be done or that the person liked to do, having been concerned, worried, or had any fears about their health, and feeling tired, worn out, used up, or exhausted. Marginally significant differences in the same direction were found for the symptom of having any illness, bodily disorder, aches or pains.

4.6.6.6 IS THERE A DIFFERENCE BETWEEN GROUPS IN PERFORMANCE ON SELECT MEMORY FUNCTIONS (NEUROPSYCHOLOGICAL TEST DATA) AT BASELINE?

The findings showed no significant baseline differences between the two groups on any of the three measures of verbal and visual recall (memory), under either immediate or delayed conditions of recall.

Of interest was the finding of a slightly below average performance for both groups on the copy trial of a complex configurational design, which was due to minor inaccuracies (e.g. poorer intersections, careless execution of lines etc.) rather than any major distortions of the overall gestalt of the design or design elements.

4.6.7 RESEARCH QUESTION 7

WHAT EFFECT DOES MICRONUTRIENT (MULTIVITAMIN AND MINERAL COMBINATION) SUPPLEMENTATION HAVE ON ALL THE VARIABLES MEASURED (WHERE RELEVANT) FOR THE TWO GROUPS?

4.6.7.1 WHAT IS THE EFFECT OF MICRONUTRIENT SUPPLEMENTATION ON PERCEPTION OF EVERYDAY ENVIRONMENTAL STRESSORS FOR THE TWO GROUPS (ACTIVE AND PLACEBO)?

A statistically significant time effect was found for perception of everyday events being stressful (daily hassles), indicating an improvement from pre- to post-test (Table 82). However, there was no significant group effect, that is, no significant difference between the two groups with respect to improvement over time and no significant time by group interaction (treatment effect) for perceived daily hassles.

4.6.7.2 WHAT IS THE EFFECT OF MICRONUTRIENT SUPPLEMENTATION ON ENVIRONMENTAL MODERATING VARIABLES, THAT IS, PERCEPTION OF EVERYDAY ENVIRONMENTAL UPLIFTS (DAILY UPLIFTS) THE TWO GROUPS (ACTIVE AND PLACEBO)?

The findings indicated no statistically significant time effect, group effect or time by group interaction (treatment effect) with regards to daily uplifting experiences from pre- to post- test. However, a trend for the Placebo group to report more everyday experiences as uplifting on post-test as compared to the Active group was noted.

4.6.7.3 WHAT IS THE EFFECT OF MICRONUTRIENT SUPPLEMENTATION ON PERSONAL RESOURCES (MODERATING VARIABLES) FOR THE TWO GROUPS (ACTIVE AND PLACEBO)?

For both perceived coping incapacity (PCI) and life orientation (LOT) the results indicated a statistically significant time effect, indicating an improvement from pre- to post-test but no significant group effect, that is, no significant difference between the two groups with respect to improvement over time or significant time by group interaction (treatment effect) for either variable. However, a trend was noted for perceived coping incapacity (control) to improve more for the Active group than the Placebo group.

4.6.7.4 WHAT IS THE EFFECT OF MICRONUTRIENT SUPPLEMENTATION ON HEALTH OUTCOMES AS MEASURED BY REPORTED STRESS SYMPTOMS, PERCEPTION OF LEVEL OF STRESS, ANXIETY, PSYCHOLOGICAL GENERAL WELL-BEING AND NEUROCOGNITIVE FUNCTION FOR THE TWO GROUPS?

Once again the findings indicated that there was a statistically significant time effect in respect of reported levels of physical stress, psychological stress, behavioural stress, overall level of stress, perception of level of stress as well as perception of level of stress at different specified time periods (morning, noon, afternoon, evening, before sleep), anxiety, and psychological general well-being. This indicates that all these variables improved with time (from pre- to post-test). However there was no significant group effect (indicating no significant difference between the two groups with respect to improvement) as well as no significant time by group interaction (treatment effect) for any of the same variables.

Some interesting trends were noted. There was a slight trend for behavioural symptoms of stress, overall level of stress, perception of level of stress at noon as well as in the afternoon and evening, anxiety, and general psychological well-being to improve more for the Active as compared to the Placebo group.

With regard to specific anxiety symptoms endorsed by both groups at baseline, the Active group improved significantly more than the Placebo group with regards to tension (P=0.0412), fears (P=0.0020) and depressed mood (P=0.0033). There was a marginally significant higher improvement for the Active than the Placebo group on genitourinary symptoms (P=0.0504).

With regard to specific symptoms of psychological general well-being endorsed by both groups at baseline, the Active group improved significantly more than the Placebo group with regards to being bothered by nervousness or 'nerves', having energy, pep, or vitality, being generally tense or feeling any tension, being concerned, worried, or having had any fears about their health, and having been anxious, worried, or upset. A marginally significantly higher improvement for the Active group over the Placebo group was found in respect of feeling tired, worn out, used up, or exhausted.

Furthermore, the findings showed no significant differences in pre-post test performance between the two groups on any of the three measures of verbal and visual recall (memory), under either immediate or delayed conditions of recall.

4.6.8 RESEARCH QUESTION 8

WHAT STRESSOR AND MODERATING VARIABLES PREDICT THE DEGREE OF PRE-POST CHANGE (DELTA) FOR EACH GROUP?

4.6.8.1 WHAT DEGREE OF CHANGE IN STRESSOR AND MODERATINGVARIABLES PREDICTS THE DEGREE OF PRE-POST CHANGE (DELTA) FOR THE ACTIVE GROUP?

The findings indicated that the delta of daily hassles predicts the delta of physical stress outcome, while the degree of improvement in psychological symptoms is predicted by daily hassles and studying. The delta of behavioural symptoms was found to be predicted by the degree of improvement in daily hassles, studying and perceived coping incapacity (control) , in contrast to that of total level of stress which was predicted by the degree of improvement in daily hassles and studying. The finding showed that the delta of perception of level of stress was predicted by the degree of improvement in daily hassles and daily uplifts, in contrast to that of anxiety which was found to be predicted by the degree of change in daily hassles and life orientation, as well as life events occurring in the 7-12 month period. Finally the results for the Active group indicated that the degree of improvement in psychological general well-being was predicted by the delta of perceived coping incapacity, daily hassles and daily uplifts.

4.6.8.2 WHAT DEGREE OF CHANGE IN STRESSOR AND MODERATING VARIABLES PREDICTS THE DEGREE OF PRE-POST CHANGE (DELTA) FOR THE PLACEBO GROUP?

The findings indicated that the delta of daily hassles predict the delta of physical stress outcome, while the degree of improvement in psychological symptoms is predicted by family responsibilities and concerns about the health of family members. The delta of behavioural symptoms was found to be predicted by recent life events in the 13-24 month period, in contrast to that of total level of stress which was predicted by the degree of improvement in family responsibilities and daily hassles. The findings indicated that the delta of perception of level of stress was predicted by the degree of improvement in concerns about oneself, daily hassles, loneliness and concerns about one's own health, unlike that of anxiety which was predicted by the degree of change in daily hassles, perceived coping incapacity and finance. Finally the results for the Placebo group indicated that the degree of improvement in psychological general well-being was predicted by the delta of daily hassles, perceived coping incapacity, finance and personal relationship.

4.6.9 RESEARCH QUESTION 9

WHAT STRESSOR AND MODERATING VARIABLES PREDICT THE DELTA (DEGREE OF PRE-POST DIFFERENCE) IN OUTCOME IN THE TOTAL SAMPLE?

The findings indicated that the delta of daily hassles, time management and concern over health of family of origin predict the delta of physical stress outcome, while the degree of improvement in psychological symptoms is predicted by daily hassles and relocation. The delta of behavioural symptoms was found to be predicted by the degree of improvement in daily hassles, studying and perceived coping incapacity (control) , in contrast to that of total level of stress which was predicted by the degree of improvement in daily hassles and time management. The findings showed that the delta of perception of level of stress was predicted by the degree of improvement in daily hassles and daily uplifts as well as concern over one's self and life orientation, in contrast to that of anxiety which was found to be predicted by the degree of change in daily hassles and perceived coping incapacity. Finally the results for the total group indicated that the degree of improvement in psychological general well-being was predicted by the delta of daily hassles, perceived coping incapacity, daily uplifts and finance.

CHAPTER 5

DISCUSSION

5.0 INTRODUCTION

The primary aims of this multifactorial study were to assess the sources of stress for South Africans; to delineate the stress-related symptoms (health outcomes), to evaluate the effects of psychosocial moderating factors such as life orientation (optimism), perceived coping incapacity (cognitive appraisal of lack of coping and control), and everyday positive experiences (daily uplifts) on outcome; and to assess the role of micronutrients in stress management (coping strategy) with regards to specifically assessing the effect of intervention with micronutrient (vitamin and mineral combination) supplementation on the stress levels and symptoms of a sample of South Africans in relation to enhancing quality of life in the patient sample studied as related to general psychological well-being, reducing stress/anxiety-related symptoms, including symptoms of tension, fears, insomnia, cognitive fallout (poor concentration / memory), fatigue, somatic complaints and depression; and improving social and occupational functioning, including increased productivity.

This present chapter discusses the general findings of the study with respect of identifying perceived sources of stress (stressors), the effects of psychosocial

moderating variables on stress outcome, developing a stress profile for South Africans, as well as assessing the effects of a micronutrient (vitamin and mineral) supplement on stress outcome. The practical and theoretical implications of the findings, particularly with regard to forming part of a comprehensive intervention programme for stress, are then discussed. Finally, the strengths and limitations of the study and implications for future research are considered.

Part One discusses the findings in relation to the total sample, while Part Two discusses the findings of the study with respect to the experimental (Active) and control (Placebo) groups and the efficacy analysis, as well as proffering a stress profile for both groups and the total group.

PART ONE

TOTAL SAMPLE

5.1 PERCEIVED SOURCES OF STRESS (STRESSORS)

This study examined two categories of stressors, namely life change events and everyday upsetting events (daily hassles).

The most significant life event stressor overall (both in the two year period, and in the 6 months prior to participating in the study) reported by South Africans related to violence, both in respect of exposure to violence (boycotts, strikes etc.) in their area of work and residence, as well as personal exposure to crime from others directed against the self (in respect of housebreakings and robberies), particularly in the more recent time period. Given this, magnitude of life event stressors was significant.

Most of the sample also reported consistently high exposure to negative life events over a two-year period (at minimum, 1-10 such events in each 6 month period, closely followed by between 11-20 such events in each time span). The overall average over the 2 year period was 23.14 life events, which is higher than the mean score (20.5) of white middle class adults reported by Lazarus and Folkman (2000).

Research has indicated a relationship between impact of life events and emotional outcome variables (Ormel & Sanderman, 1989), including greater vulnerability to emotional effects over cognitive or behavioural changes with higher negative life event scores (particularly in respect of anxiety). This study found a significant relationship between general crime and psychological symptoms of stress.

Life events demonstrated a significant relationship with global anxiety in this sample of South Africans. Given the clinical associations between traumatic exposure and the development of anxiety disorders, including for example post-traumatic stress disorder (Horowitz, 1986; Schlebusch, 2000; White, 2000; Van der Kolk & McFarlane, 1996), the presence of clinically significant anxiety (HARS score of ≥14 as per Kobak et al., 1993) in the individuals studied is in keeping with this clinical literature.

The everyday unpleasant experiences (daily hassles) reported as being a source of significant (continuous or at least daily) stress included work-related factors (predominantly workload), financial concerns (enough money for necessities, emergencies and extras), amount of free time available, and taking care of paperwork (both at home and at work). Other significant daily stressors included political or social issues, job security and the nature of the job, and other routine home related activities (such as housework, car maintenance etc.). Of interest is that the sample of South African assessed reported an average of 23.14 events over the two year period, which is higher than the average score (20.5) of white middle class adults reported by Lazarus and Folkman (2000).

The inclusion of the Combined Hassles and Uplifts Scale appears to have been justified in that the scale was significantly correlated with outcome, with this study finding a positive correlation with all outcome measures (level and symptoms of stress, perception of degree of stress, anxiety) and a negative correlation with psychological general well-being. These findings of a strong association with mental and physical health symptoms are in keeping with those of other studies who have found an association between daily hassles and a variety of psychological and somatic (physical) health outcomes (Lazarus & Folkman, 2000; Kanner et al., 1981). Furthermore, the current results lend support to the suggestion in the literature (Singer & Davidson, 1986) that daily hassles, in spite of being chronic low-intensity threats, may accumulate over time and may result in severe consequences (in particular if the stressor persists or coping abilities are diminished and that stress accumulates over stressors (Lazarus and Cohen, 1977).

The findings of this study in respect of a correlation between daily hassles and various outcome measures, as compared to life events only having a significant relationship with anxiety, offers some support to the findings in the research literature (Kanner et al., 1981; Lazarus, 1981) that hassles are a better predicator of future health than life events. However, since the two scales do not measure exactly the same kind of stimuli in that daily hassles are concerned with minor events and daily frustrations as compared to life events which refer to more powerful social stressors of life changing events such as chronic stressors, losses, death etc., these two measures could be complimentary rather than alternative measures.

Overall, events or occurrences that were perceived as most stress-inducing for South Africans related to financial concerns, various work-related problems or concerns, and violence.

An important finding of this study was that there was a significant relationship between work-related stress and psychological general well-being, which is consistent with the findings of Pines (1982) that psychological well-being is significantly impacted upon by the cognitive (e.g. increased work load) and emotional spheres of the work situation. Several studies have documented a relationship between perceptions of stressful work situations and employee well-being and health (Beehr & Newman, 1978; Schlebusch, 2000).

The prominence of financial concerns is surprising, given that nearly four fifths (79.66%) of the entire sample were in full-time employment while 12.0% were in part-time employment (12.0%), with most of them occupying administrative (54.7%) or professional (27.7%) positions. Although the present study did not specifically examine the specific nature or aetiology of the financial stress, the prevalence of financial stress in people who have employment, and at a skilled to professional level predominantly, may be related to the socio-political transformation South Africa is currently undergoing, the alterations in remuneration increases as a result of equity policies, and the poorer exchange rate of the rand to foreign currency during the time of the study.

Financial stressors impacted to the greatest degree on outcome variables, having a significant relationship with physical, psychological and behavioural symptoms of stress, the total level of stress, anxiety and psychological general well-being. The importance of adequate financial planning and money management as part of a stress management package is suggested by these findings.

Both loneliness and relocation tied for the second largest number of significant relationships with outcome variables. Loneliness has been recognised as a widespread, pervasive social problem (Rokach & Brock, 1998). Loneliness shared a significant relationship with psychological symptoms, total level of stress, perception of stress level and general psychological well-being. These current findings are similar to other studies which have found that the most salient characteristic of loneliness is emotional distress (Rokach & Brock, 1998). The importance of loneliness in relation to a variety of mental, physical and social symptoms has also been well-documented in the literature (Russel, Peplau & Cutrona, 1980).

Both the experiential and situational aspects of relocation have been identified as central antecedents (causally linked to) of loneliness as has personal inadequacy as well as relationship variables, including absence of love, support and/or intimacy in current relationships or due to relationships having lapsed or being absent (Rokach & Brock, 1998).

Relocation was significantly related to physical symptoms of stress, total level of stress, perception of amount of stress experienced and psychological general well-being. Given the difficulties experienced by many South Africans in securing suitable accommodation, at affordable prices, and given the causal links of relocation with loneliness as found in the present study, the findings of an impact on both physical and psychological domains is consistent with the findings in the literature as discussed above in relation to loneliness and mental, physical and social outcome.

Most of the sample reported that their stress impacted to the greatest extent on their capacity to carry out family chores (both on a daily basis and overall). Work and relaxation were also reported as being impacted on significantly, but to a lesser extent.

However, given the high levels of clinical anxiety in particular, in addition to other adverse psychological health symptoms reported by the current sample, it is difficult to rule out the possibility that at least some of the tendency to report more frequent and severe daily hassles or impact of stress on functioning is not a manifestation of, rather than a precursor to, negative affect.

In addition to the stressor effects of everyday unpleasant experiences (daily hassles) and life events, a number of the moderating and outcome variables (which are not considered traditional sources of stress) appear to have stressor effects. Lack of control (perceived coping incapacity) and reduced optimism as well as anxiety appeared to significantly predict poor outcome.

The data then supports a possible alternative explanation, that is, that based on the circularity principle (Lazarus & Folkman,1986), the combination of stressors experienced by the sample, which comprises objective hazards in the physical and social environment (e.g. exposure to violence as reported by the sample), life changes (e.g. financial stress which impacts on ability to meet demands for necessities, emergencies and extras, and significant work stress as reported by the sample), interpersonal social pressures (e.g. personal and work relationship difficulties as reported by the sample, relocation), inadequate social support (eg. loneliness, relocation) underpin the physical and emotional symptoms that develop in response to these stress stimuli, which then in turn impact on perception of stress (control and perceived coping capacity), areas of functioning (e.g. family chores, work etc.) and coping ability (or at least the effort it takes to cope), which possibly makes one more susceptible to stressors, and which when combined with other or ongoing stressors, results in a circular and cumulative effect which impinges negatively on overall outcome and adaptation.

Finally, another possible explanation lies in the fact that life change events can exert both predisposing as well as precipitating influences on susceptibility to stress and illness (Rahe, 1998). Life changes that occur within a preceding period of around 12 to 24 month period within onset of an illness (or stress) can be considered as precipitating life change events, as contrasted with predisposing life events which generally refer to significant events occurring early on in life (Rahe, 1998). Precipitating life events include financial problems and relocations amongst other events (as is seen in the

sample for the present study). It is possible that the high number of life events experienced by participants in the study, together with the high magnitude of trauma valence of the most commonly reported events, precipitated high levels of anxiety, which might then have increased sensitivity and responsivity to events with a lesser negative emotional valence.

5.2 APPRAISAL

Current stress theories attribute a central role to appraisal in the stress process. Both the term and the construct of appraisal as used in stress theory seems to imply the significance of cognitive factors. Although cognitive models differ in their delineation of the relationship between cognition, affect and behaviour, most modern models are based on the presumption that cognition and affect are mutually causative and interdependent (White, 2000; Lazarus, 1984; Mahoney, 1984; Greenberg & Safran, 1984).

Cognitive appraisal has been described as the ability of the person to determine two things, firstly, whether a stressor is significant in respect of well-being and secondly, whether the stressor is either challenging or threatening (Folkman et al., 1986).

While cognitive appraisal was not a specific focal area of the present study, perceived coping incapacity, which assesses an appraisal of lack of coping ability (secondary

appraisal as per Lazarus & Folkman, 1984), was an important independent predictor of outcome in the total sample of the study (cf section 5.3 of this chapter).

5.3 COPING MECHANISMS

The present study examined both the role and outcome of particular coping tasks to stress in the general population. Aspects of coping investigated included examining the effect of particular coping resources on outcome.

Whilst psychological coping strategies were not included in this study, the effect of a biological coping strategy, namely micronutrients, on outcome was investigated (and is reported upon separately in Part Two of Chapter Five).

5.3.1 COPING RESOURCES

Coping resources were found to have a mixed, bidirectional and circular relationship with outcome variables in this study, in that the findings indicated that personal coping resources appeared to be adversely impacted upon by stress and stress outcome.

5.3.1.1 PERSONAL COPING RESOURCES

5.3.1.1.1 Life Orientation (Optimism)

Life orientation (optimism) was found to be significantly positively correlated with perceived coping incapacity, which suggests in part that life orientation might be an outcome variable. An interesting finding in the study was that low optimism was found to be significantly related to higher anxiety and perception of higher levels of stress. A possible explanation for this might lie in the fact that as a whole, the sample scored in the range for clinical anxiety. The combination of high levels of stress and high anxiety with the feeling of not being able to cope (perceived coping incapacity) is likely to affect positive life orientation and feelings of control adversely. These findings are consistent with reports in the literature that optimism has been found to have a significant impact on behavioural and psychological outcome (Scheier & Carver, 1992).

5.3.1.1.2. Perceived Coping Incapacity

As noted above, perceived coping incapacity was positively related to life orientation (control). Higher levels of perceived coping ability were also found to be related to psychological general well-being in the present study. Significantly negative relationships were found between perceived coping incapacity and psychological symptoms of stress, perception of level of stress, and total level of stress.

These findings seem to be consistent with reports in the literature of an effect of perception of control on well-being being (including physical, social and psychological aspects of well-being) and that the amount of stress experienced by an individual is related to perception of controllability (Singer & Davidson, 1986). Further support for the link between positive outcomes (e.g. health, optimism, personal adjustment, etc.) and personal control reported in the literature (Skinner, 1996; Hinton, 1991) is suggested by the findings of this study.

5.3.1.2 ENVIRONMENTAL VARIABLE (DAILY UPLIFTS)

The findings indicate a significant negative relationship between daily uplifts and perception of level of stress. This finding has two possible implications. Firstly, it may be that as positive daily experiences increase, perceived levels of stress decrease. Alternative, it is possible that as levels of stress decrease, more events are appraised as rewarding.

5.4 OUTCOME AND ADAPTATION

This study incorporated a number of different indices of outcome and adaptation, including levels and symptoms of stress, perception of level of stress, anxiety, general psychological well-being and cognitive functions (complaints and select memory functions on neuropsychological tests).

5.4.1 STRESS

The findings of the study suggest that South Africans had high levels of stress overall, which is in keeping with other finding that suggested that the national average level of stress in South Africa was 36.48% (Pharma Natura, 1999; Schlebusch 2004). The fact that on average, most of the sample perceived themselves as being moderately stressed is in keeping with these findings.

5.4.2 ANXIETY

An interesting finding of the study was the high levels of anxiety in the sample, with the average meeting the criteria for clinical anxiety. As discussed previously (section 5.1 of this chapter) this might be related to both the magnitude and nature of the life events reported as most commonly experienced by the participants (exposure to violence, financial difficulties and work-related difficulties), or the high frequency of adverse everyday experiences in conjunction with the specific nature of stressors.

5.4.3 PSYCHOLOGICAL GENERAL WELL-BEING

The findings showed that on average the sample was reporting moderate levels of impairment regarding subjective feelings of distress and psychological well-being. These findings are consistent with the research literature which indicates that subjective well-being is influenced by anxiety (Cohen et al., 1995, Schlebusch 2000), personal

resources (Diener & Fujita, 1995) and recent life events (Suh, Diener & Fujita, 1995) and stressors. Thus the lower incidence of psychological well-being might well be accounted for by its correlation with anxiety, diminished personal resources such as lower optimism and less control, and the cumulative incidence of a high number of stressors and high magnitude life events experienced by the sample.

5.4.4 COGNITIVE FUNCTIONING

This study indicated that almost three-quarters of the sample reported a significant number of cognitive complaints, most prominently memory loss or forgetfulness, poor concentration, poor long-term planning, poor time management, and poor work quality. However, there was no evidence of any impaired performance on neuropsychological testing, with the sample scoring within the average range on all three indices used, although there were some indicators of poorer self-monitoring in both visual and verbal modalities. These suggest that stress does not affect actual memory functions on psychometric testing. Alternatively, it may be that the impairments are too subtle to be identified by the measures used, and other more sensitive measures might establish the presence of subtle neurocognitive deficits associated with significant stress. The suggestion of poorer self-monitoring may point to subtle attentional difficulties (which were not measured in detail in the current study), and in retrospect, using a measure such as the Paced Auditory Serial Addition Test devised by Gronwall and colleagues in 1974 (Spreen & Strauss, 1988) or the

Auditory Consonant Trigrams Task developed by Brown and Peterson (Spreen & Strauss, 1988), might have clarified these findings/ issues.

5.5 TOWARDS AN IDENTIFICATION OF THE PATHWAY AND PROFILE OF STRESS

The findings indicated that level of stress, physical, psychological and behavioural symptoms of stress, anxiety, and perception of level of stress are significantly positively correlated with each other, while there are significant negative correlations between all these variables and psychological general well being. Overall, they were less optimistic and felt less control over their situation or emotions. Less everyday events were experienced as positive and uplifting. Specifically they experienced themselves on average as having moderate levels of stress manifesting in physical, psychological and behavioural domains of functioning, more emotional distress symptoms and moderate degrees of psychological un-wellness. The high levels of anxiety experienced by the sample suggests that the level of anxiety might be approaching clinical significance.

Important risk and rescue factors were also identified for the group. Firstly, the data established that those participants who experienced significantly more recent life events were more likely to present with anxiety. Daily hassles are associated with poorer outcome generally.

Some of the difficulty and concern in researching stress outcome and developing models of stress has been related to individual differences (Lazarus and Folkman, 1984, 1988; Thoits, 1995). An important finding of this study is that there is some indication that different stressors are associated with different patterns of stress outcome. In this regard, the current study found that particular outcomes were related to particular stressors. Financial stress, time management difficulties, studying and relocation are more likely to result in physical symptoms of stress, while financial stress, health concerns about others and time management difficulties are more likely to result in psychological stress symptoms. Behavioural reactions have a greater likelihood of occurring as a result of financial stress, general crime and loneliness. Not surprisingly then, the overall level of stress experienced by the sample was found to be affected by financial stress, being stressed about the health of others (excluding family or self), time management, loneliness, and relocation. Perception by an individual of the degree of stress they were experiencing is most affected by health concerns relating to one's own health and that of the members of one's family of origin, children's behaviour, loneliness, relocation and concern over the self. People exposed to financial stress and concern over their family of origin are more likely to develop anxiety, while lower psychological general well-being arises when exposed to financial stress, work stress, concern over the health of members of one's family of origin, personal relationship difficulties, family responsibilities, loneliness and relocation.

In terms of resource variables, higher levels of control and optimism are associated with less emotional distress and greater psychological well-being, lower levels of anxiety and a lower perception of being stressed overall.

The findings indicated that level of stress, physical, psychological and behavioural symptoms of stress, anxiety, and perception of level of stress are significantly positively correlated with each other, while there are significant negative correlations between all these variables and psychological general well being.

PART TWO

EFFICACY ANALYSIS

5.6 BASELINE ANALYSIS

The findings of no significant differences between the two groups (Active and Placebo) at baseline on any of the demographic variables meant that this did not have to be controlled for in the statistical analysis.

There were also no differences between the two groups with regard to stressors (daily hassles, sources of stress on report other than A>P over concern for children's future, and P>A regarding life decision), moderating variables (life orientation, perceived coping incapacity, acceptable percentage and daily uplifts) and two of the four outcome variables included in the efficacy analysis, namely symptoms and level of stress, and perception of level of stress. However the Active group reported higher levels of anxiety than the Placebo group at baseline. A difference in the same direction was suggested by some statistical analysis for psychological well-being, but not supported by other statistical analysis. The possible implications of these differences are discussed in section 5.7.4 of the current chapter.

5.7 WHAT EFFECT DOES MICRONUTRIENT (MULTIVITAMIN AND MINERAL COMBINATION) SUPPLEMENTATION HAVE ON STRESSORS, COPING RESOURCES AND OUTCOME?

This study examined the role of micronutrient (vitamin and mineral) supplementation as a (biological) coping strategy for stress. It investigated the effect that micronutrients had on stressors, moderating variables, and outcome.

5.7.1 PERCEIVED SOURCES OF STRESS

The findings indicated that there were no differences in baseline in the number of life events reported by either group, with both groups manifesting both a high number and a high magnitude of life events in the two year period prior to the study. The importance of life events in stress outcome has been discussed in Chapter Five, Part One, section 5.1.

Although a difference in reported everyday stressors (daily hassles) and stressors on (free) self-report was found over the two time periods for both groups equally, the absence of a significant time by group effect suggests that this improvement cannot be attributed to the effect of the intervention.

There are a number of possible explanations for these findings. Firstly, it is possible that the reduction in negative experiences on a daily basis might be as a result of actual (objective) reduction of daily hassles having occurred in the intervening month (and which, in retrospect, should have been canvassed with the participants in an interview). Secondly, the improvement might be attributable to the improvement coping resources (as were found for both groups in this study). Research (DeLongis, Folkman & Lazarus, 1988) has demonstrated that fluctuations in daily stress levels co-vary with changes in health and well-being, and changes in all outcome measures were found on post-test in the current study. In particular, anxiety has been reported as an important "feed-forward" in stress (Hinton, 1991, pp55). It may be that as the participants felt emotionally better (that is less stressed), they felt more able to cope (that is, they perceived a reduction in the discrepancy between demands and capability) which is indicated by an improvement in perceived coping incapacity (as found in this study). This may have led them to perceiving the same daily hassles that were stressful earlier as less unpleasant because they were more able to cope with daily demands. Alternatively, the improvement in coping resources (optimism and perceived coping capacity as found in both samples) may account for the finding of a reported reduction in daily hassles from pre- to post-test for both groups.

One of the main findings of this study was the important predictive value of the degree of change (delta) in daily hassles on delta of outcome for both groups, although surprisingly (since participants were allocated to each group randomly and blindly), there were notable differences between the two groups in this regard (cf section 5.7.4 of

this chapter). For both groups, the pre-post improvement in daily hassles was found to predict the delta of physical symptoms of stress, total level of stress, perception of stress level, anxiety and psychological general well-being. However there was only predictive value for behavioural stress reactions for the Active group. These findings suggest that the delta of daily hassles appeared to be the most important predictor of outcome generally, which attests to the necessity of further research in this area (and possibly an alternative research design along the lines of that discussed in Part Three of this chapter), to gain clarity as to which of the possible explanations proffered might account for the improvement in daily hassles.

The study showed that at baseline, work (around 70%), finance (50%) and family responsibilities (50%), were the top three stressors reported for both groups with most (half) of both groups positively endorsing both finance and family responsibilities as stressors. For both groups, relationships were also a common stressor. However the Active group favoured work relationships as a stressor as compared to the Placebo group who reported higher stress as a result of personal relationships. Another important finding of this study was that different sources of stress predicted the delta of outcome between the two groups, although there were some overlaps. For the active group, studying predicted the delta of psychological and behavioural symptoms and total level of stress while the delta of anxiety was impacted upon by recent life events occurring in the 7-12 month period. In contrast, family responsibilities predicted the pre-post difference in psychological symptoms and total level of stress. Concerns about the health of family members predicted the delta of psychological symptoms, while

the pre-post difference in perception of level of stress was found to be predicted by concerns about oneself, about one's own health, and loneliness. Finance had predictive value for the delta of anxiety and psychological general well-being. Recent life events in the 13-24 month period was found to predict the degree of improvement in behavioural symptoms, while personal relationship difficulties were predictive for psychological general well-being.

These above findings clearly show that a larger proportion of the degree of improvement across most outcomes for the Placebo group is attributable to changes in stressors, in contrast to only a few pre-post differences being impacted upon by changes in stressors. An important possible implication is that it is possible that these findings may have obscured actual time by group (treatment effect) differences in outcome between the two groups, thereby disguising the true effect of the multinutrients on the treatment group.

Both groups reported an impact on work, family chores and relaxation. There was a trend for the Placebo group to report nearly double the number of times stress impacted upon work and relaxation and three times as frequent an impact of stress on family chores than the Active group on a continuous basis. Given that participants were randomly placed in either group, this finding is unusual for a double-blind study, and can only be attributed to chance. However this difference might have an impact on the level of perception of stress (in that it might have contributed to the perception of being more highly stressed because of a greater impact in daily living) in the Placebo group,

and might also be linked with the nature of stressors reported by the same group as a result of a circular, interactional effect on the stress process, which would clearly have implications for the pre-post differences in outcome measures for this group given the magnitude of the effect of stressor variables on the delta of outcome that was found in the study. The possible impact of these trends on the inter-group as well as the time by group effect warrants further research.

5.7.2 APPRAISAL

As discussed previously (section 5.2 of the current chapter), the second antecedent factor in stress outcome (after stressors), is the importance of perception of any stressor as actually stressful, such judgement been made on an appraisal of the discrepancy between external demands and perceived capabilities (Folkman, 1984; Folkman & Lazarus, 1985; Folkman & Lazarus, 1988; Hinton, 1991).

Perceived coping incapacity (PCI) whilst generally considered a personal resource variable (coping resource), has been reported as a cognitive judgemental variable (appraisal) in that in that stress is seen as being generated by a totally subjective perceived coping incapacity (Hinton, 1991), who further argues that such a conceptualisation of PCI avoids assessment difficulties in respect of assessing objective demands and capabilities in order to get a demand/capacity ratio. Present findings regarding PCI are discussed further on in this chapter.

5.7.3 COPING MECHANISMS

As discussed previously (Chapter 5, Part One, section 5.2), aspects of coping included in this study encompassed coping resources (perceived coping incapacity and life orientation) and micronutrients as a coping strategy and the effect of these on outcome.

5.7.3.1 PERSONAL RESOURCES

No differences in life orientation (optimism) or perceived coping incapacity (control), at baseline, were found between the two groups. Although a difference (positive change) in life orientation (optimism) and perceived coping incapacity (PCI) was found over the two time periods for both groups equally, the absence of a significant time by group effect suggests that this improvement cannot be attributed to the effect of the intervention. However, a trend was noted for perceived coping incapacity (control) to improve more for the Active group than the Placebo group.

Of interest is that in the present study there was a significant difference in reported optimism from the first to the second assessment, which appears to contradict the proposition by Scheier et al. (1986) and Scheier and Carver (1992) that optimism is a stable characteristic of personality.

Furthermore, Scheier et al (1994) have suggested that it is the different way in which optimists and pessimists cope with life challenges that underlies differential outcome.

However, the present study found a trend for differential outcome between the two groups with regard to many of the outcome measures (that is between two groups with relatively equivalent measured levels of optimism at baseline), as well as a difference in the predictive value of the delta of optimism on the delta of outcome as discussed below. These findings appear to suggest that differential outcomes (most likely dependent on specific interactive pattems with other variables) can occur between optimists.

It is possible that a significant proportion of the increase in an optimistic outlook for the Placebo group may be attributable to the significant improvement in daily stressors, and the nature of the stressors that actually improved. For example, the reduction of financial difficulties is likely to facilitate a more positive outlook on the future generally. Whilst this is probably true for the Active group as well, other factors seem likely to have played a more significant role in this regard.

An important difference between the two groups was that the delta of life orientation was found to have a significant impact on the degree of improvement of one outcome variable (anxiety) in the Active group, but had no predictive value in the Placebo group. Optimism has been linked to behavioural and psychological outcome (Scheier & Carver, 1992), and the effects of anxiety on behavioural and psychological symptoms, including a positive frame of mind (optimism) has been well-described in the clinical literature (APA, 1980, 1987, 1994, 2000a; Schlebusch, 2000). Given that the Active group had significantly more anxiety at baseline as compared to the Placebo group, it is

more likely that the significant improvement in anxiety would have significant effects on general well-being, and thereby on optimism.

It is interesting to note that the degree of improvement in perceived coping incapacity for both groups was found to be an important, albeit differential, predictor of the degree of change in various outcome variables (cf section 5.7.4) .

Overall, the findings appear to confirm the central role of perceived coping incapacity (control), in the stress process as elaborated upon in section 5.3.1.1.2. It is possible that the improvement in both groups is related, at least in part, to the significant improvement in daily hassles in respect of providing a greater sense of control over the environment (and possibly oneself). A greater sense of control (or predictablility about causality) is known to be associated with an improvement in health outcome (Hinton, 1991).

5.7.3.2 ENVIRONMENTAL RESOURCES

Given the absence of a time, group or time by group effect, the findings indicated no pre-post changes with regards to daily uplifting experiences. However a trend for the Placebo group to report more everyday experiences as uplifting on post-test as compared to the Active group was noted.

Daily uplifts (delta) were found to have some limited predictive power in respect of the pre-post differences perception in level of stress and psychological general well-being

in the Active group, but no predictive value in the Placebo group. Given that no actual pre-post changes in daily uplifts (number of daily uplifts) or differences in this regard were found in either group, it would appear that it must be the interaction of daily uplifts with the delta of other variables that would most likely account for these findings, although the present findings do not clearly indicate what such interactions are, and further research is needed to explore this dimension.

5.7.4 OUTCOME AND ADAPTATION

The findings of the present study indicated that there was a statistically significant time , but not group or time by group (treatment) effect in respect of reported levels of physical stress, psychological stress, behavioural stress, overall level of stress, perception of level of stress as well as perception of level of stress at different specified time periods (morning, noon, afternoon, evening, before sleep), anxiety, and psychological general well-being. Of interest are the trends in differences in the two group with regard to changes at post-test between the two groups, discussed in more detail in sections 5.7.4.1 to 5.7.4.4. of the current chapter.

5.7.4.1 STRESS

The Active group reported slightly more behavioural symptoms of stress than the Placebo group, as well as more complaints of memory loss or forgetfulness, poor long term planning, and poor work quality than the Placebo group. The results also indicated

a borderline significant difference between the two groups with regard to poor problem solving.

The was a slight trend for total level of stress and behavioural symptoms of stress and overall level of stress, to improve more for the Active as compared to the Placebo group.

The delta of a number of different stressors and moderator variables had a predictive effect for the pre-post changes in both groups, with a variation in the patterns of predictive value being found between the two groups (cf section 4.4.9).

As noted previously (cf 5.7.1) the actual clinical significance of these trends might have been obscured by the significant differences in the effect of the delta of stressors on the delta of outcomes between the two groups. Further research, and possibly an alternative research design (cf section 5.9) is needed in order to investigate this more fully.

5.7.4.2 PERCEPTION OF LEVEL OF STRESS

The findings indicated a significant time, but not group or time by group effect, although there was a trend for the Active group to report a reduction of perception of levels of stress at noon as well as in the afternoon and evening as compared to the Placebo group.

A significant variation in the patterns of predictive value was found between the two groups (cf section 4.4.9), namely, that the delta of perception of level of stress was predicted by the degree of improvement in daily hassles and daily uplifts for the Active group, in contrast to being predicted by the degree of improvement predominantly in specific stressors (in concerns about oneself, loneliness and concerns about one's own health) as well as daily hassles. These findings are interesting as they suggest that the cognitive judgemental process of level of stress is predominantly impacted upon by external stressors, although interactive effects with other variables cannot be excluded.

As noted previously (cf 5.7.1) the actual clinical significance of these trends might have been obscured by the significant differences in the effect of the delta of stressors on the delta of outcomes between the two groups. Further research, and possibly an alternative research design (cf section 5.9) is needed in order to investigate this more fully.

5.7.4.3 ANXIETY

The Active group entered the study with higher levels of anxiety than the Placebo group, and significant differences in respect of reporting a greater degree of fears and depressed mood, and marginally more tension and anxiousness.

With regard to specific anxiety symptoms endorsed by both groups at baseline, the Active group improved significantly more than the Placebo group with regards to

tension, fears and depressed mood, and marginally significantly more in respect of genitourinary symptoms.

A significant time effect was found, but no significant group or time by group effect. There was a trend however, for the Active group to improve more than the Placebo group. Again, different patterns of predictive value in relation to anxiety between the two groups was identified in the study. The delta of anxiety was found to be predicted by the degree of change in daily hassles, life orientation, as well as life events that in the 7-12 month period in the Active group, as compared to the predictive value being the delta of daily hassles, perceived coping incapacity and finance in the Placebo group.

The lower pre-post incidence of anxiety may arise from its correlation with the other outcome variables (as found in this study), optimism and greater control, and the cumulative, circular, interactive effect of the improvement in number of stressors.

As noted previously (cf 5.7.1) the actual clinical significance of these trends might have been obscured by the significant differences in the effect of the delta of stressors on the delta of outcomes between the two groups. Further research, and possibly an alternative research design (cf section 5.9) is needed in order to investigate this more fully.

5.7.4.4 PSYCHOLOGICAL GENERAL WELL-BEING

Findings were equivocal regarding any baseline differences between the two groups with regard to psychological general well-being, with some suggestion that the Active group was reporting a lower level of well-being than the Placebo group. Inter-group differences at baseline in respect of particular individual items were found, with the Active group reporting a high level of distress in respect of amount of energy, feeling healthy enough to carry out things that had to be done or that the person liked to do, having been concerned, worried, or had any fears about their health, and feeling tired, worn out, used up, or exhausted. Marginally significant differences in the same direction were found for the symptom of having any illness, bodily disorder, aches or pains.

There was a significant time effect for both groups, but the group and time by group effect was not significant. An interesting finding is that there is a trend for the Active group to improve slightly more than the Placebo group.

With regard to specific symptoms of psychological general well-being endorsed by both groups at baseline, the Active group improved significantly more than the Placebo group with regards to being bothered by nervousness or 'nerves', having energy, pep, or vitality, being generally tense or feeling any tension, being concerned, worried, or having had any fears about their health, and having been anxious, worried, or upset. A

marginally significantly higher improvement for the Active group over the Placebo group was found in respect of feeling tired, worn out, used up, or exhausted.

The higher pre-post incidence of psychological well-being might well be accounted for by its correlation with anxiety, with enhanced personal resources such as higher optimism and greater control, and the cumulative, circular, interactive effect of the improvement in number of stressors.

Pre-post improvement in psychological general well-being was predicted by the delta of perceived coping incapacity, daily hassles and daily uplifts for the Active group as compared to daily hassles, perceived coping incapacity, finance and personal relationship. Yet again, it is possible that the actual clinical significance of these different trends might have been obscured by the significant differences in the effect of the delta of stressors on the delta of outcomes between the two groups. Further research, and possibly an alternative research design (cf section 5.9) is needed in order to investigate this more fully.

5.7.4.4 NEUROCOGNITIVE FUNCTION

There were no significant differences between the groups at baseline or regarding pre-post differences, and no real indices of impairment at either of the time points on any of the neuropsychological measures used in the study. As a result, further group and time by group analysis was not done. Of interest was the finding of a slightly below

average performance for both groups on the copy trial of a complex configurational design, which was due to minor inaccuracies (e.g. poorer intersections, careless execution of lines etc.) rather than any major distortions of the overall gestalt of the design or design elements, the possible significant of which has been discussed previously (cf 5.5.4).

5.7.5 TOWARDS A STRESS AND COPING PROFILE AND IDENTIFYING THE PATHWAY OF STRESS

5.7.5.1 TOWARDS A STRESS AND COPING PROFILE OF THE PRE-POST DIFFERENCES (DELTA) OF THE ACTIVE AND PLACEBO GROUPS

The findings indicated that level of stress, physical, psychological and behavioural symptoms of stress, anxiety, and perception of level of stress significantly improved with time, but there was no significant time by group effect. However, a trend for the Active group to improve more than the Placebo group with regards to almost all indices of outcome was noted, including total level of stress, behavioural symptoms of stress, perception of level of stress at particular times in a 24 hour period (namely noon, afternoon and evening), total level anxiety as well as the specific symptoms of tension, fears, and depressed mood, and to a lesser extent genitourinary symptoms, and psychological general well-being.

Overall, both groups felt more optimistic and more in control over their situations and/or emotions. There was a significant decrease in the experience of everyday events as unpleasant or stressful, with a corresponding improvement in the magnitude and number of stressors generally. No change was found in the number of daily uplifts.

Important predictive interactions between the degree of improvement in outcome variables and life events, stressors, and the delta of daily hassles and coping resources were also identified. Daily hassles had the greatest predictive value on the largest number of outcome variables for both groups. Particular stressors also has specific patterns of predictive value, as did one life event time period in each group, but stressors had greater predictive power in the Placebo group (cf 5.7.1). The delta of both life orientation (optimism) and perceived coping incapacity (control) were predictive for the degree of improvement of particular outcome measures (cf 5.7.3) as was daily uplifts in both groups.

5.7.5.2 TOWARDS A STRESS AND COPING PROFILE OF THE PRE-POST DIFFERENCES (DELTA) OF THE TOTAL GROUP

The findings reported here are based on an analysis of the total group (combined Active and Placebo groups), and encompass all variables, other than efficacy of the micronutrients. The data was combined in this way in order to delineate which of the psychosocial factors investigated in the study (overall) had predictive value for the pre-post difference in the total sample if the effect of micronutrients (for which only a trend for efficacy was found) is excluded.

Overall, the total group manifested a higher level of optimism and perceived themselves as having an increased coping capacity (control), felt more optimistic and more in control over their situations and/or emotions. There was a significant decrease in the experience of everyday events as unpleasant or stressful, with a corresponding improvement in the magnitude and number of stressors generally. No change was found in the number of daily uplifts.

Important predictive interactions between the degree of change (improvement) in outcome variables and life events, stressors, and the delta of daily hassles and coping resources were again identified. As before, daily hassles had the greatest predictive value and was found to impact on all outcome measure, namely stress symptoms (physical, psychological, behavioural) as well as total level of stress, perception of level of stress, anxiety and psychological general well being. As the number of daily hassles decreases, the experience of stress and its effects on psychological outcome correspondingly diminish. An increase in positive everyday events (daily uplifts) results in an increase in psychological general well-being and a decrease in the perception of level of stress.

As before (cf 5.7.5.1) specific stressors appear to have specific patterns of predictive value in respect of the various ways stress can manifest in the psychological domain. An improvement in financial circumstances is associated with a parallel experience of greater psychological general well-being. When the stress of relocation has abated or diminished, a corresponding decrease in psychological stress symptoms is likely to

occur. Physical stress symptoms abate along with improved time management, as does overall level of stress. A positive change in studying results in a diminuation of behavioural stress symptoms. As the individual becomes less concerned over the health of members of their family of origin (such as parents, siblings, etc.), they experience a lessening of physical stress symptoms. When the person is less concerned over themselves they perceive themselves to be less stressed.

It is interesting to note that that the findings of the present study suggest that perception of level of stress will improve in relation to positive changes in external factors, namely daily hassles, stressors (time management) and daily uplifts, not any internal variable (such as personal resources or decrease in other stress symptoms), which has obvious implications for overall stress management.

The importance of life orientation (optimism) and perceived coping incapacity (control) as predictive factors for improvement in stress was highlighted in this study. An increase in an optimistic attitude (life orientation) is associated with a decrease in perception of overall level of stress. As the person perceives themselves are more able to cope (perceived coping incapacity), they also become less anxious, manifest less behavioural reactions to stress, and experience an improvement in psychological general well-being.

The study further lends strong support for the interactive and bidirectional nature of the different variables in the stress process and in diminishing stress outcome on all levels.

5.8 IMPLICATIONS OF THE STUDY FOR INTERVENTION

The overall trends in the present study, based on both the clinical and statistical analysis, support the potential beneficial value of micronutrient supplementation as part of an overall stress management programme as has also been described by other studies (Popovic, 1993; Willemsen et al., 1997; Vein et al., 1997; Carroll et al., 2000; Schlebusch et al., 2000). However, further research could demonstrate this more clearly (c.f section 5.9).

Any symptomatic treatment should ideally target several domains, including somatic, cognitive, affective and motivational spheres (Fennell, 1988). Whilst micronutrient supplementation might represent intervention at the somatic level, the findings of this study also indicate the importance of changes in stressor variables, and cognitive behavioural techniques or appropriate social intervention may assist in this regard.

Addressing malapative coping strategies is an essential part of any stress management programme (Fennell, 1988; Schlebusch, 2000) and therapeutic work in this area might involve behavioural modification or cognitive behavioural techniques to improve level of support (reduce loneliness), facilitate better time management (at work and in the home in respect of family chores), develop appropriate and sustained relaxation outlets, and target poor financial planning (specifically in this sample). Specific stress

management techniques can be taught to the person, either on an individual basis or in a group or workshop.

Enhancing coping resources is an important step in addressing the stress process in its entirety, which would involve improving optimism and perceived cognitive capacity (control), most optimally through cognitive restructuring of maladaptive assumptions/beliefs (Fennel, 1988; Schlebusch, 2000, White, 2000).

5.9 STRENGTHS AND LIMITATIONS AND IMPLICATIONS OF THE STUDY FOR FUTURE RESEARCH

The major strengths of the study lie primarily in two main factors. Firstly, this study was conceptualised and guided by the utilisation of a multifactorial, unified model of the stress and coping process to facilitate the identification of risk (negative) and protective or rescue (positive) factors the contribute to positive or negative outcomes. The research findings have highlighted a number of pivotal theoretical and practical considerations and implications of undertaking research into stress and coping. Furthermore, the findings have assisted in indicating various associations between cognitive judgemental (subjective perceptive), situational and social variables, and outcomes of stress within biopsychosocial domains.

Furthermore, the study used well-known, standardized assessment instruments whose utility specifically in stress research has been well-documented (although the latter aspect does not hold true for the neuropsychological measures). The present study examined traditional stressors from three different perspectives (namely life events, daily hassles, and sources of stress on free self-report), two personal resource measures, one environmental moderator and five outcome measures, and the relationships between these measures. The study additionally demonstrated an apparent bidirectional between all variables in the stress and coping process, namely stressors, moderating variables and outcomes. It showed that various feedback loops occur from stress responses and outcomes, resulting in not only symptoms having important effects as stressors, but that particular moderating variables appear to suffer an adverse effect as a result of these bidirectional, circular pathways operating to variably affect all dimensions in the stress process. In addition, the study suggests the possibility of improvements in either or both moderator and outcome variables to impact positively on stressors (that is, that potential for stressors to be outcome variables in this process). The study also measured the relationship between stress and (selected aspects of) neurocognitive functioning with formal psychometric testing, unlike most other studies which rely on subjective reports of such complaints or improvements in functioning in this domain.

Secondly, the intervention aspect of the study was based on a double-blind, double centre investigation of the efficacy of a micronutrient (multivitamin and mineral) supplementation, unlike other such studies (Popovic, 1993; Vein et al., 1997) and

included a large number of participants (N=300) in contrast to the two other double blind studies that have been published who used only 24 (Willemsen et al., 1997) and 80 (Carroll et al., 2000) participants respectively.

There are two main limitations to the study, both of which only became evident after statistical analysis. Firstly, a limitation of the study, in respect of the efficacy analysis, was the sample size, which had it been larger, might have been able to clarify the trends found in this study and establish if they are significant differences due to treatment effects or related to some other variables. (Esterhuizen, 2005, personal communication).

Secondly, since the research design was based on an across-subject, inter-individual mode, that is measurement at two separate points in time spaced one month apart which addresses the relationship between stress and health in a particular population, there is no way of knowing what went on psychobiologically and environmentally during the interval period, since such a design obscures what may be systematic differences amongst individuals (DeLongis, Folkman & Lazarus, 1988). As suggested by these authors, a within-subject, intra-individual design which involves obtaining multiple measures of stress and health over short periods of time which are used to calculate a separate correlation for each subject (the subject then serving as his own control), the effects of between-subject differences which could obscure nuances in results would be eliminated. Furthermore, nutritional status could then also be measured.

Other limitations of the study include the under-representations of males and non-Causasians in the sample, and limiting the participants to English-speaking South Africans which affects the generalizability of the results, and the lack of inclusion of appropriate measures of attentional functions sensitive to subtle impairments.

It is therefore recommended that future research take these suggestions into account in order to try and clarify the nature of the relationships between the different variables.

5.10 SUMMARY AND CONCLUSIONS

The present study had three primary aims, namely to investigate the sources of stress for South Africans, to delineate their stress-related symptoms, and to assess the role of micronutrient (vitamin and mineral) supplementation on stress levels and symptoms (outcome) as part of a stress management programme. A secondary aim was to investigate the inter-relationships between the variables and their role on outcome.

The general findings indicate that stress levels in South Africans are high, with anxiety (reaching clinical proportions) being a prominent feature. Various factors such as stressors (predominantly daily hassles, general sources of stress and to a lesser extent life events), life orientation (optimism) and perceived coping incapacity (control) and the cumulative effect of the dependent variables of stress, anxiety, perception of levels of stress and psychological general well-being were variably established as predictors of negative outcome and pre-to post-test improvement.

An important finding of this study was that although no definitive treatment effect was found, the overall trends in the present study, based on a combination of clinical and statistical analysis, support the potential value of micronutrient supplementation as part of an overall stress management programme.

In conclusion, it is hoped that this study as highlighted the significance of stress as a pervasive problem in South Africa, and that it will point to potential intervention strategies in this regard and stimulate further research in stress as well as micronutrient supplementation particularly amongst various ethnic groups.

REFERENCE LIST

Abramson,L., Seligman, M., & Teasdale, J. (1978). Learned helplessness in humans. *Journal of Abnormal Psychology, 87*, 49-74.

Adams, J.D. (1980). *Understanding and Managing stress: A Workbook in Changing Life Style.* San Diego University Associates, Inc.

Aguilera, D.C., & Messick, J.M. (1974). *Crisis intervention: Theory and methodology.* Saint Louis: C.V. Mosby.

Akisal, H.S. (1979). A biobehavioural approach to depression. In R.A. Depue (Ed.), *The psychobiology of depressive disorders: Implication for the effects of stress.* New York: Academic Press.

Alberts, A.S. (1993). *Knowledge beats cancer*. Pretoria: Haum Tertiary.

Allman, B.J.B. (1986). *The Efficacy of a Stress Management Programme.* Unpublished MBA dissertaton. Johannesburg: University of the Witwatersrand.

Antonovsky, A. (1974). Conceptual and methodological problems in the study of resistance resources and stressful life events. In B.S. Dohrenwend & B.P. Dohrenwen (Eds.), *Stressful life events: Their nature and effects.* (pp 245-255). New York: Wiley.

American Psychiatric Association (APA) (1980). *Diagnostic and Statistical Manual of Mental Disorders (DSM-III). Third Edition.* Washington DC.

American Psychiatric Association (APA) (1987). *Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R). Third Edition revised.* Washington DC.

American Psychiatric Association (APA) (1994). *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV). Fourth Edition.* Washington DC.

American Psychiatric Association (APA). (2000a). *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR). Fourth Edition (text revised*. Washington DC.

Appley, M.H., & Trumbull, R. (Eds.), (1986). *Dynamics of Stress. Physiological, psychological, and social perspectives.* New York: Plenum Publishing Corporation.

Audenart et al. (in prep). In K. Van Heeringen (2002). *Psychobiological approach to the vulnerability for suicidal behaviour: Implications for treatment and prevention.*

Paper presented at the 9th European Symposium on Suicide and Suicidal Behaviour. 14-17 September 2002. University of Warwick, England.

Bandura, A. (1977). *Social learning theory.* Englewood Cliffs: Prentice-Hall.

Bandura, A. (1982). Self-efficacy in human agency. *American Psychologist, 37*, 122-147.

Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist, 44*, 1175-1184.

Baron, R., & Rodin, J. (1978). Personal control as a mediator of crowing, In A. Baum, J.E. Singer, & S. Valins (Eds.), *Advances in environmental psychology: Vol 1. the urban environment.* (pp 145-192). Hillsdale, N.J: Erlbaum.

Bass, C. (1990). *Somatization: Physical symptoms and psychological illness*. Oxford: Blackwell Scientific Publications.

Baum, A., & Posluszny, D.M. (1999). Health Psychology: Mapping biobehavioural contributions to health and illness. In J.T. Spence, J.M. Darley, & D.J. Foss (Eds.), *Ann Rev Psyc Reviews* (pp 137-163). Palo Alto, USA.

Bauman, K.E., & Udry, J.R. (1972). Powerlessness and regularity of contraception in an urban Negro male sample: A research note. *Journal of Marriage and the Family, 34*, 112-114.

Bayer, W.,& Schmidt, K. (1991a). *Vitamin in Prävention und Therapie.* Stuttgart: Hippokrates Verlag, 288-292.

Bayaer, W. & Scmidt, K. (1991b). Therapeutische anwendung von vitamin B-komplex präparaten. *Vita Min Spur,6,*113-121.

Bech, P. (1993). *Rating Scales for Psychopathology, Health Status and Quality of Life.* Berlin:Springer-Verlag.

Beck, A.T. (1976). *Cognitive therapy and the emotional disorders.* New York: International University Press.

Beehr, T.A.,& Newman, J.E. (1978). Job stress, employee health, and organizational effectiveness: a facet analysis, model and literature review. *Personnel Psychology, 31*, 655-699.

Billings, A.G. & Moos, R.H. (1981). The role of coping responses and social responses in attenuating the impact of stressful life events. *Journal of Behavioural Medicine, 4*, pp139-157.

Blaney, P.H. (1985). Stress and depression in adults: A critical review. In R.M. Field, P.M. McCabe, & N. Schneiderman. (Eds.), *Stress and coping.* (pp 263-284). Hillsdale, N.J: Erlbaum.

Blau, T. (1977). Quality of life, social indicators, and criteria of change. *Professional Psychology, 11,* 464-473.

Bower, B. (1999). Immune response may tie stress to colds (stress causes rise in interleukin -6-Brief Article). *Science News March 27, 1999.* Retrieved January 15, 2005,fromhttp://www.findarticles,com/P/ARTICLES/MI_M1200/IS_13_155/AI_5441 9443.

Brown, G.W., Bhrolchain, M.N., & Harris, T. (1975). Social Class and psychiatric disturbance among women in an urban population. *Sociology, 9,* 225-254.

Brown, B.B. (1978). Social and psychological correlates of help-seeking behaviour among urban adults. *American Journal of Community Psychology, 6,* 425-439.

Brown, J.D., & Dutton, K.A. (1995). The thrill of victory, the complexity of defeat: self-esteem and people's emotional reactions to success and failure. *Journal of Personality and Social Psychology, 68(4),* 712-722.

Brisette, I., Scheier, M.F., & Carver, C.S. (2002). The role of optimism in social network development, coping and psychological adjustment during a life transition. *Jnl of Personality and Social Psychology, 82(1),* 102-111.

Buunk, B.P., & Verhoeven, K. (1991). Companionship and support at work: A microanalysis of the stress-reducing features of social interaction. *Basic and Applied Social Psychology, 12,* 243-258.

Buunk, B.P. & Hoorens, V. (1992). Social support and stress: The role of social comparison and social exchange processes. *British Journal of Clinical Psychology, 31,* 445-457.

Byrne, D.G., & White, H.M. (1986). Life events and myocardial infarction revisited: The role of individual impact. *Psychosomatic Medicine,* 42, 1-10.

Cannon, W.B. (1929). *Bodily changes in pain, hunger, fear and rage* Boston: Branford.

Cannon, W.B. (1939). *The Wisdom of the Body.* New York: Norton (London: Routledge & Kegan Paul, 1947).

Caplan, G. (1961). *Approaches to community mental health.* New York; Grune & Stratton.

Carroll, D., Ring, C., & Suter, M. (2000). The effects of an oral multivitamin combination with calcium, magnesium, and zinc on psychological well-being in healthy young male volunteers: a double-blind placebo controlled trial. *Psychopharmacology, 150,* 220-225.

Carver, C., Scheier, M., & Weintraub, J. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology, 56,* 267-283.

Cattell, V. (2001). Poor people, poor places, and poor health: the mediating role of social networks and social capital. *Social Sci Med. 52 (10),* 1501-1516.

Christensen, L. (1996). *Diet-behaviour relationships. Focus on depression.* Washington DC: American Psychological Association.

Coates, D., Renzaglia, G.J., & Embree, M.C. (1983). When helping backfires: Help and helplessness. In J.D. Fisher, A. Nadler & B.M. DePaulo (Eds.), *New Directions in Helping Behaviour, vol 1,* New York: Academic Press.

Cobb, S. (1976). Social support as a moderator of life stress. *Psychosomatic Medicine, 38,* 300-314.

Cohen, S., & McKay, G. (1984). Social support, stress and buffering hypothesis: A theoretical analysis. In A. Baum, J.E. Singer, & S.E. Taylor (Eds.). *Handbook of Psychology and Health, 4,* New Jersey: Lawrence Erlbaum Assoc.

Cohen, S., & Syme, S.L. (1985). *Social Support and Health.* London: Academic Press.

Cohen, S., & Wills, T. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin, 98,* 310-357.

Cohen, S., Kessler, R., & Gordon, L. (1995). Strategies for measuring stressing studies of psychiatric and physical disorders. In S. Chen, R. Kessler, & L. Gordon (Eds.), *Measuring stress.* (pp 3-28). New York: Oxford University Press.

Cooper, C.L. (1988). Research in stress, coping and health: theoretical and methodological issues. Editorial. *Psychological Medicine, 18,* 15-20.

Coopersmith, S. (1967). *The antecedents of self esteem.* San Francisco, California: W.H. Freeman.

Cox, T. (1978). *Stress.* London: Macmillan Press.

Culter, D.L. & Madore, E. (1980). Community-family network therapy in a rural setting. *Community Mental Health Journal, 16,* 144-155.

Cutrona, C., & Russel, D. (1990). Type of social support and specific stress: Toward a theory of optimal matching. In B. Sarason, I.G. Sarason, & G.R. Pierce (Eds.), *Social Support: an Interactional View.* New York: Wiley.

Davidson, R.J. (1993). The neuropsychology of Emotion and Affective Style. In M. Lewis & J. Haviland (Eds.), *Handbook of Emotions* (pp 143-643).

Davidson, L.M., & Baum, A. (1986). Chronic stress and posttraumatic stress disorder. *Journal of Consulting and Clinical Psychology, 54*, 303-308.

Dawes, A. (1990). The effects of political violence on children: a consideration of South African and related studies. *International Journal of Psychology, 25*, pp13-31.

de Bruin, G.P. & Taylor. (2005). Development of the sources of work stress inventory. *South African Journal of Psychology, 35(4)*, 748-765.

De Frank, R.S., & Stroup, C.A. (1989). Teacher Stress and Health: Examination of a Model. *Journal of Psychosomatic Research, 33*,99-109.

Delongis, A, Coyne, J.C., Dakof, G., Folkman, S., & Lazarus, R.S. (1982). Relationship of daily hassles, uplifts, and major life events to health status. *Health Psychology, 1*, 119-136.

Delongis, A., Folkman, S., & Lazarus, R.S. (1988). The impact of daily stress on health and mood: Psychological and social resources as mediators. *Journal of Personality and Social Psychology*, 54, 486-495.

Derogatis, L.R. (1982). Self report measures of stress. In L. Goldenberger & S. Breznitz. (Eds.). *Handbook of stress: Theoretical and clinical aspects.* (pp 270-295). New York; The Free Press.

Derogatis, L.R., & Melisaratos, N. (1983). The Brief Symptom Inventory: an introductory report. *Psy Med, 13*, 595-605.

Diener, E., & Diener, C. (1995). *Most people are happy.* Manuscript submitted for publication. University of Illinois.

Diener, E. & Fujita, F. (1995) Resources, personal strivings, and subjective well-being: A nomothetic and ideographic approach. *Journal of Personality and Social Psychology, 68*,926-935.

Dupuy, H.J. (1984). The Psychological General Well-Being (PGWB) Index. In N.K. Wenger, M.E. Mattson, C.D. Furberg, & J. Elinson (Eds.). *Assessment of quality of life in clinical trials of cardiovascular therapies.* (pp170-183). New York: LeJacq.

Eisendorfer, C. (1985). The conceptualisaton of stress and a model for further study. In M.R. Zales (Ed.), *Advances in cognitive-behavioural research and therapy.* (pp 5-23). New York: Brunner/Mazel.

Emmons, R., & Colby, P. (1995). Emotional conflict and well-being: Relation to perceived availability, daily utilization, and observer reports of social support. *Journal of Personality and Social Psychology, 68*, 947-959.

Engel, G. (1980). The clinical application of the bio-psycho-social model. *American Journal of Psychiatry, 137*, 535-543.

Esterhuizen, T. (2005). Biostatistician/Lecturer, Department of Medical Bioethics, University of KwaZulu-Natal. Personal Communication.

Everly, G. (1989). *A clinical guide to the treatment of the human stress response*. New York: Plenum Press.

Fawzy, I., & Fawzy, M.D. (1995). Behaviour and Immunity. Psychological Factors Affecting Medical Conditions. In H.I. Kaplan & B.J. Sadock (Eds.), *Comprehensive Textbook of Psychiatry/VI*. Sixth Edition. *Vols 1&2* (pp 1559-1569). Baltimore: Lippincott. Williams and Wilkins.

Felten, S.Y., & Felten, D.L. (1991). Innervation of lympoid tissue. In R. Ader, D.L. Felten, & N. Cohen (Eds.), *Pschoneuroimmunology. 2nd Edition.* (pp 27-71). San Diego: Academic Press.

Fennell, M. (1988). Depression. In K. Hawton, P. Salkovskis, J. Kirk & D. Clark (Eds.). *Cognitive Behaviour Therapy for Psychiatric Problems: A Practical Guide.* (pp 169-234). Oxford: Oxford University Press.

Feuerstein, M., Labbé, E.E., & Kuczmierczyk, A.R. (1987). *Health Psychology. A Psychobiological Perspective.* New York: Plenum Press.

Fischer, F. (1986). *Stress and Strategy*. London: Lawrence Erlbaum Associates Ltd.

Fisher, S. (1988). Life stress, control strategies and the risk of disease: A psychobiological model. In S. Fisher, & J. Reason (Eds.), *Handbook of Life Stress, Cognition and Health.* (pp 581-602). New York: John Wiley and Sons.

Fleming, J., & Courtney, B. (1984). The dimensionality of self-esteem: Hierarchical facet model for revised measurement scales. *Journal of Personality and Social Psychology, 46*, 404-421.

Flodin, N.W. (1988). *Pharmacology of micronutrients*. New York: Alan R Liss.

Florian, V., Mikulincer, M., & Taubman, O. (1995). Does hardiness contribute to mental health during a stressful real-life situation? The roles of appraisal and coping. *Journal of Personality and Social Psychology, 65(4)*, 687-695.

Folkman, S.(1984). Personal control and stress and coping processes: A theoretical analysis. *Journal of Personality and Social Psychology, 46*, 839-852.

Folkman, S., & Lazarus, R.S. (1985). If it changes it must be a process; A study of emotion and coping during three stages of a college examination. *Journal of Personality and Social Psychology,48*, 150-170.

Folkman,S., & Lazarus, R.S. (1988). Coping as a mediator of emotion. *Journal of Personality and Social Psychology, 54*, 466-475.

Frankenhaeuser, M. (1986). A Psychobiological Framework for Research on Human Stress and Coping. In M. Appley, & R. Trumbull (Eds), *Dynamics of Stress: Phyiological, Psychological and Social Perspectives* (pp 101-116). New York: Plenum Press.

Friedman, M., & Rosenman, R.H. (1974). *Type A Behaviour and your Heart.* New York: Knopf.

Glaser, R. (2000). Stress can increase disease susceptibility. *USA Today (magazine) August.* Retrieved June 12, 2002, from http://www.findarticles.com/cr_dls/,1272/27663_129/63986723/prijt.jhtml

Glass, D.C., & Singer, J.E. (1972). *Urban stress: Experiments on noise and social stressors.* New York: Academic.

Glathaar, I.I. (1999). Micronutrient and stress. *S Afr Med J, 89* (suppl 2), 16-22.

Gochman, D.S. (1982). Labels, systems and motives: Some perspectives for future research. In D.S. Parcel& G.S. Parcel (Eds.), Children's health beliefs and health behaviours. *Health Education Quarterly (Special Issue), 9*, pp167-174.

Goodman, T. (2002). Using immunization contacts to deliver vitamin A. *Sight and Life Newsletter. Many Ways one Goal, 3, Special Issue*, 37-38

Hamilton, M. (1959). The assessment of anxiety states by rating. *Br J Med Psychol, 32*, 50-55.

Hanck, A. (1984). Stress and vitamin deficiency. In: Hanck, A. (Ed.), Vitamins in therapy and prevention. *Int J Vit Nutr Res, 26* (suppl), 81-96.

Haynes Jr, R.C. (1990). Agents affecting calcification: calcium, parathyroid hormone, calcitonin, vitamin D and other compounds. In A. Goodman-Gilman, T.W. Rall, A.S.

Nies, et al. (Eds. *The pharmacological basis of therapeutics. 8th ed.* (pp 1469-1522). New York: Pergamon Press.

Heller, K.(1986). Introduction to the Special Series, *Journal of Consulting and Clinical Psychology, 54 (4),* pp 415.

Hinton, J.W. (1988). The psychophysiology of stress and personal coping styles. In H.H. Wagner (Ed.), *Social Psychophysiology and emotion: Theory and clinical applications.* (pp175-195). Chicester, England: Wiley.

Hinton, J.W. (1991). Stress model development and testing by group psychometric and one-subject psychophysiology. In C. Spielberger, I.G. Sarason, J. Strelau, & J.M. Brebner (Eds.), *Stress and anxiety.* (pp 53-77). New York: Hemisphere.

Hobfall, S.E. (1988). *The ecology of stress.* New York: Hemisphere.

Hobfall, E., & London, P. (1986). The relationship of self-concept and social support to emotional distress among women during war. *Journal of Social and Clinical Psychology, 4,* 189-202.

Holroyd, K., & Lazarus, R.S. (1979). Stress, coping and somatic adaptation. In G. Stone, F. Cohen, & N. Adler (Eds.), *Health Psychology: A Handbook. Theories, Applications and Challenges of a Psychological Approach to the Health Care System.* (pp 77-93). San Fransisco: Fosey-bass.

Holmes, T.H., & Rahe, R.H. (1967). The social readjustment scale. *Journal of Psychosomatic Research,* 11, 213-218.

Horowitz, M. (1986). *Stress Response Syndromes.* 2nd Edition. New Jersey: Jason Aronson.

House, J.S.(1981).*Work stress and social support.* Reading: Maddison Wesley.

Jermott, J., & Locke, S. (1984). Psychosocial factors, immunological mediation, and human susceptibility to infectious diseases: How much do we know? *Psychological Bulletin, 95,* 78-108.

Jordaan, W., & Jordaan, J. (1998). *People in Context. Third Edition.* Johannesburg: Heinemann and Further Education.

Jones, W.H., Freeman, J.R., & Gaswick, R.A. (1981). The persistence of loneliness: self and other determinants. *Journal of Personality, 49,* 17-48.

Jones, W.H., Rose, J., & Russel, D. (1990). Loneliness and social anxiety. In H. Leitengerg (Ed.), *Handbook of social and evaluation anxiety.* (pp 247-266). New York, Plenum

Kahana, E., Kahana, B. Harel, Z., & Rozner, T. (1988). Coping with extreme trauma. In J. Wilson, Z. Harel, & B. Kahana (Eds.), *Human adaptation to extreme stress*. (pp 78-93). Amsterdam: Eslvier.

Kanner, A.D., Coyne, J.C., Schaefer, C., & Lazarus, R.S. (1981). Comparison of two modes of stress measurement: Daily hassles and uplifts versus major life events. *Journal of Behavioural Medicine*, 4, 1-39.

Kaplan, E. (1988). A process approach to neuropsychological assessment. In T. Boll & B.K.Bryant (Eds.). *Clinical Neuropsychology and Brain Function: Research, Measurement and Practice (Vol 7).* Washington, DC: APA.

Kaplan, H.J. & Sadock, B.J. (Eds.).(1995). *Comprehensive Testbook of psychiatry/IV* (6th Ed. Vols 1 and 2), Baltimore, Maryland: Williams and Wilkins.

Kaplan, H.J. & Sadock, B.J. (Eds.).(1998). *Comprehensive Testbook of psychiatry IV* (8th Ed. Vols 1 and 2), Baltimore, Maryland: Williams and Wilkins.

Kessler, R.C., & McLeod, J. (1985). Social support and psychological distress in community surveys. In S. Cohen & S.L. Syme (Eds.), *Social support and health.* (pp 219-240). New York: Academic Press.

Kiecolt-Glaser, J.K., Garner, W., Speicher, C., Penn, G.M., Holliday, J.E., & Glaser, R. (1984). Psychosocial modifiers of immunocompetence in medical students. *Psychosomatic Medicine*, 46, 7-14.

Kiecolt-Glaser, J.K., Marucha, P.T., Malarky, W.B., Mercado, A.M., & Glaser, R. (1995). Slowing of wound healing by psychological stress. *Lancet, 346*, 1194-1196.

Kiecolt-Glaser, J.K., Glaser, R., Gravenstein, S., Malarky, W.B., & Sheridan, J. (1996). Chronic stress alters the immune response to influenza virus vaccine in older adults. *Proc Natl Acad Sci USA, 93*, 3043-3047.

Kirov, G.K. (1991). Magnesium in psychiatric disorders. In: Lasserre, B., Durlach, J. (Eds.). *Magnesium- A Relevant Ion.* London: John Libbey, 107-121.

Kizilbach, A.H., Vanderploeg, R.D., & Curtiss, G. (2002). The effects of depression and anxiety on memory performance. *Archives of Clinical Neuropsychology, 17*, 57-67,

Klienke, C.L. (1991) *Coping with life challenges.* Pacific Grove: Brooks/Cole.

Kobak, K.A., Reynolds, W.M., Greist, J.H. (1993). Development and validation of a computer administered version of the Hamilton Anxiety Scale. *Psychological Assessment, 5*, 487-492.

Kobasa, S.C. (1979). Stressful life events, personality and health: An enquiry into hardiness. *Journal of Personality and Social Psychology*, 37, 1-11.

Kobasa, S.C., Maddi , S.,& Khan,A (1982). Hardiness and health: A prospective study. *Journal of Personality and Social Psychology*, 37,168-177.

Kreusi, M.J., Dale, J., & Straus, S.E. (1989). Psychiatric diagnosis in patients who have chronic fatigue syndrome. *Journal of Clinical Psychiatry*, 50, 53-56.

Kutash, I., & Schlesinger, L. (1980). *Handbook on stress and anxiety*. San Fransisco: Jossey-bass.

Labadarios, D. (1999). Micronutrient deficiencies among South Africans. *S Afr Med J.* 89 (suppl 2), 4-10.

Lakey, B., McCabe, M., Fisicaro, S., & Drew, B. (1996). Environmental and personal determinants of support perceptions: Three generalizability studies. *Journal of Personality and Social Psychology, 70*, 1270-1280.

Laux, L., & Vossel, G. (1982). Paradigms in stress research. In L. Goldberger & s. Breznitz (Eds.), *Handbook of Stress: Theoretical and clinical aspects*. (pp201-210) New York: Free Press.

Laux, L. (1986). A Self-Presentational View of Coping with Stress. In M. Appley, & R. Trumbull (Eds), *Dynamics of Stress: Phyiological, Psychological and Social Perspectives* (pp 233-253). New York: Plenum Press.

Lazarus, R.S. (1966). *Psychological stress and the coping process*. New York: McGraw-Hill.

Lazarus, R.S., Averill, J., & Opton, E. (1970). Towards a cognitive theory of emotion. In M.B. Arnold (Ed.), *Feelings and emotions*. (pp 154-173). New York: Academic Press.

Lazarus, R.S. & Cohen, J.B. (1977). Environmental stress. In I. Altman & J.F. Wohlwill (Eds.), *Human behavour and the environment: current theory and research* (Vol 2, pp 89-128). New York: Plenum Press.

Lazarus (1981, July). Little hassles can be hazardous to your health. *Psychology Today*, pp 58-62.

Lazarus, R.S., & Folkman, S. (1984). *Stress, Appraisal and Coping*. New York: Springer Publishing Company.

Lazarus, R.S., & Folkman, S. (1988). The impact of daily stress on health and mood: psychological and social resources as mediators. *Journal of Personality and Social Psychology, 54,* 486-495.

Lazarus, R.S., & Folkman, S. (1989). *Hassles and Uplifts Scale, Research Edition.* Palo Alto, CA: Mind Garden.

Lazarus, R.S., & Folkman, S. (2000) Daily Hassles Scale. In Rush, A.J, Pincus, H.A.,First, M.B. et al. *Handbook of Psychiatric Measures*. Washington DC: APA.

Leavy, R.L. (1983). Social support and psychological disorder: A review. *Journal of Community Psychology, 11*, 3-21.

Lettko, M. & Meuer, S. (1990). Vitamin B-induced prevention of stress-related immunosuppression. *Ann N Y Acad Sci, 585,* 513-515.

Lezak, M. (1976). *Neuropsychological Assessment.* New York: Oxford University Press.

Lezak, M.1983). *Neuropsychological Assessment (2nd ed.).* New York: Oxford University Press.

Lezak, M.(1995). *Neuropsychological Assessment (3rd ed.).* New York: Oxford University Press.

Litt, M. (1988). Self-efficacy and perceived control: Cognitive mediators of pain tolerance. *Journal of Personality and Social Psychology, 54*, 149-160.
Lo Castro, A.M. (1996). *Aspects of Physical Appearance and Clothing Behaviour*. Unpublished Master's Dissertation. Pretoria. University of South Africa.

Lo Castro, A.M. (2003). *A comparative cross-cultural analysis of the effects of cancer on loneliness, stress and body-image changes in terms of psychoneuroimmunology and relative to quality of life and coping*. Unpublished Doctoral Dissertation, Durban: University of KwaZulu-Natal.

Lo Castro, A.M. & Schlebusch, L. (2006). The measurement of stress in breast cancer patients. *South African Journal of Psychology.* in press.

Locke, S., & Colligan, D. (1986). *The healer within.* New York: Signet.

Lofti, M., Mannar, M.G.V., Merx, R.J.H.M., & Naber-van den Heuvel, P. (1996). *Micronutrient Fortification of Foods. Current Practices, Research and Opportunities.* The Micronutrient Initiative (MI), c/o International Development Research Centre/International Agricultural Centre (IAC): MI: Ottawa, Ontario, Canada/IAC: Wageningen, The Netherlands.

Machlin, L.J. (1998). Health Protection by Vitamin E Supplementation. Protection Against Heart Disease by Vitamin E (Ephynal) and Other Health Effects. Schweiz Zeitschr Ganzh Med, 10: 18-25.
MacLean, P.D. (1985). Brain evolution relating to family, play and separation call. Archives of General Psychiatry, 42,405-417.

Maier, S.W., Watkins, L.R., & Fleshner, M. (1994). American Psychologist, Vol 49(12), 1004-1017. The American Psychological Association.

Marcus, R., & Coulson, A.M. (1990a). Water-soluble vitamins. In A. Goodman-Gilman, T.W. Rall, A.S. Nies, et al. (Eds. *The pharmacological basis of therapeutics. 8th ed.* (pp 1530-1552). New York: Pergamon Press.

Marcus, R., & Coulson, A.M. (1990b). The vitamins. In A. Goodman-Gilman, T.W. Rall, A.S. Nies, et al. (Eds. *The pharmacological basis of therapeutics. 8th ed.* (pp 1523-1529). New York: Pergamon Press,

Marucha, P.T., Kiecolt-Glaser, J.K., & Favagehi M. (1998). Mucosal wound healing is impaired by examination stress. Psychosomatic Medicine, 60, 362-365.

Marsh, H. (1986). Global self-esteem: Its relation to specific facets of self-concept and their importance. Journal of Personality and Social Psychology, 51, 1224-1236.

Mathews, A., & Ridgeway, V. (1981). Personality and surgical recovery: A review. British Journal of Clinical Psychology, 20, 243-260.

McDowell, I., & Newell, C. (1996). *Measuring Health: A Guide to Rating Scales and Questionnaires.* New York: Oxford University Press.

McFarlane, A. (1988). Phenomenology of post-traumatic stress disorders following a natural disaster. Journal of Nervous and Mental Diseases, 176, 22-29.

McLaren, D.S. (2002). Vitamin A and its relatives: Marvellous molecules in key life processes. Sight and Life Newsletter. Many Ways One Goal, 3, Special Issue, 3-17.

McManus, I.C. (1992). Psychology in medicine. Oxford: Butterworth-Heinemann.

Miller, K.I., Stiff, J.B., & Ellis, B.H. (1988). Communication and empathy as precursors to burnout among human service workers. Communication Monographs, 55, 250-265.

Miller, J.(1992a). Patient power resources. In J.F. Miller (Ed.), Coping with Chronic Illness: Overcoving Powerlessness. (pp 3-18). Philadelphia: Davis Company.

Miller, J. (1999b). Analysis of coping with illness. In J.F. Miller (Ed.), *Coping with Chronic Illness: Overcoving Powerlessness* (pp 19-49). Philadelphia: Davis Company.

Mills, J., & Clark, M. (1982). Exchange and communal relationships. In L. Wheeler (Ed.). *Review of Personality and Social Psychology, vol 3,* Beverly Hills, CA: Sage.

Mineska, S., & Kelly, K.A. (1989). The relationship between anxiety, lack of control and loss of control. In A. Steptoe & A. Apples. (Eds.), *Stress, personal control and health.* (pp 163-191). Chichester: Wiley.

Mitrushina, M.N., Boone, K.B., & D'Elia, L.F. (1999). *Handbook of Normative Data for Neuropsychological Assessment.* New York: Oxford University Press.

Monroe, S., & Kelly,J. (1995). Measurement of stress appraisal. In S. Cohen, R. Kessler, & L. Gordon (Eds.), *Measuring Stress.* (pp 122-147). New York: Oxford University Press.

Moos, R.H., & Billings, A.G. (1982). Conceptualising and measuring coping resources and processes. In L. Goldengerger & S. Breznitz (Eds.), *Handbook of stress: Theoretical and clinical aspects* (pp 212-229). New York: The Free Press.

Morgan, B., & Morgan , R. (1986). *Brain food.* London: Michael Joseph.

Mosely, T.H., Perrin, S.G., Neral, S.M. Dubbert, P.M., Grothues, C.A., & Pinto, B.M. (1994). Stress, coping and well-being among third year medical students. *Academic Medicine, 69,* 765-767.

Mudge, G.H., & Weiner, I.M. (1990). Agents affecting the volume and composition of body fluids. In A. Goodman-Gilman, T.W. Rall, A.S. Nies, et al. (Eds. *The pharmacological basis of therapeutics. 8th ed.* (pp 682-707). New York: Pergamon Press.

Nash, E., Stoch, B., & Harper, G. (1990). *Human Behaviour.* Cape Town: Juta.

National Research Counci.l (1989). *Recommended dietary allowances. 10th ed.* Washington: National Academic Press.

Newby-Fraser, E., & Schlebusch, L. (1997). Social support, self-efficacy and assertiveness as mediators of student stress. *Psychology – A Jnl of Human Beh, 34,* 61-69.

Newcomer, J.W., Selke, G., Melson, A.K. et al (1999). Decreased memory performance in healthy humans induced by stress-level cortisol treatment. *Archives of General Psychiatry, 56(6),* 527-533.

Noor Mohamed, S.B., Schlebusch, L. & Bosch, B.A. (2003). Suicidal behaviour in patients diagnosed with cancer of the cervix. *Crisis, 24 (4),* 168-172.

O'Leary, A. (1985). Self-efficacy and health. *Behaviour Research and Therapy, 23*, 437-451.

O'Leary, A. (1990). Stress, emotion, and human function. *Psychological Bulletin, 108*, 363-382.

Ormel, J. & Sanderman, R. (1989). Life events, personal control and depression. In A. Steptoe & A. Apples. (Eds), *Stress, personal control and health.* (pp 193-213). Chichester: John Wiley.

Östergren, P.-O., Hanson, S. –O., & Trjler. (1991). Social network, social support and acute chest complaints among young and middle-aged patients in an emergency department-case control study. *Social Science and Medicine, 33,* pp 257-267.

Paykel, E.S., & Dowlatshahi, D. (1988). Life events and mental disorder. In S. fisher & J. Reason (Eds.), *Handbook of Life stress, Cognition and Health*. (pp 241-263). Great Britain: John Wiley & Sons.

Pearlin, R., & Schooler, C. (1978). The structure of coping. *Journal of Social Behaviour*, 19, 2-21.

Pennebaker, J.W., Kiecolt-Glaser, J.K., & Glaser, R. (1988). Disclosures of trauma and immune function: Health implications for psychotherapy. *Journal of Consulting and Clinical Psychology*, 56, 239-245.

Pharma Natura. (1999).*Pharm life Natura Health Monitor*, 99/07/04, Johannesburg.

Pietrzik, K. (1985). Concept of borderline vitamin deficiencies. *Int J Vitam Nutr Res*, 27 (suppl2), 61-73.

Pillay, B.J. (1993). *A study of the relation between health attitudes, values and beliefs and help-seeking behaviour with special reference to a representative sample of Black patients attending a general hospital*. Unpublished doctoral thesis, Durban: University of Natal.

Pines, A. (1982). On burnout and the buffering effects of social support. In B.A. Faber (Ed.), *Stress and burnout in the human service professions*, (pp 155-174). New York: Pergamon.

Pines, A., & Aronson, E. (1988). Characteristics of staff burnout in mental health settings. *Hospital and Community Psychiatry*, 29, 233-237.

Pollock, K. (1988). On the nature of social stress: production of a modern mythology. *Social Science and Medicine*, 26, 381-392.

Popovic, I.C. (1993). Neurotrope Vitamin-Mineralstoff-Kombination in der Stress-Therapie. *Schweiz Zeitschr Ganzh Med*, 3: 140-143

Prokop, C.K. , Bradley, L.A., Burish, T.G., Anderson, K.O., & Fox, J.E.. (1991). *Health Psychology: clinical methods and research.* New York: McMillan.

Rabkin, J.G. (1982). Stress and psychiatric disorder. In L. Goldenberger & S. Breznitz (Eds.), *Handbook of stress: Theoretical and clinical aspects.* (pp 566-588). New York: The Free Press.

Rahe, R.H. (1998). Stress and psychiatry. In H.J. Kaplan & B.J. Sadock (Eds.) *Comprehensive Testbook of psychiatry/IV* (8t^{h} Ed. Vols 1 and 2). (pp 1545-1558). Baltimore, Maryland: Williams and Wilkins.

Rhodewalt, F., & Zone, J.B. (1979). Appraisal of life change, depression and illness in hardy and nonhardy women. *Journal of Personality and Social Psychology, 56(1)*, 81-88.

Rice, P.L. (ed.). (1992). *Stress and Health. 2nd edition.* Pacific Grove: Calif Brooks/Cole Publishing Company.

Robbins, S.P. (1996). *Organizational Behaviour: Concepts; Controversies; Applications.* New Jersey: Englewood Cliffs.

Rosenberg, M. (1965). *Society and the adolescent self-image.* New York: Princeton University Press.

Rosenman, R., & Chesney, M. (1985). Type A behaviour pattern: Its relationship to coronary heart disease and its modification by behavioural and pharmacological approaches. In M. Zales (Ed.), *Stress in Health and Disease.* (pp 24-90). New York: Brunner/Mazel.

Roth, S.,& Cohen, L. (1986). Approach, avoidance, and coping with stress. *American Psychologist, 41*, 813-819.

Rotter, J.B. (1966). Generalized expectancies for internal versus external control of reinforcement.*Psychological Monographs, 80 (1).* pp 247-355.

Russel, D., Peplau, L.A., & Cutrona, C.E. (1980). The revised UCLA loneliness scale: Concurrent and discriminant validity eveidence. *Journal of Personality and Social Psychology, 39,*427-480.

Sandvik, E., Diener, E. & Selditz, L. (1993). The assessment of well-being: A comparison of self-report and non-self-report strategies. *Journal of Personality, 61,*317-342.

Sarason, I.G., & Sarason, B.R. (Eds), (1986). Experimentally provided social support. *Journal of Personality and Social Psychology, 50,* 1222-1225.

Scheier, M., Weintraub, J., & Carver, C. (1986). Coping with stress: Divergent strategies of optimists and pessimists. *Journal of Personality and Social Psychology, 51,* 1257-1264.

Scheier, M. F., & Carver, C. S. (1992). Effects of optimism on psychological and physical well being: theoretical overview and empirical update. *Cognitive Therapy and Research, 16,* 201-228.

Scheier, M., Carver, C., & Bridges, W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A re-evaluation of the life orientation test. *Journal of Personality and Social Psychology, 67,* 1063-1078.

Schermerhorn, J.R., Hunt, J., & Osborn, R. (1997). *Organizational Behaviour.* New York: John Wiley & Sons.

Scheuch, K. (1986). Theoretical and empirical considerations in the theory of stress from a psycho-physiological point of view. In M. Appley, & R. Trumbull (Eds), *Dynamics of Stress: Phyiological, Psychological and Social Perspectives* (pp 117-139). New York: Plenum Press.

Schiewner, L. Mikronährstoffe und stress. *Vita Min Spur, 10,* 11-15.

Schlebusch, L. (1989). *Mind-body synthesis. The interactive health care equation.* Pietermaritzburg: University of Natal Press.

Schlebusch, L. (Ed.). (1990). Boundaries of clinical health psychology, behaviour medicine and related areas. In L. Schlebusch (Ed.), *Clinical Health Psychology. A Behavioural Medicine Perspective.* Midrand: Southern Book Publishers.

Schlebusch, L. (1993). The management of health-risk behaviour. *CME,* 1645-1652.

Schlebusch, L., & Van Oers, H.M. (1994). Psychological stress, adjustment and cross-cultural considerations in breast cancer patients. *South African Journal of Psychology, 20,* 30-35.

Schlebusch, L., & Cassidy, M. (1995). Stress, social support and biopsychosocial dynamics in HIV-AIDS. *South African Journal of Psychology, 25,* 27-30.

Schlebusch, L. (1996). Health Psychology in South Africa: an introduction. *South African Journal of Psychology, 26,* 1-3.

Schlebusch, L. (1997a). Stress, change and nutrition. *Earthyear. The Essential Environmental Guide. 15,* 54-59.

Schlebusch, L. (1997b).The management of posttraumatic stress disorder. Journal of trauma & Emergency Medicine,14: 6-10.

Schlebusch, L. (1998a). Recent advances in stress research and implications for health and well-being. In L. Schlebusch (Ed.), South Africa Beyond Transition. Psychological well-being. (pp 265-283). Pretoria: Psychological Society of South Africa.

Schlebusch, L. (1998b). Proverbial Stress Busters. Cape Town: Human and Rousseau.

Schlebusch, L., Schweitzer, G., & Bosch, B.A. (1998). Psychological considerations in the management of the HIV-infected patient with polytrauma: A case presentation. In L. Schlebusch (Ed.), South Africa beyond transition. Psychological well-being. (pp260-265). Pretoria: Psychological Society of South Africa.

Schlebusch, L. (Ed.), (1999). Psychological Recovery from Cancer. Cape Town: Maskew Miller Longman.

Schlebusch, L. (2000). Mind Shift Stress Management and your Health. Pietermaritzburg, South Africa: University of Natal Press.

Schlebusch, L., Bosch, B.A., Polglase, G., Kleinschmidt, I., Pillay, B.J., & Cassimjee, M.H. (2000). A double-blind, placebo-controlled, double-centre study of the effects of an oral multivitamin-mineral combination on stress. SAMJ, 90(12), 1216-1223.

Schlebusch, L., & Bosch, B.A. (2002). Emotional injuries to indirect trauma. In C. Stout. (Ed), The psychology of terrorism. Clinical aspects and responses (Vol 2), (pp 133-141). Westport, Connecticut: Praeger

Schlebusch, L. (2003). In press. Current perspectives on suicidal behaviour in South Africa. Crime, Violence and Injury review. Cape Town: MRC-UNISA.

Schlebusch, L. (2004). The development of a Stress Sumptom Checklist. South African Journal of Psychology, 34(3), 327-349.

Schneiderman, N. & McCabe, P.M. (1985). Biobehavioural responses to stressors. In T.M. Field, P.M. McCabe & N. Schneiderman (Eds.), Stress and Coping. (pp 13-54). Hillsdale, NJ: Erlbaum.

Schwarzer,R., & Leppin, A. (1989). Social support and health: A meta-analysis. Psychology and Health, 3, 1-15.

Seelig, M.S. (1994). Consequences of magnesium deficiency on the enhancement of stress reactions; preventative and therapeutic implications (a review). J Am Coll Nutr, 13,429-445.

Selichev, G.S., Petchot-Bacqué, J-P., Volkov, A.K. et al. (1998). An open non-comparative study on the efficacy of an oral multivitamin combination containing calcium and magnesium on persons permanently exposed to occupational stress-predisposing factors. *Journal of Clinical Research, 1,* 303-315.

Seligman, M.E.P. (1975). *Helplessness: On depression, development, and death.* San Franscisco: Freeman.

Seligman, M.E.P. (1985). *Helplessness: On depression, development and death.* San Francisco: W.H. Freeman.

Selye, H. (1956). *The stress of life.* NewYork: McGraw-Hill.

Selye, H. (1976). *The stress of life. Rev Ed.* New York: McGraw-Hill.

Selye, H. (1980). *Selye's Guide to Stress Research. Vol 1.* New York: Von Nostrant.

Selye, H. (1983). The stress concept; past, present and future. In C.L. Cooper (Ed.), *Stress research: issues for the eighties.* New York; Wiley.

Shadwell, A. (2003). *Stress and ill health associate with fungi, indoor environmental factors and personal factors in hospitals.* Unpublished Doctoral Dissertation, Durban: University of KwaZulu-Natal.

Shin, D.C.,& Johnson, D.M (1978). Avowed happiness as an ovrrall assessment of the quality of life. *Social Indicaators Research, 5,* 475-492.

Singer, J.E., & Davidson, L.M. (1986). Specificity and stress research. In M.H. Appley & R.Trumbull. (Eds), *Dynamics of Stress. Physiological, psychological, and social perspectives.*(pp 47-61).New York: Plenum Publishing Corporation.

Skinner, E. (1996). A guide to constructs of control. *Journal of Personality and Social Psychology, 71,* 549-570.

Skodal, A.E., Dohrenwend, B.P., Link, B.G., & Shrout, P.E. (1990). The nature of stress: problems of measurement. In J.D. Noshpitz & R.D. Coddington (Eds.), *Stressors and the adjustment disorders.* (pp 547-558). New York: Wiley & Sons.

Smith, J. (1993). *Understanding Stress and Coping.* Toronto: Macmillan Publishing.

Solomon, G.F. (1985). The emerging field of psychoneuroimmunology. *Advances, 2,* 6-19.

Solomons, N.W. (2002). Carotenes as dietary precursors of vitamin A: Their past and their future. *Sight and Life. Many Ways One Goal, 3, Special Issue,* 87-98.

Spreen, O. & Strauss, E. (1998). *A Compenduim of Neuropsychological Tests. Administration, Norms and Commentary. Second Edition.* New York: Oxford University Press.

Stanton, A., Danoff-Burg, S., Cameron, C.,& Ellis, P. (1994). Coping through emotional approach: Problems of conceptualization and confounding. *Journal of Personality and Social Psychology, 66*, 350-362.

Steptoe, A., and Apples, A. (1989). *Stress, personal control and health*.New York: Brunner/Mazel.

Steptoe, A. (1990). Psychobiological stress responses. In M. Johnston & L. Wallace (Ed.), *Stress and medical procedures*. Oxford: Oxford University Press.

Steptoe, A. (1991). Invited review: The links between stress and illness. *Journal of Psychosomatic Research*, 35 (6), pp 633-644.

Steyn, K., Fourie, J., & Bradshaw, D. (1992). The impact of chronic diseases of lifestyle and their risk factors on mortality in South Africa. *SAMJ*, 82, 227-231.

Stokes, P.E., & Sikes, C.R. (1987). Hypothalmic-pituitary-adrenal axis in affective disorders. In H.Y. Meltzer (Ed.), *Psychopharmacology. A Third Generation of Progress*. (pp 584-607). New York: raven Press.

Stone, A., Greenberg, M., Kennedy-Moor, E., & Newman, G. (1991). Self-report, situation-specific coping questionnaires: What are they measuring? *Journal of Personality and Social Psychology*, 61, 648-658.

Stone, A. (1995). Measurement of affective response. In S. Cohen, R. Kessler, & L. Gorden (Eds.), *Measuring Stress* (pp 148-174). New York: Oxford University Press.

Suh, E., Diener, E., & Fujita, F. (1995). Events and subjective well-being: only recent events matter. *Journal of Personality and Social Psychology*, (submitted).

Sutherland,V., & Cooper, C. (1990). *Understanding stress: A psychological perspective for health professionals.* London: Chapman and Hall.

Syme, L.S. (1989). Control and health: A personal perspective. In A. Steptoe & A. Apples (Eds.). *Stress, personal control and health.* (pp 3-28). Chichester: Wiley.

Tapp, J.T. (1985). Multisystems holistic model of health, stress and coping. In T.M. Field, P,M. McCabe, & N. Schneiderman (Eds.), *Stress and Coping*. (pp 2285-305). Hillsdale, NJ: Erlbaum.

Taylor, S.E.,, & Brown, J.D. (1988). Illusion and well-being: A social psychological perspective on mental health. *Psychological Bulletin*, 103,193-210.

Thoits, P. (1995). Stress, Coping and Social Support Processes. Where are We? What Next? *Journal of Health and Social Behaviour, 1,* 53-79.

Trumbull, R., & Appley, M.H. (1986). A Conceptual Model for the Examination of Stress Dynamics. In. M.H. Appley & R. Trumbull (Eds.), *Dynamics of Stress. Physiological, psychological, and social perspectives.* (pp 21-46). New York: Plenum Publishing Corporation.

Turk, D.C., & Speers, M.A. (1983). Diabetes mellitus: A cognitive-functional analysis of stress. In T.G. Burish & L. A. Bradley (Eds.), *Coping and chronic disease.* (pp 191-213). New York: Academic.

Turner, R.J. (1981). Social support as a contingency in psychological well-being. *Journal of Health and Social Behaviour, 22,* pp357-367.

Turner, R., & Marino, F. (1994). Social support and social structure: A descriptive epidemiology. *Journal of Health and Social Behaviour, 35,* 193-212.
Turner, R., & Wheaton, B. (1995). Checklist measurement of stressful life events. In S. Cohen R. Kessler and L. Gorden (Eds), *Measuring stress* (pp 29-58). New York: Oxford University Press.

Van der Kolk, BA., & McFarlane, A. (1996). The black hole of trauma. In B. Van der Kolk, A. McFarlane & L. Weisaeth (Eds.), *Traumatic Stress: The effects of overwhelming experience on mind, body and society.*(pp 3-23). New York: Guilford Press.

Van der Kolk, BA. (1996a). The complexity of adaptation to trauma: Self-regulation, stimulus discrimination and characterological development. In B. Van der Kolk, A. McFarlane and L. Weisaeth (Eds.), *Traumatic Stress: The effects of overwhelming experience on mind, body and society* .(pp 182-213). New York: Guilford Press.

Van der Kolk, BA. (1996b). The Body Keeps the Score. Approaches to the Psychobiology of Posttraumatic Stress Disorder. In B. Van der Kolk, A. McFarlane and L. Weisaeth (Eds.), *Traumatic Stress: The effects of overwhelming experience on mind, body and society* .(pp 215-241). New York: Guilford Press.

Van der Kolk, B. (1996c). Trauma and Memory. In B. Van der Kolk, A. McFarlane and L. Weisaeth (Eds.), *Traumatic Stress: The effects of overwhelming experience on mind, body and society* .(pp 279-302). New York: Guilford Press.

Van der Pompe, G., Antoni, M.H., & Heijnen, C.J. (1996). Elevated basal Cortisol Levels and Attenuated ACTH and Cortisol responses to a Behavioural Challenge in women with Metastatic Brease Cancer. *Psychoneuro-endocrinoloyg, Vol 21, No 4,* (pp 361-374. Great Britain: Elsevier Science.

Van Heeringen,K. (2002). *Psychobiological approach to the vulnerability for suicidal behaviour: Implications for treatment and prevention.* Paper presented at the 9th European Symposium on Suicide and Suicidal Behaviour. 14-17 September 2002. University of Warwick, England.

Vawda, N.B.M. (2004). *Perceived stress, coping behaviour and health outcomes among south African undergraduate medical students.* Unpublished Doctoral Dissertation, Durban: University of KwaZulu-Natal.

Vein, A.M., Filatova, E.G., Selishchev, G.S., Ponomarenko, K.V., Bolkov, A.K., Mironov, N.V., Schmyrev, V.I., Ya. Zaets, T & Bolotina, S.I. (1997). Efficacy and safety of the vitamin preparation Berocca during chronic stress. *Clinical Pharmacology and Therapeutics,* 6: 28-30 (This study was published in Russian and translated from Russian).

Vorster, H.H., Oosthuizen, W., Jerling, J.C., Veldman, F.J., & Burger, H.M. (1997). *The nutritional status of South Africans. A review of the literature.* Potchefstroom: Health Systems Trust.

Wallston, K. (1989). Assessment of control in health-care settings. In A. Steptoe & A. Appels (Eds.), *Stress, personal control and health* (pp 224-290). New York: Brunner/Mazel.

Warren, E., & Toll, C. (1993). *The stress work book. How individuals, Teams & Organisations Can Balance Pressure and Performance*. London: Nicholas Brealey.

Wasserman, D. (2001). A stress-vulnerability model and the development of the suicidal process. In D. Wasserman (Ed.), *Suicide. An unnecessary death.* (pp13-27). United Kingdom: Martin Dunitz.

Weiner, B (1985). The concept of stress in the light of studies of disaster, unemployment and loss: A critical analysis. In M.R..Zales (Ed), *Stress in health and disease.* (pp 24-90). New York/Brunner/Mazel.

White, J. (2000) *Treating Anxiety and Stress. A Group Psycho-educational Approach Using Brief CBT*. New York: John Wiley & Sons Ltd.

Willemsen, G., Petchot-Bacqué, J.-P., Alleaume, B., Suter, M., Ring, C. & Carroll, D. (1997). A double-blind placebo-controlled study of the effects of an oral multivitamin combination with calcium and magnesium on psychological well-being and cardiovascular reactions to stress in health young male volunteers. *European Journal of Clinical Research,* 9: 175-84.

Winnubst, J.A.M., Marcelissen, F.H.G., & Kleber, R.J. (1982). Effects of social support in the stressor-strain relationship: A Dutch sample. *Soc. Sci. Med., 16,* 475-482.

White, J. (2000). *Treating Anxiety and Stress. A Group Psycho-educational Approach Using Brief CBT*. New York: John Wiley and Sons.

Woods, F. (1997). Advanced workshop on neuropsychological assessment. Department of Medically Applied Psychology, Nelson R. Mandela School of Medicine, University of Natal, Durban, South Africa.

World Health Organisation (1980). *International classification of impairments, disabilities and handicaps.* Geneva: World Health Organisation.

Wrzeniewski , K. (1986). In Stress and Emotion: Anxiety, Anger, and Curiosity. Vol 14. C.D. Spielberger, I.G. Sarason, Z.Vulcsar & G.L. Van Heck (Eds.), New York: Hemisphere Publishing Corporation.

Wurtman, R.J., & Wurtman, J.J. (1990). *Nutrition and the Brain. Volume 8.* New York, Raven Press.

Zimet, G.D., Dahlem, N.W., Zimet, S.G., & Farley, G.K. (1988). The multidimensional scale of perceived social support. *Journal of Personality Assessment, 52 (1),* pp 30-41.

APPENDICES

APPENDIX A: ADVERSE EVENTS

All adverse events encountered during the clinical trial will be reported in the case report form. However, none are anticipated.

a. Definition

An ***adverse event*** is defined as any adverse change from the patient's baseline pre-treatment condition (subjective signs and symptoms at baseline) which occurs after treatment has started, whether considered related or not to the treatment. This includes clinically relevant laboratory abnormalities and inter-current illnesses which occur or worsen during the treatment period.

The ***treatment period*** covers the period of use of any marketed or non-marketed product (including placebo and comparative agents) during the course of study and during a period extending to four weeks after the last dose, or longer if necessitated by the half-life of the test product.

b. Intensity:

The intensity of adverse events will be graded on a three-point scale (mild, moderate and severe) and described in detail, along with the *investigator's* assessment of the relationship of the event to treatment. The following WHO 0-4 scale may be used:

Mild: Discomfort noted, but no disruption to normal daily activities.

Moderate: Discomfort sufficient to reduce or affect normal daily activities.

Severe:Inability to work or perform normal daily activities.

c. Relationship:

The *investigator's* assessment of the event relationship to the trial treatment will be defined according to the following categories.

Probable (must have the first three):

This category applies to those adverse events which are considered, with a high degree of certainty, to be related to the test trial medication. An adverse event may be considered ***probable***, if:

1. It follows a reasonable temporal sequence from administration of the medication.

2. It cannot be reasonably explained by the known characteristics of the patient's clinical state, environmental or toxic factors, or other modes of therapy administered to the patient.

3. It disappears or decreases on cessation or reduction in dose. (There are important exceptions when an adverse event does not disappear upon discontinuation of the medication, yet medication-relatedness clearly exists, e.g. [1] bone marrow depression, [2] tardive dyskinesias.)

4. It follows a known pattern of response to the suspected medication.

5. It reappears upon rechallenge.

Possible (must have the first two)

This category applies to those adverse events in which the connection with the test medication administration appears unlikely, but cannot be ruled out with certainty. An adverse event may be considered possible if, or when:

1. It follows a reasonable temporal sequence from administration of the trial medication.
2. It may have been produced by the patient's clinical state, environmental or toxic factors, or other modes of therapy administered to the patient.
3. It follows a known pattern of response to the suspected medication.

Remote (must have the first two)

In general, this category is applicable to an adverse event which meets the following criteria:

1. It does not follow a reasonable temporal sequence from administration of the medication.
2. It may readily have been produced by the patient's clinical state, environmental or toxic factors, or other modes of therapy administered to the patient.
3. It does not follow a known pattern of response to the suspected medication.
4. It does not reappear or worsen when the medication is readministered.

Unrelated

This category is applicable to those adverse events which are judged to be clearly and incontrovertibly due only to extraneous causes (disease, environment, etc.) and do not meet the criteria for medication relationship listed under ***Remote***, ***Possible***, or ***Probable***.

5.3.3. Immediately Reportable Adverse Events and Serious Adverse Events

An ***Immediate Reportable Adverse Event (IRAE)*** is any adverse event or abnormal laboratory test value that occurs during the defined treatment period, and which suggests a significant hazard, contraindication, side effect or precaution. An IRAE is a ***serious adverse event*** and will be reported to *the CRO* ***within one working day***.
Serious adverse events include any event or experience that is:

- fatal;
- life threatening;
- permanently disabling (i.e. severely incapacitating or interfering with ability to resume usual life patterns);
- requires inpatient hospitalization, or prolongs hospitalization;
- cancer;
- a congenital anomaly;
- an overdose (i.e. a deliberate or inadvertent administration of a treatment at a dose higher than that specified in the protocol and higher than known therapeutic doses for that specific indication);
- a pregnancy.

The definition of an IRAE includes any event which is expected or unexpected, related or unrelated to the marketed or non-marketed product.

All IRAEs must also be reported on the adverse events page of the case report form and must be assessed for severity and the relationship to the trial medication. The actions taken by the *investigator* and the outcome of the event must be reported.

IRAEs must be reported to the appropriate ethics committee, if requested by the committee and/or according to local legal requirements.

5.3.4. Treatment and Follow-up of Adverse Events

All adverse events will be documented and followed up until the event is either resolved or adequately explained, even after the patient has completed his/her trial treatment.

APPENDIX B: QUESTIONNAIRES

THE STRESS SYMPTOM CHECKLIST

Make a √ if you experience the symptoms *often* (at least once a week or more), and an × if you experience it *sometimes* (less than weekly, but at least monthly). Do you experience:

PHYSICAL REACTIONS					
- UNUSUAL TIREDNESS		- HIGH BLOOD PRESSURE		- UNEXPLAINED NAUSEA	
- APATHY LACK OF ENTHUSIASM		- SEXUAL PROBLEMS		- FREQUENT INDIGESTION	
- BREATHLESSNESS FOR NO REASON		- UNEXPLAINED HEADACHES\PAIN		- ERRATIC BOWEL FUNCTION	
- FEELINGS THAT YOUR APPEARANCE HAS ALTERED FOR THE WORSE		- FEELING FAINT OR UNUSUALLY WEAK FOR NO REASON		- EXCESSIVE PERSPIRATION FOR NO REASON	
- DIFFICULTY IN RELAXING		- MUSCLE TENSION		- DIZZY SPELLS FOR NO REASON	
- DISTURBING DREAMS/NIGHTMARES		- FEELING PHYSICALLY UNWELL		- FEELING TIGHT-CHESTED FOR NO REASON	
PSYCHOLOGICAL REACTIONS					
- FEELINGS OF HELPLESSNESS		- FEELINGS OF DISLIKING YOURSELF		- FEELINGS THAT YOU ARE A FAILURE	
- FEELINGS OF DEPRESSION		- BEING AFRAID OF DISEASE		- FEELING YOU CAN'T COPE	
- FEELINGS THAT NO ONE UNDERSTANDS YOU		- AN INCREASE IN COMPLAINTS ABOUT WHAT HAPPENS TO YOU		- FEELINGS THAT OTHER PEOPLE DISLIKE YOU	
- FEELINGS OF GENERAL ANXIOUSNESS		- LOW SELF-ESTEEM LOW OPINION OF YOURSELF		- FEELINGS OF CONFUSION	
- PHOBIAS (IRRATIONAL FEARS)		- FEELINGS OF BEING GOSSIPED ABOUT		- FEELINGS OF CONCERN MAINLY FOR YOURSELF	
- AWKWARD FEELINGS WHEN CLOSE TO OTHERS		- BEING OVER SELF-CRITICAL		- FEELINGS OF FREQUENT CRITICISM	
- FEELINGS THAT YOU HAVE FAILED IN YOUR ROLE AS A PARENT, SPOUSE, CHILD EMPLOYEE, EMPLOYER		- FEELINGS THAT NO ONE WANTS TO WORK WITH YOU		- FEELINGS THAT YOU HAVE BEEN NEGLECTED OR LET DOWN	
- PANICKY FEELINGS		- FEELING TENSE AND KEYED-UP		- FEELINGS OF LONELINESS AND NO ONE TO TALK TO	
- BEING UPSET BY DISEASE IN OTHERS		- PERSISTENT GUILT		- A LACK OF SELF-CONFIDENCE	

Patient No: Date:

BEHAVIOURAL REACTIONS

- MEMORY LOSS/ FORGETFULNESS		- DIFFICULTY IN MAKING UP YOUR MIND		- DISINTEREST IN OTHER PEOPLE	
- POOR LONG TERM PLANNING		- DIFFICULTY IN SHOWING/EXPRESSING YOUR TRUE FEELINGS		- SUPPRESSED OR UNEXPRESSED ANGER	
- POOR CONCENTRATION		- WORRYING		- FEARFULNESS	
- INCONSISTENCY		- SOCIAL WITHDRAWAL		- POOR DECISION MAKING	
- INABILITY TO MEET DEADLINES		- MAKING UNNECESSARY MISTAKES		- UNCO-OPERATIVE RELATIONSHIPS	
- POOR TIME MANAGEMENT		- THE NEED TO REGULARLY WORK LATE		- FEELING DISGRUNTLED MOODY IRRITABLE	
- PROCRASTINATION		- POOR WORK QUALITY		- EMOTIONAL OUTBURSTS	
- THE NEED TO CONSTANTLY TAKE WORK HOME		- DIFFICULTY IN COMPLETING ONE TASK BEFORE RUSHING ON TO THE NEXT		- GREATER USE OF ALCOHOL, CAFFEINE, NICOTINE, MEDICINES TO COPE	
- POOR PROBLEM SOLVING SKILLS		- THE NEED TO CANCEL LEAVE		- FIDGETING RESTLESSNESS	
- ACCIDENT-PRONENESS		- NAILBITING		- UNPREDICTABILITY	
- LOW INTEREST IN WORK		- AN EXCESSIVE APPETITE		- A LOSS O F APPETITE	
- A DROP IN PERSONAL STANDARDS		- ENGAGING IN FREQUENT CRITICISM OF OTHERS		- THE NEED TO CRY FOR NO REASON	
- INCREASED AGGRESSIVENESS		- FRANTIC BURSTS OF ENERGY		- TICS/NERVOUS HABITS	
- LACK OF INTEREST IN LIFE		- LITTLE SENSE OF HUMOUR		- SLEEP DISTURBANCES	

Rate the PRESENT INTENSITY of your stress somewhere along the scale below. Choose any number between lowest intensity (1) to highest intensity (10). Circle only one number along the scale below:

No stress — The most intense stress imaginable

☺ | | | | | | | | | | ☹

1 2 3 4 5 6 7 8 9 10

Patient No: Date:

INFORMED CONSENT FORM

I (Name)
hereby consent to the following Procedure and/or Treatment being conducted on myself.

I acknowledge that I have been informed by:

concerning the possible advantages and possible adverse effects which may result from the abovementioned procedure and/or treatment and of the ways in which it is different from the conventional procedure and/or treatment.

I hereby acknowledge that I understand and accept the "Information to Patients" leaflet handed to me in connection with this trial.

I agree that the above procedure and/or treatment will be carried out and/or supervised by

I acknowledge that I understand the contents of this form, including the information provided in the "Information to Patients" leaflet and as the
*PATIENT ☐ PARENT ☐ GUARDIAN ☐OTHER☐ (Specify)_____
freely consent to theabove procedure and/or treatment being conducted on:

(Name)

I am aware that I may withdraw my consent at any time without prejudice to further care.

Signed: _____ Date: _____
Patient/Parent/Guardian

Signed: _____ Date: _____
Witness

Signed: _____ Date: _____
Informant

Signed: _____ Date: _____
Researcher

Patient No: Date:

CASE REPORT FORM

Trial started on (date):_____
Trial ended on (date):_____

This profile contains questions that will help us to better understand your unique situation. Please read and answer each and every question carefully, and print your answers clearly. If you feel that something needs to be clarified or added, please feel free to provide additional information. Please be complete and detailed.

DEMOGRAPHIC INFORMATION

(1) Name:_____ (2) Age:_____
(3) Address:_____
(4) Home phone:_____ (5) Work phone:_____
(6) Birth date:_____ (7) Sex: ☐ Male ☐ Female
(8) Marital Status: ☐ Married ☐ Remarried ☐ Single ☐ Divorced
☐ Separated ☐ Widowed
(9) Ethnic group: ☐ White ☐ Black ☐ Coloured ☐ Asian
☐ Other_____
(10) With whom do you live?_____
(11) How many children do you have?_____
(12) Present or most recent occupation:_____
(13) Spouse's occupation:_____
(14) Present religious affiliation:_____
(15) Religious background:_____
(16) What is your current employment status?
☐ 1. Employed full time
☐ 2. Employed part time
☐ 3. Retired
☐ 4. Homemaker
☐ 5. Unemployed due to stress
☐ 6. Unemployed for other reasons (describe):_____
(17) Has your stress forced you to give up or change your type of work? ☐ Yes ☐ No
(18) If unemployed, how long have you been out of work? ☐ Months (No.___) ☐ Years (No.___)
(19) Are there any immediate reportable adverse events?
If yes, specify:_____
Reported to:_____ Date:_____
(20) Are there any protocol violations?
If yes, specify:_____
Reported to:_____ Date:_____

Patient No: Date:

INCLUSION CRITERIA

a. Patients must be English-literate and be able to understand the study and give written informed consent on the appropriate form, prior to being included in the study.

b. Patients must be willing to comply with the study conditions (e.g. filling in the patient diary in a proper way, etc.).

c. The sample group will be mixed, including both male and female patients from all ethnic groups. The age stratification will be from 18 to 45 years and 45 to 65 years.

d. Patients with predetermined stress threshold scores as measured by the Stress Symptom Checklist will be included.

EXCLUSION CRITERIA

a. Patients who fail to meet any of the inclusion criteria.

b. Patients who have participated in a clinical trial within 30 days of entering this study or who are currently enrolled in another trial or were previously enrolled in this trial.

c. Patients who have a concurrent or recent history of severe disease (including psychological/psychiatric disorders) which in the *investigator's* judgement, or as per Sponsor's package insert, are incompatible with the protocol or might negatively impact on it.

d. Females who are pregnant or breast feeding, or within one month after post partum.

e. The following treatments are forbidden at inclusion and during the course of the study: current treatment with psychotropic medication or other vitamin or mineral supplements (patients must be prepared to discontinue such other supplements for the duration of the study).

f. Trainees in stress management.

g. Patients who acquire an acute illness within seven days of entry into the study.

h. Patients who have surgery within seven days of entry into the study.

i. Patients outside the range of 18 to 45 years and 45 to 65 years.

COLLATERAL INFORMATION

CHECKED BY MONITOR:

- ☐ *VISIT ONE*: **DATE:**_____
- ☐ *VISIT TWO*: **DATE:**_____
- ☐ *VISIT THREE*: **DATE:**_____
- ☐ *VISIT FOUR*: **DATE:**_____

NEUROPSYCHOLOGICAL BATTERY

REY FIGURE COPY INSTRUCTIONS

"I want you to draw this figure onto this blank sheet of paper".

If the patient indicates he cannot draw straight lines, etc., say:

"Just draw it as nearly like this one as you can."

Patient No: Date:

RCF COPY

Patient No: Date:

REY FIGURE IMMEDIATE RECALL INSTRUCTIONS

"Now I want you to draw that same figure from memory."

If the patient has difficulty say:

"If you can remember something but are not sure where it went I want you to put it where you think it went."

RCF IMMEDIATE RECALL

Patient No: Date:

NARRATIVE PROSE MEMORY INSTRUCTIONS (STORY)

PRESENTATION

"I am going to tell you a simple story. When I am finished I want you to tell it back to me in as much detail as you can."

IMMEDIATE RECALL

"Now, you tell it back to me in as much detail as possible."

If patient stops before the end, ask:

"Is there anything else? Are there any other words or details that you can remember?"

and, if necessary:

"How did it all end?"

If the patient does not remember at the outset, say:

"It was about a farmer."

If the patient still does not remember, say:

"It was about a farmer and a dog."

If the patient *still* does not remember, give no further prompts. If he is able to recall part or all of the story following the prompts, give credit for everything remembered but no credit for items prompted, i.e., farmer, dog.

Patient No: Date:

NARRATIVE PROSE MEMORY

	TotPro		TotMem2
Raw Score Sum:		Composite = (TotPro x 2) + TotMem2	
Raw Score Difference:			
	Δ		

A farmer
from transkei
went to Durban
with his dog,
which he left

at a friend's
while he went to buy
a new suit of clothes.
All dressed up
he went back

to the dog,
whistled to him,
called him by name
and patted him.
But the dog would have nothing to do
with him

in his new hat
and coat,
but gave a mournful
howl.
Nothing seemed to work;

so the farmer went away
and put on his old clothes,
and then the dog
immediately
showed his wild joy

on seeing his master
as he thought he ought to be.

Immediate _____ Delay _____

Patient No: Date:

REY AUDITORY VERBAL LEARNING INSTRUCTIONS

For trial 1, the examiner reads a list of 15 words at the rate of one per second after giving the following instructions:

> *"I am going to read a list of words. Listen carefully, for when I stop you are to say back as many as you can remember. It doesn't matter in what order you repeat them. Just try to remember as many as you can."*

Record accuracy and order of response by numbering responses on a sheet. False words are recorded below and numbered appropriately. Repetitions are also given an appropriate number. Do not record self-acknowledged repetitions or repetitions that occur without intervening items, though this can be noted with an "R"

If the patient asks whether he has already said a word, the examiner should tell him, but the examiner should not volunteer that a word has been repeated. When the patient indicates he can recall no more words, the examiner rereads the list following a second set of instructions:

> *"Now I'm going to read the same list again, and once again when I stop I want you to tell me as many words as you can remember, including words you said the first time. It doesn't matter in what order you say them. Just say as many words as you can remember whether or not you said them before."*

This set of instructions must emphasize inclusion of previously said words for otherwise some patients will assume it is an elimination test. If patient fails to repeat words given on the first trial, E may remind to:

> *"Repeat all words each time, even ones you've said before."* (The list is reread for trials 3 and 4 saying:) *"Now let's try it again."*

For trial 5, say)

> *"Let's try it one more time. This is the last time I'm going to read this list."*

For trial 6, the examiner reads the second word list with instructions)

> *"Now let's try a new list of words just one time. Again, try to remember as many as you can and it doesn't matter in what order you repeat them."*

For trial 7, the examiner asks the patient to recall as many words from the first list as he can without reading the list again. Say)

> *"Now, once again, I want you to tell me as many words from the first list as you can remember."*

(Recognition:) (= ½ hour later.)

> *"Remember those lists of words I gave you earlier? I'm going to say a word and I want you to tell me whether it was on the first list that I read to you. Say 'yes' if it was on that first list, and 'no' if it was not."*

Patient No: Date:

REY AUDITORY LEARNING (ROTE RECALL AND RECOGNITION)

Free Recall Trials									Recognition Trial					
	1	2	3	4	5		6		7		Yes	No		Yes	No
Drum						Desk		(drum)		Coffee			Mouse		
Curtain						Ranger		(curtain)		Yellow			Farmer		
Bell						Bird		(bell)		Curtain			Color		
Coffee						Shoe		(coffee)		Bat			Shiver		
School						Stove		(school)		Certain			Chicken		
Parent						Mountain		(parent)		Plum			Plumber		
Moon						Glasses		(moon)		Parent			Nose		
Garden						Towel		(garden)		Face			Moon		
Hat						Cloud		(hat)		Spell			House		
Farmer						Bat		(farmer)		Rule			Flower		
Nose						Lamb		(nose)		Garden			Child		
Turkey						Gun		(turkey)		Hat			School		
Color						Pencil		(color)		Turkey			Drum		
House						Church		(house)		Spoon			Bell		
River						Fish		(river)		River			Cap		

.....

..... **Errors:** ( ) ( ) ( ) ( )
Yes No Yes No

1	2	3	4	5	6	7

Total Wrong Yes's : ☐

Total Wrong No's : ☐

Patient No: Date:

HAMILTON ANXIETY RATING SCALE

INSTRUCTIONS

0	=	NOT PRESENT	-	NOT PRESENT
1	=	MILD	-	OCCURS IRREGULARLY AND FOR SHORT PERIODS OF TIME
2		MODERATE	-	OCCURS MORE CONSTANTLY AND OF LONGER DURATION REQUIRING CONSIDERABLE EFFORT ON PART OF PATIENT TO COPE WITH IT
3	=	SEVERE	-	CONTINUOUS AND DOMINATES PATIENT'S LIFE
4	=	VERY SEVERE	-	INCAPACITATING

ONE RATES EACH OF THESE GROUPS OF FEATURES, AS YOU CAN SEE ON THE SCALE FORMAT ON A SIMPLE FIVE POINT SCALE:

Patient No: Date:

HAMILTON ANXIETY RATING SCALE

Place an X in the appropriate space

		0	1	2	3	4
1. Anxious	Worries, anticipation of the worst, fearful anticipation, irritability					
2. Tension	Feelings of tension, fatigueability, startle response, moved to tears easily, trembling, feelings of restlessness, inability to relax					
3. Fears	Of dark, of strangers, of being left alone, of animals of traffic, of crowds					
4. Insomnia	Difficulty in falling asleep, broken sleep, unsatisfying sleep and fatigue on waking, dreams, nightmares, night terrors					
5. Intellectual (Cognitive)	Difficulty in concentration, poor memory					
6. Depressed Mood	Loss of interest, lack of pleasure in hobbies, depression, early waking, diurnal swing					
7. Somatic (muscular)	Pains and aches, twitchings, stiffness, myoclonic jerks, grinding of teeth, unsteady voice, increased muscular tone					
8. Somatic (Sensory)	Tinnitus, blurring of vision, hot and cold flashes, feelings of weakness, prickling sensation					
9. Cardiovascular Symptoms	Tachycardia, palpitations, pain in chest, throbbing of vessels, fainting feelings, missing beat					
10. Respiratory Symptoms	Pressure or constriction in chest, choking feelings, sighing, dyspnea					
11. Gastro-intestinal Symptoms	Difficulty in swallowing, wind, abdominal pain, burning sensations, abdominal fullness, nausea, vomiting, borborygmi, looseness of bowels, loss of weight, constipation					
12. Genito-urinary symptoms	Frequency of micturition, urgency of micturition, amenorrhea, menorrhagia, development of frigidity, premature ejaculation, loss of libido, impotence					
13. Autonomic symptoms	Dry mouth, flushing, pallor, tendency to sweat, giddiness, tension headache, raising of hair					
14. Behaviour at Interview	Fidgeting, restlessness or pacing, tremor of hands, furrowed brow, strained face, sighing or rapid respiration, facial pallor, swallowing, belching, brisk tendon jerks, dilated pupils, exophthalmos					

No of X's in each column						
Multiplication factor	x0	x1	x2	x3	x4	
Column Scores	0 +	+	+	+	+	=

Total Score

Patient No: Date:

PSYCHOLOGICAL GENERAL WELL-BEING SCHEDULE

For each question make a ✓ in the appropriate ☐. Only one ✓ per question.

1. HOW HAVE YOU BEEN FEELING IN GENERAL (DURING THE PAST MONTH)?

- ☐ IN EXCELLENT SPIRITS (5)
- ☐ IN VERY GOOD SPIRITS (4)
- ☐ IN GOOD SPIRITS MOSTLY (3)
- ☐ I HAVE BEEN UP AND DOWN IN SPIRITS A LOT (2)
- ☐ IN LOW SPIRITS (1)
- ☐ IN VERY LOW SPIRITS (0)

---

2. HOW OFTEN WERE YOU BOTHERED BY ANY ILLNESS, BODILY DISORDER, ACHES OR PAINS (DURING THE PAST MONTH)?

- ☐ EVERY DAY (0)
- ☐ ALMOST EVERY DAY (1)
- ☐ ABOUT HALF THE TIME (2)
- ☐ NOW AND THEN, BUT LESS THAN HALF THE TIME (3)
- ☐ RARELY (4)
- ☐ NONE OF THE TIME (5)

---

3. DID YOU FEEL DEPRESSED (DURING THE PAST MONTH)?

- ☐ YES - TO THE POINT THAT I FELT LIKE TAKING MY LIFE (0)
- ☐ YES - TO THE POINT THAT I DID NOT CARE ABOUT ANYTHING (1)
- ☐ YES - VERY DEPRESSED ALMOST EVERY DAY (2)
- ☐ YES - QUITE DEPRESSED SEVERAL TIMES (3)
- ☐ YES - A LITTLE DEPRESSED NOW AND THEN (4)
- ☐ NO - NEVER FELT DEPRESSED AT ALL (5)

---

4. HAVE YOU BEEN IN FIRM CONTROL OF YOUR BEHAVIOUR, THOUGHTS, EMOTIONS, OR FEELINGS (DURING THE PAST MONTH)?

- ☐ YES, DEFINITELY SO (5)
- ☐ YES, FOR THE MOST PART (4)
- ☐ GENERALLY SO (3)
- ☐ NOT TOO WELL (2)
- ☐ NO, AND I AM SOMEWHAT DISTURBED (1)
- ☐ NO, AND I AM VERY DISTURBED (0)

Patient No: Date:

5. **HAVE YOU BEEN BOTHERED BY NERVOUSNESS OR YOUR 'NERVES'(DURING THE PAST MONTH)?**

- ☐ EXTREMELY SO - TO THE POINT WHERE I COULD NOT WORK OR TAKE CARE OF THINGS (0)
- ☐ VERY MUCH SO (1)
- ☐ QUITE A BIT (2)
- ☐ SOME - ENOUGH TO BOTHER ME (3)
- ☐ A LITTLE (4)
- ☐ NOT AT ALL (5)

---

6. **HOW MUCH ENERGY, PEP, OR VITALITY DID YOU HAVE OR FEEL (DURING THE PAST MONTH)?**

- ☐ VERY FULL OF ENERGY - LOTS OF PEP (5)
- ☐ FAIRLY ENERGETIC MOST OF THE TIME (4)
- ☐ MY ENERGY LEVEL VARIED QUITE A BIT (3)
- ☐ GENERALLY LOW IN ENERGY OR PEP (2)
- ☐ VERY LOW IN ENERGY OR PEP MOST OF THE TIME (1)
- ☐ NO ENERGY OR PEP AT ALL - I FELT DRAINED, SAPPED (0)

---

7. **I FELT DOWNHEARTED AND BLUE DURING THE PAST MONTH.**

- ☐ NONE OF THE TIME (5)
- ☐ A LITTLE OF THE TIME (4)
- ☐ SOME OF THE TIME (3)
- ☐ A GOOD BIT OF THE TIME (2)
- ☐ MOST OF THE TIME (1)
- ☐ ALL OF THE TIME (0)

---

8. **WERE YOU GENERALLY TENSE OR DID YOU FEEL ANY TENSION (DURING THE PAST MONTH)?**

- ☐ YES - EXTREMELY TENSE, MOST OR ALL OF THE TIME (0)
- ☐ YES - VERY TENSE MOST OF THE TIME (1)
- ☐ NOT GENERALLY TENSE, BUT DID FEEL FAIRLY TENSE SEVERAL TIMES (2)
- ☐ I FELT A LITTLE TENSE A FEW TIMES (3)
- ☐ MY GENERAL TENSION LEVEL WAS QUITE LOW (4)
- ☐ I NEVER FELT TENSE OR ANY TENSION AT ALL (5)

---

9. **HOW HAPPY, SATISFIED, OR PLEASED HAVE YOU BEEN WITH YOUR PERSONAL LIFE (DURING THE PAST MONTH)?**

- ☐ EXTREMELY HAPPY - COULD NOT HAVE BEEN MORE SATISFIED OR PLEASED (5)
- ☐ VERY HAPPY MOST OF THE TIME (4)
- ☐ GENERALLY SATISFIED - PLEASED (3)
- ☐ SOMETIMES FAIRLY HAPPY, SOMETIMES FAIRLY UNHAPPY (2)
- ☐ GENERALLY DISSATISFIED, UNHAPPY (1)
- ☐ VERY DISSATISFIED OR UNHAPPY MOST OR ALL OF THE TIME (0)

Patient No: Date:

10. DID YOU FEEL HEALTHY ENOUGH TO CARRY OUT THE THINGS YOU LIKE TO DO OR HAD TO DO (DURING THE PAST MONTH)?

- ☐ YES - DEFINITELY SO (5)
- ☐ FOR THE MOST PART (4)
- ☐ HEALTH PROBLEMS LIMITED ME IN SOME IMPORTANT WAYS (3)
- ☐ I WAS ONLY HEALTHY ENOUGH TO TAKE CARE OF MYSELF (2)
- ☐ I NEEDED SOME HELP IN TAKING CARE OF MYSELF (1)
- ☐ I NEEDED SOMEONE TO HELP ME WITH MOST OR ALL OF THE THINGS I HAD TO DO (0)

---

11. HAVE YOU FELT SO SAD, DISCOURAGED, HOPELESS, OR HAD SO MANY PROBLEMS THAT YOU WONDERED IF ANYTHING WAS WORTHWHILE (DURING THE PAST MONTH)?

- ☐ EXTREMELY SO - TO THE POINT THAT I HAVE JUST ABOUT GIVEN UP (0)
- ☐ VERY MUCH SO (1)
- ☐ QUITE A BIT (2)
- ☐ SOME - ENOUGH TO BOTHER ME (3)
- ☐ A LITTLE BIT (4)
- ☐ NOT AT ALL (5)

---

12. I WOKE FEELING FRESH AND RESTED DURING THE PAST MONTH.

- ☐ NONE OF THE TIME (0)
- ☐ A LITTLE OF THE TIME (1)
- ☐ SOME OF THE TIME (2)
- ☐ A GOOD BIT OF THE TIME (3)
- ☐ MOST OF THE TIME (4)
- ☐ ALL OF THE TIME (5)

---

13. HAVE YOU BEEN CONCERNED, WORRIED, OR HAD ANY FEARS ABOUT YOUR HEALTH (DURING THE PAST MONTH)?

- ☐ EXTREMELY SO (0)
- ☐ VERY MUCH SO (1)
- ☐ QUITE A BIT (2)
- ☐ SOME, BUT NOT A LOT (3)
- ☐ PRACTICALLY NEVER (4)
- ☐ NOT AT ALL (5)

---

14. HAVE YOU HAD ANY REASON TO WONDER IF YOU WERE LOSING YOUR MIND, OR LOSING CONTROL OVER THE WAY YOU ACT, TALK, THINK, FEEL OR OF YOUR MEMORY (DURING THE PAST MONTH)?

- ☐ NOT AT ALL (5)
- ☐ ONLY A LITTLE (4)
- ☐ SOME - BUT NOT ENOUGH TO BE CONCERNED OR WORRIED ABOUT (3)
- ☐ SOME AND I HAVE BEEN A LITTLE CONCERNED (2)
- ☐ SOME AND I AM QUITE CONCERNED (1)
- ☐ YES, VERY MUCH SO AND I AM VERY CONCERNED (0)

Patient No: Date:

15. MY DAILY LIFE WAS FULL OF THINGS THAT WERE INTERESTING TO ME DURING THE PAST MONTH.

- ☐ NONE OF THE TIME (0)
- ☐ A LITTLE OF THE TIME (1)
- ☐ SOME OF THE TIME (2)
- ☐ A GOOD BIT OF THE TIME (3)
- ☐ MOST OF THE TIME (4)
- ☐ ALL OF THE TIME (5)

---

16. DID YOU FEEL ACTIVE, VIGOROUS, OR DULL, SLUGGISH (DURING THE PAST MONTH)?

- ☐ VERY ACTIVE, VIGOROUS EVERY DAY (5)
- ☐ MOSTLY ACTIVE, VIGOROUS - NEVER REALLY DULL, SLUGGISH (4)
- ☐ FAIRLY ACTIVE, VIGOROUS - SELDOM DULL, SLUGGISH (3)
- ☐ FAIRLY DULL, SLUGGISH - SELDOM ACTIVE, VIGOROUS (2)
- ☐ MOSTLY DULL, SLUGGISH - NEVER REALLY ACTIVE, VIGOROUS (1)
- ☐ VERY DULL, SLUGGISH EVERY DAY (0)

---

17. HAVE YOU BEEN ANXIOUS, WORRIED, OR UPSET (DURING THE PAST MONTH)?

- ☐ EXTREMELY SO - TO THE POINT OF BEING SICK OR ALMOST SICK (0)
- ☐ VERY MUCH SO (1)
- ☐ QUITE A BIT (2)
- ☐ SOME - ENOUGH TO BOTHER ME (3)
- ☐ A LITTLE BIT (4)
- ☐ NOT AT ALL (5)

---

18. I WAS EMOTIONALLY STABLE AND SURE OF MYSELF DURING THE PAST MONTH.

- ☐ NONE OF THE TIME (0)
- ☐ A LITTLE OF THE TIME (1)
- ☐ SOME OF THE TIME (2)
- ☐ A GOOD BIT OF THE TIME (3)
- ☐ MOST OF THE TIME (4)
- ☐ ALL OF THE TIME (5)

---

19. DID YOU FEEL RELAXED, AT EASE, OR HIGHLY STRUNG, TIGHT, OR KEYED-UP (DURING THE PAST MONTH)?

- ☐ FELT RELAXED AND AT EASE THE WHOLE MONTH (5)
- ☐ FELT RELAXED AND AT EASE MOST OF THE TIME (4)
- ☐ GENERALLY FELT RELAXED BUT AT TIMES FELT FAIRLY HIGHLY STRUNG (3)
- ☐ GENERALLY FELT HIGHLY STRUNG, BUT AT TIMES FELT FAIRLY RELAXED (2)
- ☐ FELT HIGHLY STRUNG, TIGHT AND KEYED-UP MOST OF THE TIME (1)
- ☐ FELT HIGHLY STRUNG, TIGHT AND KEYED-UP THE WHOLE TIME (0)

---

20. I FELT CHEERFUL, LIGHTHEARTED DURING THE PAST MONTH.

- ☐ NONE OF THE TIME (0)

Patient No: Date:

- ☐ A LITTLE OF THE TIME (1)
- ☐ SOME OF THE TIME (2)
- ☐ A GOOD BIT OF THE TIME (3)
- ☐ MOST OF THE TIME (4)
- ☐ ALL OF THE TIME (5)

---

21. I FELT TIRED, WORN OUT, USED UP, OR EXHAUSTED DURING THE PAST MONTH.

- ☐ NONE OF THE TIME (5)
- ☐ A LITTLE OF THE TIME (4)
- ☐ SOME OF THE TIME (3)
- ☐ A GOOD BIT OF THE TIME (2)
- ☐ MOST OF THE TIME (1)
- ☐ ALL OF THE TIME (0)

---

22. HAVE YOU BEEN UNDER OR FELT YOU WERE UNDER ANY STRAIN, STRESS, OR PRESSURE (DURING THE PAST MONTH)?

- ☐ YES - ALMOST MORE THAN I COULD BEAR OR STAND (0)
- ☐ YES - QUITE A BIT OF PRESSURE (1)
- ☐ YES SOME - MORE THAN USUAL (2)
- ☐ YES SOME - BUT ABOUT USUAL (3)
- ☐ YES - A LITTLE (4)
- ☐ NOT AT ALL (5)

Patient No: Date:

VISUAL ANALOGUE SCALES

Stress is your physiological, psychological, and behavioural reactions when you attempt to adapt and adjust to internal and/or external demands or pressures that you cannot cope with. A stressor can be any event, situation, person etc. that you perceive as stressful and induces your stress reaction.

1. Rate the PRESENT INTENSITY of your stress somewhere along the scale below. Choose any number between lowest intensity (1) to highest intensity (10). Circle only one number along the scale below:

No stress — The most intense stress imaginable

1 2 3 4 5 6 7 8 9 10

2. Rate the USUAL INTENSITY of your stress throughout the day with a circle along the scales below. Choose any number between lowest intensity (1) to highest intensity (10). Circle only one number along each scale below:

TIME

Morning No stress — The most intense stress imaginable

1 2 3 4 5 6 7 8 9 10

Noon No stress — The most intense stress imaginable

1 2 3 4 5 6 7 8 9 10

Afternoon No stress — The most intense stress imaginable

1 2 3 4 5 6 7 8 9 10

Evening No stress — The most intense stress imaginable

1 2 3 4 5 6 7 8 9 10

Sleep No stress — The most intense stress imaginable

1 2 3 4 5 6 7 8 9 10

Patient No: Date:

SOURCES OF STRESS

DEFINITION OF STRESS / STRESSOR

Stress is your physiological, psychological, and behavioural reactions when you attempt to adapt and adjust to internal and/or external demands or pressures that you cannot cope with. A stressor can be any event, situation, person etc. that you perceive as stressful and induces your stress reaction.

DETERMINING YOUR STRESSORS

1. List your FIVE most common STRESSORS and their REASONS.

	STRESSORS	REASONS
a)		
b)		
c)		
d)		
e)		

2. Rate how much your stressor(s) interfere(s) with your activities: ✓ the one which best fits each column.

WORK	FAMILY CHORES	RELAXATION	
			Continuously
			Several times a day
			Once a day
			Several times a week
			Several times a month
			Once monthly
			Less than once monthly
			Never

3. In general, how likely do you feel that your stress will be decreased or better managed during the next month? Circle one of the following:

Patient No: Date:

Unlikely Impossible Certain Uncertain Likely

4. If it is not possible to completely alleviate your stress (that is to a rating of 0%), what percentage of stress is an acceptable stress level for you to live with?

Acceptable Stress Level: _____ %

RECENT LIFE CHANGES

Please answer whether the events below have happened to you WITHIN THE PAST TWO YEARS, by indicating when it occurred by circling the appropriate number(s) to the right of the event according to the following scale:

1 = 0 - 6 months ago

2 = 7 - 12 months ago

3 = 13 - 18 months ago

4 = 19 - 24 months ago

If you experienced an event more than once over the past two years, circle all appropriate numbers. If the event did not occur over the last two years (or never occurred) leave all numbers uncircled.

WITHIN THE TIME PERIODS LISTED, HAVE YOU EXPERIENCED:

HEALTH				
an illness or injury which:				
kept you in bed a week or more, or sent you to the hospital?	1	2	3	4
was less serious than above?	1	2	3	4
major dental work?	1	2	3	4
a major change in eating habits?	1	2	3	4
a major change in sleeping habits?	1	2	3	4
a major change in your usual type and/or amount of recreation?	1	2	3	4
WORK				
a change to a new type of work?	*1*	*2*	*3*	*4*
a change in your work hours or conditions?	*1*	*2*	*3*	*4*
a change in your responsibilities at work:				
more responsibilities?	1	2	3	4
less responsibilities?	1	2	3	4
promotion?	1	2	3	4
demotion?	1	2	3	4
transfer?	1	2	3	4
troubles at work:				
with your boss?	1	2	3	4
with your co-workers?	1	2	3	4
with persons under your supervision?	1	2	3	4
other work troubles?	1	2	3	4
a major business readjustment?	1	2	3	4

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a retirement?	1	2	3	4
a loss of job:				
laid off work?	1	2	3	4
fired from work?	1	2	3	4
a correspondence course to help you in your work?	1	2	3	4

HOME AND FAMILY

a major change in your living conditions (home improvements or a decline in your home or neighbourhood)?	1	2	3	4
a change in residence:				
move within the same town or city?	1	2	3	4
move to a different town, city or province?	1	2	3	4
a change in family "get togethers"?				
a major change in the health or behaviour of a family member (illness, accidents, drug or disciplinary problems, etc)?	1	2	3	4
marriage?	1	2	3	4
a pregnancy?	1	2	3	4
a miscarriage or abortion?	1	2	3	4
a gain of a new family member:				
birth of a child?	1	2	3	4
adoption of a child?	1	2	3	4
a relative moving in with you?	1	2	3	4
a spouse beginning or ending work outside the home?	1	2	3	4
a child leaving home:				
to attend college?	1	2	3	4
due to marriage?	1	2	3	4
for other reasons?	1	2	3	4
a change in arguements with your spouse?	1	2	3	4
in-law problems?	1	2	3	4
a change in the marital status of your parents:				
divorce?	1	2	3	4
remarriage?	1	2	3	4
a separation from your spouse:				
due to work?	1	2	3	4
marital problems?	1	2	3	4
a divorce?	1	2	3	4
the birth of a grandchild?	1	2	3	4
the death of a spouse?	1	2	3	4

the death of another family member:				
child?	1	2	3	4
brother or sister?	1	2	3	4
parent?	1	2	3	4
PERSONAL AND SOCIAL				
a change in personal habits (your dress, friends, lifestyle etc)?	1	2	3	4
beginning or ending school or college?	1	2	3	4
a change of school or college?	1	2	3	4
a change in political beliefs?	1	2	3	4
a change in religious beliefs?	1	2	3	4
a change in social activities (clubs, movies, visiting etc)?	1	2	3	4
a vacation?	1	2	3	4
a new, close, personal relationship?	1	2	3	4
an engagement to marry?	1	2	3	4
girlfriend or boyfriend problems?	1	2	3	4
sexual difficulties?	1	2	3	4
a "falling out" of a close personal relationship?	1	2	3	4
an accident?	1	2	3	4
a minor violation of the law (traffic ticket etc)?	1	2	3	4
being held in jail (DUI, felony etc)?	1	2	3	4
the death of a close friend?	1	2	3	4
a major decision regarding your immediate future?	1	2	3	4
a major personal achievement?	1	2	3	4
FINANCIAL				
a major change in finances:				
increased income?	1	2	3	4
decreased income?	1	2	3	4
investment and/or credit difficulties?	1	2	3	4
a loss or damage to personal property?	1	2	3	4
a moderate purchase (such as an automobile)?	1	2	3	4
a major purchase (such as a home)?	1	2	3	4
a foreclosure of a mortgage or loan?	1	2	3	4
VIOLENCE				
unrest in your area?	1	2	3	4
boycotts, strikes, protests:				
in your area?	1	2	3	4

at your work?	1	2	3	4
housebreaking or robbery:				
in your area?	1	2	3	4
your own house?	1	2	3	4
your family?	1	2	3	4
your friends?	1	2	3	4
attempted or actual hijacking:				
yourself?	1	2	3	4
your family?	1	2	3	4
your friends?	1	2	3	4
in your area?	1	2	3	4
attempted or actual rape:				
yourself?	1	2	3	4
your family?	1	2	3	4
your friends?	1	2	3	4
in your area?	1	2	3	4

DAILY HASSLES AND UPLIFTS SCALE

Hassles are irritants - things that annoy or bother you; they can make you upset or angry. UPLIFTS are events that make you feel good; they can make you joyful, glad or satisfied. Some hassles and uplifts occur on a fairly regular basis and others are relatively rare. Some have only a slight effect, others have a strong effect.

This questionnaire lists things that can be hassles and uplifts in day-to-day life. You will find that during the course of a day some of these things will have been only a hassle for you and some will have been only an uplift. **OTHERS WILL HAVE BEEN BOTH A HASSLE AND AN UPLIFT**.

Please think about how much of a hassle and how much of an uplift each item was for you before you went to bed yesterday. Please indicate on the left hand side of the page (under Hassles) how much of a hassle the item was by circling the appropriate number. Then indicate on the right hand side of the page (under Uplifts) how much of an uplift it was for you by circling the appropriate number.

Remember, circle one number on the left-hand side of the page AND one number on the right-hand side of the page for **EACH** item, according to the scale below:

0 = none or not applicable
1 = somewhat
2 = quite a bit
3 = a great deal

PLEASE INDICATE HOW YOU FELT JUST BEFORE GOING TO BED LAST NIGHT.

HASSLES		UPLIFTS
0 1 2 3	1. Your child	0 1 2 3
0 1 2 3	2. Your parents of parents-in-law	0 1 2 3
0 1 2 3	3. Other relative(s)	0 1 2 3
0 1 2 3	4. Your spouse	0 1 2 3
0 1 2 3	5. Time spent with family	0 1 2 3
0 1 2 3	6. Health or well-being of a family member	0 1 2 3
0 1 2 3	7. Sex	0 1 2 3
0 1 2 3	8. Intimacy	0 1 2 3
0 1 2 3	9. Family-related obligations	0 1 2 3
0 1 2 3	10. Your friend(s)	0 1 2 3
0 1 2 3	11. Fellow workers	0 1 2 3

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0	1	2	3	12.	Clients, customers, patients etc.	0	1	2	3
0	1	2	3	13.	Your supervisor or employer	0	1	2	3
0	1	2	3	14.	The nature of your work	0	1	2	3
0	1	2	3	15.	Your work load	0	1	2	3
0	1	2	3	16.	Your job security	0	1	2	3
0	1	2	3	17.	Meeting deadlines or goals on the job	0	1	2	3
0	1	2	3	18.	Enough money for necessities (e.g.food, clothing, housing, health care, taxes, insurance)	0	1	2	3
0	1	2	3	19.	Enough money for education	0	1	2	3
0	1	2	3	20.	Enough money for emergencies	0	1	2	3
0	1	2	3	21.	Enough money for extras (eg. entertainment recreation, vacation)	0	1	2	3
0	1	2	3	22.	Financial care for someone who doesn't live with you	0	1	2	3
0	1	2	3	23.	Investments	0	1	2	3
0	1	2	3	24.	Your smoking	0	1	2	3
0	1	2	3	25.	Your drinking	0	1	2	3
0	1	2	3	26.	Mood-altering drugs	0	1	2	3
0	1	2	3	27.	Your physical appearance	0	1	2	3
0	1	2	3	28.	Contraception	0	1	2	3
0	1	2	3	29.	Exercise(s)	0	1	2	3
0	1	2	3	30.	Your medical care	0	1	2	3
0	1	2	3	31.	Your health	0	1	2	3
0	1	2	3	32.	Your physical abilities	0	1	2	3
0	1	2	3	33.	The weather	0	1	2	3
0	1	2	3	34.	News events	0	1	2	3
0	1	2	3	35.	Your environment (eg.quality of air, noise level, greenery)	0	1	2	3
0	1	2	3	36.	Political or social issues	0	1	2	3
0	1	2	3	37.	Your neighbourhood (eg.neighbours, setting)	0	1	2	3
0	1	2	3	38.	Conserving (gas, electricity, water, gasoline, etc)	0	1	2	3
0	1	2	3	39.	Pets	0	1	2	3
0	1	2	3	40.	Cooking	0	1	2	3
0	1	2	3	41.	Housework	0	1	2	3
0	1	2	3	42.	Home repairs	0	1	2	3
0	1	2	3	43.	Yardwork	0	1	2	3
0	1	2	3	44.	Car maintenance	0	1	2	3

Patient No: Date:

0	1	2	3	45.	Taking care of paperwork (eg. Paying bills, filling out forms)	0	1	2	3
0	1	2	3	46.	Home entertainment (eg.TV, music, reading)	0	1	2	3
0	1	2	3	47.	Amount of free time	0	1	2	3
0	1	2	3	48.	Recreation and entertainment outside the home (eg.movies, sports, eating out, walking)	0	1	2	3
0	1	2	3	49.	Eating (at home)	0	1	2	3
0	1	2	3	50.	Church or community organizations	0	1	2	3
0	1	2	3	51.	Legal matters	0	1	2	3
0	1	2	3	52.	Being organized	0	1	2	3
0	1	2	3	53.	Social commitments	0	1	2	3

PERCEIVED COPING INCAPACITY SCALE

Please indicate how much you agree with the following statements by circling the appropriate number on the right-hand side of the item, according to the following scale:

	STRONGLY AGREE				STRONGLY DISAGREE
1. I find many things too difficult to handle	5	4	3	2	1
2. Mostly, I feel I am able to make the correct decision	5	4	3	2	1
3. I can usually think clearly	5	4	3	2	1
4. I usually feel capable	5	4	3	2	1
5. I feel that most situations are easy to deal with	5	4	3	2	1
6. Usually I have no difficulty in sorting out ideas	5	4	3	2	1
7. My abilities are sufficient for what I am expected to do	5	4	3	2	1
8. Generally I feel that I am coping well	5	4	3	2	1
9. Frequently I cannot reason as clearly as I should	5	4	3	2	1

Patient No: Date:

LIFE ORIENTATION TEST- REVISED VERSION

Below are ten statements with which you may agree or disagree. Using the scale below, indicate your agreement/disagreement by circling the appropriate number on the right-hand side of the item. Please be open and honest in your responding.

The 5 point scale is:

0 = strongly disagree

1 = disagree

2 = neutral

3 = agree

4 = strongly agree

1.	In uncertain times, I usually expect the best	5	4	3	2	1
2.	It's easy for me to relax	5	4	3	2	1
3.	If something can go wrong for me, it will	5	4	3	2	1
4.	I'm always optimistic about my future	5	4	3	2	1
5.	I enjoy my friends a lot	5	4	3	2	1
6.	It's important for me to keep busy	5	4	3	2	1
7.	I hardly ever expect things to go my way	5	4	3	2	1
8.	I don't get upset too easily	5	4	3	2	1
9.	I rarely count on good things happening to me	5	4	3	2	1
10.	Overall, I expect more good things to happen to me than bad	5	4	3	2	1

Patient No: Date:

REY FIGURE DELAYED RECALL INSTRUCTIONS

(½ - 1 hr after Immediate Recall)

"Remember, when we first began I gave you a large figure to draw."

If the patient indicates yes, say:

"I want you to draw it from memory on this sheet.

If the patient indicates no, prompt by saying:

"It was a large figure with a lot of lines."

Give no further prompts.

RCF DELAYED RECALL

Patient No: Date:

NARRATIVE PROSE MEMORY DELAYED RECALL

"Remember that story I told you when we first began?"

If the patient indicates yes, say:

"I want you to tell it back to me again in as much detail as possible."

If the patient indicates no, give some prompts as in immediate recall (page 11) and score similarly on page 12.

Patient No: Date:

RAVLT RECOGNITION TRIAL

(Recognition:) (= ½ hour later.)

"Remember those lists of words I gave you earlier? I'm going to say a word and I want you to tell me whether it was on the first list that I read to you. Say 'yes' if it was on that first list, and 'no' if it was not."

Score on page 14.

VISUAL ANALOGUE SCALES

Stress is your physiological, psychological, and behavioural reactions when you attempt to adapt and adjust to internal and/or external demands or pressures that you cannot cope with. A stressor can be any event, situation, person etc. that you perceive as stressful and induces your stress reaction.

1. Rate the PRESENT INTENSITY of your stress somewhere along the scale below. Choose any number between lowest intensity (1) to highest intensity (10). Circle only one number along the scale below:

No stress — The most intense stress imaginable

1 2 3 4 5 6 7 8 9 10

2. Rate the USUAL INTENSITY of your stress throughout the day with a circle along the scales below. Choose any number between lowest intensity (1) to highest intensity (10). Circle only one number along each scale below:

TIME

Morning No stress — The most intense stress imaginable

1 2 3 4 5 6 7 8 9 10

Noon No stress — The most intense stress imaginable

1 2 3 4 5 6 7 8 9 10

Afternoon No stress — The most intense stress imaginable

1 2 3 4 5 6 7 8 9 10

Evening No stress — The most intense stress imaginable

1 2 3 4 5 6 7 8 9 10

Sleep No stress — The most intense stress imaginable

Patient No: Date:

NEUROPSYCHOLOGICAL BATTERY

REY FIGURE COPY INSTRUCTIONS

"I want you to draw this figure onto this blank sheet of paper".

If the patient indicates he cannot draw straight lines, etc., say:

"Just draw it as nearly like this one as you can."

RCF COPY

Patient No: Date:

REY FIGURE IMMEDIATE RECALL INSTRUCTIONS

"Now I want you to draw that same figure from memory."

If the patient has difficulty say:

"If you can remember something but are not sure where it went I want you to put it where you think it went."

RCF IMMEDIATE RECALL

Patient No: Date:

NARRATIVE PROSE MEMORY INSTRUCTIONS (STORY)

PRESENTATION

"I am going to tell you a simple story. When I am finished I want you to tell it back to me in as much detail as you can."

IMMEDIATE RECALL

"Now, you tell it back to me in as much detail as possible."

If patient stops before the end, ask:

"Is there anything else? Are there any other words or details that you can remember?"

and, if necessary:

"How did it all end?"

If the patient does not remember at the outset, say:

"It was about a lion."

If the patient still does not remember, say:

"It was about a lion and a baby."

If the patient *still* does not remember, give no further prompts. If he is able to recall part or all of the story following the prompts, give credit for everything remembered but no credit for items prompted, i.e., lion, baby.

NARRATIVE PROSE MEMORY

	TotPro		TotMem2
Raw Score Sum:		Composite = (TotPro x 2) + TotMem2	
Raw Score Difference:			
	Δ		

A lion
called Sultan
escaped from his cage
through the door left unlocked
by the careless attendant,
a large crowd of visitors
on that Sunday
ran to the nearest buildings.
A woman dressed in blue
dropped her one year old baby which
she carried in her arms.
The lion grabbed the baby.
The woman was brave
and tried to pull the baby back.
But the lion got away
and took the baby to his cage.
Then the woman got scared
and she asked a policeman for help
but the policeman was so frightened
that he ran away.
That made the woman so angry
that she went into the cage herself and
angrily told the lion
to give her baby back.
The lion was so surprised
that he let the baby go
without hurting it.
The woman held the baby
in her arms
and proudly walked away.

Immediate_____ Delay _____

Patient No: Date:

REY AUDITORY VERBAL LEARNING INSTRUCTIONS

For trial 1, the examiner reads a list of 15 words at the rate of one per second after giving the following instructions:

"I am going to read a list of words. Listen carefully, for when I stop you are to say back as many as you can remember. It doesn't matter in what order you repeat them. Just try to remember as many as you can."

Record accuracy and order of response by numbering responses on a sheet. False words are recorded below and numbered appropriately. Repetitions are also given an appropriate number. Do not record self-acknowledged repetitions or repetitions that occur without intervening items, though this can be noted with an "R"

If the patient asks whether he has already said a word, the examiner should tell him, but the examiner should not volunteer that a word has been repeated. When the patient indicates he can recall no more words, the examiner rereads the list following a second set of instructions:

"Now I'm going to read the same list again, and once again when I stop I want you to tell me as many words as you can remember, including words you said the first time. It doesn't matter in what order you say them. Just say as many words as you can remember whether or not you said them before."

This set of instructions must emphasize inclusion of previously said words for otherwise some patients will assume it is an elimination test. If patient fails to repeat words given on the first trial, E may remind to:

"Repeat all words each time, even ones you've said before." (The list is reread for trials 3 and 4 saying:) *"Now let's try it again."*

For trial 5, say)

"Let's try it one more time. This is the last time I'm going to read this list."

For trial 6, the examiner reads the second word list with instructions)

"Now let's try a new list of words just one time. Again, try to remember as many as you can and it doesn't matter in what order you repeat them."

For trial 7, the examiner asks the patient to recall as many words from the first list as he can without reading the list again. Say)

"Now, once again, I want you to tell me as many words from the first list as you can remember."

(Recognition:) (= ½ hour later.)

"Remember those lists of words I gave you earlier? I'm going to say a word and I want you to tell me whether it was on the first list that I read to you. Say 'yes' if it was on that first list, and 'no' if it was not."

REY AUDITORY LEARNING (ROTE RECALL AND RECOGNITION)

Free Recall Trials									Recognition Trial					
	1	2	3	4	5		6		7		Yes	No		Yes	No
Doll						Dish		(doll)		Nail			Screw		
Mirror						Jester		(mirror)		Sand			Music		
Nail						Hill		(nail)		Bed			Helmet		
Sailor						Coat		(sailor)		Pony			Bread		
Heart						Tool		(heart)		Jail			Sheet		
Desert						Forrest		(desert)		Envelope			Head		
Face						Water		(face)		Milk			Desert		
Letter						Ladder		(letter)		Toad			Machine		
Bed						Girl		(bed)		Silk			Horse		
Machine						Foot		(machine)		Sofa			Stall		
Milk						Shield		(milk)		Face			Captain		
Helmet						Pie		(helmet)		Sailor			Letter		
Music						Insect		(music)		Road			Doll		
Horse						Ball		(horse)		Dart			Heart		
Road						Car		(road)		Mirror			Start		

.....

..... **Errors:** ( ) ( ) ( ) ( )
Yes No Yes No

1	2	3	4	5	6	7

Total Wrong Yes's : ☐

Total Wrong No's : ☐

Patient No: Date:

HAMILTON ANXIETY RATING SCALE

INSTRUCTIONS

0	=	NOT PRESENT	-	NOT PRESENT
1	=	MILD	-	OCCURS IRREGULARLY AND FOR SHORT PERIODS OF TIME
2		MODERATE	-	OCCURS MORE CONSTANTLY AND OF LONGER DURATION REQUIRING CONSIDERABLE EFFORT ON PART OF PATIENT TO COPE WITH IT
3	=	SEVERE	-	CONTINUOUS AND DOMINATES PATIENT'S LIFE
4	=	VERY SEVERE	-	INCAPACITATING

ONE RATES EACH OF THESE GROUPS OF FEATURES, AS YOU CAN SEE ON THE SCALE FORMAT ON A SIMPLE FIVE POINT SCALE:

Patient No: Date:

HAMILTON ANXIETY RATING SCALE

Place an X in the appropriate space

		0	1	2	3	4
1. Anxious	Worries, anticipation of the worst, fearful anticipation, irritability					
2. Tension	Feelings of tension, fatigueability, startle response, moved to tears easily, trembling, feelings of restlessness, inability to relax					
3. Fears	Of dark, of strangers, of being left alone, of animals of traffic, of crowds					
4. Insomnia	Difficulty in falling asleep, broken sleep, unsatisfying sleep and fatigue on waking, dreams, nightmares, night terrors					
5. Intellectual (Cognitive)	Difficulty in concentration, poor memory					
6. Depressed Mood	Loss of interest, lack of pleasure in hobbies, depression, early waking, diurnal swing					
7. Somatic (muscular)	Pains and aches, twitchings, stiffness, myoclonic jerks, grinding of teeth, unsteady voice, increased muscular tone					
9. Somatic (Sensory)	Tinnitus, blurring of vision, hot and cold flashes, feelings of weakness, prickling sensation					
9. Cardiovascular Symptoms	Tachycardia, palpitations, pain in chest, throbbing of vessels, fainting feelings, missing beat					
10. Respiratory Symptoms	Pressure or constriction in chest, choking feelings, sighing, dyspnea					
11. Gastro-intestinal Symptoms	Difficulty in swallowing, wind, abdominal pain, burning sensations, abdominal fullness, nausea, vomiting, borborygmi, looseness of bowels, loss of weight, constipation					
12.Genito-urinary symptoms	Frequency of micturition, urgency of micturition, amenorrhea, menorrhagia, development of frigidity, premature ejaculation, loss of libido, impotence					
14. Autonomic symptoms	Dry mouth, flushing, pallor, tendency to sweat, giddiness, tension headache, raising of hair					
14. Behaviour at Interview	Fidgeting, restlessness or pacing, tremor of hands, furrowed brow, strained face, sighing or rapid respiration, facial pallor, swallowing, belching, brisk tendon jerks, dilated pupils, exophthalmos					
	No of X's in each column					
	Multiplication factor	x0	x1	x2	x3	x4
	Column Scores	0 +	+	+	+	+ =
Total Score						

Patient No: Date:

PSYCHOLOGICAL GENERAL WELL-BEING SCHEDULE

For each question make a ✓ in the appropriate ☐. Only one ✓ per question.

1. HOW HAVE YOU BEEN FEELING IN GENERAL (DURING THE PAST MONTH)?

- ☐ IN EXCELLENT SPIRITS (5)
- ☐ IN VERY GOOD SPIRITS (4)
- ☐ IN GOOD SPIRITS MOSTLY (3)
- ☐ I HAVE BEEN UP AND DOWN IN SPIRITS A LOT (2)
- ☐ IN LOW SPIRITS (1)
- ☐ IN VERY LOW SPIRITS (0)

---

2. HOW OFTEN WERE YOU BOTHERED BY ANY ILLNESS, BODILY DISORDER, ACHES OR PAINS (DURING THE PAST MONTH)?

- ☐ EVERY DAY (0)
- ☐ ALMOST EVERY DAY (1)
- ☐ ABOUT HALF THE TIME (2)
- ☐ NOW AND THEN, BUT LESS THAN HALF THE TIME (3)
- ☐ RARELY (4)
- ☐ NONE OF THE TIME (5)

---

3. DID YOU FEEL DEPRESSED (DURING THE PAST MONTH)?

- ☐ YES - TO THE POINT THAT I FELT LIKE TAKING MY LIFE (0)
- ☐ YES - TO THE POINT THAT I DID NOT CARE ABOUT ANYTHING (1)
- ☐ YES - VERY DEPRESSED ALMOST EVERY DAY (2)
- ☐ YES - QUITE DEPRESSED SEVERAL TIMES (3)
- ☐ YES - A LITTLE DEPRESSED NOW AND THEN (4)
- ☐ NO - NEVER FELT DEPRESSED AT ALL (5)

---

4. HAVE YOU BEEN IN FIRM CONTROL OF YOUR BEHAVIOUR, THOUGHTS, EMOTIONS, OR FEELINGS (DURING THE PAST MONTH)?

- ☐ YES, DEFINITELY SO (5)
- ☐ YES, FOR THE MOST PART (4)
- ☐ GENERALLY SO (3)
- ☐ NOT TOO WELL (2)
- ☐ NO, AND I AM SOMEWHAT DISTURBED (1)
- ☐ NO, AND I AM VERY DISTURBED (0)

Patient No: Date:

5. HAVE YOU BEEN BOTHERED BY NERVOUSNESS OR YOUR 'NERVES'(DURING THE PAST MONTH)?

- ☐ EXTREMELY SO - TO THE POINT WHERE I COULD NOT WORK OR TAKE CARE OF THINGS (0)
- ☐ VERY MUCH SO (1)
- ☐ QUITE A BIT (2)
- ☐ SOME - ENOUGH TO BOTHER ME (3)
- ☐ A LITTLE (4)
- ☐ NOT AT ALL (5)

---

6. HOW MUCH ENERGY, PEP, OR VITALITY DID YOU HAVE OR FEEL (DURING THE PAST MONTH)?

- ☐ VERY FULL OF ENERGY - LOTS OF PEP (5)
- ☐ FAIRLY ENERGETIC MOST OF THE TIME (4)
- ☐ MY ENERGY LEVEL VARIED QUITE A BIT (3)
- ☐ GENERALLY LOW IN ENERGY OR PEP (2)
- ☐ VERY LOW IN ENERGY OR PEP MOST OF THE TIME (1)
- ☐ NO ENERGY OR PEP AT ALL - I FELT DRAINED, SAPPED (0)

---

7. I FELT DOWNHEARTED AND BLUE DURING THE PAST MONTH.

- ☐ NONE OF THE TIME (5)
- ☐ A LITTLE OF THE TIME (4)
- ☐ SOME OF THE TIME (3)
- ☐ A GOOD BIT OF THE TIME (2)
- ☐ MOST OF THE TIME (1)
- ☐ ALL OF THE TIME (0)

---

8. WERE YOU GENERALLY TENSE OR DID YOU FEEL ANY TENSION (DURING THE PAST MONTH)?

- ☐ YES - EXTREMELY TENSE, MOST OR ALL OF THE TIME (0)
- ☐ YES - VERY TENSE MOST OF THE TIME (1)
- ☐ NOT GENERALLY TENSE, BUT DID FEEL FAIRLY TENSE SEVERAL TIMES (2)
- ☐ I FELT A LITTLE TENSE A FEW TIMES (3)
- ☐ MY GENERAL TENSION LEVEL WAS QUITE LOW (4)
- ☐ I NEVER FELT TENSE OR ANY TENSION AT ALL (5)

---

9. HOW HAPPY, SATISFIED, OR PLEASED HAVE YOU BEEN WITH YOUR PERSONAL LIFE (DURING THE PAST MONTH)?

- ☐ EXTREMELY HAPPY - COULD NOT HAVE BEEN MORE SATISFIED OR PLEASED (5)
- ☐ VERY HAPPY MOST OF THE TIME (4)
- ☐ GENERALLY SATISFIED - PLEASED (3)
- ☐ SOMETIMES FAIRLY HAPPY, SOMETIMES FAIRLY UNHAPPY (2)
- ☐ GENERALLY DISSATISFIED, UNHAPPY (1)
- ☐ VERY DISSATISFIED OR UNHAPPY MOST OR ALL OF THE TIME (0)

Patient No: Date:

10. DID YOU FEEL HEALTHY ENOUGH TO CARRY OUT THE THINGS YOU LIKE TO DO OR HAD TO DO (DURING THE PAST MONTH)?

- ☐ YES - DEFINITELY SO (5)
- ☐ FOR THE MOST PART (4)
- ☐ HEALTH PROBLEMS LIMITED ME IN SOME IMPORTANT WAYS (3)
- ☐ I WAS ONLY HEALTHY ENOUGH TO TAKE CARE OF MYSELF (2)
- ☐ I NEEDED SOME HELP IN TAKING CARE OF MYSELF (1)
- ☐ I NEEDED SOMEONE TO HELP ME WITH MOST OR ALL OF THE THINGS I HAD TO DO (0)

---

11. HAVE YOU FELT SO SAD, DISCOURAGED, HOPELESS, OR HAD SO MANY PROBLEMS THAT YOU WONDERED IF ANYTHING WAS WORTHWHILE (DURING THE PAST MONTH)?

- ☐ EXTREMELY SO - TO THE POINT THAT I HAVE JUST ABOUT GIVEN UP (0)
- ☐ VERY MUCH SO (1)
- ☐ QUITE A BIT (2)
- ☐ SOME - ENOUGH TO BOTHER ME (3)
- ☐ A LITTLE BIT (4)
- ☐ NOT AT ALL (5)

---

12. I WOKE FEELING FRESH AND RESTED DURING THE PAST MONTH.

- ☐ NONE OF THE TIME (0)
- ☐ A LITTLE OF THE TIME (1)
- ☐ SOME OF THE TIME (2)
- ☐ A GOOD BIT OF THE TIME (3)
- ☐ MOST OF THE TIME (4)
- ☐ ALL OF THE TIME (5)

---

13. HAVE YOU BEEN CONCERNED, WORRIED, OR HAD ANY FEARS ABOUT YOUR HEALTH (DURING THE PAST MONTH)?

- ☐ EXTREMELY SO (0)
- ☐ VERY MUCH SO (1)
- ☐ QUITE A BIT (2)
- ☐ SOME, BUT NOT A LOT (3)
- ☐ PRACTICALLY NEVER (4)
- ☐ NOT AT ALL (5)

---

14. HAVE YOU HAD ANY REASON TO WONDER IF YOU WERE LOSING YOUR MIND, OR LOSING CONTROL OVER THE WAY YOU ACT, TALK, THINK, FEEL OR OF YOUR MEMORY (DURING THE PAST MONTH)?

- ☐ NOT AT ALL (5)
- ☐ ONLY A LITTLE (4)
- ☐ SOME - BUT NOT ENOUGH TO BE CONCERNED OR WORRIED ABOUT (3)
- ☐ SOME AND I HAVE BEEN A LITTLE CONCERNED (2)
- ☐ SOME AND I AM QUITE CONCERNED (1)
- ☐ YES, VERY MUCH SO AND I AM VERY CONCERNED (0)

---

15. MY DAILY LIFE WAS FULL OF THINGS THAT WERE INTERESTING TO ME DURING THE PAST MONTH.

- ☐ NONE OF THE TIME (0)
- ☐ A LITTLE OF THE TIME (1)
- ☐ SOME OF THE TIME (2)
- ☐ A GOOD BIT OF THE TIME (3)
- ☐ MOST OF THE TIME (4)
- ☐ ALL OF THE TIME (5)

---

16. DID YOU FEEL ACTIVE, VIGOROUS, OR DULL, SLUGGISH (DURING THE PAST MONTH)?

- ☐ VERY ACTIVE, VIGOROUS EVERY DAY (5)
- ☐ MOSTLY ACTIVE, VIGOROUS - NEVER REALLY DULL, SLUGGISH (4)
- ☐ FAIRLY ACTIVE, VIGOROUS - SELDOM DULL, SLUGGISH (3)
- ☐ FAIRLY DULL, SLUGGISH - SELDOM ACTIVE, VIGOROUS (2)
- ☐ MOSTLY DULL, SLUGGISH - NEVER REALLY ACTIVE, VIGOROUS (1)
- ☐ VERY DULL, SLUGGISH EVERY DAY (0)

---

17. HAVE YOU BEEN ANXIOUS, WORRIED, OR UPSET (DURING THE PAST MONTH)?

- ☐ EXTREMELY SO - TO THE POINT OF BEING SICK OR ALMOST SICK (0)
- ☐ VERY MUCH SO (1)
- ☐ QUITE A BIT (2)
- ☐ SOME - ENOUGH TO BOTHER ME (3)
- ☐ A LITTLE BIT (4)
- ☐ NOT AT ALL (5)

---

18. I WAS EMOTIONALLY STABLE AND SURE OF MYSELF DURING THE PAST MONTH.

- ☐ NONE OF THE TIME (0)
- ☐ A LITTLE OF THE TIME (1)
- ☐ SOME OF THE TIME (2)
- ☐ A GOOD BIT OF THE TIME (3)
- ☐ MOST OF THE TIME (4)
- ☐ ALL OF THE TIME (5)

---

19. DID YOU FEEL RELAXED, AT EASE, OR HIGHLY STRUNG, TIGHT, OR KEYED-UP (DURING THE PAST MONTH)?

- ☐ FELT RELAXED AND AT EASE THE WHOLE MONTH (5)
- ☐ FELT RELAXED AND AT EASE MOST OF THE TIME (4)
- ☐ GENERALLY FELT RELAXED BUT AT TIMES FELT FAIRLY HIGHLY STRUNG (3)
- ☐ GENERALLY FELT HIGHLY STRUNG, BUT AT TIMES FELT FAIRLY RELAXED (2)
- ☐ FELT HIGHLY STRUNG, TIGHT AND KEYED-UP MOST OF THE TIME (1)
- ☐ FELT HIGHLY STRUNG, TIGHT AND KEYED-UP THE WHOLE TIME (0)

---

20. I FELT CHEERFUL, LIGHTHEARTED DURING THE PAST MONTH.

- ☐ NONE OF THE TIME (0)

Patient No: Date:

- ☐ A LITTLE OF THE TIME (1)
- ☐ SOME OF THE TIME (2)
- ☐ A GOOD BIT OF THE TIME (3)
- ☐ MOST OF THE TIME (4)
- ☐ ALL OF THE TIME (5)

---

21. I FELT TIRED, WORN OUT, USED UP, OR EXHAUSTED DURING THE PAST MONTH.

- ☐ NONE OF THE TIME (5)
- ☐ A LITTLE OF THE TIME (4)
- ☐ SOME OF THE TIME (3)
- ☐ A GOOD BIT OF THE TIME (2)
- ☐ MOST OF THE TIME (1)
- ☐ ALL OF THE TIME (0)

---

22. HAVE YOU BEEN UNDER OR FELT YOU WERE UNDER ANY STRAIN, STRESS, OR PRESSURE (DURING THE PAST MONTH)?

- ☐ YES - ALMOST MORE THAN I COULD BEAR OR STAND (0)
- ☐ YES - QUITE A BIT OF PRESSURE (1)
- ☐ YES SOME - MORE THAN USUAL (2)
- ☐ YES SOME - BUT ABOUT USUAL (3)
- ☐ YES - A LITTLE (4)
- ☐ NOT AT ALL (5)

Patient No: Date:

VISUAL ANALOGUE SCALES

Stress is your physiological, psychological, and behavioural reactions when you attempt to adapt and adjust to internal and/or external demands or pressures that you cannot cope with. A stressor can be any event, situation, person etc. that you perceive as stressful and induces your stress reaction.

1. Rate the PRESENT INTENSITY of your stress somewhere along the scale below. Choose any number between lowest intensity (1) to highest intensity (10). Circle only one number along the scale below:

No stress — The most intense stress imaginable

1 2 3 4 5 6 7 8 9 10

2. Rate the USUAL INTENSITY of your stress throughout the day with a circle along the scales below. Choose any number between lowest intensity (1) to highest intensity (10). Circle only one number along each scale below:

TIME

Morning No stress — The most intense stress imaginable

1 2 3 4 5 6 7 8 9 10

Noon No stress — The most intense stress imaginable

1 2 3 4 5 6 7 8 9 10

Afternoon No stress — The most intense stress imaginable

1 2 3 4 5 6 7 8 9 10

Evening No stress — The most intense stress imaginable

1 2 3 4 5 6 7 8 9 10

Sleep No stress — The most intense stress imaginable

1 2 3 4 5 6 7 8 9 10

Patient No: Date:

DAILY HASSLES AND UPLIFTS SCALE

Hassles are irritants - things that annoy or bother you; they can make you upset or angry. UPLIFTS are events that make you feel good; they can make you joyful, glad or satisfied. Some hassles and uplifts occur on a fairly regular basis and others are relatively rare. Some have only a slight effect, others have a strong effect.

This questionnaire lists things that can be hassles and uplifts in day-to-day life. You will find that during the course of a day some of these things will have been only a hassle for you and some will have been only an uplift. **OTHERS WILL HAVE BEEN BOTH A HASSLE AND AN UPLIFT**.

Please think about how much of a hassle and how much of an uplift each item was for you before you went to bed yesterday. Please indicate on the left hand side of the page (under Hassles) how much of a hassle the item was by circling the appropriate number. Then indicate on the right hand side of the page (under Uplifts) how much of an uplift it was for you by circling the appropriate number.

Remember, circle one number on the left-hand side of the page AND one number on the right-hand side of the page for **EACH** item, according to the scale below:

0 = none or not applicable
1 = somewhat
2 = quite a bit
3 = a great deal

PLEASE INDICATE HOW YOU FELT JUST BEFORE GOING TO BED LAST NIGHT.

HASSLES		UPLIFTS
0 1 2 3	1. Your child	0 1 2 3
0 1 2 3	2. Your parents of parents-in-law	0 1 2 3
0 1 2 3	3. Other relative(s)	0 1 2 3
0 1 2 3	4. Your spouse	0 1 2 3
0 1 2 3	5. Time spent with family	0 1 2 3
0 1 2 3	6. Health or well-being of a family member	0 1 2 3
0 1 2 3	7. Sex	0 1 2 3
0 1 2 3	8. Intimacy	0 1 2 3
0 1 2 3	9. Family-related obligations	0 1 2 3
0 1 2 3	10. Your friend(s)	0 1 2 3
0 1 2 3	11. Fellow workers	0 1 2 3

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0	1	2	3	12.	Clients, customers, patients etc.	0	1	2	3
0	1	2	3	13.	Your supervisor or employer	0	1	2	3
0	1	2	3	14.	The nature of your work	0	1	2	3
0	1	2	3	15.	Your work load	0	1	2	3
0	1	2	3	16.	Your job security	0	1	2	3
0	1	2	3	17.	Meeting deadlines or goals on the job	0	1	2	3
0	1	2	3	18.	Enough money for necessities (e.g.food, clothing, housing, health care, taxes, insurance)	0	1	2	3
0	1	2	3	19.	Enough money for education	0	1	2	3
0	1	2	3	20.	Enough money for emergencies	0	1	2	3
0	1	2	3	21.	Enough money for extras (eg. entertainment recreation, vacation)	0	1	2	3
0	1	2	3	22.	Financial care for someone who doesn't live with you	0	1	2	3
0	1	2	3	23.	Investments	0	1	2	3
0	1	2	3	24.	Your smoking.	0	1	2	3
0	1	2	3	25.	Your drinking	0	1	2	3
0	1	2	3	26.	Mood-altering drugs	0	1	2	3
0	1	2	3	27.	Your physical appearance	0	1	2	3
0	1	2	3	28.	Contraception	0	1	2	3
0	1	2	3	29.	Exercise(s)	0	1	2	3
0	1	2	3	30.	Your medical care	0	1	2	3
0	1	2	3	31.	Your health	0	1	2	3
0	1	2	3	32.	Your physical abilities	0	1	2	3
0	1	2	3	33.	The weather	0	1	2	3
0	1	2	3	34.	News events	0	1	2	3
0	1	2	3	35.	Your environment (eg. quality of air, noise level, greenery)	0	1	2	3
0	1	2	3	36.	Political or social issues	0	1	2	3
0	1	2	3	37.	Your neighbourhood (eg. neighbours, setting)	0	1	2	3
0	1	2	3	38.	Conserving (gas, electricity, water, gasoline, etc)	0	1	2	3
0	1	2	3	39.	Pets	0	1	2	3
0	1	2	3	40.	Cooking	0	1	2	3
0	1	2	3	41.	Housework	0	1	2	3
0	1	2	3	42.	Home repairs	0	1	2	3
0	1	2	3	43.	Yardwork	0	1	2	3
0	1	2	3	44.	Car maintenance	0	1	2	3
0	1	2	3	45.	Taking care of paperwork (eg. Paying bills,				

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					filling out forms)	0	1	2	3
0	1	2	3	46.	Home entertainment (eg. TV, music, reading)	0	1	2	3
0	1	2	3	47.	Amount of free time	0	1	2	3
0	1	2	3	48.	Recreation and entertainment outside the home (eg. movies, sports, eating out, walking)	0	1	2	3
0	1	2	3	49.	Eating (at home)	0	1	2	3
0	1	2	3	50.	Church or community organizations	0	1	2	3
0	1	2	3	51.	Legal matters	0	1	2	3
0	1	2	3	52.	Being organized	0	1	2	3
0	1	2	3	53.	Social commitments	0	1	2	3

PERCEIVED COPING INCAPACITY SCALE

Please indicate how much you agree with the following statements by circling the appropriate number on the right-hand side of the item, according to the following scale:

	STRONGLY AGREE				STRONGLY DISAGREE
1. I find many things too difficult to handle	5	4	3	2	1
2. Mostly, I feel I am able to make the correct decision	5	4	3	2	1
3. I can usually think clearly	5	4	3	2	1
4. I usually feel capable	5	4	3	2	1
5. I feel that most situations are easy to deal with	5	4	3	2	1
6. Usually I have no difficulty in sorting out ideas	5	4	3	2	1
7. My abilities are sufficient for what I am expected to do	5	4	3	2	1
8. Generally I feel that I am coping well	5	4	3	2	1
9. Frequently I cannot reason as clearly as I should	5	4	3	2	1

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LIFE ORIENTATION TEST- REVISED VERSION

Below are ten statements with which you may agree or disagree. Using the scale below, indicate your agreement / disagreement by circling the appropriate number on the right-hand side of the item. Please be open and honest in your responding.

The 5 point scale is:

0 = strongly disagree

1 = disagree

2 = neutral

3 = agree

4 = strongly agree

1.	In uncertain times, I usually expect the best	5	4	3	2	1
2.	It's easy for me to relax	5	4	3	2	1
3.	If something can go wrong for me, it will	5	4	3	2	1
4.	I'm always optimistic about my future	5	4	3	2	1
5.	I enjoy my friends a lot	5	4	3	2	1
6.	It's important for me to keep busy	5	4	3	2	1
7.	I hardly ever expect things to go my way	5	4	3	2	1
8.	I don't get upset too easily	5	4	3	2	1
9.	I rarely count on good things happening to me	5	4	3	2	1
10.	Overall, I expect more good things to happen to me than bad	5	4	3	2	1

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REY FIGURE DELAYED RECALL INSTRUCTIONS

(½ - 1 hr after Immediate Recall)

"Remember, when we first began I gave you a large figure to draw."

If the patient indicates yes, say:

"I want you to draw it from memory on this sheet.

If the patient indicates no, prompt by saying:

"It was a large figure with a lot of lines."

Give no further prompts.

RCF DELAYED RECALL

Patient No: Date:

NARRATIVE PROSE MEMORY DELAYED RECALL

"Remember that story I told you when we first began?"

If the patient indicates yes, say:

"I want you to tell it back to me again in as much detail as possible."

If the patient indicates no, give some prompts as in immediate recall (page 44) and score similarly on page 45.

RAVLT RECOGNITION TRIAL

(Recognition:) (= ½ hour later.)

"Remember those lists of words I gave you earlier? I'm going to say a word and I want you to tell me whether it was on the first list that I read to you. Say 'yes' if it was on that first list, and 'no' if it was not."

Score on page 47.