BIOLOGICAL AND BEHAVIOURAL CORRELATES OF PROTECTIVE PSYCHOSOCIAL FACTORS IN UK AND CROSS-CULTURAL SAMPLES

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I, Nina Grant, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Signature…….....

Date……

ABSTRACT

The overall aim of this thesis is to examine the relationship between psychosocial factors and health; the specific aims are: to investigate links between psychosocial factors; to investigate the relationship between psychosocial factors, health behaviour and biology and finally, to investigate these relationships in cross-cultural samples. The recent incorporation of positive aspects, such as happiness and increased social support, into models of health has indicated a protective link between psychosocial factors and health outcomes. Psychosocial factors may impact upon health through behavioural and biological pathways, and there may be interactions between psychosocial factors, including constructs such as psychological and social function and both behavioural and biological pathways, This thesis focuses on the association of three psychosocial constructs, positive well-being, social support and optimism, with health. The first study investigates the relationship between positive well-being and health behaviour in an international sample. The findings showed that life satisfaction was associated with increased healthy behaviours for smoking, exercise, fat intake, sun protection and fruit intake, with no relationship for alcohol consumption or fibre intake. The second study investigated the associations of positive well-being, social support and optimism, and found that social support was strongly related to positive well-being. This study also found a relationship between social support and exercise; between social support and cortisol, and an association between these and positive affect. The third study presents data from a Japanese sample. This study found that social support was related to positive well-being, although effects were different to those found in the UK study. Although effects were small and there were several null findings, overall this thesis concludes that social support and positive well-being may be a part of a protective network of wider psychosocial factors, and that effects on health are exerted by moderation of behavioural and biological pathways.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

PUBLICATIONS

Some of the work described in this thesis has been published, and other sections will be submitted for publication. In addition, some of the research described here has been presented at conferences.

Grant, N., Wardle, J. & Steptoe, A. (2009). Life satisfaction and health behaviour: A cross-cultural analysis of young adults. *International Journal of Behavioural Medicine.* Published online March 25th ahead of journal copy.

Grant, N., Hamer, M. & Steptoe, A. (2009). Social isolation and stress-related cardiovascular, lipid, and cortisol responses. *Annals of Behavioral Medicine, 37*(1), 29-37.

Grant, N., Dockray, S. & Steptoe, A. (2009). Marital status and marital role quality: Associations with cortisol profile in healthy women. Poster presented at American Psychosomatic Society Annual Meeting, Chicago, IL, USA. March 2009.

Grant, N., Hamer, M. & Steptoe, A. (2008). Neuroendocrine, metabolic and cardiovascular responses associated with social isolation. Paper presented at International Congress of Behavioral Medicine, Tokyo, Japan. August 2008.

Grant, N., Chida, Y., Okamura, H., Honda, M., Tsuda, A. & Steptoe, A. Relationship between cortisol and positive affect in a UK and Japanese sample. Poster presented at International Congress of Behavioral Medicine, Tokyo, Japan. August 2008.

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LIST OF ABBREVIATIONS

ACTH	Adreno corticotrophin hormone
AIDS	Acquired immuno deficiency syndrome
ANOVA	Analysis of Variance
AUC	Area under the curve
BMI	Body mass index
CAR	Cortisol awakening response
CHD	Coronary heart disease
CRF	Corticotrophin releasing factor
DRM	Day reconstruction method
EMA	Ecological momentary assessment
ESM	Event sampling method
HBM	Health belief model
HDL	High density lipoprotein
HPA	Hypothalamic pituitary adrenal axis
IL-1 IL-6	Interleukin-1 -6
IPAQ	International Physical Activity Questionnaire
IPNAT	Implicit positive and negative affect test
ISEL	Interpersonal Support Evaluation List
LOT	Life Orientation Test
MI	Myocardial infarction
NA	Negative affect
PA	Positive affect
PANAS	Positive and Negative Affect Schedule
PSM-2	Optimism Pessimism Scale
SAM	Sympathetic Adreno Medullary
SES	Socio economic status
SHS	Subjective Happiness Scale
SNI	Social Network Index
TNF	Tumour necrosis factor
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UCL	University College London

CHAPTER 1: PSYCHOSOCIAL FACTORS LITERATURE REVIEW

1.1 Psychosocial factors and physical health

There is a considerable body of research evidence linking a range of psychosocial factors with poor health outcomes across a range of diseases. Traditionally, investigation of the links between psychosocial factors and physical health has tended to focus on the impact of negative states, including depression, anxiety, hostility, work stress, financial stress and low socio-economic status. In comparison, research investigating protective psychosocial factors, such as happiness, life satisfaction and social support, and health is still in its infancy. Psychosocial factors are thought to exert their effect on health outcomes by moderating an individual's response to stress. According to the theory of allostatic load (McEwan, 2000) frequent episodes of strain increase wear and tear on bodily systems eventually leading to ill-health. Psychosocial factors can affect both reactivity of the physiological stress response and also the recovery of normal levels, or return to homeostasis, thereby increasing allostatic load. Negative states are thought to increase allostatic load and are therefore thought of as adverse psychosocial factors, whereas recent evidence suggests that there may be certain protective psychosocial factors which reduce allostatic load.

Depression has been consistently linked with increased risk of poor physical health outcome. Dysphoria and major depressive symptoms have been associated with increased risk of myocardial infarction (MI), higher mortality after MI and higher mortality from coronary heart disease (CHD; Ahern et al., 1990; Ladwig, Kieser, Konig, Breithardt, & Borggrefe, 1991; Pratt et al., 1996). Review papers have found evidence of a robust relationship between depression and ill-health, including all cause mortality, and CHD (Hemingway & Marmot, 1999; Rugulies, 2002; Wulsin, Vaillant, & Wells,

1999). A stressful work environment has also been linked to decreased physical health, often measured using the balance of effort made to rewards gained. A high ratio of effort to reward in the workplace, and low job control, have been found to predict increased risk of CHD and poor physical health functioning (Bosma, Peter, Siegrist, & Marmot, 1998; Kuper, Singh-Manoux, Siegrist, & Marmot, 2002). A high level of hostility has also been identified as an independent risk factor for CHD (Miller, Smith, Turner, Guijarro, & Hallet, 1996). Finally, lower socio-economic status has also been consistently linked with increases in both mortality and morbidity (e.g. Marmot, 2004).

Protective psychosocial factors include both positive psychological states and social relationships. As recently defined by Everson-Rose and Clark (in press), psychosocial factors can be broadly defined as *"a variety of psychological characteristics, including emotional states and personality factors, social networks and support, as well as socio-environmental characteristics".* Therefore this definition of psychosocial factors encompasses a range of factors including positive well-being, optimism, social support, resilience, coping, hostility, depression and anxiety. These factors can be grouped as psychological, social or personality aspects, although relationships do exist across these groups. For the purposes of this work, one factor from each of these three groups has been selected in order to investigate the thesis aims. These are positive well-being (defined as both eudaimonic and hedonic aspects), social support (defined by both functional and structural aspects) and optimism. In the context of this thesis, these will be referred to throughout as protective psychosocial factors.

Everson-Rose & Clark (in press) also note that the relationship between psychosocial factors and health and illness has been extensively researched across a range of outcomes, including cardiovascular diseases, diabetes, cancer, disability and Alzheimer's disease. Presence of a marital partner has been associated with increased longevity and decreased mortality and morbidity across a wide range of diseases (House, Landis, & Umberson, 1988; Manzoli, Villari, & Boccia, 2007). However, it is

important to note that being married may only be protective for those in well functioning relationships as negative effects have been found in poor quality partnerships (e.g. Kiecolt-Glaser & Newton, 2001). Other measures of social support such as number of social network members, and a high level of perceived social support have also been consistently linked with improved outcomes and decreased mortality (Berkman, Leo-Summers, & Horwitz, 1992; Orth-Gomer & Johnson, 1987). Positive psychological states such as happiness and life satisfaction have also been linked to health outcomes. A detailed review paper reported that trait positive affect was associated with longevity and lower morbidity, and that state and trait positive affect were associated with reduced symptom reporting and pain (Pressman & Cohen, 2005).

Therefore there is strong and consistent evidence linking psychosocial factors with health. The focus of this PhD work has been to investigate the specific role of protective psychosocial factors and health-related biology and behaviour, and to examine the influence of cultural factors. The following literature review will outline the evidence linking protective psychosocial factors and health outcomes, specifically examining positive well-being, social support and optimism. There are two broad pathways that may explain any observed relationship, firstly behavioural factors and secondly biological factors. Further chapters will review evidence relating to the biological and behavioural pathways which may explain this relationship. Throughout this thesis, positive well-being is used as an umbrella term to describe both eudaimonic aspects of well-being – such as personal growth, hedonic aspects of well-being – such as positive affect and life satisfaction. Social support is used to refer to both functional and structural aspects of support. These terms will be further outline in further sections.

1.2. Positive well-being

"*positive health is not, in the final analysis, a medical question but rather is fundamentally a philosophical issue that requires articulation of the meaning of the good life." (Ryff & Singer, 1998)*.

Positive well-being is an umbrella term which encompasses various state and trait dispositions, including happiness, life satisfaction, cheerfulness and enjoyment. Researchers in this area utilise these terms to a different extent, often with their own definitions of individual constructs. However, two distinct but overlapping approaches have recently emerged as key constructs within the well-being literature, namely hedonic and eudaimonic well-being (Ryan & Deci, 2001). Throughout this thesis, the term positive well-being will be used to refer to a general state of improved mood, which includes positive affect, life satisfaction, and both eudaimonic and hedonic well-being. Where these specific constructs are being directly referred to, those terms will be used.

1.2.1 Hedonic well-being

Hedonism is commonly believed to refer to the pursuit of pleasure. In the 4th Century B.C., Aristippus suggested that happiness was the ultimate goal of life, however the early Greek philosophers disagreed on the precise nature of hedonism. Aristippus believed that hedonism referred to immediate gratification and the pursuit of bodily pleasures in comparison to the Epicureanism school which believed in pursuit of a simple life, where hedonism is derived from mental gratification. This disagreement has continued throughout history and there are now many different conceptual definitions of hedonistic well-being, with some having a narrow focus. For

psychologists, hedonism can incorporate pleasures both of the body and the mind, such as sexual gratification and conversation (Kubovy, 1999). In 1999, a large edited book announced the arrival of a new field of psychology, the study of hedonism, defined as "*the study of what makes experiences in life pleasant and unpleasant. It is concerned with feelings of pleasure and pain…and of satisfaction and dissatisfaction*." (Kahneman, 1999, *pg ix*). This volume described hedonistic psychology in detail, including methodological considerations, correlates with social and biological aspects and provided a clear and detailed operational definition for researchers interested in this field to use. This publication has guided research into hedonistic well-being over the past decade by introducing new methodologies and encouraging theoretical debate.

Empirical research carried out in this new field focuses on subjective well-being, which is usually defined as general satisfaction, indexed by personal judgements of being satisfied with life; positive affect, defined as the presence of pleasant emotion such as joyfulness or cheerfulness and negative affect, defined as unpleasant emotion such as anger or fear (Biswas-Diener, Diener, & Tamir, 2004). Therefore subjective well-being encompasses both cognitive and affective aspects of well-being (Diener & Lucas, 2000). The three states of general satisfaction, positive affect, and negative affect which comprise subjective well-being, often co-occur, however it is possible for these states to be separate (Lucas, Diener, & Suh, 1996). Each of these three states can be studied separately to give a complete picture of an individual's level of subjective well-being (Lucas, Diener & Suh, 1996). However, some researchers argue that life satisfaction cannot generally be considered a facet of hedonism (Deci & Ryan, 2008). The concept of subjective well-being as outlined above is often used interchangeably with happiness, therefore a high level of subjective well-being is considered synonymous with high feelings of happiness (Deci & Ryan, 2008). By definition, measuring subjective well-being involves asking individuals to assess their own feelings, and therefore is not a judgement that can be made by an external

observer. Subjective well-being can be measured both using momentary assessments and also longer term feelings of well-being (Diener & Lucas, 1999). Researchers suggest that for subjective well-being to be a useful construct, measurement must include longer term, trait like assessments. However, whilst it is noted that momentary influences can affect individual assessment of life satisfaction (Schwarz & Strack, 1991), evidence for stability of subjective well-being has been found (Costa & McCrae, 1988). For example, subjective well-being was reported to be relatively constant when comparing those with a reasonably stable life and those with a highly changeable life (Costa, McCrae, & Zonderman, 1987) and this was replicated using a sample with varying levels of income (Diener, Sandvik, Seidlitz, & Diener, 1993). These findings suggest that external factors can vary by some margin without affecting reported levels of subjective well-being.

Hedonic psychology has been criticised as a bottom-up account that lacks a theoretical basis and is determined by post-hoc findings, however, prominent researchers in this area have argued that more work is needed before a theory is developed (Diener, Sapyta, & Suh, 1998). It has been suggested that principles of hedonic well-being, and subjective well-being, have similarities with general theories of social science, behavioural theories based on reward and punishment and cognitive theories based on value judgements (Ryan & Deci, 2001). Without a theoretical basis, the use of subjective well-being as a measure of hedonistic well-being can be questioned. Hedonistic well-being is operationally defined as the study of what makes life pleasant and unpleasant by Kahneman in their seminal volume on this topic (Kahneman, 1999). In a review of research on hedonic psychology, Ryan & Deci suggested that there are three viewpoints which could be taken using the above definition of hedonic well-being. The first is to accept the arguments for hedonic well-being along with the use of subjective well-being as its marker. The second is to accept the use of subjective well-being as a measure of general well-being, but seek a more eudaimonic view of what drives subjective well-being. The third is to reject both the

view of hedonic well-being and the use of subjective well-being as its marker. However, despite the theoretical and methodological criticisms of this theory, the expansive proliferation of research within the field of subjective well-being over the recent past suggests that its use within the field of well-being is durable.

1.2.2 Eudaimonic well-being

In contrast to the philosophical school of Aristippus, other philosophers including Aristotle argued that the only goal worth striving for in life was eudaimonia. This term is often translated as happiness, however, this definition does not offer a complete understanding of the original concept. Eudaimonia can be more accurately translated as the pursuit of human flourishing, and Aristotle believed that this was centred on living a virtuous life and the pursuit of knowledge. Therefore followers of eudaimonic well-being believe that well-being is more than just happiness, but consists of a process of fulfilling one's true potential, also known as self-actualization (Deci & Ryan, 2008). Aristotle likened the hedonic view to a life of "grazing animals" and argued that followers of this route were slaves to their desires (Waterman, 1993).

A prominent researcher in this area is Carol Ryff, who defines eudaimonic well-being as *"the striving for perfection that represents the realization of one's true potential"* (Ryff, 1995, pg 100). In this regard, eudaimonic well-being is distinct from subjective well-being and Ryff argues that it can be thought of as a more general state of psychological well-being (Ryff & Keyes, 1995). Ryff and colleagues have attempted to offer a detailed operational definition of their concept of psychological well-being, and, in contrast to hedonic well-being, this gives both a theoretical basis and a platform for empirical study. Psychological well-being has been defined into 6 areas, and a structured, self-report scale has been designed and standardised to allow for easy measurement. The six dimensions of psychological well-being are: self-acceptance; purpose in life; environmental mastery; personal growth; positive relations with others

and, autonomy. Each of these 6 facets of psychological well-being were developed by Ryff in an attempt to draw together theory relating to eudaimonic well-being, beginning with Aristotle and incorporating prominent psychologists across the 20th Century (Ryff, 2008).

The first facet, self-acceptance, is influenced by humanistic and existential psychologists such as Maslow's self-actualization theory, Rogers' theory of optimal functioning and Jung's theories centred on individuation and ego identity. Self-acceptance describes a process of self-evaluation that is long-term, and incorporates knowledge and acceptance of individual strengths and weaknesses (Ryff, 2008). Therefore, self-acceptance can be defined as the ability to see one's own strengths and limitations. Using Ryff's self-acceptance subscale, a high score on this facet would be described as having a positive attitude towards one's self, whilst acknowledging both good and bad aspects, whereas a low scorer would be described as dissatisfied with one's self.

The second facet, purpose in life, is related to existential theories concerning the search for meaning in times of adversity and suffering (e.g. Frankl, 1963). This facet of psychological well-being is concerned with having meaning and direction in life, however, relating to Aristotle's theories, this purpose must be allied with one's true potential. Ryff also draws on Jahoda's concept of mental health, and Allport's maturation theories when defining purpose in life as a facet of psychological well-being (Allport, 1952; Jahoda, 1980). In accordance with a lifespan perspective, purpose in life will vary across the life course in response to changing goals and desires. Therefore, purpose in life can be defined as the presence of desired goals in life. A high score on this subscale would be someone who has meaning and direction in life with a low score indicating someone lacking in a sense of direction.

The third psychological well-being aspect is environmental mastery, which Ryff describes as being related to Jahoda's theory of mental health, and life span developmental perspectives. Jahoda argued that the ability to choose environments

matched to psychological states was an important aspect determining mental health. The life span perspective suggests that being able to adapt, control and manipulate ones environment is central to successful ageing. Ryff argued that these theories suggest environmental mastery as an important facet of psychological well-being. Environmental mastery has also been defined more generally as the ability to manage everyday life (Ryan & Deci, 2001). A high score on the environmental mastery subscale indicates an ability to choose or adapt situations based on personal needs, with a low score relating to a difficulty in managing everyday affairs.

The next facet of psychological well-being is autonomy, which is a central tenet of the theories of Maslow, Rogers and Jung (Jung, 1933; Maslow, 1968; Rogers, 1980). Ryff's description of autonomy makes reference to societal norms and argues that individuals must make their own choices without giving in to pressures from society. However, this concept may be seen as relevant only in Western cultures where individualism is valued. Therefore autonomy can be defined as having the courage to follow an individual path. Using the subscale for autonomy, a high score would describe someone who makes their own choices regardless of societal pressures whereas a low scorer would be someone who conforms to social norms and relies upon the judgements of others. One of the themes across the two studies in this thesis is the consistency of associations between positive affect and health-related variables in England, a Western country in which individualism is favoured, and Japan, which is a more collectivist culture. This has allowed investigation of some of these issues surrounding the importance of autonomy on well-being.

Ryff's aspect of personal growth is the most similar to Aristotle's conception of eudaimonia, as it is directly concerned with self-realisation. This concept is therefore closely related to Maslow's theory of self-actualization. By definition, personal growth is a fluid process which will continue over the life course and may change according to alternate circumstances. This aspect is also related to other psychological constructs such as openness to experience (Schmutte & Ryff, 1997). Therefore personal growth

can be defined as feelings that one is moving towards desired outcomes. Using Ryff's scales of well-being, a high score is indicative of feelings that the self is growing and continuing to develop, with a low score depicting an inability to develop or change.

The final aspect of psychological well-being as described by Ryff is personal relations to others. This aspect was outlined in the description of the pursuit of a eudaimonic life by Aristotle, was seen as central to the self-actualizers described by Maslow and has been a central theme of development stage theories. Ryff outlines close relations with others as "criterial goods" to a well-lived life. Therefore, personal relations to others can be defined as having close social connections. A high score on Ryff's subscale would indicate someone capable of forming close attachments and having empathy with a low score describing someone with few close friends who is isolated. This component of psychological well-being is clearly allied with social networks and social support, themes that are discussed in section 3 of this chapter.

However, some theorists have suggested parallels between some of Ryff's subscales, such as environmental mastery, and other psychological constructs including self-efficacy and sense of control (van Dierendonck, 2004). Ryff has responded to these claims by arguing that environmental mastery is a separate condition due to its specific definition of the ability to surround oneself in an environment that suits personal needs and capacities. There have also been doubts raised over the six factor solution of Ryff's Psychological Well-being Scales with little empirical support for the factor loadings described by Ryff. For example, a 15 factor solution was found by Kafka & Kozma (2002) and when these authors forced a 6 factor solution, items did not load onto the subscales as described by Ryff, and this has been supported by others (e.g. Burns & Machin, 2009; Springer & Hauser, 2006). Recent evidence has also suggested that a hierarchical representation might present a better model fit (Abbott et al., 2006). This study used a UK birth cohort of women aged 52 to examine the latent structure and factorial validity of the Ryff scales using latent variable modelling. The 42-item version of the Ryff scale was used; two items were removed

from the personal growth subscale as they had both positive and negative wording, and one item was moved from the environmental mastery subscale to the relations to other subscales as factor loadings suggested a better fit. A single, second order factor solution presented the best fit for the data. This model included a general well-being factor which was comprised of four of the six subscales (environmental mastery, personal growth, purpose in life and self-acceptance), two distinct first orders factors comprising the other two subscales (relation to others and autonomy) and also two method factors. The findings from this study suggest that using a shortened form of the Ryff scales may not be an acceptable method due to the low factor loadings of many of the items.

In contrast to studies of subjective well-being, which have tended to show stability over life course and events, psychological well-being varies across the life span (Kwan, Love, Ryff, & Essex, 2003). Using the multidimensional measure of psychological well-being, it is possible to investigate whether an individual's conception of well-being varies across the life span, and also if there are specific variations between subscales (Ryan & Deci, 2001). Different age groups were found to hold similar views about close relationships and enjoyable activities as importance aspects of well-being, however differences were found on other facets. For example, older adults tended to focus more on positive coping, perhaps reflecting episodes of change in life circumstances, whilst younger adults were more focussed on self-evaluation and goals (Ryff, 1989). A number of other variations have also been identified, with higher levels of mastery amongst middle and older groups, older groups having less instance of personal growth, and middle groups reporting more autonomy compared to younger and older groups (Ryff, 1991).

1.2.3 Integration of the two perspectives?

The previous two sections have described the two areas of eudaimonic and hedonic well-being. Researchers in each field argue that these are separate constructs, and independent theoretical accounts are offered for each. However, it is also possible to investigate well-being for another perspective, that does not have an *a prioi* basis for how well-being is constructed. This alternative way to measure well-being is employed by Waterman and colleagues to compare hedonic and eudaimonic well-being (Waterman, 1993; Waterman, Schwartz, & Conti, 2008). Rather than defining a set of constructs that map eudaimonic well-being, this approach uses a more narrow definition using self-reported activities (Waterman et al, 2008). These are described as those that cause hedonic and eudaimonic experience, those that only induce hedonic experience and finally those that only induce eudaimonic experience (Waterman et al, 2008). These activities are assessed using a single scale measure, termed the Personally Expressive Activities Questionnaire (PEAQ). Participants are instructed to select 5 personally salient activities and then to rate these using six statements for hedonic well-being (for example “this activity gives me my greatest pleasure”) and six for eudaimonic well-being (for example “this activity gives me my strongest feeling that this is who I really am”). In addition, measures are included to assess intrinsic motivation behind tasks and also frequency and self-rated importance of each activity (Waterman, 2008). Using this measure, Waterman and colleagues have been able to compare hedonic and eudaimonic well-being.

In an extensive analysis of a large dataset from 3 different sites, results supported the notion that hedonic and eudaimonic well-being are related, yet distinct, constructs. Firstly, Waterman et al (2008) were able to demonstrate high correlations between the two types of well-being, as measured by each subscale. However, referring to the three types of activity outlined above, support for only two types of activity was found. The first are activities which support both hedonic and eudaimonic feelings and the second are activities which support hedonic but not eudaimonic

feelings. Therefore there is no research evidence to support the presence of a third activity type, those which promote eudaimonic but not hedonic well-being. Waterman et al also investigated intrinsic motivations behind the types of activities selected by participants as important. For hedonic activities, self-determination and interest were important factors but for those promoting both hedonic and eudaimonic well-being, self-realization, effort, importance, and challenges and skills were important.

The definition of hedonic well-being used by Waterman is in line with the original notion disputed by Aristotle, due to its focus on material possessions. However, this may no longer fit with the definition used by hedonic well-being researchers, who prefer a broader description based on positive and negative affect, and life satisfaction (e.g. Kahneman, 1999). In addition, given the discrepancy in measurement of eudaimonic well-being between the groups of Ryff and Waterman, care must be taken when generalising these findings to other studies of eudaimonic well-being. Therefore, whilst Waterman et al have found correlations with hedonic and eudaimonic factors, these may not be comparable to other studies which use different operational definitions of these terms. Further work in this area has supported the concept of two separate but related branches of well-being. Using a factor analytic technique, two correlated constructs of subjective well-being and psychological well-being were identified (Keyes, Shmotkin, & Ryff, 2002).

1.2.4 Positive and negative affect: polar opposites?

At first consideration, it may seem that positive affect (PA) and negative affect (NA) are two opposite ends of one continuum, however, there is much evidence to counter this (e.g Costa & McCrae, 1980; Watson & Clark, 1997; Zautra, Potter, & Reich, 1997). When considering this issue practically, it is possible to imagine being both high in negative and positive feelings over a period of time. For example, during a weekend, positive emotions may be high upon completing the working week on a

Friday evening. Positive feelings during the first leisure day may become lower due to particular commitments, with a rise again in the evening. By the end of the second leisure day, negative affect may be high as one is preparing for the working week ahead. Therefore, if positive and negative affect are measured at separate momentary incidences over the course of the weekend, both may yield a high score. If PA and NA were truly opposites, their scores should be negative correlated. Early analysis of PA and NA suggested that these were not polar opposites as only weak negative correlations, and separate factor solutions, were found (McNair & Lorr, 1964; Thayer, 1967), and this was supported using more modern scales such as the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988).

There are three issues that can be investigated when assessing the bipolarity of PA and NA. The first is the effect of measurement errors, which includes acquiescence, the tendency for individuals to agree with items regardless of their content and this has been shown to operate on affect scales (Bentler, 1969). Using advanced statistical methods, this has been replicated in a more recent study which suggested that the true correlation between PA and NA measures was strongly negative, although this was masked when using observed values (Green, Goldman, & Salovey, 1993). The second issue is differences in unit of time, as affect can be measured both using momentary sampling of specific incidences, or longitudinally over time. Differences between these two measurement types can be shown to affect the bipolarity argument. On the one hand, momentary sampling has supported evidence that PA and NA are bipolar opposites (e.g. Diener & Emmons, 1984) whereas other researchers have found that they are independent across different time formats (e.g. Watson et al., 1988). The third issue concerns the multidimensional nature of affect. As outlined above, positive affect can be studied using a range of operational definitions. Using the definition offered by Ryff, individuals are free to vary across six different domains of well-being, and therefore conceptualising a negative opposite for each of these does not appear desirable.

In an extensive analysis of positive and negative affect, it was concluded that a model of polarity offered the best fit of the data (Russell & Carroll, 1999). This conclusion suggests that happiness is the opposite of sadness, and that only one of these can be felt at any one time. Previously it has been argued that if positive and negative affect are opposites, then they should correlate to a figure approaching -1. Reported correlation coefficients, however, tend to be somewhat weaker than this, often around -0.4. Russell & Carroll (1999) argued that in conceptualising PA and NA as polar opposites, the issue of mutual exclusivity should be considered, so that happiness precludes sadness and vice versa. This model of mutual exclusivity would be demonstrated by weaker correlation coefficients, and therefore Russell & Carroll suggested that this provided support for their model. However, previous evidence found that at moderate level, PA and NA co-existed (Diener & Iran-Nejad, 1986). After experiencing graduation, moving out of college dormitory or watching an emotional film, Larsen and colleagues found that participants were likely to experience both positive and negative emotion (Larsen, McGraw, & Cacioppo, 2001). However, after more stable circumstances, Larsen e al (2001) found support for the circumplex model of Russell & Carroll (1999). Larsen et al (2001) concluded that whilst PA and NA could be conceptualised as mutually exclusive, their underlying mechanisms may be better defined as bivariate processes, and other authors argue that they are independent variables (e.g. Rafaeli & Revelle, 2006). The issue of whether PA and NA are separate or distinct constructs can also be examined using evidence from biological studies, and these shall be discussed in Chapter 3.

1.2.5 Measurement of positive well-being

Traditionally, measurement of emotion has tended to use retrospective self-report data, including recall of both qualitative and quantitative information related to moods over a certain time period. A wealth of standardised scales is available to

measure both positive and negative well-being retrospectively, including the Positive and Negative Affect Scale (PANAS; Watson et al 1988) and the Scales of Psychological Well-being (Ryff & Keyes, 1995).

Standardised psychometric scales measuring positive well-being use global assessments of well-being, in which people are typically asked to rate their affective state over the last week or month. These scales provide a practical choice for both researchers and participants; they are easy to complete and administer, have good reliability and validity and are economical in terms of time and budget (Baker & Brandon, 1990; Stone, Shiffman, & DeVries, 1999). However, there have also been a number of criticisms of these scales. Focussing illusion refers to the framing of questionnaire responses by specific associations, and therefore may not be an accurate reflection of their feelings over the time period specified. This concept was demonstrated in an interesting study, where one group of students were asked “how satisfied are you with your life in general” followed by another question “how many dates have you had in the past month” (Strack, Martin, & Schwarz, 1988). The correlation between these two questions was not significant, indicating that there was no relationship between the two measures. However, when the questions were presented in the alternative order, the two items had a high positive correlation, so that people who had had more dates rated their life satisfaction as higher (Strack et al, 1988). This finding has been replicated using questions about marriage (Schwarz, Strack, & Mai, 1991) and health (Smith & Schwarz, 1988). There are two further criticisms of the use of retrospective, self-report scales. Firstly, participants may not accurately remember how they have been feeling over the designated time period even despite their best efforts to remember, which can lead to memory loss or distortion (Stone & Broderick, 2007). Secondly, memory has been shown to be selective, both in terms of storage and retrieval, and cognitive theory has demonstrated that negative events are more likely to be remembered than positive events when one is in a bad mood (Kihlstrom, Eich, Sandbrand, & Tobias, 1999).

In recent years a new methodology has been developed and is now used extensively in both psychological and physiological research, namely the use of ecological momentary assessment (EMA). The experience sampling method (ESM) was first devised by Csikszentmihalyi and colleagues (Csikszentmihalyi & Larson, 1987) as an assessment tool making use of momentary markers of behaviours and emotions. The ESM has since been updated and termed ecological momentary assessment (EMA; Stone & Shiffman, 1994). EMA questions ask participants to think about how they are feeling at a specific moment in time, an example of an EMA question is "On a scale of 1 to 5, please rate how happy you are at this moment". There are three important ways in which EMA differs from standardised self-report measures. Unlike retrospective reports of feelings as used in standardised scales, EMA requires participants only to think about how they are feeling now, which reduces the impact of recall bias and other cognitive errors (Gorin & Stone, 2001). EMA measures are very convenient for participants, taking place during their normal day to day lives thereby maximising ecological validity (Stone & Shiffman, 1994). Finally, EMA makes use of a series of assessments made over a set period of time. These individual assessments can then be aggregated to provide an average over a day, weekend or any other period.

There are a number of advantages of the EMA approach. Use of the repeated sampling approach allows comparisons to be made at both a within- and between-subjects level. This in direct contrast to the use of standardised scales, which typically are administered at one time point only. However, EMA can also be used at the between-subject level, for instance to investigate differences between healthy and unhealthy groups. EMA reports can be used to examine diurnal effects on mood; for example, it may be hypothesized that participants would be happier in the evening compared to the morning on a working day, and this could be tested using an EMA design. Therefore EMA is useful for testing both state and trait aspects of mood. Despite these benefits, there are also some limitations. Repeated sampling significantly

increases participant burden and this must be taken into account when designing EMA questions, for instance by reducing the numbers of items or the sampling schedule. By keeping statements brief, researchers can reduce the impact of EMA sampling procedures. There is some concern that asking participants to rate how they are feeling at repeated intervals could impact on their perception of their experiences (Gorin & Stone, 2001). EMA also presents challenges for researchers, including the abundance of data to manage for each participant and how this can best be utilised for data analysis.

In response to some of the limitations of ESM and EMA measures, Kahneman and colleagues devised the Day Reconstruction Method (DRM; Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004). For this method, participants recreate the sequence of events for their previous day in a diary format. This diary is shaped by a series of episodes, which are defined as separate activities such as exercise, preparing food or commuting. Respondents then describe each episode by answering a set of questions about the setting and their subjective experience of it. This method is designed to reduce cognitive biases and recall errors inherent in standardised retrospective reports and has a number of advantages over ESM methods. The DRM reduces participant burden as reports are completed at a single sitting at the end of the sampling period. Therefore, participants are not disrupted during their daily activities, and the testing procedure does not impact on their experiences during each episode. The DRM does not miss out on rare events which may not be captured using ESM methods, and finally time budget information can be gathered reflecting how participants choose to spend their time (Kahneman et al, 2004). Time budget studies provide information about how people use their time and the frequency and intensity of affective states. This allows researchers to measure the quality and duration of people's experiences in their daily life. However, there are also some limitations involved with the DRM methodology. Compared to a self-report measure of affect, the DRM requires significantly more effort and time from participants. If used as part of a

larger research methodology, completion of the DRM may be too time consuming and the use of DRM may not be practical in large scale surveys. Use of the DRM in research to date has been limited, with few studies reporting findings using these methods. This makes it difficult to assess the merits and limitations of this new research methodology.

Therefore various measures have been developed to measure positive well-being, including retrospective and momentary sampling methods. Each of these methods has advantages and limitations for both researchers and participants, which must be considered when selecting measures for inclusion and also when assessing study limitations. This thesis will allow for the assessment of the benefits of both retrospective and momentary assessment, including a comparison between positive well-being as measured by traditional retrospective scales, event momentary assessment and also day reconstruction method. Previous studies in this area have mostly taken place with Western samples particularly in the UK and USA. The work presented in this thesis will be able to extend this work by including a Japanese sample, to examine the influence of cultural factors. The majority of literature investigating positive well-being has tended to focus on one particular aspect, such as hedonic well-being. The three studies in this thesis will investigate different aspects of positive well-being including life satisfaction, eudaimonic well-being and momentary measurements of positive affect. Examining the correlations between these will further understanding of how different aspects of positive well-being may be related.

1.2.6 Positive well-being and health

In recent years, there has been increasing evidence of an association between positive well-being and health. This is a new research area; it has been reported that up to 20 times more studies have been published on the relationship between negative affect and health than positive affect (Pressman & Cohen, 2005). However, research

has shown that positive affective states are related to more positive health outcomes across a number of measures. This section will review the literature examining the relationship between positive well-being and health using epidemiological, laboratory and naturalistic studies. The biological and behavioural pathways which may be important in this relationship will also be discussed.

A systematic review found differential effects for state and trait measures of positive well-being on health, but concluded that positive well-being was generally associated with more favourable health outcomes (Pressman & Cohen, 2005). In morbidity studies, higher positive affect was related to better health across a range of outcomes including stroke, common cold and accidents. The evidence relating positive affect with survival was inconsistent and no conclusions about an effect could be drawn. General outcomes such as asthma and irritable bowel syndrome were lower in those with higher positive affect, and self-rated health measured by symptom reporting and pain level were also lower with higher positive affect. Taken together, the findings of this systematic review suggest that positive affect is associated with a more favourable health profile across a range of measures. However, there were differences reported between laboratory, experimental and ambulatory studies. Laboratory studies may involve shorter, more intense periods of positive affect that are not directly comparable to the experience of positive affect in real-life. This may mean that relationships between affect and health outcomes in the laboratory are magnified. This theory is supported as the relationship between pulmonary function in the laboratory and in real-life studies is more comparable when studying extreme positive affect. Further, effects are comparable when studying more moderate states of affect in the laboratory such as calmness and contentment.

This review highlighted that there are considerable methodological and conceptual problems within this literature which must be taken into account when analysing the relationship between positive affect and health. As outlined above, there are wide variations regarding the conceptualisation and operational definition of

positive affect, which cause problems in attempting to identify when positive affect is beneficial for health. This review focussed on articles examining positive affect, and avoided studies employing more general positive psychological constructs such as resilience and vigour, and those which used cognitive measures of well-being such as life satisfaction. In addition, Pressman & Cohen (2005) did not report the effects of covariates other than negative affect throughout their review. Therefore, the potential confounding effects of socio-economic status, age or gender were not examined. However, this review does provide preliminary evidence suggesting that trait and state positive affect can be beneficial for health, that their effects are independent of negative affect, and also that state and trait positive affect have differential relations with health outcomes.

A later meta-analytical review paper investigated links between positive well-being and health and focussed on studies measuring subjective well-being (Howell, Kern, & Lyubomirsky, 2007). Studies were included in this review if they used ambulatory, experimental or longitudinal designs and if they used a true health outcome measure rather than an indicator such as physical activity or self-report health status. Therefore this review excluded many of the studies that were included by Pressman & Cohen (2005). The final number of studies used in this review was 212. Effect sizes showed a protective effect for well-being on health, which varied between study design. Ambulatory studies reported significantly lower effect sizes compared with longitudinal and experimental. Laboratory studies may involve shorter, more intense periods of positive affect that are not directly comparable to the experience of positive affect in real-life. This may mean that relationships between affect and health outcomes in the laboratory are magnified. This theory is supported as the relationship between pulmonary function in the laboratory and in real-life studies is more comparable when studying extreme positive affect. Further, effects are comparable when studying more moderate states of affect in the laboratory such as calmness and contentment. Well-being was also positively related to short-term outcome, long-term

outcomes and disease control. In terms of specific disease markers, well-being was related to improved immune functioning, higher pain tolerance and decreased endocrine system response however there was no relation with cardiovascular reactivity. Short term outcomes were found to be related to state measures whereas longer term outcomes were related to trait measures. This review adds some interesting evidence to that of Pressman and Cohen by reviewing specific effects of subjective well-being, and also by the exclusion of cross-sectional studies. However, it also fails to assess any relationship between eudaimonic measures of well-being and health outcome. This review was not able to control for the effects of negative affect on health and therefore conclusion cannot be drawn about the independence of reported relationships.

A more recent paper meta-analysed studies relating positive well-being with mortality (Chida & Steptoe, 2008). This review examined studies using initially healthy populations and disease populations and therefore was able to examine separate effects in these two groups. The results of this meta-analysis are presented in figure 1.1. Overall, the meta-analysis found that positive psychological well-being demonstrated a significant protective effect on mortality, with 51% of studies in the healthy population finding this effect and 31% in the disease population. Studies with older samples in the healthy population showed a stronger protective effect for positive well-being than the overall effect for this group. This review also compared studies which controlled for baseline negative affect, and reported that the protective effect of positive well-being remained significant in both the healthy and disease populations. In the comparison of state and trait-like measures of well-being, no marked differences were found in their protective effects on mortality. In the disease population, a protective effect for positive well-being was found for patients with renal failure and HIV, but not for cardiovascular disease or cancer. However, in the healthy group, protective effects were found for mortality from all-causes and also cardiovascular causes. This meta-analysis paper presented the first quantitative review of papers

linking positive well-being and mortality and has a number of strengths. The studies included in the meta-analysis were subject to strict exclusion criteria, including only using direct evaluations of positive measures and not using reversed indicators such as hopelessness/hopefulness, not using studies with death caused by injury, accident or suicide, and only including studies with a follow-up period of more than one year. Each study was allocated a quality score, the average score for healthy populations was 2.81 and for disease populations was 2.11, from a maximum of 4, indicating that studies were of a good quality based on recruitment, explanatory variables, outcome variables and covariates. The review was able to categorise studies investigating trait and state like measures of positive well-being, enabling conclusions to be drawn about the separate effects of these two measures.

The study was also able to investigate the contribution of baseline negative affect, therefore further disentangling the issue of positive and negative affect and how these two concepts are related to health outcomes. However, there are also a number of limitations which must be taken into account. This review was focussed only on prospective studies and therefore does not provide evidence from cross-sectional studies, which could provide further important findings. All research papers published have a tendency to report positive results, a concept known as publication bias. Although this study did find some evidence of null results, it is highly likely that many more null results have been found but not accepted for publication. The review also focussed primarily on hedonic type measures of well-being and neglected eudaimonic measures of well-being. This review provides evidence that protective psychosocial factors may have an important effect on mortality. However, it is important to note that this effect was only found in half of the studies reviewed.

The review papers outlined above all tend to focus on the relationship between hedonic definitions of well-being to the deficit of the eudaimonic conceptualisation of well-being. At present the relationship between eudaimonic measures of well-being and health are not known. This thesis will allow investigation of links between

eudaimonic well-being and biological markers of health, and also behavioural factors such as physical activity and smoking. In general, a protective effect has been identified, indicating that higher levels of positive well-being are associated with improved health outcomes and reduced mortality. However, identification of the pathways which may mediate this effect is needed, including both biological and behavioural measures.

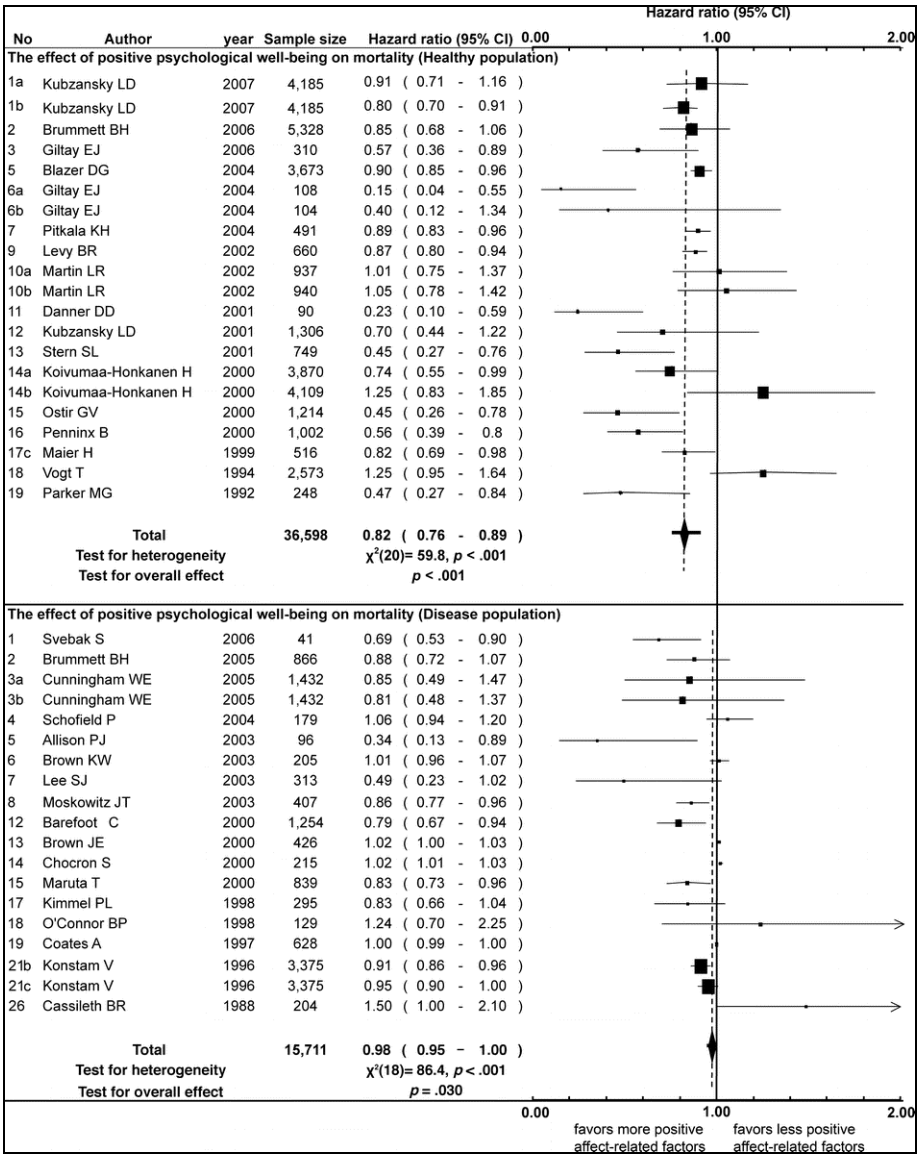


FIGURE 1.1 META-ANALYSIS POSITIVE WELL-BEING AND MORTALITY

1.3 Social support

Social relationships are another factor which can protect people from the adverse effects of stress upon health. There is a considerable literature relating positive social support with positive health outcomes, across a range of illnesses. Within this research there is a consensus that social support is associated with lower mortality from cardiovascular disease, cancer and other diseases. This section of the literature review will present evidence of this link from epidemiological, laboratory and naturalistic studies. A following section will then review the pathways which may mediate the link between social support and health.

There are many ways of methodologically defining social support, however, a major distinction that has been made is between structural and functional support (Tomaka, Thompson, & Palacios, 2006; Uchino, Cacioppo, & Kiecolt-Glaser, 1996; Wills & Fegan, 2001). Structural support refers to the numbers of people involved in a social network whereas functional support refers to the quality of the available support. Functional support can include a range of different areas such as emotional support and practical support, so an individual may have adequate support in some functional areas but not in others. These two main branches of social support may each exert their effects on health through different mechanisms, so that structural support is protective of some aspects and functional support is protective of other aspects (Wills & Fegan, 2001).

1.3.1 Structural social support

Structural social support is concerned with the extent to which individuals are integrated in their social network and can be studied by measuring the numbers of network members, and the degree to which individuals are connected within this network. The original concept of structural social support stems from Durkheim's sociological theory of suicide, which argued that rates of suicide were increased

amongst more socially isolated and unmarried individuals (Durkeim, 1951). This theory suggested that an important factor in explaining suicide was poor social ties, which consist of two factors. The first factor is attachment to other individuals in society, termed social integration, and the second factor is attachment to society's norms, termed social regulation. Durkheim's theory argued that there were four types of suicide, each defined by different levels of social integration and social regulation. Despite some criticisms, these theories have endured and have since been expanded to incorporate more modern aspects of social support which argue that structure, norms and purpose in life are influenced by our social connections (Stryker & Burke, 2000).

In the past thirty years since social networks were proposed as a critical factor for health outcomes, various measures have been introduced to study network size. Social network theory was proposed to analyse social ties that did not fall across traditional groups such as communities or families (Barnes, 1954; Bolt, 1957). This theory uses network analysis to assess the structure and function of groups. Berkman et al (2000) suggested a number of ways in which social networks can be measured including size (number of network members), density (degree to which different members of the network are connected), boundedness (extent to which the network is defined by traditional roles such as family or work) and homogeneity (extent to which individuals within a network are similar). Further, characteristics of social networks can also be studied such as frequency of contact, duration and intimacy. Berkman et al (2000) suggested that social networks must be studied with reference to larger social groups and cultural context for a fuller understanding of the protective effects of structural types of social support to be reached.

Studying the role of social support from a purely structural perspective does not allow for investigation into why some relations with health are negative. For example, increased network size may be related to increased likelihood of engaging in certain risky behaviours such as drug taking and not practising safe sex (Berkman et al, 2000).

Further, social relationships can often be accompanied by periods of conflict which are stressful for the individuals involved. Numbers of problematic social relationships was found to be related to decreased psychological well-being in a sample of elderly women (Rook, 1984) suggesting that measures of social networks should include a marker for numbers of conflict relationships (Brissette, Cohen, & Seeman, 2000). Another limitation of structural measures of support is that most measures do not weight certain relationships, such as having a marital or marital-type partner, as being more important than others, such as sibling relationships. Evidence suggests that certain relationships are more relevant for health than others (Norton, 2002; Styker, 1987). Further, it is important to consider that social relationships may not always be beneficial. For example, negative marital partnerships have been associated with increased poor health outcomes (e.g.Kiecolt-Glaser & Newton, 2001). Negative social interactions have also been linked with increased psychological distress (Lakey & Cohen, 2000).

1.3.2 Functional social support

Functional social support refers to the different types of support available to individuals and includes emotional support, tangible support, appraisal support and belonging support (Barrera, 2000; Lett et al., 2005). Emotional support involves having someone to provide affection, care and concern. Appraisal support involves having access to important feedback and information helpful to recognize and identify solutions to problems that have been encountered. Tangible support is practical and instrumental help in situations of need and belonging support refers to being part of a group and sharing values and interests.

A further distinction that is made within functional social support refers to perceived and received support. Perceived social support refers to an individual's subjective belief about how much support they have available whereas received

support is an objective measure based on how much support they actually receive (Lett et al, 2005). Received social support is thought to be a more accurate social support measure (Barrera, 1986) and this has been supported by empirical studies (e.g. Cohen, 2005), whereas perceived social support is subjective and may be affected by individual differences in memory, perception and judgment (Lakey & Drew, 1997) or value judgments (Sarason, Sarason, & Pierce, 1995). Some types of social support may not be noticed, for example one study of couples found higher well-being in partners with high levels of received support even when certain types of support were not reported (Bolger, Zuckerman, & Kessler, 2000). Individual differences may also affect the need or desire for social support, such as personality factors and need for autonomy (Deci & Ryan, 1985). Received social support has been related to lower reporting of symptomatology (Krause, Sternberg, Lottes, & Maides, 1997) and increased coping with natural disasters (Norris & Kaniasty, 1996). However, there have also been conflicting results (e.g. Helgeson, 1993). Little research to date has investigated the links between received and perceived social support (Wills & Shinar, 2000). The stress and coping theory of social support (Lakey & Cohen, 2000) argues that there should be a high correlation between received and perceived social support, particularly when the needs of situations match support available (Cutrona & Russell, 1990). However, a recent meta-analysis comparing received and perceived social support found that received support only explained 10-15% of the variance in measures of perceived support. This finding clearly suggests that other factors are involved in explaining the constituents of perceived social support. The relationship between received and perceived social support was also found to vary between study samples, including age and gender (Haber, Cohen, Lucas, & Baltes, 2007).

1.3.3 Methodological distinctions

There are also a variety of statistical issues when studying links between social support and health. The main two areas here involve the main effects model and the buffering model. If social support is viewed as a main effect then positive effects will be present across all stress levels. The buffering model however suggests that the effects will be greater for those with higher stress levels (Wills & Fegan, 2001). The two models are presented visually in figure 1.2, based on Cohen & Wills (1985).

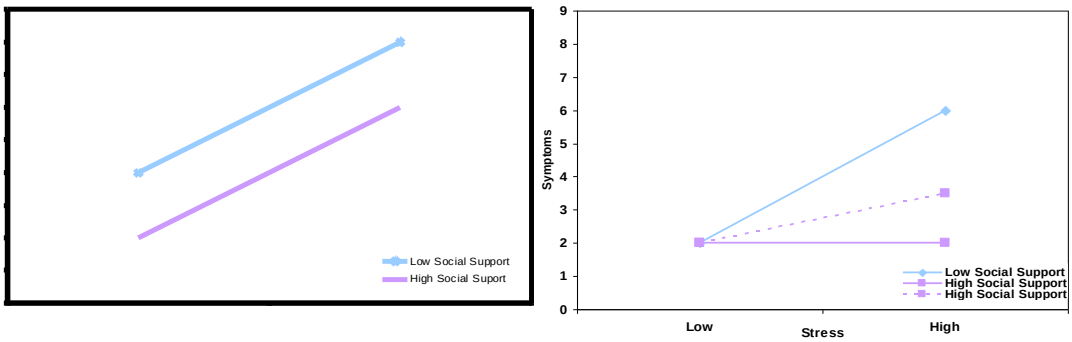


FIGURE 1.2 LEFT SIDE OF FIGURE SHOWS THE MAIN EFFECTS MODEL OF SOCIAL SUPPORT, RIGHT SIDE SHOWS BUFFERING MODEL OF SOCIAL SUPPORT.

1.3.3.1 Buffering hypothesis

The stress buffering hypothesis argues that psychosocial stressors will have more negative effects for those with low or negative social support compared to those with high or positive social support, whereas in situations of non-stress, there will be no marked differences between the two groups (Cohen & McKay, 1984). This theory is based on the transactional model of stress and coping, which argued that stress occurs when an individual appraises an event as stressful and does not have appropriate coping strategies to deal effectively with that stress (Lazarus, 1966). Two cognitive appraisal processes are important aspects of this theory, the primary appraisal refers to the evaluation of the situation as stressful, and the secondary appraisal refers to the evaluation of available coping resources. Negative appraisals at both levels increase

emotional distress (Lazarus & Folkman, 1984). The stress buffering hypothesis of social support argues that the presence of support increases the resources available to individuals at times of stress and therefore reduces the negative impact of that stress (Cohen & Wills, 1985). Social support is thought to affect both appraisal judgments.

There is extensive evidence supporting the stress buffering hypothesis in relation to a range of outcomes including relevant to health, for example disease severity, and other areas such as job strain and financial stress (see section 1.3.4; Cohen & Wills, 1985; Kawachi & Berkman, 2001; Wills & Fegan, 2001) and the pathways which may explain this link will be reviewed in Chapter 3. The buffering effect can also be demonstrated in prospective studies with healthy samples. One study followed a group of initially healthy participants, measuring number of stressful life events and perceived emotional support at baseline. At follow up, there was a significant difference in mortality between those with high stressful life events; participants with low social support were more likely to die by follow up compared to those with high social support. Amongst those participants with low stressful life events, there was no difference in mortality at follow up. This study therefore demonstrates that in times of stress, higher levels of social support are protective, whereas in times of low stress, there is no difference between high and low levels of support (Rosengren, Orth-Gomer, Wedel, & Wilhelmsen, 1993). Different types of social support may have differential effects dependent on the type of stressful event encountered (Cohen & McKay, 1984; Norton, 2002) and the quality of social relationships (Styker, 1987). Other factors such as personality may play a role in determining the buffering effect of social support by influencing an individual's interaction with social ties, and can also affect perceptions of the quality of social interactions (Cohen, Sherrod, & Clark, 1986; Pierce, Lakey, Sarason, Sarason, & Joseph, 1997). Factors around the stressor may also alter the buffering impact of social support, for example a long term illness or other chronic stressor may deplete available social support (Johnson, 1991; Lepore, Evans, & Palsane, 1991).

1.3.3.2 Main effects model

The main effects model of health, in contrast to the buffering hypothesis, argues that social support is protective regardless of the level of stressful life events. This model is closely associated with the study of social integration and social isolation. Social integration, measured through structural social support, is associated with increased access to others and there is increased likelihood for individuals to be influenced towards normative, health protective, behaviours (Umberson, 1987). Social integration may also lead to an increased feeling of responsibility to take care of oneself by, for example, engaging in healthy behaviours (Cohen, 2004). However, social integration may not always foster protective behaviours, there is some evidence that social integration is associated with increased performance of risky behaviours (Christakis & Fowler, 2008; Rook, 1984). The main effects model argues that social isolation, on the other hand, is directly damaging to well-being and health, and this has been supported by considerable research evidence (House et al., 1988).

The main effects model also argues that being socially integrated leads to beneficial effects through self-esteem, sense of identity and existential purpose, which in turn affect health and well-being through altering the neuroendocrine stress response and also increasing desire to take care of oneself (Kawachi & Berkman, 2001). Social integration may also be associated with other protective factors, such as increased positive affect and reduced negative affect (Cohen, 1988), and increased access to information and resources from social network members (Berkman, 1985). Therefore the main effects model argues that increased social integration is beneficial for both physical and mental health through a number of different pathways. However, research investigating the effects of self-esteem and sense of identity is limited (Cohen, 1988). Studies of social integration have been criticised for using crude measurement scales which view social networks as unidimensional (Glass, Mendes de Leon, Seeman, & Berkman, 1997) and it has been suggested that more refined measures are used (Berkman, 1986). The main effects model proposes that as social support

increase, positive benefits of health will increase. However, there is some evidence that beyond a minimum level, increases in social integration are not beneficial for health (House, Robbins & Metzner, 1982).

1.3.4 Review of social support literature

Social support has been conceptualised as structural support or functional support and measured using the stress buffering hypothesis or the main effects model and there is research evidence to support each theoretical aspect. Comparing the efficacy of support using a main effect versus buffering effect of social support is challenging as it is linked to the type of measure of social support used by the researcher. For example, the buffering model tends to have the strongest support when using functional measures of social support, for example practical or emotional support, whereas the main effects model has stronger support when using structural measures of support, such as number of network members. This suggests that the theoretical differences in how social support influences health may be rooted in the methodological distinctions of researchers. The two models are both valid but it is difficult to compare the efficacy of the two models, due to the differences in methodology used.

How to integrate these different theories in order to formulate a conceptual framework is important for a fuller understanding of the link between social support and health. Berkman & Glass (2000) have suggested that social support must be studied within the context of a more general social context. They suggest that the influence of social integration on health should be studied at four levels: macrosocial, which combines culture, socio-economic factors, politics and social change; mezzo, which includes social network structure and characteristics of social networks; micro level factors, which is the functional aspects of social support and also social engagement, and finally the model also includes potential pathways which may explain the link

between social integration and health. Other researchers suggest that it is necessary to further investigate links between the two theoretical perspectives, to measure how one is related to the other, and how stress buffering and main effects may affect each other (Uchino, 2004).

1.3.5 Social support and health

Social support could affect health outcomes by protecting from disease onset, slowing disease course or aiding recovery from illness. It is possible that different types of social support can affect health at different time points. There are also various mechanisms by which social support can be protective against ill health. These include biological, such as through increased immune responsivity, behavioural, such as increases in adherence to medication and cognitive, such as appraising an event as less stressful. Structural and functional measures of social support may show different effects on these pathways. Often the relationship found between social support and health is independent of gender, age, socioeconomic factors and also traditional risk factors such as diabetes (House et al., 1988).

Research linking both structural and functional measures of social support has reliably identified a protective effect for health. A review of early studies demonstrates that links between social support and health have been identified for some time. In the 1970s two review articles described reliable evidence that lower social support was associated with increased mortality (Cassel, 1976, 1995; Cobb, 1976). The papers reviewed by Cassell (1976) and Cobb (1976) covered a wide range of samples and illnesses and therefore it was concluded that the relationship was robust and causal. However, these reviews were not able to answer questions about the nature of the relationship between social support and health, and it was argued that the issue of indirect or direct causation should be taken into account.

Social support has been found to be protective across a wide range of health outcomes such as reduced complications from childbirth (Collins, Dunkel-Schetter, Lobel, & Scrimshaw, 1993) to improved management of chronic conditions such as diabetes (Marteau, Bloch, & Baum, 1987). Social support is also related to improved recovery after illness and is associated with lower morbidity amongst patients suffering from chronic conditions including cardiovascular disease, rheumatoid arthritis and stroke (Berkman et al., 1992; Ikeda et al., 2008; Kulik & Mahler, 1993; Morris, Yelin, Wong, & Katz, 2008). In addition, social support can also reduce the negative psychological effects of ill-health and improve coping after acute and chronic illness (Cohen & Wills, 1985; Kawachi & Berkman, 2001).

An early prospective study followed up a large number of US residents and measured four types of social support; marriage, close family and friends, attending church and group membership. This study also controlled for the effects of initial health status, socioeconomic status, health behaviours and a number of other factors. Mortality across a 9 year follow-up period was predicted by combined social network, with those having a larger network being less likely to die (Berkman & Syme, 1979). Evidence from the Alameda County Study (Berkman & Glass, 2000) suggests that this may in part be due to a difference in performance of healthy behaviours. Having a smaller social network was associated with increased risky health behaviours for both men and women. A later study was able to control for biological risk factors at baseline including blood pressure and cholesterol, and also found an inverse relationship between functional measures of social support and mortality (House, 1981). These findings were also replicated in the Evans County Sample over an 11year follow-up using social network as an index of social support (Schoenbach, Kaplan, Fredman, & Kleinbaum, 1986) and in two Scandinavian studies (Orth-Gomer & Johnson, 1987; Welin, Wilhelmsen, Svardsudd, Larsson, & Tibblin, 1985). A review of these studies concluded that there was a consistent pattern of results linking lower social support with higher all-cause mortality (House et al., 1988). House et al (1988) proposed that

social support should be conceptualised into two structures, social integration and social network structure. Further, House et al (1988) suggested that three main social processes should also be studied: Social support; relational demands and conflicts, and social regulation/control. However, variations were also found between ethnicity, sex and rural or urban location. Social support was associated with increased survival in patients with acute myelogenous leukaemia (Pinquart, Hoffken, Silbereisen, & Wedding, 2007).

A detailed review paper (Uchino et al., 1996) found consistent links in cross-sectional studies between social support and functioning of the cardiovascular, immune and endocrine systems, using meta-analytic techniques. Studies were divided into those that measured structural and functional social support but no differences were found in effect size between the two. Of the studies which failed to find links between social support and health, most used measures of job-related social support in contrast to the more standard measures of social networks and this could be responsible for the differences in findings. This review also analysed the effects of prospective interventions designed to increase social support on cardiovascular responses. Interventions included participation in activity groups (Arnetz, Theorell, Levi, Kallner, & Eneroth, 1983) and group discussion (Andersson, 1985; Gill, Veigl, Shuster, & Notelovitz, 1984). Of the six studies reviewed, four found that the intervention impacted positively on cardiovascular measure, one had no increase on social support and one found no relationship. Finally, prospective intervention studies with hypertensive patients were reviewed and it was concluded that increasing social support reduced cardiovascular responses.

Another review paper investigating the link between social support and coronary heart disease incidence and development compared 8 studies of between 4 and 15 years follow up, with an average sample size of 10 273 patients (Lett et al, 2005). Lower social support was associated with increased risk of CHD both among those with good health at baseline and those with CHD at baseline. Lett el al (2005)

also argued that these studies showed high levels of variability in the methods used to measure social support and also that few of the studies compared different measures of social support. Therefore, conclusions could not be drawn about which types of social support may be most relevant for CHD. This review also found limited evidence that increasing social support had a protective effect against CHD. These findings have been supported by other similar review papers (e.g. Hemingway & Marmot, 1999; Uchino, 2004). Further evidence suggests that other psychological aspects may be important in determining the protective effect of social support. For example, Lett et al (2007) showed that high levels of social support were associated with non-fatal prognosis after myocardial infarction, but only for patients with low levels of depression.

Therefore links have been consistently demonstrated between social support and health, across a range of study designs and samples. However, it must also be considered that social support can have negative effects of health. Larger social networks can increase opportunities for spread of disease and increase exposure to stressful situations, due to greater interaction with greater numbers of people (Cohen, 2004). Infection with common cold virus was more than twice as likely in individuals undergoing a period of long term social conflict (Cohen et al., 1998). Social networks can also increase ill health by promoting risky health behaviours, such as drug taking and drinking large quantities of alcohol. Additionally, a lack of social support or an increase in conflicts within social networks can lead to negative physiological changes (e.g. Herbert & Cohen, 1993; Lepore, 1992; Nealey-Moore, Smith, Uchino, Hawkins, & Olson-Cerny, 2007).

The protective effects of social support can also be studied from the perspective of specific social relationships, such as marriage. Marriage is the central relationship for the majority of adults, and has been consistently linked with lower morbidity and mortality across a range of acute and chronic conditions (Chandra, Szklo, Goldberg, & Tonascia, 1983; Goodwin, Hunt, Key, & Samet, 1987; Gordon & Rosenthal, 1995). Married people enjoy better physical and mental health compared to their non-married

peers, however, this relationship is stronger for men than women (Berkman & Breslow, 1983). One study has reported that nonmarried women have 50% greater mortality, whereas for men this increased to 250% (Ross, Mirowsky, & Goldsteen, 1990). Additionally, divorce or becoming widowed have increased detrimental effects for husbands compared to wives (House et al, 1988). However, marriage is not always harmonious and the effects of a conflictory marriage confer more negative effects than not being married at all (Glenn & Weaver, 1981). Marital strain and disruption have been associated with a range of illnesses, risk factors and impaired prognosis (Baker et al., 2000; Orth-Gomer et al., 2000).

This research clearly demonstrates a protective effect of social support on health. However, studies have often found inconsistencies with regard to the mediating effects of age, gender and other socioeconomic factors. Additionally studies which compare both structural and functional measures of support are rare and further research in this area is needed (Wills & Fegan, 2001). Further investigation of the pathways which mediate the relationship between social support and health will be able to inform interventions for a range of groups and potentially will have important consequences for recovery and incidence. This thesis will examine relationships between social support and health-related biology and behaviour. Chapter 8 will also be able to include cultural factors in the analysis by comparing relationships in a UK and a Japanese sample. This is in contrast to previous work that has focussed on Western samples.

1.4. Optimism

This chapter has reviewed literature relating to positive well-being and social support, and how these factors may be related to health. The final psychosocial factor that will be studied within this thesis is optimism. Optimism refers to expectancies regarding future events, with optimistic people tending to hold more positive beliefs

about the outcomes of these events. Optimism contributes to a favourable profile of psychological well-being, but differs from positive affect due to the focus on future outcomes. Dispositional optimism refers to the types of outcome expectancies people hold about certain activities. For example, when applying for a job, some people can be thought of as optimistic about the outcome such as imagining themselves as successful, whereas others will hold a more pessimistic attitude such as imagining they will not even be successful in securing an interview for the job. Dispositional optimism describes these types of outcomes expectancy and can be thought of as "expectancies on the part of the person that good, as opposed to bad, outcomes will generally occur when confronting problems in life" (Scheier et al., 1989, page 2). Outcome expectancies lead behavioural and affective consequences. The behavioural consequences of positive outcome expectancies are prolonged striving for the desired outcome, whereas for negative outcome expectancies behavioural consequences involve giving up and turning away (Scheier & Carver, 1985). There are also affective consequences, with those who believe their desired goals are achievable demonstrating positive affect but those with unfavourable outcome expectancies demonstrating negative affect (Scheier & Carver, 1992).

Scheier and colleagues (1985) developed the Life Orientation Test (LOT) to measure dispositional optimism with items such as "I'm always optimistic about my future". Early studies found that optimism was positively related to measures of subjective well-being. For example, women with higher optimism scores has lower depression 3 weeks after giving birth (Carver & Gaines, 1987). Patients undergoing coronary artery bypass graft were happier, felt greater relief and had a higher quality of life after surgery if they had higher optimism scores pre-surgery (Scheier et al, 1989) and this was confirmed in a follow up of the same sample. However, the construction and validity of this scale has been questioned (e.g. Andersson, 1996). Some researchers have suggested that the LOT should be analysed as a two factor measure, tapping optimism and pessimism (Chang, D'Zurilla, & Maydeu-Olivares, 1994). This

has been supported by the finding that pessimism was related to neuroticism and negative affect, whereas optimism was related to extraversion and positive affect (Marshall, Wortman, Kusulas, Hervig, & Vickers, 1992). A meta-analysis found a strong correlation between LOT and coping, somatic symptoms and negative affect, with the strongest relationship being between LOT and negative affect (Andersson, 1998). However, this review paper does not discuss in detail the types of coping that have been associated with the LOT and therefore it is difficult to consider this relationship in depth. This suggests that LOT shares a significant proportion of variance with measures of negative affect and may be measuring the same underlying concept. However, the author of this meta-analysis concluded that the LOT could be refined to more adequately separate optimism and pessimism from negative affect. The original authors of the LOT have since devised the LOT-R (revised version) which includes only future-oriented items (Scheier, Carver, & Bridges, 1994), however, use of the original scale is still common as it has been subject to extensive empirical testing (Reilley, Geers, Lindsay, Deronde, & Dember, 2005).

Optimism has also been conceptualised in other ways, for instance, explanatory style was developed as an individual difference construct from the Reformulated Learned Helplessness Theory (Abramson, Seligman, & Teasdale, 1978). An individual's explanatory style refers to the ways people habitually explain life events. An optimist faced with a negative event will explain this using external (it was someone else's fault), unstable (it won't happen again) and specific (it was just a one off) explanatory styles. A pessimist faced with a negative event however, will use the opposite styles of internal (it was my fault), stable (this will happen every time this events occurs) and global (this will happen to every event). These styles will then reverse when an optimist and pessimist encounter a positive event (Peterson & Vaidya, 2001). Explanatory styles which one has previously used for past events are thought to have an influence on future expectations, and therefore future behaviour (Carver & Scheier, 2003). Explanatory styles are most often tested using the Attributional Styles

Questionnaire (Seligman, Abramson, Semmel, & von Baeyer, 1979), which measures the three styles detailed above across positive and negative conditions. Traditionally, a single dimension of CP-CN (composite positive and negative events) has been used, but recently it was been suggested that they should be used independently as each predict different criterion variables (Reivich & Gillham, 2003).

1.4.1 Optimism and health

A large scale prospective study with the Arnheim Elderly Study found that higher optimism scores were related to lower all-cause mortality and lower cardiac mortality (Giltay, Geleijnse, Zitman, Hoekstra, & Schouten, 2004). Optimism was found to have a stronger protective effect for men than women and both of these findings remained significant after controlling for an extensive range of confounders, including diet, smoking and obesity which are related to mood, alcohol which is related to feelings of hopelessness, and traditional risk factors including hypertension. This suggests that optimism is an important predictor of mortality. This study used the Dutch Scale of Subjective Well-being for Older persons, which contains an optimism subscale including questions about the future such as “I still have many goals to strive for” and general well-being items “there are many moments of happiness in my life”. Therefore this scale is measuring both goal oriented aspects of optimism as well as more general feelings of optimism in day to day life, and this may represent a slightly different operational definition of optimism than other studies.

A further study from this group found that optimism was a relatively stable trait across the life course and was related to lower mortality from cardiac death (Giltay, Kamphuis, Kalmijn, Zitman, & Kromhout, 2006). Dispositional optimism in heart surgery patients was related to higher mood, better adjustment and quality of life, and also to nurse ratings of health at 6 month follow up (Leedham, Meyerowitz, Muirhead, & Frist, 1995). Dispositional optimism has also been related to faster physical recovery,

faster rate of return to normal life activities and higher quality of life after coronary artery bypass graft surgery (CABG; Scheier et al, 1989), lower likelihood of rehospitalisation for related and all cause problems after CABG surgery (Scheier et al., 1999), while pessimism was related to higher mortality in younger cancer patients receiving radiation therapy (Schulz, Bookwala, Knapp, Scheier, & Williamson, 1996).

Explanatory styles have been studied in relation to cardiac and all cause mortality. A prospective study found support for a protective effect of optimism on cardiac mortality (Kubzansky, Sparrow, Vokonas, & Kawachi, 2001). Higher optimism scores were related to lower nonfatal myocardial infarction as well as death from coronary heart disease and this was found with both a continuous score and using the highest tertile group, suggesting a dose response relationship. A one standard deviation increase in optimism was associated with a relative risk of 0.74 for total coronary heart disease. This relationship remained significant when the highest scoring individuals for anger, anxiety and hostility were excluded, which provides support for the argument that optimism reflects a separate protective effect for cardiac health and is not simply an absence of negative affect. A one standard deviation increase in optimism was associated wtih a relative risk of 0.74 for total coronary heart disease. However, this study found no relationship between optimism and lower all-cause mortality, which has been suggested by other studies (e.g. GIltay et al, 2004). Kubzansky et al (2001) suggest that this could be due to prior health screening of participants in this study and better access to health care.

The Optimism-Pessimism Scale (PSM-R; Malinchoc, Offord, & Colligan, 1995), was used in this study, which is adapted from the Minnesota Multiphasic Personality Inventory 2 scale. Using techniques from content analysis verbatim explanations, a panel of independent raters give each item a composite weight based on the degree to which it assesses internality, stability and globality. High PSM-R scores are related to pessimistic explanatory styles and low scores relate to optimistic explanatory styles (Malinchoc et al, 1995). In that study, high PSM-R scores were related to increased

negative emotions, decreased positive emotions and happiness, and decreased scores on the LOT-R. This pattern of correlations suggests that the PSM-R measure is high in validity. Other studies have supported this finding. For example, an open ended questionnaire measure of pessimistic explanatory style administered at age 25 predicted poor health at follow up age of 45 to 60 (Peterson, Seligman, & Vaillant, 1988), a pessimistic style was associated with increased mortality after 30 year follow up (Maruta, Colligan, Malinchoc, & Offord, 2002) and an optimistic style predicted lower all cause mortality after 50 year follow up (Peterson, Seligman, Yurko, Martin, & Friedman, 2002).

Studies investigating the relationship between optimism and health have controlled for covariates to a varying degree. Giltay et al (2004) investigated the impact of optimism on cardiovascular outcomes, and controlled for standard cardiovascular covariates such as age, smoking status, alcohol consumption, hypertension and body mass index. Other studies have also controlled for these factors (e.g. Giltay et al, 2006; Kubzansky et al, 2001). However, some studies have also controlled for other personality factors when looking at optimism and health. Scheier et al (1999) measured depression and self-esteem, and found that optimism was an independent predictor of rehospitalisation . Kubzansky et al (2001) also measured negative emotions such as anger, anxiety and depression and reported that the relationship between optimism and cardiac outcomes remained significant. Therefore, optimism has been shown to be a robust correlate of cardiovascular outcomes when controlling for a range of known covariates.

Optimism about future events has so far been reviewed as a positive construct, however, there is also evidence of a negative side of optimism, termed unrealistic optimism. This refers to the tendency to view ones own chances of experiencing a negative event as lower compared to others, and the chances of experiencing a positive event as higher than others (Weinstein, 1980). These unrealistically optimistic expectations may have important and relevant implications for health. Studies have

found evidence of unrealistic optimism across different outcomes including likelihood of being sterile (Weinstein, 1980), being involved in a car accident (Robertson, 1997) and having a heart attack (Perloff & Fetzer, 1986). Unrealistic optimism about being involved in personal accidents can lead to a reduction is self-protective behaviours such as wearing a seat-belt (McKenna, Warburton, & Winwood, 1993). Smokers have been shown to underestimate their risk of contracting lung cancer compared to other smokers and to non-smokers, and also to over-estimate the reparative effects of exercise or quitting smoking in the future (Weinstein, Marcus, & Moser, 2005). There is also support for the presence of unrealistic optimism when assessing chance of contracting HIV in both a student and homosexual male sample (Gold, 2006). Therefore it must be considered that optimism is not always synonymous with a positive or protective effect for health.

1.5. Methodological considerations

Different research paradigms can be employed when investigating the links between psychosocial factors and health outcomes, including epidemiological, naturalistic, prospective and laboratory studies. Each of these alternate methods has associated strengths and limitations, and there is no one “gold standard” study design which presents the ideal when researching psychosocial factors and health. Rather, studies should be used in combination to provide aggregated data from different types of studies. Within this thesis, both epidemiological and naturalistic methods will be used, which will allow investigation of the thesis hypotheses using different methodologies.

1.5.1 Epidemiological studies

Epidemiological studies attempt to identify the causes of human disease and illness, often using a large sample. These studies are used to determine which factors are associated with diseases; those positively associated with disease are known as risk factors and those negatively associated with disease are known as protective factors. For example, epidemiological studies were responsible for identifying the link between smoking and lung cancer. These studies represent the core method for establishing the links between psychosocial factors and health, and also in identifying the behavioural and biological pathways which may mediate this link. Epidemiological studies either focus on retrospective reports of outcomes that have already happened or prospective analysis of outcomes which may happen in the future. A number of large longitudinal epidemiological cohort studies now exist, including the Whitehall II study, which follows a large number of UK civil servants and is an example of a prospective epidemiological study. This cohort was established to investigate links between psychosocial aspects at work, such as work stress and social support, and disease, their moderating effects and also the interaction between psychosocial aspects and other established risk factors (Marmot & Brunner, 2005). The cohort has been followed up every 5 years and consistent links have been demonstrated between lower grade of employment and higher mortality and morbidity.

There are a number of advantages to using epidemiological methodology. It is relatively cost and time effective to measure both psychosocial and biological outcomes from a large sample of participants, leading to the generation of a large data set. Prospective study designs allow for the identification of risk and protective factors over time. The potential effects of confounders can be controlled for by employing appropriate statistical methodologies when using an epidemiological study. The main advantage of using a large scale epidemiological study is the identification of risk and protective factors which affect health outcomes. However, there are also a number of limitations which must be considered. Studies can be subject to random or systematic

errors, leading to the results from the sample varying from the results of the population. Systematic errors can be controlled for using careful study design, or identified during analysis and taken into consideration. Random effects however are due to artefacts within the specific study sample and cannot be controlled for. Biological measures obtained in epidemiological studies may lack validity due to the testing procedure; participants are often measured on one occasion and this usually involves a visit to a research laboratory or other similar setting. This may cause a change in biological responses that would not occur during everyday life. This also means that limited information can be gathered regarding biological responses to specific situations, which may be an important factor in predicting disease outcome.

1.5.2 Naturalistic studies

Naturalistic studies measure participants over the course of their everyday life, and can include psychosocial, behavioural and biological measures. Studies can follow participants during specific events such as public speaking or across an ordinary day. Biological measures which can be taken in this way include repeated sampling of salivary cortisol or blood pressure. Ambulatory blood pressure monitors can be used in clinical investigation, and these have been employed effectively in many studies. Using such biological measures allows researchers to investigate the relationship between everyday life situations and biological reactivity. A range of health outcomes have been studied using naturalistic monitoring methods, including asthma and muscle tension. One study followed 20 asthmatic and non-asthmatic patients for a minimum time period of three weeks (Ritz & Steptoe, 2000). During this time regular self-reports of positive and negative mood state were obtained, along with self-assessment of pulmonary function. The study was able to show that strong moods, both positive and negative, were associated with reduced pulmonary function in everyday life in asthmatics, but not

in non-asthmatic controls. Other studies have found a relationship between cortisol release in daily life and stressful events (van Eck, Nicolson, & Berkhof, 1998).

The major advantage of naturalistic monitoring studies is that they have a high level of ecological validity by measuring biological responses in everyday life rather than forced laboratory situations. This allows for relationships to be detected that would not be apparent under single testing conditions such as with epidemiological studies. However, due to the sampling in everyday life there are limitations on the types of biological measures which can be taken. For example, in the laboratory it is possible to take larger quantities of blood for analysis of immunological markers or lipids, but in field settings this is not a practical option. Blood sampling is possible within naturalistic studies; however, the repeated collection and process of blood sampling may lead to stress or discomfort for the participants involved. This may lead to elevations in psychological measures and biological markers which may obscure the true relationship between psychosocial factors and biology. Equipment used to measure biological markers must be unobtrusive otherwise it will interfere with participants' daily lives therefore comprising ecological validity. Advances have been made in this area, and small blood pressure monitors are available as well as devices to record activity, heart rate and heart rate variability. Finally there are many confounding factors which must be taken into account in naturalistic monitoring studies, such as smoking, food, caffeine and alcohol intake, rates of physical activity and amounts of sleep. Nonetheless, naturalistic monitoring was used for the studies described in chapters 7 and 8 of this thesis.

1.6 Summary and next steps

The research reviewed in this chapter indicates that positive well-being, social support and optimism have protective effects for health across a diverse range of outcomes. However, there are various theoretical and methodological limitations which

limit the ability to draw useful conclusions from this research. Firstly, across the three domains there is a general lack of consensus relating to operational definitions of constructs. Within positive well-being these relate to hedonic and eudaimonic well-being, within social support these relate to the measurement of social network size and functional aspects of support, and within optimism these relate to definition of a general personality construct or an explanatory style. Consensus amongst researchers in these areas will allow for more targeted research to be carried out, which can in turn inform effective interventions. With specific reference to social support, neither operational definition is able to explain fully why increased social networks and high social support are linked with negative health across some domains. There is also a need for studies to investigate how each of the different aspects of positive well-being, social support and optimism might differently explain relationships with health outcomes. Current evidence investigating protective factors and health has focussed on either the domains of positive well-being, optimism or social support. However, it is also possible that these, and other protective aspects such as coping and resilience, may act in combination to offer protection against stressful life experiences and benefit future health outcome. Therefore the first main aim of this thesis is to investigate how psychosocial factors may be inter-related. This analysis will be presented in chapters 7 and 8.

Secondly, studies across these three areas tend to focus on specific methodologies, such as epidemiological or laboratory based techniques. Studies which make use of a variety of measures will be able to identify different relationships with health which in turn will have important implications for theory and guided interventions. This thesis will make use of naturalistic and epidemiological studies to allow a full and robust testing of protective psychosocial factors on health.

The research reviewed within this chapter has demonstrated the effect of positive well-being, social support and optimism on health outcomes. However, it is important to understand how this relationship is moderate, and this can either be

through behavioural or biological pathways. Therefore, the second main aim of this work is to investigate the relationships between psychosocial factors, health behaviour and biology.

As noted within this review, although there are some studies, particularly in the area of social support, there is in generally rather little evidence from non-Western samples about these three domains. It is likely that cultural factors may be an important dimension in explaining relationships in different countries. Previous studies have also made use of different methodologies including epidemiological and laboratory based work.

The work presented in this thesis will combine these broad areas to investigate the relationships between protective psychosocial factors and health-related biology and behaviour. Specifically, this work will address these issues in three ways: Firstly, a population-based study of well-being and behavioural pathways, including a cross-cultural focus; secondly, a naturalistic study of well-being, social support and both biological and behavioural pathways and finally, a naturalistic cross-cultural study of social support, well-being and biological and behavioural pathways. The next chapter will present literature surrounding health behaviours, and links between protective psychosocial factors and health behaviour.

CHAPTER 2: HEALTH BEHAVIOURS LITERATURE REVIEW

2.1 Introduction

Chapter one introduced the central argument under investigation throughout this thesis, which is to examine the behavioural and biological pathways through which psychosocial factors may affect health-related biology and behaviour. The first study in this thesis focuses on positive well-being and the behavioural pathway, specifically looking at the relationship between life satisfaction and performance of health behaviour. Life satisfaction was presented in section 1.2.1 of chapter one, and is a cognitive aspect of hedonic well-being. This aspect of positive well-being was selected to include a cognitive aspect of well-being in the thesis work, in comparison to studies presented in later chapters. This chapter will review theoretical aspects of health behaviour theory and literature investigating life satisfaction and health behaviour.

2.2 What are health behaviours?

The performance of certain behaviours and the avoidance of others have a clear and causal link to many chronic diseases including cancer, diabetes and cardiovascular conditions, which are amongst the leading causes of death in the Western world. Arguably the most well-known relationship between behaviour and illness is the link between smoking and lung cancer, which was first identified by Doll and Hill in 1954. Smokers are now known to be more likely to die early and to suffer disability compared to non-smokers (Peto, Lopez, & Boreham, 1994). Before discussing the factors which affect the performance of health behaviours, it is necessary to determine what a health behaviour is and how health behaviours affect health and illness.

Early definitions of health behaviours referred to three categories of behaviour: a health behaviour; a sick role behaviour and an illness behaviour (Kasl & Cobb, 1966). A health behaviour was seen as any behaviour which prevented disease, a sick role behaviour was an intention to get better and an illness behaviour resulted from being unwell. Health behaviours can be broadly divided into two main categories: those that increase the risk of illness or injury (known as negative or risky behaviours), and those that promote health or wellness (known as positive or protective behaviours). Risky behaviours include smoking, drinking high quantities of alcohol and driving whilst drunk. There is, however, less consensus about the definition of health promoting behaviours, which have been described as being undertaken with the purpose of preventing a disease or detecting the presence of a disease. However, the definition of a particular behaviour as either risky or protective is influenced by the framing of this definition, for example, "not smoking cigarettes" is a protective behaviour whilst "smoking cigarettes" is a risk behaviour. Therefore, it can be helpful to think of health behaviours as a dichotomy, each having a positive and a negative alternative. Steptoe & Wardle (2004) have argued that it is not necessary to carry out a behaviour for the purpose of promoting health in order for it to be a health behaviour. For example, applying sunscreen could be motivated by a desire to maintain light skin or a desire to protect against skin cancer. Whichever the motivation, the application of sunscreen is still a health promoting behaviour. Therefore, Steptoe and Wardle suggested that a health behaviour be defined as "*activities that may help to prevent disease, detect disease and disability at an early stage, promote and enhance health, or protect from risk of injury".*

There are a number of important considerations which must be made when attempting to study performance of health behaviours. Firstly, behaviours defined as health promoting or risky vary according to current research evidence, and a behaviour that is seen as healthy at one time may later be linked to an increased risk of disease or ill-health. Individuals may not be aware that certain behaviours are linked to positive

health outcomes, or may not be up to date when the status of a certain behaviour has changed. For example, drinking 2 litres of water a day is recommended for all adults, however, the status of drinking tea, coffee and other soft drinks as part of this is contested. Current evidence suggests that other soft drinks can be included in this 2 litre target, however, many people may not be aware of this. Therefore, the status of particular health behaviours can affect performance where guidance is not clear or has changed. This may also affect reporting of health behaviours. Using the above example if individuals are asked if they drink 2 litres of water per day, some may say yes because they are including all soft drinks, and others may say yes but only include water. This limitation can be controlled for when designing studies by using strict definitions of each health behaviour.

Certain behaviours may require alternative measurement, as not all behaviours may be best studied using a dichotomous question such as “do you smoke?”. Eating a healthy diet is a protective health behaviour, but this consists of a number of actual occurrences, such as eating 5 portions of fruit and vegetables per day, reducing fat intake, increasing fibre intake and eating oily fish. In this case it can be more beneficial to measure each separate behaviour and construct an index score for a healthy diet. Other similar examples include drinking alcohol, which in small quantities may not be harmful to health, but in large quantities is associated with increased risk of certain types of cancer and heart disease. Therefore consumption of alcohol may be best measured by using a consumed within a given time frame. Other options are to use a dichotomous definition based on national guidelines for what is healthy, such as “do you drink more than 2 glasses of wine per day?”. Problems with measurement and other limitations will be discussed further in following sections.

2.2 Health Behaviour Theories

There are in fact a number of factors which determine whether or not a person performs healthy behaviours, including control over the behaviour, beliefs in the importance of the behaviour and barriers to performing the behaviour. Health behaviour models have been developed in order to try to model the relationships between these factors and health behaviours. Theories that have been applied to the explanation of health behaviours can be general, in that they can be applied to other behaviours, or specific, in that they been developed to explain health behaviours. The Theory of Planned Behaviour (TPB), and its predecessor, the Theory of Reasoned Action (TRA) are examples of general theories and the Health Belief Model (HBM) is a specific theory. Further, there are also examples of health-specific models such as the AIDS risk reduction model (Catania, Kegeles, & Coates, 1990). It has also been suggested that general theories should be used wherever possible as using a different theory for different types of behaviour becomes complicated and can make it difficult to identify underlying constructs (Sutton, 2004; Stroebe, 2000).

2.2.1 Theory of Reasoned Action/Theory of Planned Behaviour

Originally developed by Fishbein and Ajzen (1975), the theory of reasoned action attempted to explain behaviour by placing the individual within their social context and represented a move away from more traditional theories. The TRA and TPB argue that an individual's social cognitions determine their behavioural intention. These cognitions are the individual's attitude towards the behaviour, their beliefs about social norms and their subjective norm. These factors interact to affect intention to perform the behaviour, which in turns affects the actual performance of the behaviour. This theory was later developed by Ajzen and others to include the role of behavioural control, and was then labelled the Theory of Planned Behaviour. The main components of the TPB are presented in figure 2.1.

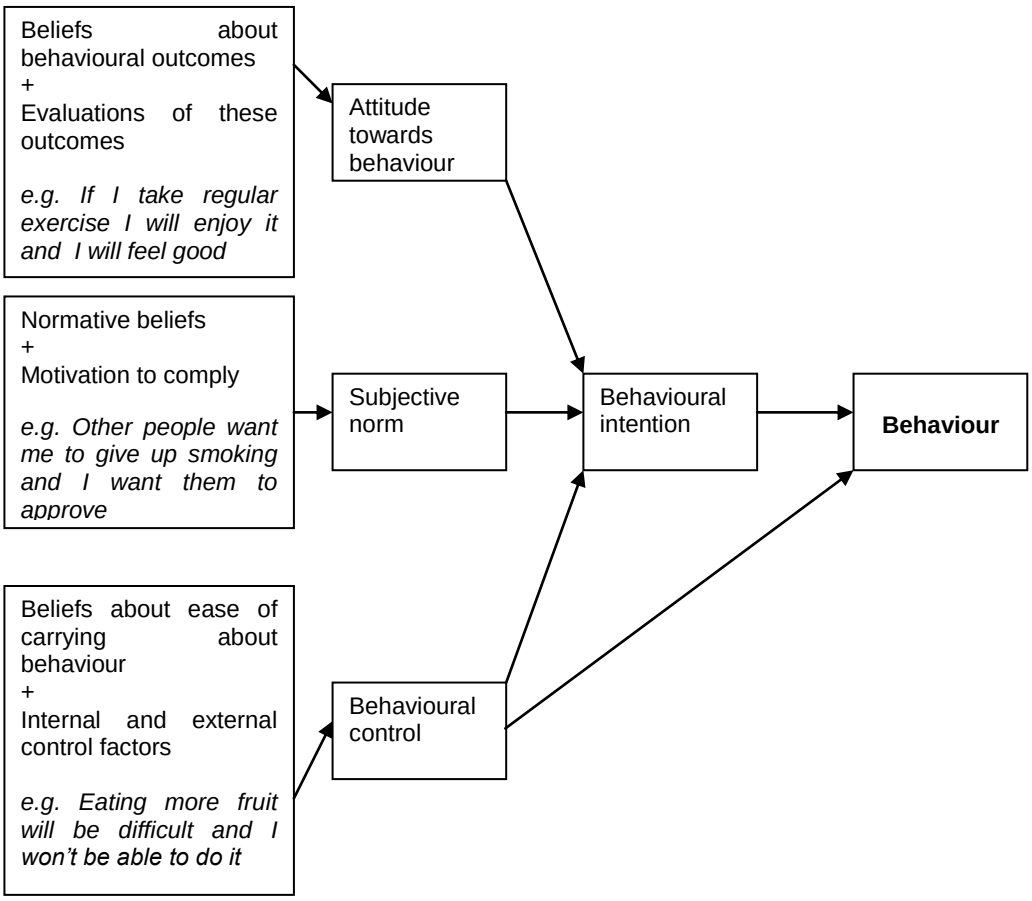


FIGURE 2.1 THEORY OF PLANNED BEHAVIOUR

This model is causal and therefore predicts that if two components are held constant and one is changed, the behavioural intention will also change, which will in turn affect the behaviour. The TPB has been used to measure behaviour change in a number of areas, such as attendance at screening, increasing fruit and vegetable consumption and using condoms. The predictive power of the TPB can be assessed by examining this research. The TPB has been supported in a variety of research, with one meta-analysis finding that the model account for 39% of variance across health behaviours (Armitage & Conner, 2001). However, significant differences in the efficacy of the TPB were found when using self-report and actual measures of behaviour. Other recent meta-analyses have also found support for the role of the TRA and TPB in

predicting behaviour, including condom use (Albarracin, Johnson, Fishbein, & Muellerleile, 2001; Sheeran & Taylor, 1999) and physical activity (Hagger, Chatzisarantis, & Biddle, 2002).

There are a number of issues related to the overall merit of this theory. First, most studies which have measured the association between TPB components and behaviour have used self-report behaviour as their outcomes measure rather than objective or actual behaviour. This presents difficulties in assessing the ability of the model to account for behaviour and/or change in behaviour. There have also been criticism about the definition of behavioural control and the methodological definitions of perceived control used by researchers when testing this theory may have an impact on results. Finally, the TPB suggest that attitudes, perceived behavioural control and subjective norm all affect behavioural intention, which in turn affects behaviour. This would suggest that there should be a high correlation between behavioural intention and behaviour, however, this is often not the case and there has been much debate about the "intention-behaviour" gap.

2.2.2 Health Belief Model

The Health Belief Model was originally developed by Rosenstock in 1966 but has since been revised by Rosenstock and Becker (Becker, 1974; Rosenstock, 1966, 1974) and is shown in figure 2.2. Rosenstock suggested that there were two main factors which influenced performance of preventive health behaviours, with each being two-dimensional. The first factor is psychological readiness to act, which is composed of perceived *susceptibility* or *vulnerability* to a threat and the perceived *severity* that this threat has for the individual. The second factor is the benefit of taking action to reduce this threat, which is composed of the perceived *costs* and the perceive *benefits*. These two factors alone were not thought to explain action, a third factor termed "cues to action" is included in the model to account for the initial trigger to change behaviour,

these include factors such as illness, family illness or heightened media attention. Additional factors have now been added to this model, including health motivation and self-efficacy (Becker, Haefner et al., 1977; Becker, Maiman et al, 1977). Finally, behavioural intention was added to the model as a step between these initial factors and performance of behaviour.

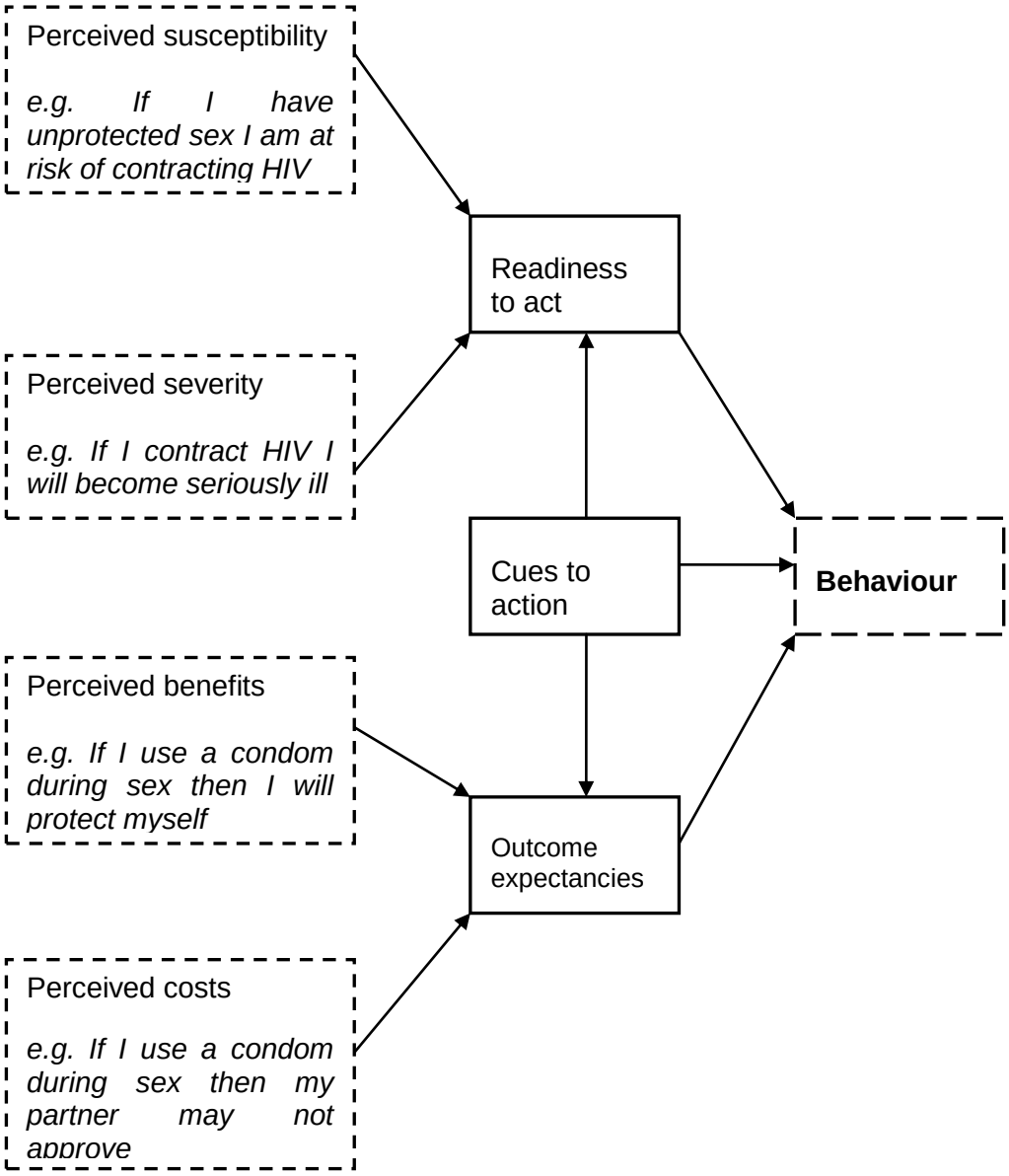


FIGURE 2.2 HEALTH BELIEF MODEL

Reviews of the HBM have found support for this model (Janz & Becker, 1984; however this review has since been criticised (Munro, Lewin, Swart, & Volmink, 2007).

A more recent meta-analysis concluded that there were significant relationships between the main constructs of the HBM and health behaviours (Harrison, 1992). Each of the four main dimensions (susceptibility, severity, costs and benefits) were analysed separately and accounted for a maximum of 10% of the variance in explaining health behaviours. However, this analysis did not look at a sum of each of the dimensions. Despite the popularity of this theory, there have been a number of criticisms of the HBM. The first major limitation of the health belief model is that each of the constructs originally proposed by Rosenthal have not been given an explicit operational definition. This may account for some of the variation reported in the review by Harrison and colleagues (1992) where effect sizes were across a large range. Another major criticism of the HBM relates to the relationships between the four main constructs; it is unclear if each should be combined to give an additive causal model of health behaviours. Researchers have approached this problem in various ways, for example adding susceptibility and severity (e.g. Witte, Stokols, Ituarte, & Schneider, 1993), multiplying them (e.g. Conner & Norman, 1994), and also subtracting costs from benefits (e.g. Wyper, 1990). Again this leads to difficulties when comparing different studies and attempting to assess the predictive power of the HBM across research groups.

2.3 General problems with health behaviour theories

There are a number of advantages to the use of health behaviour theories in guiding research and intervention studies. Firstly, these models offer a clear theoretical background to guide research, allowing researchers to identify salient constructs and effectively operationalise these measures. Secondly, theories of health behaviour add to our overall understanding of health in general. Health behaviour theories identify similar constructs which are useful in predicting health behaviours, such as control and attitudes to health. These constructs can then be incorporated into interventions

designed to promote healthy behaviour, such as increased attendance at screening. However, there are also a number of limitations associated with these models.

Social cognition models of health behaviour often account for only a small proportion of the variance in explaining health behaviour (e.g. Bish et al, 2000; Garcia & Mann, 2003). Noar & Zimmerman (2005) have suggested ways in which health behaviour research can test theories in order to move forward and identify the most salient aspects of models. However, one aspect which is clear from studies of the HBM and TPB is that cognitive predictors of behaviour are not explaining the full picture in terms of health behaviours of individuals. Health behaviour models should be parsimonious and not contain additional constructs which do not add predictive power to the overall model. However, this quest for a trim and efficient model may preclude the addition of some useful factors and often only cognitive factors are measured. Relevant additional factors include the role of emotions in determining performance of health behaviours, which may be particularly important for certain health behaviours such as smoking. Traditional health behaviours theories also do not include psychological, social or personality factors as predictors of health behaviour. Increasing the scope of these theories by considering the impact of psychosocial factors may be increase the explanatory power of these models. Health behaviour theorists have now begun to investigate the impact of affective beliefs on health behaviours and this will be discussed in the following section.

2.4 Affective beliefs and health behaviours

There is increasing evidence that there is a role for affect in the prediction of a number of health behaviours. Many authors have suggested that more research should be focussed on the affective components of attitudes. According to French et al (2005) this refers to "*emotions and drives engendered by the prospect of performing a behaviour".* Affective beliefs associated with a specific behaviour include factors such

as “If I exercise then I will feel good afterwards” but can also be negative such as “If I drink alcohol then I will feel ill tomorrow”. For instance, in a study of self-reported and actual speeding, affective beliefs were predicted to be more important in predicting speeding than instrumental beliefs. Instrumental beliefs included items such as “driving at 70mph would get me to my destination faster” and both positive (“driving at 70mph makes me feel good”) and negative (“driving down this road at 70mph would make me feel anxious about causing harm to others”) affective beliefs were measured. For self-report speeding, affective beliefs accounted for an additional 16% of the variance after controlling for age, sex, mileage and instrumental beliefs. For actual speed, affective beliefs added 5% to the variance explained, but age and negative affect emerged as the most important predictors in this model. This study also assessed smoking behaviour in adolescents using self-report and objective measurement of carbon monoxide in a breath sample. For self-report smoking, positive and negative affect accounted for 23% of the variance after sex and instrumental beliefs were controlled for, and for objective measures of smoking these two variables accounted for 12% of the variance and were the only significant predictors in the model. However, this study only used one measure for positive and negative affect in the second study and findings with a specific age sample such as this may not be comparable to a larger range. This study reported that when affective beliefs were included in the regression models for both speeding and smoking, instrumental beliefs were no longer significant predictors. This finding has also been replicated in a study predicting intention to quit smoking (Rise, Kovac, Kraft, & Moan, 2008). Extensive and robust statistical modelling of affective beliefs by Kraft and colleagues has demonstrated that models predicting intention to exercise provide a better fit when instrumental and affective beliefs and separate, and also that affective belief is a more important predictor of intention and instrumental attitudes (Kraft, Rise, Sutton, & Roysamb, 2005).

The role of affective beliefs in predicting healthy behaviours was discussed in detail by French and colleagues (2005). French et al (2005) reported evidence that

instrumental and affective beliefs are measuring different constructs, suggesting that models using single attitude measures are not sufficient. These two types of attitudes did overlap to a small extent, but the finding that instrumental attitudes and affective beliefs were related to different underlying beliefs provides further support for the inclusion of both in studies predicting health behaviours. French et al (2005) conclude that this may be leading to an underestimation of the relationship between behavioural beliefs and attitudes. Using prediction of intention to increase physical activity, French et al (2005) found that affective beliefs were stronger predictors than instrumental attitudes. However, the Cronbach's alpha reported for their instrumental scale was just .4 suggesting that the scale was not very reliable. French et al (2001) suggested that future work should substitute use of the adjective "good" for "useful" and this has in fact been supported in other research, which found that a semantic differential of "good/bad" loaded onto both instrumental and affective factors (Kraft et al, 2005). This study used open-ended questions to elicit participants' beliefs and attitudes about both instrumental and affective aspects of intention and therefore provides important theoretical evidence that there is an affective component to behavioural intention.

It is also possible that background and existing levels of positive affect in everyday life may have an affect on performance of health behaviours. For example, happier people might be more likely to engage in physical activity and unhappier people may be more likely to smoke. The potential relationships between health behaviours and affect in daily life will be discussed in the following section.

2.5 Life satisfaction and health behaviours

There is substantial evidence that behaviours such as smoking, lack of physical exercise and heavy alcohol consumption are associated with stress and negative mood states like depression and anxiety (Biddle & Mutrie, 2001; Kassel, Stroud, & Paronis, 2003; Regier et al., 1990). The relationship of prudent health behaviours with positive

well-being is less well established. Life satisfaction is a cognitive component of positive well-being, as introduced in section 1.2.1 and there has been some research investigating the specific relationship between life satisfaction and health behaviours. Although associations between life satisfaction and physical activity, not smoking, and moderate alcohol consumption have been documented in some studies (Dear, Henderson, & Korten, 2002; Patterson, Lerman, Kaufmann, Neuner, & Audrain-McGovern, 2004; Schnohr, Kristensen, Prescott, & Scharling, 2005; Valois, Zullig, Huebner, & Drane, 2004), results have been inconsistent (Diener & Seligman, 2002; Murphy, McDevitt-Murphy, & Barnett, 2005). Even less is known about associations between well-being and other health behaviours such as dietary choice.

2.5.1 Exercise studies

Physical activity is one health behaviour for which the benefits have been widely recognised, increased physical activity has been associated with physiological measures such as lower body fat, lower triglyceride levels and higher HDL cholesterol (LaPorte, Montoye, & Caspersen, 1985) and also psychological measures such as increased well-being and reduced distress (Byrne & Byrne, 1993; Cramer, Nieman, & Lee, 1991). Links have been identified between low life satisfaction and low physical activity. Lower levels of life satisfaction was related to poor physical activity in a sample of US adolescents (Zullig, Valois, Huebner, & Drane, 2005). Valois, Zullig, Huebner, & Drane (2004) included a range of measures of physical activity in their study of American adolescents and found that lower rates of activity were related to reduced life satisfaction. These authors suggest that not participating in sports' teams at school leads to a decrease in both physiological and psychological aspects of well-being that would contribute to life satisfaction. Studies using clinical populations have also found a complex relationship between physical activity and life satisfaction (Thome & Espelage, 2004).

Links between physical activity and well-being may be affected by type of activity. Leisure time physical activity was found to be related to increased positive affect and decreased negative affect amongst relatives of breast cancer patients. However, no relationship was found between well-being and occupational/household activity (Audrain, Schwartz, Herrera, Goldman, & Bush, 2001) and Stephens (1988) found that women reporting both recreational and household activity had lower levels of positive affect compared to those only reporting recreational activity. However, not all studies have found evidence of a link between physical activity and well-being. In a brief report, Diener & Seligman (2002) found no difference in rates of exercise between very happy and less happy participants, as measured by life satisfaction.

Evidence of a link between physical activity and an increase in positive mood can also be found in intervention studies. An increase in physical activity was found to increase life satisfaction when comparing those who are sedentary and those who are joggers. Additionally, those who changed from being sedentary at time point 1 to joggers at time point 2 showed an increase in life satisfaction, with a decrease for those who changed from joggers to sedentary (Schnohr, Kristensen, Prescott, & Scharling, 2005). However, a physical activity intervention study found no improvements in life satisfaction amongst a sample of healthy females (Ornes, Ransdell, Robertson, Trunnell, & Moyer-Mileur, 2005). A small scale Scottish study, using 26 overweight older women, reported an improvement in life satisfaction in the intervention group compared to controls (McMurdo & Burnett, 1992). Exercise interventions with healthy older adults have also shown an increase in physical activity in the exercise group, with frequency of exercise emerging as an important predictor of improved life satisfaction (McAuley et al., 2000).

2.5.2 Alcohol studies

Individuals who experience a decline in life satisfaction may engage in an increased number of risky behaviours, such as smoking and drinking, in an attempt to improve their life satisfaction. Alternatively, the risky behaviours could be leading to a change in life satisfaction through an alteration in biological mechanisms. Later alcohol use has been shown to be associated with early life dissatisfaction in a sample of US high school students (Newcomb & Bentler, 1986) suggesting a causal link from life dissatisfaction to risky behaviour. Although this finding was not replicated (Clark & Kirisci, 1996) the measures of life satisfaction used in each study were not comparable. Other studies have also found a link between low life satisfaction and drinking (Kuntsche & Gmel, 2004; Murphy et al 2005, 2006; Zullig, Valois, Huebner, Oeltmann, & Drane, 2001). However, a U-shaped relationship between life satisfaction and drinking was shown by Dear et al (2002), with lower life satisfaction in both abstainers and heavy drinkers compared to moderate drinkers.

2.5.3 Smoking studies

Smoking is also related to life satisfaction, with relationships being reported amongst Hungarian adolescents (Piko, 2006); Chinese school children (Tao, Huang, Gao, & Su, 2006); Polish adolescents (Mazur & Woynarowska, 2004); American college students (Patterson, Lerman, Kaufmann, Neuner, & Audrain-McGovern, 2004); Korean adolescents in Australia (Hong & Faedda, 1996); rural-urban migrants in China (Chen et al., 2004) and young adults in Hong Kong (Lam, Stewart, & Ho, 2001). Although smoking has been related to increased levels of negative well-being such as anxiety and depression, relationships with life satisfaction have been the subject of less research.

2.5.4 Other health behaviours

Research examining relationships between well-being and other health behaviours is sparse. Previous research has suggested that changing diet to incorporate more healthy foods can lead to increases in perception of inconvenience and affect quality of life. However, in a four-year randomised clinical trial, changing diet to incorporate low fat, high fibre, high fruit and vegetable foods was found to have no effect on life satisfaction (Corle et al., 2001). Whilst this study suggests that changes in diet do not lead to changes in life satisfaction, it was based on an intervention to alter diet amongst clinical trial participants and does not provide evidence about the relationships between life satisfaction of normal participants and diet that is self-selected.

2.6 Cross-cultural studies

Much of the previous literature on life satisfaction and health behaviours has been based on US samples. This is particularly true for research on exercise and alcohol although studies focussing on smoking and life satisfaction have tended to be more diverse. In a sample of Hungarian adolescents, life satisfaction has been associated with measures of psychosocial health (such as drinking and smoking; Piko, 2006) and in a Polish sample, risk behaviours (such as smoking and drinking) were associated with lower life satisfaction. There is also a limited number of studies with Asian samples, for instance, smoking has been associated with low life satisfaction in rural-urban migrants in China (Chen et al, 2004) and in young adults in Hong Kong (Lam et al 2001). Parent-rated life satisfaction was found to be predictive of alcohol use and smoking amongst Korean adolescents in Australia (Hong & Faedda, 1996).

Associations between life satisfaction and health behaviours may be moderated by larger scale cultural issues. For example, smoking is viewed negatively in many advanced economies, so smokers may feel somewhat guilty about their habit and

experience reduced satisfaction with their lives. But there may be other countries in which smoking is not viewed negatively but rather may be a source of prestige and an indicator of affluence. Under these circumstances, a positive relationship between smoking and life satisfaction could emerge. Countries of course vary in many ways, so it is difficult to delineate the characteristics that could be important. But one influential dimension is individualism and collectivism and this may in part explain differences in observed levels of life satisfaction. Countries characterised by collectivism such as those in Africa and the Indian Sub-continent have lower life satisfaction scores than those characterised by individualism such as those in North America and Western Europe (Dear, Henderson & Korten, 2002).

Cross country ratings of life satisfaction tend to be relatively stable over time, for instance, average life satisfaction of Japanese was around 6 on a 10 point scale over a 20 year period, and average ratings from Denmark were around 8 on the same scale over the same period (Veenhoven, 1993). Life satisfaction differences between cultures are likely to be due to many factors rather than any one single factor (Diener, Oishi, & Lucas, 2003). Different societies place different values upon happiness, for instance, countries in Latin America have reported higher ratings of the importance of subjective well-being compared to countries in Pacific Asia (Diener, 2000). It has been suggested that this could be due to the sacrifice of happiness for gain in other areas such as personal achievement or family (Diener et al., 2003). One possible explanation for the observed differences in life satisfaction between cultures is variations in individualism and collectivism. Western Europe and North American are typically thought of as individualistic societies, where the self is considered relatively autonomous from external, society level factors (Geertz, 1984; Triandis, 1989). Emphasis is placed on developing personal qualities and attributes which distinguish one from others (Markus & Kitayama, 1991). Collectivist cultures place more emphasis on maintaining harmony between societal members and working together for the collective good. Estimates suggest that approximately two thirds of the world's

population live in collectivist cultures (Triandis, 1995). The thoughts and feelings of individuals are nested within the thoughts and feelings of others, and individuals are expected to moderate their own desires and goals to provide a better fit with their group (Markus & Kitayama, 1991).

A large scale analysis of life satisfaction judgements involving over 60 000 participants suggested that cultural factors such as collectivism may have chronic influences on the judgements used to rate life satisfaction (Suh, Diener, Oishi, & Triandis, 1998). This study hypothesized that individualistic societies would be characterised by a stronger correlation between internal feelings and life satisfaction, whereas in collectivist societies, perception of cultural norms would be correlated with life satisfaction judgements. The findings supported this theory, as the emotional experience of individuals was more closely related to their life satisfaction judgements in individualist countries. This suggests that life satisfaction may be informed by different factors in cultures with individualist or collectivist values, and further suggests that as life satisfaction ratings may be reflecting different judgments between cultures, the relationship between life satisfaction and other variables may vary between these cultures.

Other cultural variables include materialism; individuals who value material pursuits are found to report lower levels of well-being along with increased symptom reporting and increased anxiety (Kasser & Ahuvia, 2002). Amongst young groups, materialism is associated with increased substance abuse (Williams, Cox, Hedberg, & Deci, 2000). Wealth between countries is also thought to have an impact on well-being, with relationships reported between subjective well-being and income (Diener & Biswas-Diener, 2002; Diener & Diener, 1995). This relationship may be more relevant for those living in poorer countries, as income is thought to be more strongly related to subjective well-being at low levels of wealth (Biswas-Diener & Diener, 2001) and the correlation between subjective well-being and wealth is much smaller in more economically developed nations (Diener & Biswas-Diener, 2002).

2.7 Summary and next steps

This chapter has reviewed literature around performance of health behaviours, relationships between psychosocial factors and health behaviours and finally cultural aspects of health behaviour research. This literature review has informed the development of the specific aims and hypothesis to be investigated in study 1, chapter 5. Previous work in this area has tended to focus on only one health behaviour, preventing identification of common relationships across a wider range of behavioural measures. Review of social cognition models of health behaviour showed that these theories are not capturing an accurate picture of the factors which affect performance of health behaviours. It is possible that analysing affective relationships with health behaviours may add explanatory power to these models. Finally, previous studies in this area have focussed on samples from one country, which prevents investigation of the effects of cultural aspects. Studying these relationships cross-culturally will allow for the effects of historical, political and social to be analysed. The following chapter will review the literature investigated how biological pathways may explain the link between psychosocial factors and health.

CHAPTER 3: BIOLOGICAL PATHWAYS LITERATURE REVIEW

3.1 Introduction

The previous study investigated links between protective psychosocial factors and performance of health behaviours. That study found that higher life satisfaction was related to increased performance of certain health behaviours, suggesting that behavioural pathways could, in part, explain the relationship between protective psychosocial factors and health that has been documented in recent years. However, behavioural pathways are not the only important factors in explaining this relationship. Protective psychosocial factors may be associated with an altered biological profile, including changes to the cardiovascular, neuroendocrine and immunological systems. Negative psychosocial factors such as depression have been linked with alterations in the functioning of the neuroendocrine system. In order to further understand how protective psychosocial factors impact upon health outcomes, it is necessary to investigate the biological pathways which may explain this relationship. Psychosocial factors may be important for health outcomes by moderating the impact of stressful events on biological and behavioural aspects. For example, during a period of chronic stress such as unemployment, having increased social support and positive well-being may reduce the body's biological response to this stress. This could involve various pathways, but this thesis will focus on the neuroendocrine system, specifically cortisol production. Chapter 7 will present findings from the second study, which measured a range of protective psychosocial factors and their relationship with cortisol in an ambulatory study.

3.2. Stress

The definition of stress is a complex and much debated issue although many theorists agree that stress is an adaptive process (Dougall, 2001). The term stress was first used by Selye in 1936, and was defined as a non-specific response of an organism to noxious stimuli. Traditionally stress was thought of as a physiological response to a physiological stressor, but more recently it has been conceptualised in a biopsychosocial framework. Stress has been described as a state of arousal allowing action to be taken (Baum, 1990; Mason, 1971). A stressor causes threat to the body's maintenance of homeostasis (Collins, Sorocco, Haala, Miller, & Lovallo, 2003). Physiological stressors challenge the body beyond normal capacity and include injury, extremes of heat or cold, and exertion (McEwan, 2000). Psychological stressors challenge mental capacity and can include pressured tasks such as oral presentations.

A stressor will result in a stress response, and this response can be behavioural, emotional, cognitive and physiological. The behavioural stress response was traditionally thought of in terms of the fight or flight response (Cannon, 1914) but is now more commonly characterised by behavioural responses such as smoking, and increased or decreased physical activity. The Yerkes-Dodson law is an example of the cognitive responses to stress and describes how at low levels of stress performance is high, but at high levels of stress performance is low, with optimal performance at mid-stress levels. This shows that cognitive functions such as attention and memory are affected by stressful situations. The emotional response to stress can include feelings of anxiety, fear and depression but these feelings will vary depending on the person and the situation. Finally the physical stress response will activate various physiological systems such as the mobilisation of proteins and fats. The physiological stress response leads to the activation of two bodily systems, the sympathetic-adrenal-medullary (SAM), and the hypothalamic pituitary adrenal (HPA) axes. These two systems are regulated by the neuroendocrine system.

3.3 Neuroendocrine system

The neuroendocrine system is important in mediating the effects of psychological factors on physical health outcomes, by regulating the physiological stress response. The SAM exerts an immediate response after a stressor has been appraised. The sympathetic nervous system signals the release of catecholamines from the adrenal medulla. Epinephrine and norepinephrine are released into the blood and as a neurotransmitter within the brain. They act to mobilise resources enabling the body to mount a fight or flight response to the stressor, for example by increasing blood flow to muscles and stimulating breakdown of glycogen in the liver for energy.

The second system to be activated is the HPA axis, which is responsible for dealing with the longer term effects of a threat (see figure 3.1). The paraventricular nucleus of the hypothalamus releases corticotrophin releasing factor (CRF), which then signals release of adrenocorticotrophin releasing hormone (ACTH) from the anterior lobe of the pituitary gland. ACTH then travels via the bloodstream to the adrenal cortex, causing the release of cortisol. This process takes about 20 minutes from appraisal of a stressor. Cortisol has a number of physiological effects which represent a continuation of those triggered by the SAM, including the breakdown of amino acids used by the liver for glycolysis, the release of fatty acids for energy use by muscles, and suppression of the immune system. Cortisol also acts as the regulator for the HPA axis by controlling a negative feedback system to the hypothalamus and pituitary gland, halting production of CRF and ACTH. However, the HPA axis can become dysregulated due to prolonged episodes of stress, leading to a number of effects including an abundance of cortisol but also a flattened cortisol profile. These alterations are then implicated with a range of negative health outcomes, including heart disease, diabetes and auto-immune disorders. These effects will be reviewed in section 3.6.

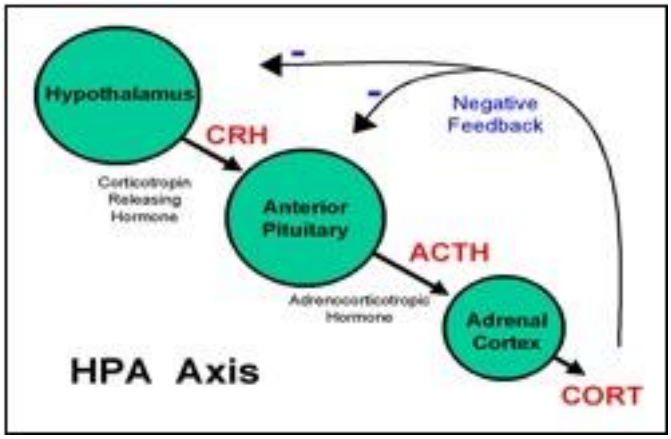


FIGURE 3.1 HYPOTHALAMIC PITUITARY ADRENAL AXIS.

Cortisol has a diurnal profile; there is a peak in the morning, with the highest level following waking, and then a gradual decline throughout the day. A nadir is reached in the evening with the lowest levels around midnight (see figure 3.2, blue line). There is some variation in the cortisol profile between individuals, although it is common to find fairly consistent patterns at the within individual level. The pattern of cortisol release can be affect by consumption of food and physical activity. Cortisol will also rise after a stressful event in order to return the body to homeostasis. Cortisol levels vary with age, with a flatter profile apparent it older adults. Because of the diurnal nature of cortisol secretion, there are a number of options for measurement in psychological research, including the cortisol awakening response and the total cortisol output over the day, and these will be reviewed in the following section.

There are a number of ways in which cortisol measures cannot be utilised in psychobiological research. Previously it was common to use single measures of cortisol collected in early morning hours as a marker of unstimulated HPA function (Walker, Best, Noon, Watt, & Webb, 1997). However, single measures do not tend to have a satisfactory intra-individual stability and also show a large inter-individual overlap, with some values for healthy individuals exceeding that of clinical samples (Laudat et al., 1988; Schulz & Knabe, 1994). Three methods are now commonly used in psychological research; the cortisol awakening response (CAR), the slope of cortisol

decline over the day, and the total cortisol output (see figure 3.2). The CAR and cortisol output over the rest of the day (including slope assessment) appear to be regulated differently, with distinctive genetic influences, and are poorly intercorrelated (Schmidt-Reinwald et al., 1999; Wust, Wolf et al., 2000). This suggests that each measure may have different correlations with disease outcomes and psychosocial factors, and should be studied separately.

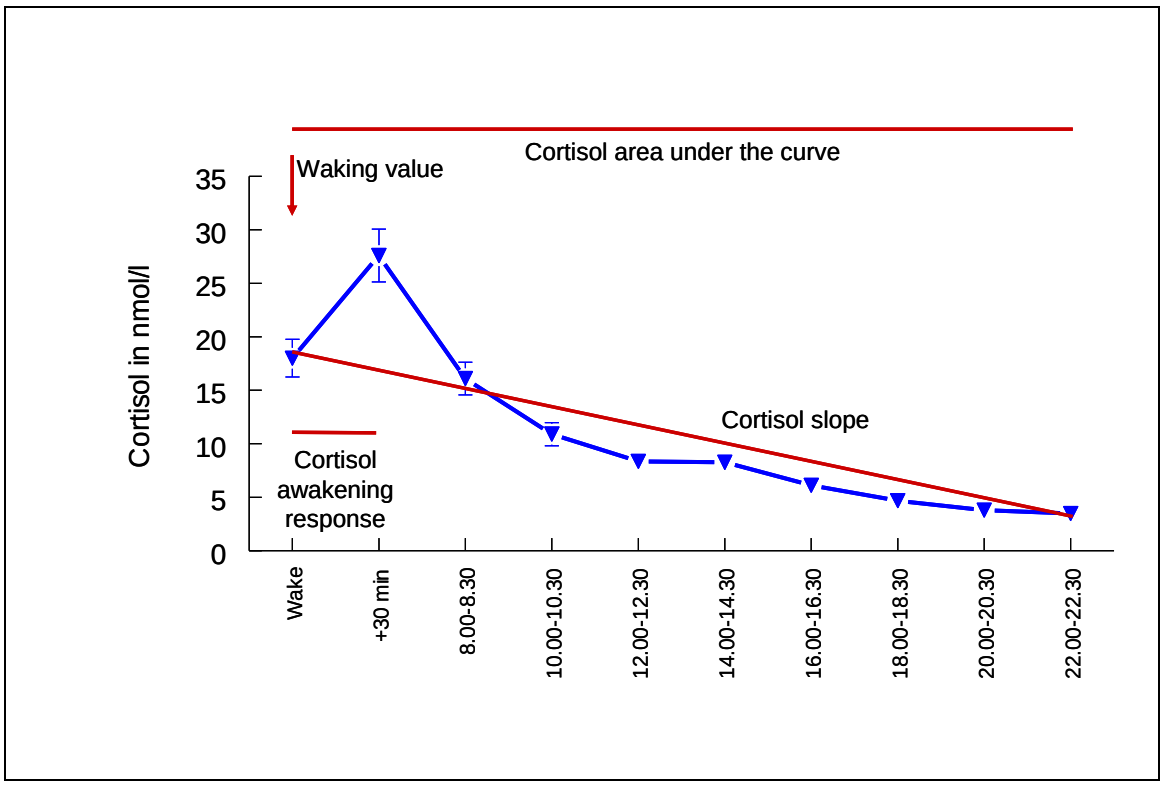


FIGURE 3.2 CORTISOL PROFILE AND ASSOCIATED MEASURES

3.4 Measurement of cortisol

3.4.1 Cortisol awakening response

Cortisol has been shown to rise 50-60% after waking, with this rise continuing for about 60 minutes (Pruessner et al., 1997; Schulz, Kirschbaum, Pruessner, & Hellhammer, 1998). The CAR response can be captured in a number of ways, and differences in its measurement may explain discrepancies between research groups. It

is common to compute an area under the curve (AUC) measurement, and this can be calculated with a minimum of three samples (Clow, Thorn, Evans, & Hucklebridge, 2004). AUC can either be calculated with reference to zero or with reference to the waking increase (Pruessner, Kirschbaum, Meinlschmid, & Hellhammer, 2003). It is also possible to study a mean increase in cortisol level post awakening (Wust, Federenko, Hellhammer, & Kirschbaum, 2000). The use of AUC with reference to cortisol increase, and also the mean increase measurement, rely heavily on the waking sample, which is subject to participant adherence.

The CAR is reported to be independent of time of waking, amount of time slept, sleep quality, physical activity and morning routines (Wust et al, 2000) but does vary with gender, chronic pain, burnout and chronic stress (Geiss, Varadi, Steinbach, Bauer, & Anton, 1997; Pruessner, Hellhammer, & Kirschbaum, 1999; Pruessner et al., 1997; Schulz et al., 1998). These findings suggest that the CAR is able to capture alterations in the function of the HPA axis. The CAR has been shown to be quite stable within individuals, with one study reporting moderate to strong correlations between measures on different days (Wust, 2000a) and measures a week apart (Pruessner et al, 1997). This stability reduces unexplained variance and increases the chance of finding reliable relationships between HPA activity and psychological variables. Although the CAR presents significant advantages to single measurement of cortisol, there are a number of methodological issues which must be considered. Gender differences have been found, with studies reporting a higher CAR in pre-menopausal women compared to men (Pruessner et al, 1997; 1999; Wust, 2000a) however this has not been replicated in other studies (Edwards, Evans, Hucklebridge, & Clow, 2001; Kudielka & Kirschbaum, 2003). Recent results have also suggested that there may be differences in the CAR of women on week and weekend days (Kunz-Ebrecht, Kirschbaum, Marmot, & Steptoe, 2004). Women taking oral contraceptives are found to have an attenuated CAR (Pruessner et al, 1997; 1999) but no differences have been observed between stage of monthly cycle (Kudielka & Kirschbaum, 2003). There has

been much debate relating to the effect of waking time on the CAR, with some studies reporting no relation between time of waking and strength of CAR (Pruessner et al, 1997; Wust 2000b; Brooke-Wavell, Clow, Ghazi-Noori, Evans, & Hucklebridge, 2002; Kunz-Ebrect et al, 2003). However, other studies have found that early risers exhibit a larger CAR (Edwards et al 2001b; Kudielka & Kirschbaum, 2003; Federenko et al., 2004).

Alterations in the CAR have been associated with a range of health outcomes, however, there is a lack of consistency across findings. A blunted CAR was related to a negative index of cardiovascular health and lower bone density (Eller, Netterstrom, & Hansen, 2001; Brooke-Wavell et al 2002). An increased CAR has been associated with perceived stress by some (e.g. Schulz et al 1998; Steptoe, Cropley, Griffith, & Kirschbaum, 2000) but not others (Pruessner et al 1999; Kunz-ebrect et al, 2003) and findings are also contradictory amongst those with burnout (Pruesner et al 1999; De Vente, Olff, Van Amsterdam, Kamphuis, & Emmelkamp, 2003; Grossi et al., 2005). An elevated CAR has also been associated with aspects of clinical depression (Pruessner et al, 2003; Harmer, Bhagwagar, Shelley, & Cowen, 2003), lower grade of employment (Kunz-Ebrect et al, 2003) and loneliness (Steptoe, Owen, Kunz-Ebrecht, & Brydon, 2004).).

Although the evidence reviewed above shows that the CAR has been related to a variety of psychosocial and physical health factors, this research is characterised by an overall lack of consensus, making it difficult to draw conclusions about the significance of a blunted or elevated rise in cortisol after waking. A recent review of CAR and psychosocial factors reported that general work stress and life stress were related to an increased CAR whereas burnout or fatigue (Chida & Steptoe, 2009) were related to a reduced CAR. This difference is perhaps not surprising given the variation in methodology employed by each study, and the extent to which potential confounding factors have been controlled for. However, recently it has been suggested that in order to reliably assess differences in the CAR related to trait factors, it is necessary to

sample participants over a number of days (Hellhammer et al., 2007). This may not be a practical option due to cost and participant burden, however, further research into confounding factors and sampling procedures will attempt to identify aspects which can be controlled in order to increase reliability of CAR findings.

3.4.2 Total cortisol output

Total output of cortisol over the day can be computed using area under the curve measures (AUC). Pruessner, Kircshbaum, Meinlschmid & Hellhammer (2003) described two computations for this measure, the first with reference to the increase of cortisol after awakening, termed AUC_I, the second referring to total cortisol output over the day, termed $AUC_{G.}$ These measures allow researchers to estimate circadian changes in cortisol output and assess overall cortisol secretion over a set time period. AUC results in a simplified statistical analysis and still makes use of single time point data, but using these computations, minimises risk of type 1 error.

3.4.3 Cortisol slope

The slope of decline of cortisol over the day can be calculated as the difference between post-awakening level and evening level. This reflects the rate of decline over the diurnal profile, with a flatter slope indicating a smaller difference between waking and evening values, and a steeper decline indicating a large difference between those two samples. The cortisol slope has been shown to be an important measure of HPA system function in both healthy and clinical populations. A flatter slope was related to increased coronary calcification in a cross-sectional sample using 6 saliva samples (Rosmond et al., 2003). A study investigating the effects of adherence on calculation of cortisol slopes found little difference between participants using self-report and memory cap data (Kraemer et al., 2006). Kraemer et al (2006) concluded that calculation of

slopes was so similar using only two samples (waking and 9pm) compared to 5 samples that studies could use a more limited sampling protocol. This reduces participant burden, which may encourage participation and limit impact of testing protocol on cortisol profile. A flatter cortisol profile has also been found in women with breast cancer compared to healthy controls (Abercrombie et al., 2004) using cortisol samples measured over 3 days. This finding supported previous research indicating a flatter cortisol profile was associated with severe metastases (Touitou et al., 1995) and that a loss of normal variation in diurnal cortisol profile predicted mortality in breast cancer patients (Sephton, Sapolsky, Kraemer, & Spiegel, 2000). A flatter cortisol slope has also been related to chronic stress, for example patients with chronic fatigue syndrome (MacHale et al., 1998), mothers of young children with negative relationship functioning and high demands (Adam & Gunnar, 2001) and emergency room nurses (Yang et al., 2001). Intervention studies have also shown a move towards a steeper cortisol decline after a stress-reducing program (Carlson, Speca, Patel, & Goodey, 2004).

3.5 Methodological considerations

3.5.1 Saliva sampling

Cortisol can be measured via the blood, urine or saliva. In recent years collection via saliva has become a viable alternative to blood plasma, especially useful for naturalistic studies. Salivary cortisol has been shown to be a reliable biomarker of psychological stress across many populations and study designs (Hellhammer, Wust, & Kudielka, 2009) and has a high correlation with blood saliva (Levine, Zagoory-Sharon, Feldman, Lewis, & Weller, 2007). Cortisol is transported to saliva via a passive diffusion process, meaning that levels are comparable to the free cortisol found in blood plasma and is therefore unaffected by rate of saliva flow (Kirschbaum & Hellhammer, 1994). Measuring cortisol in saliva has a number of advantages. Saliva

collection by participants is easy and unobtrusive, which means it can be done at any time at with regular frequency. Devices for the collection of saliva have been developed, with one common example the Salivette made by Sarstedt (see figure 5.3). This consists of a small cotton swab, held inside a centrifugation tube. The cotton swab is inserted into the mouth, and saliva is absorbed onto this swab. The procedure does not require participants to handle their saliva. Saliva collected in this way should ideally be frozen when stored, however, research has shown that it is possible for the samples to be held at room temperature for up to 4 weeks, with little degeneration of cortisol (Kirschbaum & Hellhammer, 1994).

FIGURE 3.3 SALIVETTE TUBE

3.5.2 Participant adherence

The diurnal profile of cortisol, with the rise in the morning and decline over the day, means that time of sampling in naturalistic studies must be considered. If researchers wish to analyse the cortisol awakening response, and calculate an accurate slope estimate, they must rely on participants to collect their samples at designated time, and to accurately record these time. Failure to take the saliva samples when designated by the researchers can have a significant impact on the magnitude of

the CAR, and the slope over the day (Broderick, Arnold, Kudielka, & Kirschbaum, 2004). Research from medication adherence studies demonstrates a strong bias towards over-estimation of compliance due to social pressures (Johnston, French, Bonetti, & Johnston, 2004). This social pressure may also be relevant in psychological studies, where participants feel obligated towards the researcher. Participant characteristics such as gender, health status, and age, and also motivation for being involved in the research, may affect compliance with research protocols. Electronic monitoring devices have been developed which allow researchers to verify the accuracy of participant self-report data. An initial study using these monitoring devices found that 26% of participants were non-compliant for one sample, with 21% being non-compliant for one or more (Kudielka, Broderick, & Kirschbaum, 2003). Kudielka et al (2003) also reported that half of the non-compliant samples involved the waking sample, which is the most crucial sample for calculation of CAR and cortisol slope over the day.

Broderick and colleagues compared a healthy control group with fibromalgia patients, hypothesizing that the clinical group would be more compliant due to their increased motivation to participant in research which may benefit their condition (Broderick et al., 2004). Each group were further divided, with half being informed that their compliance with time of collections was being monitored. Amongst participants who were aware their compliance was being monitored, there was no difference between the control and clinical group, however, for naïve participants, there was a significant difference in compliance between the two groups. For the clinically unaware group, compliance was at the same level as the informed group, but was significantly lower for the unaware controls. Further analyses revealed no differences in compliance between any groups across a 7 day testing period. The researchers were also able to measure the impact of compliance on cortisol levels; a standard CAR was found in compliant samples, with no rise apparent in non-compliant samples, and there was a steeper slope over the day amongst compliant samples compared to a flat slope in

non-compliant samples. This study provides information about the factors which may affect participant adherence to saliva sampling protocols, however, only middle-aged women were included and it is possible that affects would be different for a variety of participant groups. Participants did not receive payment for this study, in contrast to many large scale naturalistic studies, and payment may have an important impact on compliance.

Another issue involved with participant compliance is the area of waking up, which is a crucial aspect of the CAR, slope over the day and total cortisol output. It is not always obvious at which moment one becomes awake, and what constitutes being awake may vary between individuals. This can lead to variation within participants. Some will wake up using an alarm clock, which is perhaps more likely during the week for working participants, however, at the weekend or in non-working groups, waking up may not be so defined. This allows for variation in the time between waking and collecting of the sample, based on participants own perceptions of when they are awake. Recently, researchers have investigated the use of actigraphs, which measure activity, to assess the time lag between waking up and taking the waking saliva sample (Eissa, Poffenbarger, & Portman, 2001; Jean-Louis, Zizi, von Gizycki, & Hauri, 1999). However, compliance with times for taking samples, and differences between definition of being awake, are not the only factors which can affect cortisol levels. Typical saliva sampling procedures that are explained to participants in naturalistic studies include information about the importance of sampling times, and also about avoidance of eating, drinking and physical activity before collection of samples. Although electronic monitoring devices can be employed to increase compliance with timing of samples, they are not able to control for the effects of daily activities.

3.6 Cortisol and ill-health

3.6.1 Cardiovascular disease

An altered cortisol profile has been associated with a range of cardiovascular outcomes including increased risk of cardiovascular disease, increased mortality amongst those with these diseases and cardiovascular risk factors. A prospective association was found between cortisol and future coronary heart disease in middle aged men (Smith et al., 2005) and raised cortisol predicted mortality in patients with chronic heart failure (Guder et al., 2007). Increased total cortisol output was found in patients with coronary artery disease compared to matched controls (Otte et al., 2004), and acute rises in cortisol after an acute coronary syndrome predicted cardiac outcomes (Bain, Poeppinghaus, Jones, & Peaston, 1989; Tenerz et al., 2003). Correlations have also been found between various measures of cortisol and degree of coronary artery disease as indexed by calcification of vessels and atherosclerosis (Alevizaki, Cimponeriu, Lekakis, Papamichael, & Chrousos, 2007; Koertge et al., 2002; Troxler, Sprague, Albanese, Fuchs, & Thompson, 1977). Troxler et al studied men from the United States Air Force and reported an associated between fewer cardiac lesions and a faster rate of decline of cortisol over the monitoring period. Further, increased cortisol was related to higher cholesterol, elevated blood pressure and increased likelihood of smoking. In a sample of women aged over 65 presenting with acute coronary syndrome, increased morning levels of cortisol were related to cardiac stenosis (Koertge et al, 2002) and in a sample of men and women elevated morning cortisol was also associated with cardiac stenosis was independent of age or sex (Alevzaki et al, 2007). Other studies have found mixed results, with total cortisol output being related to number of plaques but no relationship with cortisol slope (Dekker et al., 2008), however a flatter slope has been related to increased coronary calcification by others (Rosmond et al, 2003; Matthews, Schwartz, Cohen, & Seeman, 2006) and no correlation found between cortisol awakening response and number of diseased

vessels (Whitehead, Perkins-Porras, Strike, Magid, & Steptoe, 2007). There is also evidence that elevated cortisol levels are related to increased coronary risk factors (Rosmond & Bjorntorp, 2000) and may explain increased endothelial damaged in depressed individuals (Broadley et al., 2005).

Overall, these studies provide evidence for a link between elevated levels of cortisol and increased coronary damage, however, there is a lack of consistency within these findings. Some studies used only a single estimate of cortisol, or reported morning levels with no measure of the awakening response, which do not provide accurate estimates of the diurnal profile of cortisol. In addition, there is an overall lack of studies which measure cortisol awakening response, total cortisol output and cortisol slope, and more studies are needed which investigate the specific effects of each of these measures. Despite these limitations, there is evidence that cortisol is related to a systemic profile of inflammatory activity associated with negative cardiac outcome, and the specific processes which may explain this link will now be reviewed.

Excess levels of cortisol act on many systems to increase risk of cardiovascular ill-health, including increased inflammation of blood vessels leading to advancement of atherosclerosis, as shown in figure 5.4. Firstly, cortisol affects break down and storage of lipids, which has a particular effect on increasing visceral fat deposits (Bujalska, Kumar, & Stewart, 1997) leading to higher abdominal fat and also to decreased muscle mass (Girod & Brotman, 2004). Fat cells are metabolically active and have a negative impact on cardiovascular risk factors including blood pressure and insulin resistance (Trayhurn & Beattie, 2001). Increased visceral obesity is associated with an altered cholesterol profile, leading to higher levels of high-density lipoprotein cholesterol (Rainwater, Mitchell, Comuzzie, & Haffner, 1999). Secondly, cortisol is associated with increased endothelial dysfunction which is a precursor to atherosclerosis. Endothelial dysfunction can be caused by hyperglycaemia and hypertension, which are known to be effects of chronically elevated levels of cortisol (Jensen-Urstad, Johansson, &

Jensen-Urstad, 1997). Cortisol also increases vascular tone via other pathways independent of endothelial function (e.g. Ullian, 1999; Walker & Williams, 1992).

A final pathway implicating elevated levels of cortisol with cardiovascular disease is effects on inflammation and tissue repair. Atherosclerosis is known to be associated with inflammation of endothelial cells, and increased levels of proinflammatory cells, such as tumour necrosis factor (TNF), are thought to encourage plaque development and rupture (Hansson, 2005; Hansson & Libby, 2006). Increased inflammatory activity has been reported in patients with coronary artery disease, and elevated levels of proinflammatory cytokines have been reported as predictors of coronary events (Danesh et al., 2000; Ridker, Cushman, Stampfer, Tracy, & Hennekens, 1997; Ridker, Hennekens, Buring, & Rifai, 2000) and reduced activity of anti-inflammatory cytokines have also been found (Heeschen et al., 2003). There is a reciprocal relationship between cytokines such as IL-1 and IL-6 and cortisol; cytokines act to promote HPA axis function leading to production of cortisol, and cortisol acts to inhibit levels of cytokines (Nijm & Jonasson, 2009). Although this may lead to a protective inflammatory state under normal conditions, an imbalance in the function of the HPA axis can lead to an enhanced inflammatory state. Levels of IL-1 and IL-6 have been associated with increased cortisol levels in patients with coronary artery disease (Nijm, Kristenson, Olsson, & Jonasson, 2007), but this relationship was only significant for evening levels of cortisol. The relationship between HPA axis function and inflammation, and the coronary consequences of this relationship, are complex and require detailed investigation of a number of biological systems. However, research in this area does suggest that cortisol may represent one causal link between stress and inflammation in heart disease.

3.6.2 Adiposity

Obesity is linked with a range of disorders including elevated risk of cardiovascular disease, increased type 2 diabetes and higher mortality (Kissebah & Krakower, 1994). There is accumulating evidence that alterations in cortisol and HPA axis function are associated with obesity and adiposity particularly of the central and abdominal regions (e.g. Bjorntorp & Rosmond, 2000). Cushing's disease, which is accompanied by an elevated cortisol profile, is associated with a higher waist-to-hip ratio, insulin resistance and dyslipidaemia (Tauchmanova et al., 2002). Impaired suppression of cortisol after administration of the dexamethasone suppression test has been associated with obesity in women (Pasquali et al., 2002) and waist-to-hip ratio in men (Ljung, Andersson, Bengtsson, Bjorntorp, & Marin, 1996). Elevated urinary cortisol has been found in premenopausal women with higher waist-to-hip ratios and larger abdominal diameter (Marin et al., 1992). Altered reactions to administration with cortisol enhancing drugs have also been found amongst obese men and women (Pasquali et al., 1996; Pasquali et al., 1999). There is also evidence that heightened cortisol responses to stress may be important in this relationship (Moyer et al., 1994; Rosmond, Dallman, & Bjorntorp, 1998). However, relationships between cortisol and body composition are not always in the expected direction (e.g. Travison, O'Donnell, Araujo, Matsumoto, & McKinlay, 2007) and may vary with age and gender of participants (Lottenberg et al., 1998; Strain et al., 1982).

Rosmond (2003) proposed that disturbances in regulation of the HPA axis occur in genetically susceptible individuals due to environmental pressures, and one consequence of this dysregulation is development of type 2 diabetes (Rosmond, 2003). Cortisol interferes with the action of insulin. Figure 5.4 shows the pathways which link elevated levels of cortisol to adiposity, affecting the liver, skeletal muscle, adipose tissue and pancreas. Although the mechanisms that explain the link between cortisol and obesity are not yet known, there is some evidence of role of appetite regulation. Stress is known to affect appetite, leading in a reduction in some individuals but an

increase for others (Epel et al., 2004; Stone & Brownell, 1994). Higher levels of stress, which cause elevations in cortisol, have been associated with an increased intake of calories (Tataranni et al., 1996) and increased weight gain (Epel et al, 2004). Alterations in cortisol profile have also been demonstrated in those with eating disorders including anorexia and bulimia nervosa (Gluck, 2006; Lo Sauro, Ravaldi, Cabras, Faravelli, & Ricca, 2008). A recent review paper suggested that chronic or repeated instances of stress may result in higher desire for foods, termed "stress-induced food reward dependence" (Adam & Epel, 2007). Further, Dallman and colleagues (2003) suggested that eating during times of stress can become a reward system, due to a negative feedback system with corticotrophin releasing factor.

3.6.3 Summary of cortisol and ill-health review

There is extensive research investigating the links between altered cortisol profiles and a range of poor health outcomes. For the purpose of this thesis links between cortisol and cardiovascular disease and adiposity have been reviewed. The evidence presented here shows a reliable relationship between elevated cortisol and both outcomes. Further, research investigating the mechanisms that may mediate this relationship has been reviewed. If psychosocial factors also have a relationship with cortisol then it is probable that these factors can moderate the negative effects of cortisol. Therefore the following sections will outline the relationship between positive well-being, optimism, social support and cortisol.

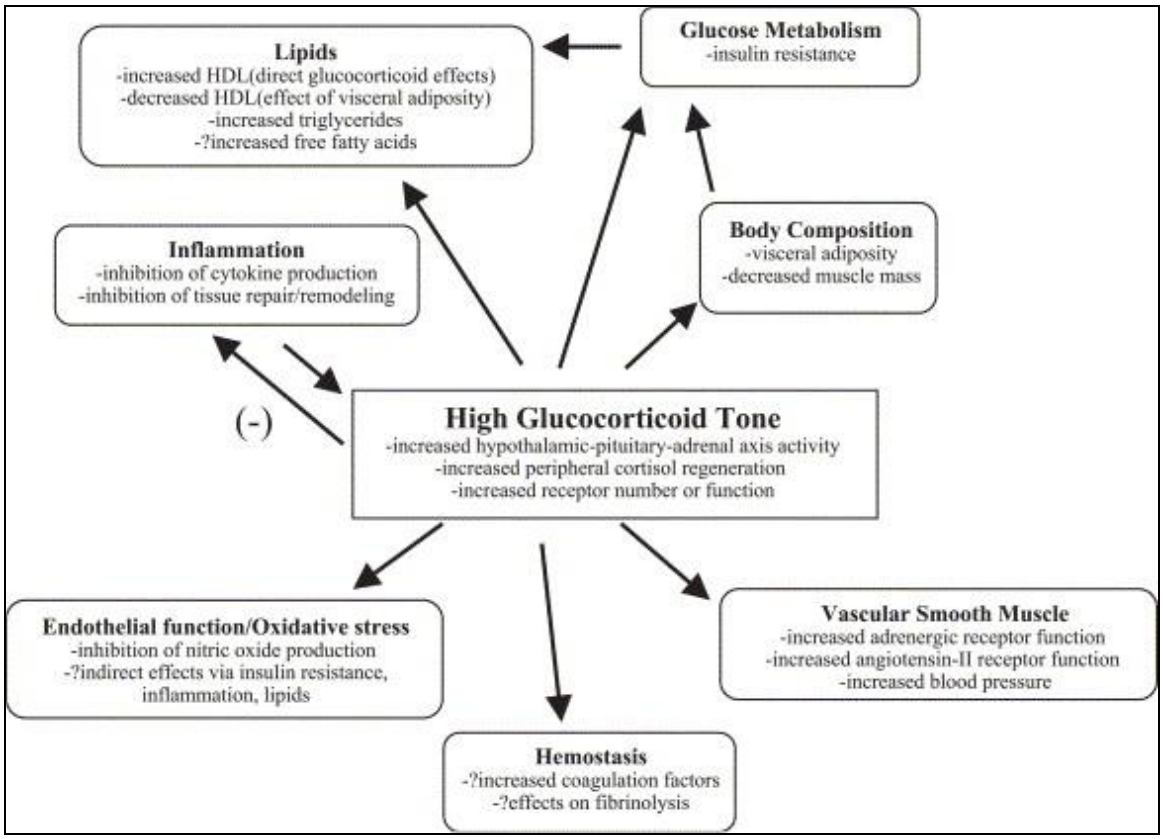


FIGURE 3.4 GLUCOCORTICOID EFFECTS ON CARDIOVASCULAR RISK FACTORS (GIROD & BROTMAN, 2004)

3.7 Positive psychosocial factors and cortisol

3.7.1 Positive well-being, optimism and cortisol

There have been two main approaches to the study of cortisol profiles and positive well-being. The first is to measure within-person associations using repeated measurement of affect and cortisol over a certain period. Davydov, Shapiro, Goldstein & Chicz-DeMet (2004) measured 203 registered nurses who worked daytime shifts, all were female and aged between 24 and 50 years. A lower cortisol level was associated with a greater number of happiness ratings, however, this was only the case during the luteal phase of the menstrual cycle (Davydov, Shapiro, Goldstein, & Chicz-DeMet, 2005). Participants were measured on a work and a rest day, and this relationship was only significant on the working day. Hoppmann & Klumb (2006) measured 53 couples

and reported that positive affect was an independent predictor of cortisol, using a time specific and area under the curve measure. Amongst working parents, cortisol was found to be lower during periods of positive affect and enjoyment (Adam, 2005). Smyth et al (1998) measured cortisol over the day and EMA ratings of positive affect in 127 male and female participants. Smyth et al (1998) found that positive affect was significantly related to lower cortisol, and also reported a large difference in total cortisol output when comparing the highest and lowest positive affect quartiles. However, not all studies have found an inverse relationship between positive well-being and cortisol (e.g. van Eck, Berkhof, Nicolson, & Sulon, 1996). Jacobs et al (2007) reported that cortisol was not related to ratings of happiness across 5 days in a sample of 556 women. This study used only a total measure of cortisol, and did not measure the effects with cortisol awakening response or slope over the day. Peeters et al (2003) also failed to find a relationship between positive affect or positive events and cortisol levels in a sample of depressed and healthy participants. These studies show inconsistent findings when relating cortisol profile to repeated measurement of affect, although more studies have reported that higher positive affect is associated with lower cortisol. The studies reviewed above have used measures of total cortisol rather than cortisol slope or cortisol awakening response and it is possible that different results may be found using these measures. Also, the studies have controlled for known confounding factors to a varying degree and therefore it is difficult to draw conclusions about the relationship between state measures of affect and cortisol.

A second method to assess the relationship between cortisol and positive well-being involves the use of state measures of affect. These allow researchers to investigate whether happier people or those with higher levels of positive affect have a different cortisol profile to those who are less happy or have lower levels of positive affect. Steptoe, Wardle, & Marmot (2005) measured EMA ratings of happiness on both work and leisure days in a sample of 228 men and women from the Whitehall II cohort. Happiness ratings were aggregated and participants divided into 5 groups based on

percentage of happy ratings. After controlling for age, grade of employment, smoking status and body mass index, cortisol over the day was significantly lower in those with more happiness ratings. This study found that cortisol output was 32% higher in the lowest compared with the highest happiness group. These findings were replicated on both a working and a leisure day and were independent of general distress scores. These findings were replicated in a three year follow-up (Steptoe & Wardle, 2005). A more recent study with a large sample of 2873 healthy men and women aged on average 60 years also found that cortisol output levels were inversely associated with positive affect (Steptoe et al, 2008b). A marked difference in total cortisol output was again observed in the highest and lowest happiness groups, after adjustment for age, gender, income, ethnicity, body mass index, waist-to-hip ratio, smoking status, employment status and time of waking. Another large scale study used aggregated measures of positive affect collected over a period of 7 days (Polk, Cohen, Doyle, Skoner, & Kirschbaum, 2005). Positive affect was assessed by calling participants over a period of 6 weeks and asking how they were feeling, this information was then used to calculate measures of both trait and state affect. Men with low trait positive affect had a high, flat cortisol slope over the day, whereas women had a low, flat slope. Trait measures of positive affect were not related to cortisol awakening response in men or women, but a relationship was found with state positive affect amongst women. The participants in this study were staying at a hotel during their cortisol sampling procedure, and this, along with the unusual method of calculating the affect scores, may explain the differing results from other studies.

A further study which investigated both state and trait positive affect and cortisol found a different pattern of results (Steptoe, Gibson, Hamer, & Wardle, 2007). State measures of positive affect were calculated from ecological momentary assessment of happiness over two working days to give a mean percentage of time happy. Trait positive affect was measured using the Positive and Negative Affect Schedule (PANAS). State positive affect related to cortisol output over the first hour after waking,

but was not related to waking value, total cortisol output over the day or cortisol slope. For trait positive affect, no relationships were found. Finally, in a study using a eudaimonic measure of well-being, lower total cortisol output was related to higher well-being (Lindfors & Lundberg, 2002), however, this study only included 23 adults and therefore need replication in a larger study before conclusions can be drawn.

The relationship between optimism and cortisol has been scarcely investigated. Lai et al (2005) compared dispositional optimism and positive affectivity to cortisol profiles in a sample of 80 Hong Kong Chinese adults. Higher optimism was related to a lower cortisol awakening response, with this effect being more apparent in males than females. Although there was no relationship between optimism and cortisol decline over the day, higher positive affect was related to lower cortisol levels over the day. These findings suggest a differential effect for dispositional optimism and generalised positive affectivity on cortisol production.

A recent and interesting study by Quirin and colleagues (2009) investigated differences between implicit and explicit measures of affect and relationship to cortisol. Implicit positive and negative affect were assessed using the Implicit Positive and Negative Affect Test (IPNAT; Quirin, Kazen, Rohrmann, & Kuhl, 2009) which requires participants to match nonsense words with emotion words such as happy and helpless. Implicit positive or negative affect is calculated from the likelihood of participants to rate each nonsense word as sounding like positive or negative emotions. Quirin et al reported a relationship between implicit positive affect and cortisol awakening response and cortisol response to stress in a sample of young adult women. This sample used a comprehensive cortisol sampling procedure including measures at waking, 30, 45, 60 and 75 minutes later, and controlled for a number of covariates. The relationship between cortisol and implicit affect remained significant after controlling for the effects of explicit positive affect (as measured by PANAS) suggesting that implicit positive affect has an important relationship with cortisol over and above that of explicit positive affect. However, in a second study, cortisol reactivity to a noise aversion task was not

related to any measures of positive affect. This study suggests a new and interesting way to test relationships between psychosocial factors and physiological responses.

Evidence from cross-sectional studies suggests that there is an inverse relationship between cortisol output and positive well-being, using a variety of measures and samples. However, these associations are not consistent, and there is varying control of well known covariates. Chapters 7 and 8 will further investigate this relationship, using EMA measures of affect, retrospective diary measures (DRM) and also state measures and relate these to total, slope and CAR measures of cortisol output. It will also be possible to control for the effects of a number of confounding factors including age and body mass index.

3.7.2 Social support and cortisol

As reviewed in Chapter 1, there is extensive evidence that greater numbers of social network members and higher levels of perceived social support are linked with reduced negative outcome over a range of health markers. There is some evidence that a dysregulated neuroendocrine system may be one pathway which mediates this link, however, research in this area is limited and inconsistent (Uchino, Cacioppo, & Kiecolt-Glaser, 1996). A prospective study of 125 breast cancer patients, who took 4 cortisol samples over 3 days, found that appraisal, belonging and tangible support was related to lower mean cortisol level, with no relationship found for social network size with no relationships found between social support and diurnal slope of cortisol (Turner-Cobb, Sephton, Koopman, Blake-Mortimer, & Spiegel, 2000). This finding suggests that the psychological appraisal of available support, and the type of support, may be important in understanding the relationship between social support and the neuroendocrine system. Naturalistic studies have found that pregnant women had lower levels of ACTH and cortisol if they had higher levels of perceived social support, and also higher levels of pregnancy specific social support (Wadhwa, Dunkel-Schetter,

Chicz-DeMet, Porto, & Sandman, 1996) but no association between social support and cortisol in breast milk was found in mothers after giving birth (Groer, Humenick, & Hill, 1994). Frequency of emotional support and instrumental support was related to lower levels of urinary cortisol in older men but not in older women, (Seeman, Berkman, Blazer, & Rowe, 1994). Another naturalistic monitoring study which measured cortisol over 3 work and 2 leisure days in nurses and accountants, found no association between work social support and cortisol level on work days (Evans & Steptoe, 2001). Evidence also suggests that the relationship between high social support and lower cortisol are relatively stable, as Rosal et al (2004) found a significant relationship at baseline and at 12 month follow up.

Experimental studies have also provided evidence about gender differences in social support (Kirschbaum, Klauer, Filipp, & Hellhammer, 1995). Participants were allocated no support, stranger support or partner support whilst preparing a presentation and their cortisol levels were then monitored whilst giving the talk. For men, differences were found in the expected direction so that cortisol was highest in the no support group, intermediate in the stranger support group and lowest in the partner support group. However, for women the results were not as expected. Cortisol levels in the no support and stranger support group were similar, but were significantly higher for the partner support group, suggesting that there was no positive benefit of having their partner present for women. The findings of these studies suggest that gender may be an important factor when attempting to explain the relationship between health and social support. Amongst adult males, support provided by a best friend reduced stress related cortisol after the Trier Psychosocial Stress Test compared to a group with no support (Heinrichs, Baumgartner, Kirschbaum, & Ehlert, 2003).

Therefore evidence from cross-sectional and experimental studies suggests a link between social support and cortisol pathway. This is also supported by findings from intervention studies, designed to increase levels of social support between baseline and follow up examine the effect on cortisol levels. Early studies found no

difference in levels of plasma cortisol between older men and women or unemployed and employed women receiving a psychosocial intervention, designed to increase social support (Arnetz et al, 1983; 1987). However, other intervention studies have found a protective effect for social support on cortisol levels. Van der Pompe et al (1997) assigned women with breast cancer to a 13 week intervention or wait list control and found lower levels of plasma cortisol amongst the intervention group. However, this effect was only found for those who had high levels of cortisol at baseline. HIV positive and negative homosexual men who attended a bereavement counselling support group were found to have significantly lower plasma cortisol levels, even at 6 month follow up (Goodkin et al., 1998), suggesting that the benefits of social support interventions are enduring.

There is also evidence of a link between structural measures of social support and an altered cortisol profile. Social integration, or a larger social network, has been reliably linked with reduced disease and increased longevity (see Chapter 1), but research investigating a physiological pathway to explain this relationship has been relatively unaddressed. It has been suggested that social relationships and social integration have a direct effect on regulation of hormonal systems that are relevant for health (Stetler & Miller, 2008). Higher levels of social contact were related to a steeper cortisol decline over the day (Stetler, Dickerson, & Miller, 2004) and a higher morning rise in cortisol (Stetler & Miller, 2005). Further work has also identified that cortisol secretion was predicted by social contacts on the same and preceding day (Stetler & Miller, under review). However, cortisol slope did not predict social contact, suggesting a directional relationship between social contact and cortisol output. This study also reported that having social contact during events was more important than total number of daily contacts over the day. However, this finding suggests a role for more functional aspects of social support rather than structural measures. An experimental manipulation study found no difference in cortisol slope on days when eating lunch with a friend or alone (Stetler & Miller, 2008).

Naturalistic studies have also found evidence of a link between structural measures of social support and cortisol. This author carried out a secondary analysis investigating links between social isolation (a marker of a very small social network) and cortisol profiles over everyday life in order to further investigate the pathways that may link social support with future health outcomes (Grant, Hamer, & Steptoe, 2009). This work is not included as part of this thesis but is broadly relevant to the overall aims. Participants were a subsample from the Whitehall II cohort, and 128 men and 110 women took part in this study. All participants were working, of White European ethnicity and had no history of coronary heart disease or medication for hypertension. Participants were rated as socially isolated on a 0 to 3 point scale, and comparisons were made between low, medium and high levels of social isolation. Ten saliva samples were collected over the day for measurement of cortisol, first at waking, followed by 30 minutes later, and at two hour intervals over the day. Cortisol awakening response, total cortisol output and cortisol slope were calculated.

It was found that the CAR was significantly different between social isolation groups, so that the high isolation group showed a greatly elevated CAR response, and this remained significant after controlling for covariates including age, SES, BMI, smoking, time of waking and loneliness. This association was also found for total cortisol output, with the high isolation group having a significantly larger output compared to medium and low isolation groups (see figure 5.5.), although there was no difference in cortisol slope between the social isolation groups. However, other work has found a link between social integration and a steeper cortisol decline (Sjogren, Leanderson, & Kristenson, 2006). This work adds to previous findings that higher levels of perceived social support are related to cortisol output by finding similar results with a structural measure of social support.

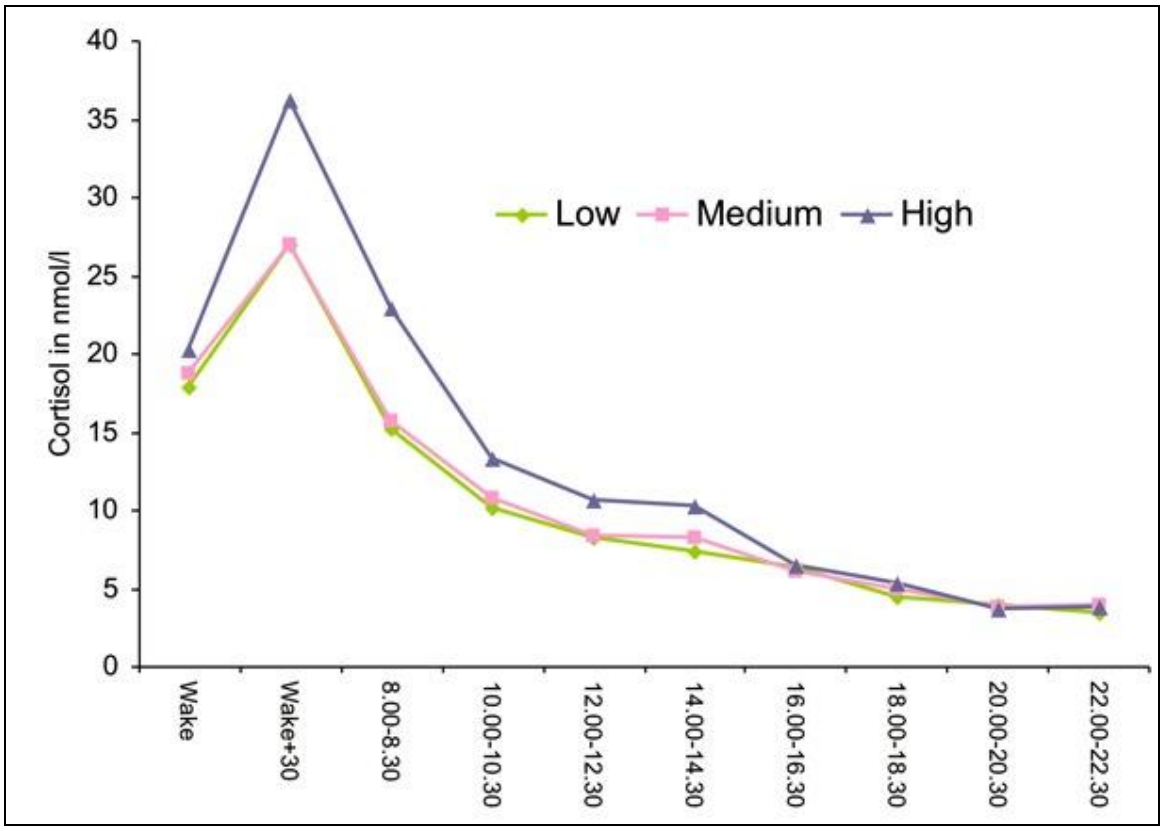


FIGURE 3.5 SOCIAL ISOLATION AND CORTISOL OUTPUT

Overall, these research studies suggest a tentative pathway between dysregulation of the HPA axis and social support in both naturalistic, experimental and intervention studies. However, studies have varied in their use of statistical control for a range of factors known to affect cortisol level such as age, gender and body mass index, which may have an important impact upon the results. In addition, studies have not utilised different measures of cortisol including cortisol awakening response, slope over the day and total cortisol output. These measures are known to have different relationships with health outcomes, and therefore may represent independent pathways between social support and future health status. There has also been a lack of comparison between structural and functional measures of social support, with most studies focussing on just one of these aspects. It will be possible to measure the effects of structural and functional social support on cortisol output over the day, using the three measures of cortisol outlined in this chapter in chapter 7 of this thesis.

3.8 Overview

Alterations in the diurnal profile of cortisol have been consistently linked with mortality and morbidity across a range of diseases and disorders, and also with increased depression. Dysregulation of the HPA axis presents one biological pathway which may be important in explaining the relationship between psychosocial factors and ill-health. In terms of negative affect, depression has been consistently linked with increases in cortisol level. However, research investigating correlations between positive affect and well-being and cortisol is limited and needs further study. Previous research has identified a link between social support and cortisol, finding that a greater social network or greater levels of functional support are associated with a more favourable cortisol profile. However, research in this area has been inconsistent and has not controlled for standard co-variates, or investigated differences in the relationship between social support and the three measures of cortisol outlined in this chapter (the cortisol awakening response, total cortisol output and cortisol slope). Chapters 7 and 8 will address the limitations of previous studies in this area. In terms of positive well-being, both hedonic and eudaimonic measures of well-being will be used. For social support, the measures of structural social support, functional social support and cortisol in a sample of working women. In addition, it will be possible to control for a number of covariates identified in previous research, such as age, grade of employment and body mass index.

3.8.1 Summary and next steps

Dysregulation of the cortisol profile is one pathway by which psychosocial factors may exert their effects on health. Consistent links have been found between negative psychosocial factors such as depression and anxiety, and alteration of the

cortisol profile. This thesis will present two studies that investigate the relationship between social support and cortisol profiles, which is the focus of the second main aim of this thesis. In addition, the relationship between social support and cortisol will be tested in a Japanese sample in chapter 8, thereby testing the third main aim of this thesis. The next chapter will present the main aims and hypotheses of this thesis.

CHAPTER 4: AIMS AND HYPOTHESES

4.1 Thesis aims

The overall aim of this thesis work is to further understanding of the emerging protective relationship between psychosocial factors and health. The specific aims of the thesis, which will be investigated using three studies, are:

1. To investigate links between psychosocial factors
2. To investigate the relationship between psychosocial factors, health behaviour and biology
3. To investigate these relationships in cross-cultural samples

The following table shows how each study contributes to the investigation of these thesis aims.

Aims	Studies
Links between psychosocial factors	2, 3
Relationship between psychosocial factors, behaviour and biology	1, 2, 3
Investigate cross cultural differences	1, 2, 3

TABLE 4.1 THESIS AIMS AND STUDIES

This chapter will demonstrate how the individual studies contribute to the thesis aims, and how they have been informed from the literature reviewed in chapters 1, 2 and 3.

4.2 Study one

Previous studies have tended to examine the impact of life satisfaction on one specific health behaviour. Therefore the first aim of the first study in this thesis (see chapter 5) was to investigate the association between life satisfaction and seven health behaviours. The hypothesis was that life satisfaction would be positively associated with not smoking, exercising regularly, drinking moderately, using sunscreen, eating fruit, avoiding fat and consuming fibre in young adults. This will allow the relationship between life satisfaction and health behaviours to be closely examined within the same population across a range of outcomes. Whilst previous research has identified links between certain health behaviours and life satisfaction, measures are not always comparable. Combining these health behaviours in one study will allow all factors to be held constant, such as the measure of life satisfaction, which has varied widely in previous studies.

The second aim was to test the consistency of associations between life satisfaction and health behaviour across cultures. There has been a focus on Western societies in current research, though there is now some evidence relating behaviours such as smoking and heavy drinking with low well-being in Eastern Europe (Mazur & Woynarowska, 2004; Piko, 2006). It is not clear that comparable associations between life satisfaction and health behaviour will necessarily be present in different parts of the world. For example, individualism-collectivism differs across cultures and may partly explain variation in subjective well-being (Hofstede & McCrae, 2004). In a previous analysis, it was found that depressed mood was greater in collectivist than individualist cultures (Steptoe, Tsuda, Tanaka & Wardle, 2007). People in individualist cultures may base their judgments of life satisfaction more on their own emotions, whereas those in collectivist cultures place greater emphasis on society and the views of others (Suh et al., 1998). If the origins of life satisfaction differ, then associations with health behaviour may also vary.

Examination of an international sample will be valuable as it allows for identification of common relationships between life satisfaction and health behaviours across countries. This will allow researchers to define variations across cultures and point to common determinates across countries. In the study described in chapter 5, three different regions will be examined Western Europe and USA, Central and Eastern Europe, and Pacific Asia. The first of these regions is characterised by an establish democratic society and market economy, the second region consists of countries with emerging market economies and recent socialist governments, and finally the third region is more heterogeneous, with countries such as Japan being economically advanced whereas countries such as Thailand are less affluent. Therefore the second aim of this study was to investigate whether links between life satisfaction and health are consistent across a range of countries.

The third issue investigated in this study was whether associations between life satisfaction and prudent health behaviours are dependent on health-related motives and cognition. Attitudes and beliefs are determinants of health behaviours, and they are central to many theories of health behaviour change, including the theory of reasoned action (Fishbein & Ajzen, 1975), the health belief model (Becker, 1974) and social cognitive theory (Bandura, 1986). Beliefs about the benefits to health are a common element of all these models (Fishbein et al., 2001). Positive health behaviours may not be driven by health-related concerns at all. For example, it could be that regular physical activity is stimulated by social factors or concerns about physical appearance, rather than any beliefs about the importance of physical activity for health, and that these are in turn associated with life satisfaction. This possibility was tested by investigating the contribution of beliefs about behaviours to the association between life satisfaction and behaviour. It was reasoned that if people with higher life satisfaction engage in more prudent health behaviours for health reasons, then the association with life satisfaction would be reduced or eliminated once health beliefs had been included in the statistical models.

4.3 Study two

The second study investigates the first and third aims of this thesis. The broad aim for the analyses presented in chapter 7 is to investigate links between positive well-being, social support and optimism; the associations between social support and health-related biology and behaviour and finally the effect of positive affect on the relationship between social support, health behaviours and biology. In order to assess these aims, three different aspects of social support were used: marriage, structural support and functional support. Positive well-being and optimism were tested using questionnaire measures (eudaimonic well-being, PANAS positive affect, optimism), and also measures of affect in everyday life using ecological momentary assessment and day reconstruction method techniques.

Positive well-being, social support and optimism may be protective for health because they are part of a larger network of favourable psychosocial attributes. If this assumption is correct, relationships between each of these factors may have important consequences for health. Previous evidence has identified consistent links between higher levels of positive affect and aspects of social support, including numbers of friends and general social support (e.g. Baldassare, Rosenfield & Rook, 1984; Pinquart & Sorenson, 2000). In addition, negative affects such as depression and anxiety, have been associated with lower social support and greater social isolation (Lee & Ishii-Kuntz, 1987). A more recent study investigated the relationship between positive affect and social support in more detail in the Whitehall II study (Steptoe et al, 2008a). Positive affect was higher in married participants, those with greater social connectedness and those with higher emotional and practical support. Optimism was also positively correlated with positive affect. Steptoe et al (2008a) reported that emotional support and optimism were independent predictors of positive affect. Further, participants from that study who rated themselves as happy 100% of the time on the

ecological momentary assessments had lower social isolation, and higher emotional support. These findings show a clear relationship between emotional support and positive affect, and also suggest that qualitative aspects of support are more important than structural aspects (such as marriage and social isolation) when predicting levels of positive affect. It could be argued that the protective effects of marriage and structural social support are experienced through more functional aspects of social support. The broad hypothesis investigated with reference to the first aim is that higher levels of social support will be related to higher levels of psychological well-being. The specific hypotheses to be tested are:

7.1a) Marital status would be associated with higher levels of psychological well-being, as measured by PANAS positive affect, Scales of Psychological Well-being and momentary assessments.

7.1b) Structural measures of social support have been related to higher positive affect in previous studies. Therefore, it was expected structural social support to be positively related to PANAS positive affect. Relationships with more eudaimonic measures of well-being are less obvious. Having a larger social network may be associated with increased fulfilment in life and sense of well-being, and therefore it was also predicted a positive relationship with the Scales of Psychological Well-being. EMA and DRM assessments over the work and weekend day may not be related to structural social support. Number of network members is unlikely to influence momentary experience of positive affect. However, this relationship may be different across work and weekend days.

7.1c) Functional social support has previously been identified as an independent correlate of positive affect as measured by EMA techniques. There has also been evidence showing positive links between functional aspects of support and

positive affect. Therefore, it was predicted that functional social support would be associated with higher levels of PANAS positive affect, optimism, Scales of Psychological Well-being and EMA and DRM momentary assessments.

7.1d) In order to determine the relative effects of the three social support measures, regression models were used to predict levels of positive affect. In the final stage of each analysis, the three social support measures were entered simultaneously. Functional social support is considered to be an individual's psychological representation of their support system (Cohen & Syme, 1985) and are therefore more proximal to satisfaction with support available. Measures of structural support do not allow for identification of negative aspects of social support. For example, someone who is unhappily married and feels that they receive no support from their spouse, would score the same for structural support although they are unlikely to be less happy, in comparison to someone who is happily married. It is also likely that functional support is the mechanism by which the support offered by social contacts is experienced. For these reasons it was predicted that functional social support would emerge as the strongest independent correlate of PANAS positive affect, optimism, EMA and DRM ratings.

The second main aim of these analyses was to investigate the relationship between social support and health behaviours and neuroendocrine function. Some previous findings relating social support with health behaviours have suggested a trend for a negative pattern, whereby lower social support is associated with more risky health behaviours and less protective behaviours. However, results are not always consistent. Lower social support was associated with reduced alcohol consumption and lower rates of physical activity in a cross-country sample of young adults (Allgöwer, Wardle, & Steptoe, 2001), but not with fruit and vegetable consumption or smoking.

Marital status has also been linked with a decrease in risky health behaviours such as smoking and drinking alcohol (Umberson, 1987).

7.2a) Marital status will be related to decreased smoking and decreased heavy drinking. Expected relationships with physical activity are less clear, although there is evidence to suggest that greater social support is associated with greater rates of exercise. Therefore, it was hypothesized that marital status would be linked with increased exercise. Finally, it was expected that marital status would be associated with increased fruit and vegetable consumption.

7.2b) Structural social support will be positively associated with moderate alcohol consumption and higher rates of exercise. It was expected fruit and vegetable consumption to be higher and smoking rates to be lower for those with greater structural social support.

7.2c) Previous studies linking social support with health behaviours have tended to focus on structural aspects of social support, therefore projected relationships between functional social support and health behaviours are less clear. Studies have suggested that social norms can influence health behaviours, and so it is possible that having a higher level of functional social support could be related to increased performance of health behaviour. Therefore, it was hypothesized that functional support would be positively related to fruit and vegetable consumption and exercise, and inversely related to smoking and alcohol consumption.

Social support has also been related to cortisol in previous studies, but again results have been inconsistent. Functional social support was related to lower mean cortisol in a sample of breast cancer patients (Turner-Cobb et al, 2001) but no relationship was found for structural support. Structural support has been related to a

steeper cortisol slope (Stetler, Dickerson & Miller, 2004). It has also been found that social isolation (a marker of low structural support) was related to total cortisol output over the day in middle-aged adults participating in a Whitehall substudy (Grant, Steptoe & Hamer, 2009). Relationships between marriage and cortisol profiles have often focussed on the quality of the marital partnership, with favourable cortisol profiles for those with a happy marriage (e.g. Kiecolt-Glaser & Newton, 2001). However, previous studies have not compared structural and functional social support within the same study and also have not compared relationships on working and leisure days. There is also evidence that cortisol measures have differential relationships with health outcomes (e.g. Dekker et al, 2008; Whitehead et al, 2007) and psychosocial factors (Polk et al, 2005). Therefore, CAR, slope and total cortisol measures were assessed separately throughout.

Specific hypotheses to be tested are:

7.2d) Marital status will be associated with a more favourable cortisol profile, as measured by total cortisol output, slope and CAR, on both the work and leisure day.

7.2e) Structural social support will not be related to CAR or cortisol slope, but will be related to total cortisol output.

7.2f) Functional social support will be related to a lower total cortisol output. Expected relationships with CAR and slope of decline are less clear, but it was hypothesized that higher levels of functional support would not be related to these measures, based on the findings of previous studies.

7.2g) When entered into a combined model, functional social support will be a an independent correlate of cortisol

The third aim of the analyses presented in Chapter 7 is to investigate whether positive affect is important in explaining the relationship between social support and health-related biology and behaviour. This thesis will test the argument that relationships between social support and behaviour and neuroendocrine function will be stronger for people with high rather than low positive affect. To test this, high and low positive affect measured by DRM and also PANAS will be used. The hypotheses to be tested are:

7.3a) Relationships between marital status, structural social support, functional social support and health-related behaviours will be stronger for those with high positive affect.

7.3b) Relationships between marital status, structural social support, functional social support and neuroendocrine function will be stronger for those with high positive affect.

4.4 Study three

The third study presented in this thesis investigates each of the three main thesis aims. Cross-cultural studies provide a unique opportunity to test the consistency of associations between social protective factors and positive affect, behaviour and biology. The results in the previous chapter indicated that functional social support was related to greater positive affect measured with the PANAS and EMA sampling, whereas marriage was not. Greater social support was also related to more frequent physical activity and higher cortisol on the leisure day. Marriage by contrast was associated with lower cortisol output over the day. The question arises whether these associations are universal, or depend on the cultural context and the meaning of these constructs. Therefore, the first aim of this study was to test whether the observations

made in Chapter 7 in the UK Daytracker sample could be replicated in Japan. The hypotheses for this study will be presented in chapter 8, based on the findings of that chapter. The second aim for this study is to compare levels of positive well-being, health behaviours and cortisol in the UK and the Japanese samples to identify if there are similar patterns that may suggest a link between positive well-being and these pathways.

4.5 Summary and next steps

This chapter has presented the main aims and hypotheses for each of the studies in this thesis. The following chapter will present the finding from study 1, which investigates the relationship between life satisfaction and health behaviour in a cross-cultural sample. This study investigates the first and third main aims of this thesis.

CHAPTER 5: LIFE SATISFACTION AND HEALTH BEHAVIOURS METHODS AND RESULTS

5.1 Participants

In order to test the aims and hypotheses described in chapter 4, it was necessary to use a large, cross cultural dataset with uniform measures in each country. Therefore the International Health and Behaviour Study was selected, a cross-sectional questionnaire survey of university students administered in 24 countries between 1999 and 2001, which has been analysed and reported elsewhere (Steptoe, Tsuda, Tanaka, & Wardle, 2007; see Appendix 1). The questionnaire was developed in English, then translated and back-translated into 18 languages (Bulgarian, Czech, Dutch, Flemish, French, German, Greek, Hungarian, Icelandic, Italian, Japanese, Korean, Mandarin, Polish, Portuguese, Romanian, Spanish and Thai). It was administered to students from a single university in each of 21 countries, and two universities in the remaining 3 countries. Institutions in the different countries were selected as having comparable academic standing. Respondents were enrolled on a variety of programs, including economics, languages, law and engineering. Students studying health-related or medical topics were excluded as they may have knowledge about the relationships between health behaviours and long term health outcomes, which may have affected their ratings on the health belief questions.

The questionnaire consisted of a range of measures of health behaviour, attitudes to health and health beliefs, and was typically administered at the end of classes. Participants were told that the survey measured activities relevant to health and formed part of an international comparison, but were given no other information. Completion of the survey was voluntary; however, response rates in most countries were over 90%. The target sample size was 800 students aged 17-30 years per

country, but ranged from 376 to 2028 depending on the interests of collaborators in each country.

The total sample size was 19,647. Three countries (Colombia, South Africa and Venezuela) were excluded since they did not fit into the geopolitical regions compared in this analysis. Data were therefore analyzed from 17,246 participants from 21 countries, categorised into three regions as follows: Western Europe and the USA (Belgium, England, France, Germany, Greece, Iceland, Ireland, Italy, Netherlands, Portugal, Spain, USA), Central and Eastern Europe (Bulgaria, Hungary, Poland, Romania and Slovakia) and Pacific Asia (Japan, Korea, Taiwan and Thailand).

5.2 Measures

5.2.1 Life satisfaction

Life satisfaction was measured using a single item, “All things considered, how satisfied are you with your life as a whole?”. Responses were rated on a scale from 1 to 5, ranging from “very satisfied” to “very dissatisfied” with higher scores indicating greater dissatisfaction. Single item life satisfaction measures have been widely used in the literature in several different cultures (Diener, Diener, & Diener, 1995; Diener, Oishi, & Lucas, 2003). The proportion of participants rating themselves as “very dissatisfied” was low, so this responses were amalgamated with “fairly dissatisfied” to generate four categories.

5.2.2 Health behaviours

The following seven health behaviours were included in this analysis: cigarette smoking, alcohol consumption, physical exercise, use of sun protection, fruit intake, avoidance of dietary fat, and consumption of dietary fibre. For the purposes of analysis, each behaviour was coded into a binary variable, with 0 as the unhealthy

option. Binary outcomes were chosen for three reasons. First, several behaviours were measured in binary format, so a uniform method of data presentation seemed desirable. Second, there may have been minor variations in the interpretation of items across languages, so a conservative approach to data reduction seemed warranted. Third, binary outcomes allowed us to compute odds ratios, so effect sizes across regions and behaviours could be computed.

5.2.2.1 Smoking

Participants were asked to read a list of statements and then select which one was most appropriate for them. This list had 8 options: “I have never smoked a cigarette, not even a puff”; “I have only ever tried one or two cigarettes”; “I used to smoke cigarettes but I don’t now”; “I don’t smoke cigarettes but smoke a pipe or cigars”; “I smoke cigarettes but not as many as one per day”; “I usually smoke between 1 and 10 cigarettes per day”; “I usually smoke between 10 and 20 cigarettes per day”; “I usually smoke more than 20 cigarettes per day”. Participants were also asked to indicate if they would like to reduce the amount they smoked with a yes/no response option. Participants were characterised as smokers if they selected the response for either pipe/cigar smoking, or more than 1 cigarette per day.

5.2.2.2 Drinking alcohol

Participants were asked to think about how often they had drunk beer, wine, spirits and any other alcoholic drink. They were asked to indicate if they were a non-drinker; a very occasional (special occasions only) drinker; an occasional drinker; or a regular drinker. Those who answered occasional or regular drinking were also asked to state how many days out of the previous 14 they had had a drink, and how much they had drunk on those days. Finally, participants were asked if they would like to reduce the amount they drank. Drinking small quantities of alcohol is thought to be beneficial

for health (Mukamal, Chiuve, & Rimm, 2006), however, regularly drinking more than the recommend amount of alcohol is associated with increased incidence of depression (O'Donnell, Wardle, Dantzer, & Steptoe, 2006) and poor physical health (Corrao, Bagnardi, Zambon, & La Vecchia, 2004). Since the effects for moderate drinking are not uniform across different health outcomes, participants were categorised as either heavy drinkers or not heavy drinkers as these options have a clear healthy/unhealthy distinction. Alcohol consumption was assessed by asking participants if they drank alcohol and if so, how many drinks they consumed on a typical occasion as used in previous studies (Dantzer, Wardle, Fuller, Pampalone, & Steptoe, 2006). They were divided into heavy drinkers (coded 0), and nondrinkers or light/moderate drinkers (coded 1). Amount of alcohol consumed in an average two week period was first calculated by multiplying the number of days out of the past 14 when an alcoholic drink had been consumed by the number of alcoholic drinks consumed on each occasion. A value of 28 or greater was labelled as a heavy drinker for this analysis, and 27 or less as a moderate drinker. Data concerning alcohol consumption were not obtained in Japan, Korea or Taiwan, so the Pacific Asian region was excluded from these analyses.

5.2.2.3 Fruit intake

Participants were asked to indicate how often they ate fruit using the following response options: at least once a day; every 2 or 3 days; about once a week; less than once a week; never. These responses were then categorised as healthy if they ate fruit at least once per day, and were compared to the unhealthy option of less than once a day.

5.2.2.4 Sun protection

Using sunscreen is protective against development of skin cancers and is recommended when sunbathing. Participants were asked to rate if they used sunscreen whilst sunbathing, with “yes”, “no” or “I never sunbathe” responses. Healthy responses indicating use of sunscreen were compared to unhealthy responses of not using sunscreen. Although not sunbathing is also an example of a healthy behaviour, it is a different behaviour to wearing sunscreen whilst sunbathing and therefore participants who indicated that they did not sunbathe were excluded from these analyses.

5.2.2.5 Fibre intake

Eating a high fibre diet is thought to be beneficial for long term health, in particular prevention of obesity (Slavin, 2005). Participants were asked “Do you make a conscious effort to eat foods that are high in fibre?” with yes/no response options. A healthy response of yes was coded as 1 and an unhealthy response of no was coded as 0.

5.2.2.6 Fat consumption

A diet high in certain types of fat and cholesterol is associated with development of atherosclerosis, which can lead to coronary heart disease. Participants were asked if they made “a conscious effort to avoid eating foods that contain fat and cholesterol” and responded as yes/no. These were then coded as healthy for yes and unhealthy for no.

5.2.2.7 Physical activity

To measure physical activity, participants were asked to indicate both whether they had taken any exercise in the previous two weeks, and how many times they had exercised. Taking part in any physical activity at least once in the previous 14 days was coded as healthy, and those participants who indicated that they had not exercised were coded as unhealthy. Participants were also asked to indicate if they wished to increase their current level of activity.

5.2.3 Health beliefs

Health beliefs were assessed by asking participants to rate the importance to health of not smoking, not drinking too much alcohol, taking regular exercise, using sun protection, eating fruit, limiting fat intake, and eating fibre. Ratings were made on 1-10 point Likert scales ranging from 1 = "of very low importance" to 10 = "of very great importance". These ratings were included as continuously distributed variables in the regression models. The data were positively skewed, so were analyzed by categorizing ratings of 9 or 10 as strong beliefs, and comparing them with weaker beliefs (8 or less). However, similar results emerged when beliefs were analyzed as continuous variables.

5.3 Statistical analysis

The analysis presented in the following chapter is a secondary analysis of an existing data set. The distribution of life satisfaction ratings in men and women over the complete sample was analyzed using STATA version 9.0 with country as the primary sampling unit so as to obtain accurate confidence intervals, taking account of the clustered nature of the data. The mean age of participants was 20.53 (2.08), but there were small differences in mean age between country samples, ranging from 18.84 in Ireland to 22.55 in Germany. Age was therefore taken into account in the analyses as

a covariate. The associations between life satisfaction and behaviours were analyzed using logistic regression models with the "*svylogit*" command in STATA. The dependent variable in each analysis was the health behaviour. Model 1 included life satisfaction, age and sex as independent variables. Age was included as a factor in the model since previous analysis show that age is related to health behaviours. Model 2 investigated the extent to which associations between life satisfaction and health behaviour were mediated by health beliefs by adding the appropriate health belief to each regression model. The odds of healthy behaviour for each level of life satisfaction adjusting for age and sex were computed, with 'dissatisfied' as the reference category. 95% confidence intervals (CIs) taking account of data clustering and *p* values for trends across categories are presented. Each model was repeated for the complete sample and for the three geopolitical regions separately.

5.4 Results

The proportion of respondents from each country is shown in table 5.1. The sample size ranged from 376 in Taiwan to 2028 in Italy.

5.4.1 Health behaviours

The rates of health behaviour performance for each region are shown in table 5.2. More than three-quarters (78%) of participants in this study were non-smokers, ranging from 76% in Western Europe and USA and in the Central and Eastern region to 89% in the Pacific Asian region. The proportion of respondents who did not drink or drank only moderately was 63% overall, being more common in Western Europe and the USA compared with Central and Eastern Europe (65% versus 59%). Leisure time physical exercise was reported by 70% of participants, with the highest prevalence (71%) in Western Europe and the USA. Using sun protection was most common in respondents from Western Europe and the USA (76%) and lowest in Pacific Asian

countries (66%). Fewer than half respondents ate fruit at least daily. Rates were higher among respondents from Western Europe and the USA (47%), compared with the Central and Eastern Europe (43%) and were very low in the Pacific Asia region (29%). Attempts to limit fat in the diet were similar across all three regions, averaging 36% overall. Respondents from Pacific Asia reported the highest rates of deliberate efforts to consume fibre (51%) compared with 31% in Western Europe and USA and 28% in Central and Eastern Europe.

TABLE 5.1 SAMPLE SIZE AND AGE IN MEN AND WOMEN

	Sample size (N) (100%)	**Men (%)**	**Women (%)**	**Age M (SD)**
Country	17 246 (100)	7429 (43)	9817 (57)	20.5 (2.1)
Belgium	536	258 (48)	277 (52)	19.2 (.04)
Bulgaria	797	376 (47)	421 (53)	20.8 (0.8)
England	847	455 (54)	392 (46)	19.9 (.06)
France	771	399 (52)	372 (48)	19.9 (.06)
Germany	730	335 (46)	395 (54)	22.6 (.09)
Greece	794	398 (50)	396 (50)	21.2 (.06)
Hungary	593	238 (40)	355 (60)	21.8 (.08)
Iceland	683	321 (47)	362 (53)	21.1 (.08)
Ireland	471	109 (23)	362 (77)	18.8 (.06)
Italy	2028	777 (38)	1251 (62)	20.3 (.04)
Japan	533	269 (50)	264 (50)	19.3 (.07)
Korea	711	243 (34)	468 (66)	21.2 (.08)
Netherlands	687	279 (41)	408 (59)	21.1 (.07)
Poland	762	336 (44)	426 (56)	20.9 (.05)
Portugal	951	479 (50)	472 (50)	21.1 (.07)
Romania	789	396 (50)	393 (50)	20.8 (.07)
Slovakia	1259	560 (44)	699 (56)	21.0 (.04)
Spain	483	219 (45)	264 (55)	20.9 (1.0)
Taiwan	376	179 (48)	197 (52)	21.8 (1.2)
Thailand	843	316 (37)	527 (63)	19.6 (.05)
USA	1672	515 (31)	1157 (69)	19.3 (.04)

TABLE 5.2 PROPORTIONS OF HEALTHY BEHAVIOURS OVERALL AND IN EACH REGION

	Overall % (95% CI)	Region 1: Western Europe & USA % (95% CI)	Region 2: Central & Eastern Europe % (95% CI)	Region 3: Pacific Asia % (95% CI)
Non smokers	78 (77-79)	76 (75-77)	76 (74-77)	89 (88-90)
Moderate drinking	63 (62-65)	65 (64-67)	59 (57-62)	-
Exercise	70 (69-70)	71 (70-72)	69 (68-71)	66 (64-68)
Sun protection	72 (71-72)	76 (75-76)	71 (69-72)	53 (51-56)
Fruit consumption	44 (43-45)	44 (47-48)	43 (42-45)	29 (27-31)
Fat avoidance	36 (36-37)	38 (37-39)	36 (35-37)	31 (29-32)
Fibre intake	31 (32-34)	31 (30-31)	28 (27-30)	51 (49-53)

5.4.2 Life satisfaction

The sample characteristics and ratings of life satisfaction for each region are shown in table 5.3. The sample from Western Europe and the USA was larger (10603) than for Central and Eastern Europe (4186) and Pacific Asia (2458), because the number of countries included in these regions was greater. Overall, 8.1% of respondents rated themselves as dissatisfied, 13.4% as neutral, 56.0% as moderately and 22.5% as very satisfied with life and this is shown in figure 5.1. The distribution differed between Western Europe and the USA and Central and Eastern Europe (χ^2=56.18, p<.005), Western Europe and the USA and the Pacific Asian region (χ^2=653,0, p<.005), and between Central and Eastern Europe and Pacific Asia (χ^2=247.7, p<.005). As can be seen from Table 5.3, life satisfaction ratings were highest in Western Europe and the USA, intermediate in Central and Eastern Europe, and lowest in Pacific Asia. For example, the proportion of respondents who were very satisfied was 26%, 18% and 12% in these three geopolitical regions. There were significant gender differences in the distribution of life satisfaction ratings in all three regions (χ^2= 34.67, 16.32, and 12.15, p <.01). In both Western Europe and the USA and Central and Eastern European regions, men were more satisfied with their lives

than women. But in the Pacific Asian region, men were more likely to be dissatisfied with their lives than women. The proportion of men and women who were very satisfied in each region is shown in figure 5.2 and the proportion of men and women who were dissatisfied is shown in figure 5.3.

TABLE 5.3 SAMPLE SIZE, AGE, AND LIFE SATISFACTION IN MEN AND WOMEN

	Sample size (N) (%)	**Men (%)**	**Women (%)**	**Age M (SD)**
All countries	17 246 (100)	7429 (43)	9817 (57)	20.53 (2.1)
Dissatisfied	1392 (8)	649 (9)	743 (8)	
Neutral	2303 (13)	1067 (14)	1236 (13)	
Quite satisfied	9663 (56)	3920 (53)	5743 (58)	
Very satisfied	3888 (23)	1793 (24)	2095 (21)	
Region 1: Western Europe & USA	10603	4524 (43)	6079 (57)	20.38 (2.1)
Dissatisfied	566 (5)	263 (6)	303 (5)	
Neutral	1216 (11)	557(12)	659 (11)	
Quite satisfied	5994 (57)	2409 (53)	3585 (59)	
Very satisfied	2827 (27)	1295 (29)	1532 (25)	
Region 2: Central and Eastern Europe	4186	1899 (45)	2287 (55)	21.03 (1.9)
Dissatisfied	391 (9)	186 (10)	205 (9)	
Neutral	534 (13)	266 (14)	268 (12)	
Quite satisfied	2495 (60)	1069 (56)	1426 (62)	
Very satisfied	766 (18)	378 (20)	388 (17)	
Region 3: Pacific Asia	2458	1007 (41)	1451 (59)	20.37 (2.1)
Dissatisfied	435 (18)	200 (20)	235 (16)	
Neutral	553 (22)	244 (24)	309 (21)	
Quite satisfied	1174 (48)	442 (44)	732 (50)	
Very satisfied	295 (12)	120 (12)	175 (12)	

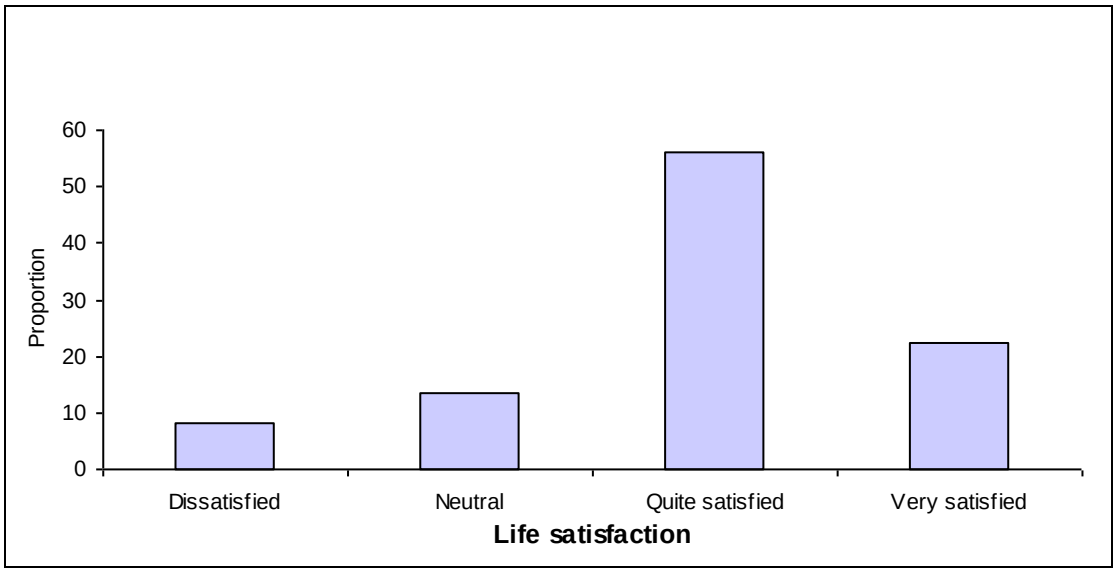


FIGURE 5.1 LIFE SATISFACTION RATINGS FOR COMPLETE SAMPLE

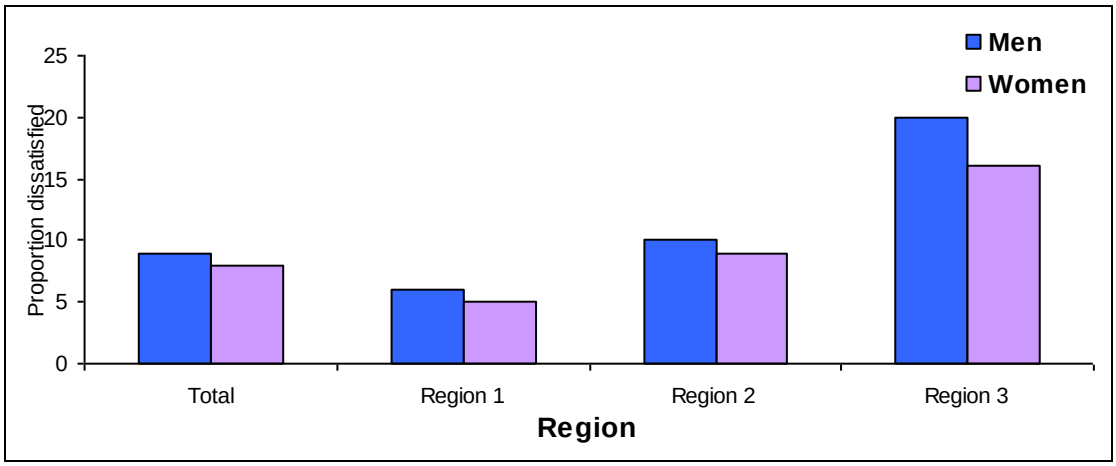


FIGURE 5.2 PROPORTION OF SAMPLE VERY SATISFIED (REGIONS: 1- WESTERN EUROPE & USA; 2- CENTRAL EUROPE; 3- PACIFIC ASIA)

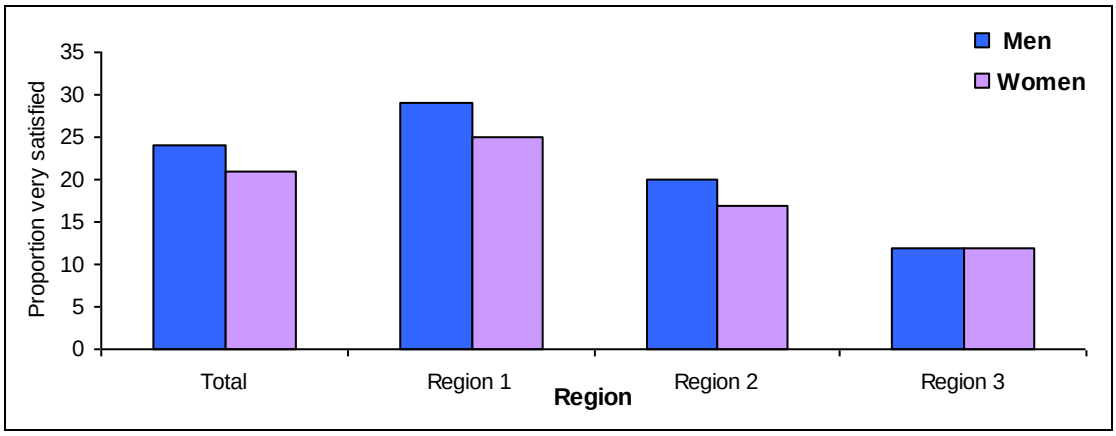


FIGURE 5.3 PROPORTION OF SAMPLE DISSATISFIED (REGIONS: 1- WESTERN EUROPE & USA; 2- CENTRAL EUROPE; 3- PACIFIC ASIA)

5.4.3 Life satisfaction and health behaviours

The association between life satisfaction and each of the seven health behaviours is shown in table 5.4. The association between life satisfaction and smoking, physical activity and fruit consumption is also displayed in figure 5.4. Separate analysis by each region is shown in table 5.5.

Smoking. Across the complete sample, those with higher life satisfaction were more likely to be non-smokers than those with lower life satisfaction (see table 5.4). The trend across categories was significant (p = .004), with odds ratios increasing from 1.14 to 1.57 across neutral to very satisfied (table 5.4). Across all life satisfaction categories, participants in Pacific Asia had higher rates of not smoking compared to Western Europe and USA and Central and Eastern Europe. In separate analysis of the regions, the trend across life satisfaction categories was significant in all three, with stronger effects in Western Europe and USA and Pacific Asia than in Central and Eastern Europe (see table 5.5). Results from Western Europe and USA and Central and Eastern Europe show a dose response relationship, so that likelihood of not smoking increases as life satisfaction increases. However, this relationship was not as clear in Pacific Asia.

Alcohol. There was no significant relationship between life satisfaction and drinking in the complete sample (table 5.4), Western Europe & USA or Central and Eastern Europe (table 5.5). Levels of moderate drinking were highest in the neutral life satisfaction group for each three sub-samples outlined above but lower in the dissatisfied and very satisfied groups. Although the results of each regression analysis were not significant, there was a trend towards higher life satisfaction being associated with lower levels of moderate drinking.

Physical exercise. A strong association with life satisfaction emerged (p < .001), and this was replicated across the three geopolitical regions. As can be seen in Table 5.4, only 61% of participants who were dissatisfied with life exercised, compared

with 77% of those with high life satisfaction, and a dose-response relationship was evident, with the likelihood of engaging in regular exercise increasing as life satisfaction increases. The pattern was replicated in all three geopolitical regions (Table 5.5).

Sun protection. Life satisfaction was positively associated with sunscreen use, with levels ranging from 63% among dissatisfied or neutral respondents to 74% in the moderately and very satisfied ($p < .001$). These effects were significant in Western Europe and USA and in Central and Eastern Europe, but not in the Pacific Asian region. Use of sun protection was low overall in Pacific Asia (as shown in table 5.2) and there was no relationship with life satisfaction.

Fruit Intake. A positive association was found overall between life satisfaction and eating fruit, with a significant trend across categories ($p = .003$, table 5.4). Levels ranged from 36% of the dissatisfied to 49% of the very satisfied. This effect was significant in separate analyses of Central and Eastern Europe ($p = .026$) and Pacific Asia ($p = .008$) but not in Western Europe and the USA ($p = .556$). However, it is notable that the prevalence of fruit intake was higher in Western Europe and the USA than other regions, irrespective of life satisfaction. Only the respondents from the other two regions who were most satisfied with their lives attained these levels (table 4.5).

Fat Avoidance. A moderate but significant association between life satisfaction and fat avoidance emerged, with a dose-response relationship, since the odds ratio for those with high life satisfaction was 1.39, moderate life satisfaction 1.30 and neutral 1.19. However, the pattern was not consistent across regions, being significant only in the separate analysis of Central and Eastern European countries.

Fibre Intake. There were no significant relationships between life satisfaction and fibre intake in the complete sample (table 5.4), or in any of the regions separately (table 5.5).

TABLE 5.4 ASSOCIATIONS BETWEEN LIFE SATISFACTION AND HEALTH BEHAVIOURS IN WHOLE SAMPLE

Smoking	% Non-smokers	Odds ratio (95% C.I)
Life satisfaction	77	
Dissatisfied	73	1
Neutral	76	1.14 (.92-1.14)
Quite satisfied	78	1.24 (1.04-1.47)
Very satisfied	82	1.57 (1.16-2.13)
P trend	-	.004
Alcohol consumption	% Moderate drinkers	Odds ratio (95% C.I.)
Life satisfaction	64	
Dissatisfied	60	1
Neutral	70	.63 (.46-.85)
Quite satisfied	64	.82 (.62-1.07)
Very satisfied	60	.93 (.64-1.37)
P trend	-	.389
Physical exercise	% Physical exercise	Odds ratio (95% C.I.)
Life satisfaction	50	
Dissatisfied	61	1
Neutral	63	1.11 (.92-1.33)
Quite satisfied	70	1.52 (1.28-1.80)
Very satisfied	77	2.17 (1.80-2.64)
P trend	-	.001
Sun protection	% Sun protection	Odds ratio (95% C.I.)
Life satisfaction	69	
Dissatisfied	63	1
Neutral	63	1.01 (.75-1.36)
Quite satisfied	74	1.55 (1.23-1.96)
Very satisfied	74	1.79 (1.34-2.39)
P trend	-	.001

Fruit intake	% Eating fruit daily	Odds ratio (95% C.I)
Life satisfaction	32	
Dissatisfied	36	1
Neutral	38	1.12 (.90-1.40)
Quite satisfied	44	1.41 (1.08-1.84)
Very satisfied	49	1.70 (1.20-2.44)
P trend	-	.003
Fat Avoidance	% Limiting fat	Odds ratio (95% C.I.)
Life satisfaction	35	
Dissatisfied	30	1
Neutral	34	1.19 (.93-1.52)
Quite satisfied	37	1.30 (1.03-1.63)
Very satisfied	38	1.39 (1.04-1.86)
P trend	-	.023
Fibre intake	% Increasing fibre	Odds ratio (95% C.I.)
Life satisfaction	33	
Dissatisfied	33	1
Neutral	31	.88 (.68-1.13)
Quite satisfied	34	.97 (.78-1.22)
Very satisfied	32	.94 (.71-1.24)
P trend	-	.999

* Note Adjusted for age, sex, and country of origin. *P* trend indicates significance of trend across life satisfaction categories

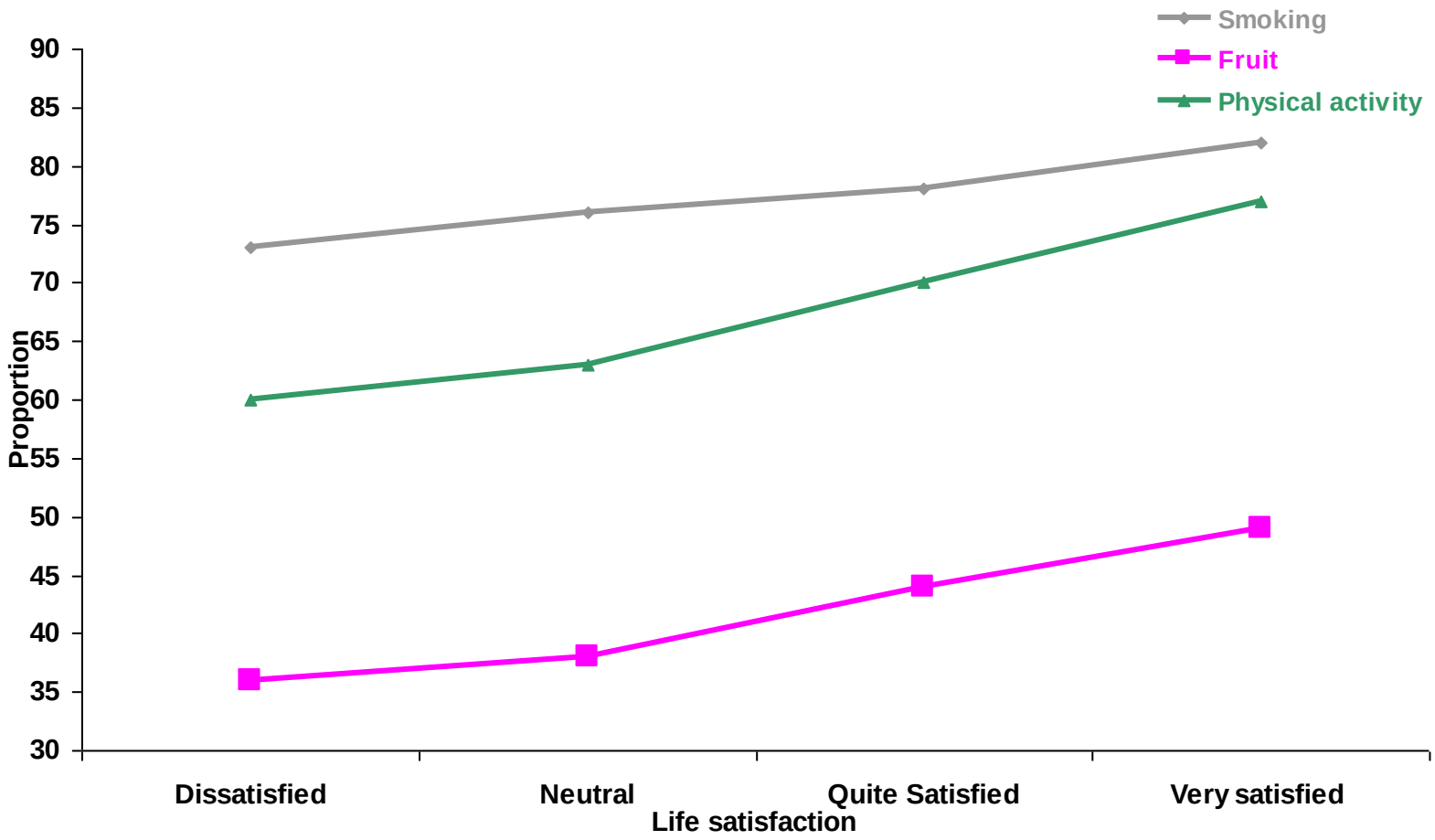
TABLE 5.5 ASSOCIATIONS BETWEEN LIFE SATISFACTION AND HEALTH BEHAVIOURS IN REGIONS

	Region 1: Western Europe & USA		**Region 2: Central and Eastern Europe**		**Region 3: Pacific Asia**	
Smoking	% non-smokers	Odds ratio* (95% C.I.)	% non-smokers	Odds ratio* (95% C.I.)	% non-smokers	Odds ratio* (95% C.I.)
Life satisfaction Dissatisfied	67	1	73	1	82	1
Neutral	73	1.34 (1.02-1.76)	70	.89 (.67-1.19)	88	1.55 (.81-2.97)
Quite satisfied	76	1.51 (1.24-1.83)	76	1.20 (.84-1.71)	92	2.29 (1.24-4.23)
Very satisfied	81	2.01 (1.41-2.87)	82	1.68 (1.27-2.23)	90	2.01 (1.62-2.50)
P trend	-	.001	-	.014	-	.007
	Region 1: Western Europe & USA		**Region 2: Central and Eastern Europe**		**Region 3: Pacific Asia**	
Alcohol Consumption	% Moderate/ Non-Drinkers	Odds ratio* (95% C.I.)	% Moderate/ Non-Drinkers	Odds ratio* (95% C.I.)	% Moderate/ Non-Drinkers	Odds ratio* (95% C.I.)
Life satisfaction Dissatisfied	63	1	56	1	-	-
Neutral	71	.69 (.45-1.06)	70	.52 (.37-.75)	-	-
Quite satisfied	66	.87 (.63-1.20)	60	.88 (.49-1.58)	-	-
Very satisfied	62	1.00 (.78-.98)	52	1.13 (.45-2.87)	-	-
P trend	-	.272	-	.375	-	-
	Region 1: Western Europe & USA		**Region 2: Central and Eastern Europe**		**Region 3: Pacific Asia**	
Physical Exercise	Physical Exercise %	Odds ratio* (95% C.I.)	Physical Exercise %	Odds ratio* (95% C.I.)	Physical Exercise %	Odds ratio*(95% C.I.)
Life satisfaction Dissatisfied	60	1	64	1	59	1
Neutral	63	1.16 (.94-1.43)	61	.86 (.60-1.25)	65	1.32 (.49-3.56)
Quite satisfied	70	1.62 (1.33-1.96)	69	1.28 (.90-1.82)	67	1.53 (1.02-2.29)
Very satisfied	77	2.21 (1.82-2.67)	80	2.27 (1.70-3.02)	72	1.89 (1.38-2.59)
P trend	-	.001	-	.001	-	.048

* Note Adjusted for age, sex, and country of origin. *P* trend indicates significance of trend across life satisfaction categories

	Region 1: Western Europe & USA		Region 2: Central & Eastern Europe		Region 3: Pacific Asia	
Sun protection	% Sun Protection	Odds ratio* (95% C.I.)	% Sun Protection	Odds ratio* (95% C.I.)	% Sun Protection	Odds ratio* (95% C.I.)
Life satisfaction						
Dissatisfied	71	1	73	1	82	1
Neutral	71	1.34 (1.02-1.76)	70	.89 (.67-1.19)	88	1.55 (.81-2.97)
Quite satisfied	77	1.51 (1.24-1.83)	76	1.20 (.84-1.71)	92	2.29 (1.24-4.23)
Very satisfied	75	2.01 (1.41-2.87)	82	1.68 (1.27-2.23)	90	2.01 (1.62-2.50)
P trend	-	.001	-	.014	-	.007
	Region 1: Western Europe & USA		**Region 2: Central & Eastern Europe**		**Region 3: Pacific Asia**	
Fruit Intake	% Eating Fruit Daily	Odds ratio* (95% C.I.)	% Eating Fruit Daily	Odds ratio* (95% C.I.)	% Eating Fruit Daily	Odds ratio* (95% C.I.)
Life satisfaction						
Dissatisfied	47	1	37	1	20	1
Neutral	47	.99 (.77-1.29)	33	.81 (.46-1.43)	26	1.39 (.68-2.85)
Quite satisfied	48	1.01 (.94-1.23)	43	1.23 (.80-1.29)	31	1.71 (.80-3.63)
Very satisfied	48	1.04 (.84-1.29)	54	1.98 (.93-4.23)	41	2.81 (1.88-4.18)
P trend	-	.566	-	.026	-	.008
	Region 1: Western Europe & USA		**Region 2: Central & Eastern Europe**		**Region 3: Pacific Asia**	
Fat Avoidance	% Fat Avoidance	Odds ratio* (95% C.I.)	% Fat Avoidance	Odds ratio* (95% C.I.)	% Fat Avoidance	Odds ratio* (95% C.I.)
Life satisfaction						
Dissatisfied	36	1	31	1	23	1
Neutral	35	.94 (.71-1.23)	37	1.37 (1.11-1.70)	30	1.42 (.56-3.58)
Quite satisfied	39	1.06 (.88-1.27)	36	1.26 (1.08-1.47)	32	1.44 (.64-3.26)
Very satisfied	38	1.08 (.86-1.35)	37	1.38 (1.03-1.84)	38	1.94 (.81-3.26)
P trend	-	.146	-	.049	-	.089
	Region 1: Western Europe & USA		**Region 2: Central & Eastern Europe**		**Region 3: Pacific Asia**	
Fibre Intake	Increasing Fibre %	Odds ratio* (95% C.I.)	Increasing Fibre %	Odds ratio* (95% C.I.)	Increasing Fibre %	Odds ratio* (95% C.I.)
Life satisfaction						
Dissatisfied	30	1	30	1	41	1
Neutral	28	.87 (.68-1.12)	24	.75 (.98-1.46)	44	1.09 (.40-2.95)
Quite satisfied	32	1.05 (.86-1.27)	28	.91 (.41-1.99)	55	1.60 (.53-4.85)
Very satisfied	29	.96 (.76-1.22)	31	1.06 (.60-1.97)	64	2.45 (.81-7.49)
P trend	-	.844	-	.453	-	.086

FIGURE 5.4 LIFE SATISFACTION AND HEALTH BEHAVIOURS IN WHOLE SAMPLE



5.4.4 Health beliefs, health behaviours and life satisfaction

The mean health beliefs scores for the whole sample and each region is shown in table 5.6. Beliefs in the importance of not smoking were highest at 8.19 in the overall sample and there was little variation between regions. The importance of avoiding dietary fat and increasing dietary fibre was lower than the other health belief scores. However, health beliefs relating to fibre were higher in the Pacific Asia region compared to Western Europe and the USA and Central and Eastern Europe. Beliefs in the importance of using sun protection for health was lower in the Pacific Asia region compared to Western Europe and USA and Central and Eastern Europe. Beliefs in the importance of eating fruit was highest in Central and Eastern Europe compared to the other two regions. Associations between the importance of each behaviour for health and life satisfaction were positive, but very small (data not presented).

TABLE 5.6 MEAN HEALTH BELIEFS SCORES OVERALL AND IN EACH REGION

Health belief Importance to health of:	**Overall** Mean (SD)	**Region 1: Western Europe & USA** Mean (SD)	**Region 2: Central and Eastern Europe** Mean (SD)	**Region 3: Pacific Asia** Mean (SD)
Not smoking	8.19 (2.6)	8.07 (2.5)	8.17 (2.6)	8.74 (2.2)
Not drinking too much alcohol	7.39 (2.4)	7.17 (2.4)	7.62 (2.3)	7.93 (2.2)
Taking regular exercise	8.08 (2.1)	8.07 (2.0)	8.04 (2.1)	8.17 (2.2)
Using sun protection	7.07 (2.6)	7.14 (2.5)	7.13 (2.7)	6.67 (2.7)
Eating fruit	7.82 (2.0)	7.59 (2.0)	8.49 (1.9)	7.69 (2.1)
Avoiding fat	6.38 (2.5)	6.19 (2.4)	6.51 (2.6)	6.97 (2.3)
Eating fibre	6.71 (2.3)	6.47 (2.2)	6.73 (2.5)	7.65 (2.0)

The relationship between health behaviours and health beliefs are shown in table 5.7. The relationships between health behaviours and health beliefs were as expected, with stronger health beliefs being associated with healthier behavioural choices. For example, participants with strong beliefs in the impact of not smoking were more than six times more likely to be non-smokers than those with weak beliefs. Adjusted odds ratios ranged from 1.84 for the association between strong beliefs in the importance of not drinking too much alcohol and being a moderate drinker or abstinent, to 8.51 for strong beliefs in the importance to health of using sunscreen and sunscreen use.

TABLE 5.7 HEALTH BEHAVIOUR AND HEALTH BELIEFS

Belief	**Behaviour**	**Odds of carrying out the behaviour (high *vs* low belief ratings) Odds ratio (95% C.I.) adjusted for age and gender**
Importance to health of: Not smoking	Not smoking	6.49 (5.19-8.13)
Taking regular exercise	Leisure time physical activity	2.54 (2.09-3.09)
Not drinking too much alcohol	Drinking heavily	1.84 (1.38-2.45)
Eating fruit	Fruit at least once a day	2.54 (2.02-3.21)
Eating fibre	Eating fibre	4.45 (3.51-5.65)
Limiting fat intake	Avoiding dietary fat	3.96 (3.11-5.05)
Use sunscreen when sunbathing	Sunscreen use	8.51 (6.29-11.50)

The extent to which health beliefs mediate the relationship between life satisfaction and healthy behaviour was analyzed using logistic regression. In no case were the odds ratios relating life satisfaction with behaviour (significant for smoking, physical exercise, sun protection, fruit intake and fat avoidance) markedly altered when health beliefs were included in the models. These results are displayed in table 4.8. The study therefore found no evidence that health beliefs mediated the association between life satisfaction and prudent health behaviour.

TABLE 5.8 ASSOCIATIONS BETWEEN LIFE SATISFACTION AND HEALTH BEHAVIOURS, CONTROLLING FOR HEALTH BELIEFS

	Complete Sample	**Region 1: Western Europe & USA**	**Region 2: Central & Eastern Europe**	**Region 3: Pacific Asia**
Smoking	Odds ratio (95% C.I.)	Odds ratio*(95% C.I.)	Odds ratio*(95% C.I.)	Odds ratio*(95% C.I.)
Life satisfaction				
Dissatisfied	1	1	1	1
Neutral	1.20 (.95-1.53)	1.49 (1.12-2.0)	.86 (.60-1.24)	1.50 (.81-2.78)
Quite satisfied	1.29 (1.05-1.58)	1.61 (1.30-1.99)	1.14 (.76-1.70)	2.26 (1.19-4.26)
Very satisfied	1.62 (1.20-2.20)	2.10 (1.52-2.89)	1.62 (1.16-2.28)	1.87 (1.55-2.25)
P trend	.004	.001	.016	.010
	Complete Sample	**Region 1: Western Europe & USA**	**Region 2: Central & Eastern Europe**	**Region 3: Pacific Asia**
Alcohol Consumption	Odds ratio*(95% C.I.)	Odds ratio*(95% C.I.)	Odds ratio*(95% C.I.)	Odds ratio*(95% C.I.)
Life satisfaction				
Dissatisfied	1	1	1	-
Neutral	.63 (.46-.86)	.68 (.45-1.04)	.53 (.36-.78)	-
Quite satisfied	.81 (.61-1.08)	.86 (.62-1.21)	.90 (.49-1.66)	-
Very satisfied	.93 (.62-1.40)	1.00 (.68-1.49)	1.15 .43-3.06)	-
P trend	.403	.247	.368	-
	Complete Sample	**Region 1: Western Europe & USA**	**Region 2: Central & Eastern Europe**	**Region 3: Pacific Asia**
Physical Exercise	Odds ratio (95% C.I.)	Odds ratio*(95% C.I.)	Odds ratio*(95% C.I.)	Odds ratio*(95% C.I.)
Life satisfaction				
Dissatisfied	1	1	1	1
Neutral	1.23 (1.01-1.51)	1.28 (.98-1.67)	.94 (.67-1.33)	1.39 (.48-4.01)
Quite satisfied	1.66 (1.37-2.02)	1.68 (1.36-2.07)	1.40 (.95-2.06)	1.63 (1.17-2.27)
Very satisfied	2.29 (1.86-2.81)	2.19 (1.78-2.69)	2.29 (1.80-2.91)	2.02 (1.59-2.56)
P trend	.001	.001	.001	.028
	Complete Sample	**Region 1: Western Europe & USA**	**Region 2: Central & Eastern Europe**	**Region 3: Pacific Asia**
Sun Protection	Odds ratio (95% C.I.)	Odds ratio*(95% C.I.)	Odds ratio*(95% C.I.)	Odds ratio*(95% C.I.)
Life satisfaction				
Dissatisfied	1	1	1	1
Neutral	1.07 (.79-1.45)	1.05 (.75-1.46)	.78 (.46-1.32)	1.01 (.36-2.81)
Quite satisfied	1.64 (1.25-2.15)	1.44 (1.05-1.97)	1.34 (.75-2.41)	1.15 (.69-1.92)
Very satisfied	1.81 (1.33-2.47)	1.35 (1.01-1.80)	2.03 (1.14-3.63)	1.11 (.38-3.65)
P trend	.001	.033	.004	.557

	Complete Sample	**Region 1: Western Europe & USA**	**Region 2: Central & Eastern**	**Region 3: Pacific Asia**
Fruit Intake	Odds ratio (95% C.I.)	Odds ratio (95% C.I.)	Odds ratio (95% C.I.)	Odds ratio (95% C.I.)
Life satisfaction				
Neutral	1.17 (.92-1.48)	1.00 (.74-1.34)	.82 (.46-1.44)	1.48 (.70-3.14)
Quite satisfied	1.46 (1.11-1.91)	1.00 (.83-1.21)	1.25 (.78-1.99)	1.76 (.80-3.86)
Very satisfied	1.78 (1.21-2.61)	1.00 (.77-1.29)	2.03 (.90-4.60)	2.99 (2.05-4.35)
P trend	.004	.954	.032	.006
	Complete Sample	**Region 1: Western Europe & USA**	**Region 2: Central & Eastern**	**Region 3: Pacific Asia**
Fat avoidance	Odds ratio (95% C.I.)	Odds ratio (95% C.I.)	Odds ratio (95% C.I.)	Odds ratio (95% C.I.)
Life satisfaction				
Neutral	1.27 (1.00-1.62)	.99 (.73-1.34)	1.30 (.92-1.83)	1.49 (.60-3.68)
Quite satisfied	1.47 (1.18-1.83)	1.16 (.96-1.41)	1.30 (.98-1.75)	1.54 (.66-3.60)
Very satisfied	1.56 (1.17-2.08)	1.14 (.89-1.47)	1.46 (1.00-2.15)	2.06 (.85-5.04)
P trend	.004	.103	.058	.079
	Complete Sample	**Region 1: Western Europe & USA**	**Region 2: Central & Eastern**	**Region 3: Pacific Asia**
Fibre consumption	Odds ratio (95% C.I.)	Odds ratio (95% C.I.)	Odds ratio (95% C.I.)	Odds ratio (95% C.I.)
Life satisfaction				
Neutral	.96 (.75-1.24)	.93 (.75-1.15)	.77 (.40-1.50)	1.13 (.43-2.93)
Quite satisfied	1.13 (.88-1.41)	1.13 (.89-1.44)	.98 (.43-2.24)	1.64 (.55-4.87)
Very satisfied	1.08 (.80-1.46)	1.01 (.79-1.29)	1.11 (.48-2.55)	2.63 (.85-8.12)
P trend	.111 (.398)	.780	.506	.078

5.5 Discussion

The three main aims for study 1 were: to investigate the relationship between life satisfaction and seven health behaviours; to test these relationships across three geopolitical regions, and finally to assess whether health beliefs may account for any relationship that was found.

5.5.1 Life satisfaction and health behaviour findings

The main hypothesis of the study was largely confirmed, in that life satisfaction was positively associated with all of the prudent health behaviours except alcohol consumption and fibre intake. Effects were strong for physical exercise, with the very satisfied being much more likely to exercise than the dissatisfied, intermediate for sun protection and fruit intake, and lower but significant for cigarette smoking and dietary fat (see figure 5.4). In each case, there was a graded association, with the healthy behavioural choice being most common in the very satisfied, intermediate in the moderately satisfied and neutral categories, and rare among respondent reporting low life satisfaction. These effects will now be discussed with reference to each health behaviour and therefore discuss the first two aims of this study.

Rates of smoking were highest amongst Pacific Asian students and lowest in Western Europe and USA. In all three regions, higher life satisfaction was related to increased likelihood of being a non-smoker. This supports the results of previous findings which have found links between smoking and life satisfaction in adolescents, including one study which compared students from Hungary, Poland, Turkey and USA (Piko et al, 2006). Knowledge of the specific health risks of smoking were found to be lower in Asian and developing countries (Steptoe et al., 2002) suggesting that a lack of awareness could be responsible for the increased prevalence of smoking found in the Pacific Asia region. Rates of smoking are known to be higher in those who have higher levels of negative well-being and this has been studied extensively (e.g. Kassel,

Stroud, & Paronis, 2003). Smoking can be influenced by negative affect in two ways, firstly negative affect may promote rates of smoking, and secondly, smoking may help to alleviate feelings such as stress and anxiety. The relationship with life satisfaction may work in a similar way.

Physical activity was more likely in those with higher life satisfaction across all three regions. In every case, the proportion of participants engaging in physical activity increased as life satisfaction increased. However, the relationship was only marginally significant in the Pacific Asia region, but highly significant in both Western Europe & USA, and Central and Eastern Europe. Increasing physical activity is thought to have a positive effect on feelings of well-being, and this has been supported by the results of meta-analyses (e.g. McDonald & Hodgdon, 1991; Spence, McGannon, & Poon, 2005). Results from intervention studies designed to increase levels of physical activity have reported a positive effect on life satisfaction (McMurdo & Burnett, 1992; Schnor et al 2005; but see also Ornes et al, 2005). Therefore there is some evidence to suggest that increasing physical activity exerts an effect on positive well-being, thereby implying direction of this relationship. However, other studies have suggested that the type of physical activity is important in determining the effect on positive well-being (e.g. Audrain et al, 2001; Stephen, 1988). The relationship between life satisfaction and physical behaviour in each region suggests that this relationship is robust and not affected by cultural variables.

Heavy drinking was more prevalent amongst the Western Europe & USA region compared to the Central and Eastern European region. This thesis failed to discern any association between life satisfaction and alcohol intake in this analysis. Heavy alcohol consumption has previously been linked with low life satisfaction in female college students (Murphy et al., 2005), but no effect was found for either men or women in this study. One explanation is that reported levels of alcohol intake in this study were not very high, and associations with low life satisfaction may only emerge when heavy drinkers are tested. Alcohol measures were not included in the Pacific Asia region,

therefore the sample size for this analysis was markedly lower than for all other health behaviours. There are marked cultural variations in the use of alcohol, particularly among women, which may confound relationships. Additionally, the association between alcohol consumption and mood state could be curvilinear (Paschall, Freisthler, & Lipton, 2005). In another analysis from this data set, it was found that high levels of depressed mood were more prevalent among nondrinkers and heavy drinkers than in moderate drinkers (O'Donnell et al., 2006). Life satisfaction was also greater in moderate users compared with abstainers and heavy users in a nationally representative sample of Australian adults (Dear et al., 2002). The data presented in this chapter do suggest that the relationship between alcohol and life satisfaction may not be linear, as the proportions of heavy drinkers were lowest amongst those who were dissatisfied or very satisfied with their lives.

In the case of sunscreen use, the association with life satisfaction was significant in Western Europe and USA, and also in Central and Eastern Europe, but was not significant in the Pacific Asia region. In Western Europe and USA, participants who were dissatisfied and neutral had the same reported use of sun protection, and also those who were quite and very satisfied. In Central and Eastern Europe, the relationship with life satisfaction was not linear; those with neutral life satisfaction ratings had lower reported levels compared to those who were dissatisfied. However, in both these regions participants were most likely to use sun screen if they were very satisfied with their life. There was no relationship between life satisfaction and sun protection in the Pacific Asia region. Respondents from these countries had the lowest overall use of sunscreen, and the smaller sample size may have resulted in a lack of statistical power. Also participants in these countries may engage in other forms of protection from the sun such as using parasols or staying out of the sun, therefore reducing their need to use sun screen. Research investigating levels of sunscreen use and attitudes towards its use tend to focus on USA, Australia and Europe (e.g. Keeney,

McKenna, Fleming, & McIlfatrick, 2009) and therefore evidence about the prevalence of and knowledge of the importance of sunscreen in Pacific Asian countries is limited.

Fruit intake was not related to life satisfaction in Western Europe and the USA. One reason may be that the highest consumption category was one portion per day, and this was achieved by nearly half the respondents in this region. A more sensitive scale discriminating between people who ate greater amounts of fruit might have generated a gradient in this region. However, this figure was comparable with Central and Eastern Europe, where a relationship between life satisfaction was found. Fruit consumption within individual countries included in the Western Europe and USA region was varied, with 34% and 39% eating fruit once a day in the USA and England respectively, compared to 60% in both Spain and Portugal. This suggests that there are important differences between the countries making up this region, such as availability of fruit and attitudes towards eating fruit.

Previous research relating fruit and vegetable intake with positive well-being in Western countries has been inconsistent. However, it must be noted that the study under investigation in this thesis used a measure of fruit consumption only, not fruit and vegetables together. A four-year randomized dietary intervention trial of a low fat, high fibre, high fruit and vegetable regimen showed no effect on life satisfaction (Corle et al., 2001). But another study of brief behavioural counselling to increase fruit and vegetable consumption resulted in improvements in health-related quality of life that correlated with individual differences in intake and in plasma vitamin C and E concentrations, independently of covariates (Steptoe, Perkins-Porras, Hilton, Rink, & Cappuccio, 2004). Fruit consumption was related to life satisfaction in both the Central & Eastern Europe and in the Pacific Asia region. For Central & Eastern Europe, fruit consumption was considerably higher for those with high life satisfaction compared to those who were dissatisfied. In the Pacific Asia region, fruit intake was varied widely across life satisfaction categories, ranging from 20% amongst the dissatisfied to 41% in the very satisfied. Participants in the different regions may have different motivations

for fruit intake, for example, in Western Europe and USA individuals could be responding to increased pressure from public health information to consume fruit. However, in Central and Eastern Europe, and Pacific Asia, public health information regarding fruit consumption may be less well advertised and promoted. In this case, individuals from these regions make their choice to eat fruit or not based on individual variables, rather than societal pressures, allowing differences in life satisfaction to have more of an impact. The explanation for the difference in relationship between the three regions is unclear, however, this relationship will be further investigated using data from in the third study of this thesis. This study is simultaneously being carried out with a limited sample in Japan. Although this will not allow for extensive analysis used in this study to be replicated, it will be possible to examine the relationship between psychosocial factors and fruit consumption in the UK and Japan.

No association between life satisfaction and fibre intake was found. There may genuinely have been no relationship, but measurement issues could also have contributed. The fibre intake item was not very precise, since it did not enquire about specific foods but about whether participants made conscious efforts to eat more fibre. People might not make conscious efforts because their diets are already rich in fibre, and not because they are uninterested in healthy eating. Individuals in this study may also have limited knowledge about which foods contain fibre. A relationship with life satisfaction and fibre intake may be found with an older sample, as a student population may not be focussed on increasing aspects of a healthy diet. It is notable that the fat avoidance item shared some aspects of question wording with the fibre measure, and also had rather inconsistent associations with life satisfaction. These two items both asked participants if they were making an effort to perform the behaviour, which is a rather different question to the other health behaviours. For example, smoking or not smoking is an act which is performed as part of a habit based behaviour, whereas increasing fibre or decreasing fat intake requires a conscious effort to increase consumption of these foods. In the Pacific Asia region, there was a

relationship approaching significance between life satisfaction and fibre intake. The proportion of respondents indicating that they increased fibre intake shows a linear relationship with life satisfaction in this region, however, there was a wide variability in the confidence intervals.

In the Central and Eastern Europe region there was a marginally significant relationship between life satisfaction and decreasing consumption of fat, and in Pacific Asia there was a relationship approaching significance. However, there was no relationship in Western Europe and USA. Overall examination of the three diet variables (eating fruit, limiting fat and increasing fibre) suggests that there are differences in the relationship between diet and life satisfaction in each of the three regions. None of the variables are associated with life satisfaction in Western Europe & USA, fruit consumption and fat intake are related to life satisfaction in Central and Eastern Europe, and in Pacific Asia, there is a relationship with fruit and life satisfaction and a trend towards significance for both fat and fibre intake. This suggests that other factors are important in determining diet related health behaviours in Western Europe and USA, although life satisfaction is relevant in other regions. In this study fruit consumption was measured as a single question, with the highest response option being “at least once per day”. As noted earlier, it would have been preferable to measure consumption of both fruit and vegetables, as both are now known to be an essential part of a healthy diet, and public health campaigns tend to target these two types of food together (e.g. NHS 5 a day campaign). Additionally, recommended intake of fruit is higher than one portion per day, so the respondents who are only eating fruit once daily are not meeting current guidelines. If this variable contained a larger range of data, for example, having a higher response category such as “more than once a day”, a relationship with life satisfaction may have become apparent in the Western Europe and USA region.

Associations were moderately consistent across geopolitical region. For smoking and exercise, the association with life satisfaction was significant for all three

regions, and effects were present in two of the regions for sun protection and fruit intake. These results therefore add to the limited data currently available relating life satisfaction with prudent health behaviour in non-Western countries (Mazur & Woynarowska, 2004; Piko et al, 2006). Cross cultural differences, for example wealth and individualist vs. collectivist societies seem to have a limited impact on performance of the health behaviours measured in this study. The most marked difference found between the regions was in the measures of dietary behaviours, with no relationships found between fat, fibre and fruit intake in Western Europe & USA compared to Central & Eastern Europe and Pacific Asia. This finding suggests that other factors are more important for predicting performance of diet related health behaviours in more Westernised societies. Explanations for this finding include the vast health promotion campaigns aimed at increasing a healthy diet in Western societies; information is readily available across many forms of media and therefore reaches a wide target audience. These information campaigns may be encouraging all individuals in Western societies to eat a healthy diet, thereby reducing the impact of life satisfaction. Another explanation involves the emphasis placed on physical appearance, which has a long history in Western cultures. Regional differences in life satisfaction may also be explained by a range of factors, for example a study from Korea found living arrangements were an important variable related to life satisfaction and reported that older women were happiest if living with their married son (An, An, O'Connor, & Wexler, 2008).

The causal pathways linking behaviour with positive well-being are not well understood. Bidirectional processes are probably involved. For example, the alleviation of clinical depression is characteristically followed by increased physical activity, while both longitudinal observational and interventional trials have shown that increasing physical activity has beneficial effects on positive psychological states (Steptoe, 2006). Smoking may partly be a consequence of negative affective states, while stopping smoking leads to enhanced well-being (Kassel et al., 2003). It is

plausible in the present study both that cigarette smoking and lack of physical exercise contribute to low satisfaction, and that people who are dissatisfied with their lives could become lethargic and inactive and turn to smoking. But while it appears reasonable to posit that individuals who are dissatisfied with their lives exert less self-care, so fail to use sun protection or engage in healthy dietary choices, the reverse pattern (that not using sunscreen or eating fruit regularly promotes low life satisfaction) is less plausible.

Several additional unmeasured factors could contribute to the observed relationships between life satisfaction and health behaviours. There may be unmeasured factors underlying associations between life satisfaction and health behaviours, indicating that the relationship is not causal. For example, low socioeconomic status is linked with a range of risk behaviours and low life satisfaction, while conscientiousness as a personality trait has been related both to prudent health behaviours (Bogg & Roberts, 2004) and to life satisfaction (Heller, Watson, & Hies, 2004). Extraversion is associated with behaviours such as exercise and is also related to life satisfaction (Lyubomirsky, King, & Diener, 2005). Stubbe et al (2007) have recently demonstrated that the association between exercise participation and positive well-being may be mediated by genetic factors influencing both the behaviour and well-being.

Another factor which may explain the relationship between life satisfaction and increased health behaviours is social support. Higher levels of positive well-being have previously been associated with increased social network size and higher ratings of functional types of social support (Baldassare, Rosenfield, & Rook, 1984; Cooper, Okamura, & Gurka, 1992; Steptoe et al, 2008a). Wilson (1967) suggested that a crucial determinate of happiness was successful involvement with people, and this suggestion has since been the subject of much research. Possible mediators between positive well-being and social support include one's need for social contact, presence of a supportive network and novelty of social contact (Bradburn & Noll, 1969; Diener, Larsen, & Emmons, 1984; Palys & Little, 1983). A recent analysis found that higher

positive affect was associated with being married, an important aspect of structural social support, and also social connectedness (Steptoe, et al, 2008). Therefore evidence suggests that there is a positive relationship between positive well-being and social support, using a variety of measures. The hypothesis that social support could explain the relationship found in this study between life satisfaction and health behaviours is further supported by evidence of a link between higher levels of social support and performance of healthy behaviours (e.g. Berkman & Breslow, 1983; Gottlieb & Green, 1984; Umberson, 1987). The current sample in this study may exhibit similar levels of social support as was used as a student sample. However, individual perception of the availability and quality of social support may vary between students. It will be possible able to further investigate this hypothesized relationship in the final study of this thesis (see Chapter 8).

5.5.2 Life satisfaction, health behaviours and health beliefs

Another issue this study addressed is whether the association between life satisfaction and prudent health behaviour is mediated through health motives. There were robust associations between health behaviours and beliefs in the importance to health of carrying out these activities. However, health beliefs did not mediate associations between life satisfaction and behaviour, as defined by changes in regression coefficients when appropriate beliefs were entered into regression models. These results are consistent across behaviours, and strongly suggest that if high life satisfaction does drive people to engage in more prudent behaviour, it is not for health-related reasons. Each of the behaviours studied in this investigation has multiple determinants apart from health maintenance. Motives for physical activity include the enjoyment of sport, excitement, bodily appearance and social interaction (Sallis, Hovell, & Hofstetter, 1992). Food choices are influenced by taste, habit, cost and convenience as well as health and weight control (Pollard, Steptoe, Canaan, Davies, & Wardle, 1995). Social norms and cosmetic motives are important determinants of sunscreen

use in young adults (Bränström, Ullen, & Brandberg, 2004). It is possible that any influence of life satisfaction on behavioural choices is mediated through these or other factors, rather than through health motives.

5.5.3 Gender differences

The majority of young adults in this study reported positive wellbeing, with 70% of men and 79% of women saying that they were moderately or very satisfied with their lives. However, the prevalence of high life satisfaction varied across geopolitical regions, with the highest levels in Western Europe & USA, and lowest levels in the Pacific Asian region. There was an interesting difference in the gender distribution of life satisfaction across regions, with men reporting similar levels of life satisfaction on average in Western Europe & USA and in Central & Eastern Europe, but much lower levels than women in the Pacific Asian regions. The explanation for this pattern is not clear. No gender differences in life satisfaction were found amongst Chinese Malaysians (Ng, Teik-Cheok, Gudmunson, & Cheong, 2009), but in an Israeli sample, women were found to score lower on measures of psychological well-being in comparison to men (Carmel & Bernstein, 2003). Previous studies have suggested that men's and women's psychological well-being may be predicted by different factors, such as relationship harmony for women and self-esteem for men (Reid, 2004) and this may explain the difference found between regions. Cultural explanations for variations in life satisfaction between regions suggest that different factors predict life satisfaction ratings between collectivist and individualist countries, therefore it may be that the influence of these factors has a differential effect on males and females. Previous studies of life satisfaction have not investigated effects of gender (Suh, 2002; Kwan, Bond, & Singelis, 1997; Suh, Diener, Oishi, & Triandis, 1998).

5.5.4 Strengths and limitations

This study has a number of strengths, including a large homogenous sample, uniform measures of health behaviours, and a standard assessment of life satisfaction. There are also several limitations. The study was cross-sectional, so causal conclusions cannot be drawn. The study was carried out with students from a small number of universities in each country, and inclusion of other centres could have resulted in different effects. University students are not representative of young adults in general, and the prevalence of life satisfaction and health behaviours may be different in other sectors of the population. Students were tested here as an easily identifiable and accessible group of relatively healthy young adults with similar educational attainment. The measures in this study were simple self-report items, and more refined assessments with objective verification would have been desirable. Regions were compared to examine cultural differences in the variation between life satisfaction and health behaviours, however, it was not possible to control for the potential confounding effects of ethnicity within regions. Previous studies have found that life satisfaction varies in different ethnic groups living in the same cultures (e.g. (Oishi & Diener, 2001; Okazaki, 1997). A further issue with the cross-cultural aspect of this study is that the measurement of well-being across countries presents significant challenges, including response biases such as social desirability, impression management, and tendency to use the middle numbers of response scales. However, consistent evidence suggests that these do not present serious problems with cross-cultural research of this type (e.g. Park et al, 1988; Diener et al, 1993; Okazaki 1997). Nevertheless, the results add to the literature in documenting associations between positive well-being and a range of behaviours relevant to health in different cultural groups. The findings provide evidence that health behaviours are associated with positive psychological states. It is possible therefore that health behaviours explain in part associations between positive states and good health.

5.5.5 Future directions

This study has allowed for investigation of the relationship between life satisfaction and health behaviours in a large sample across a range of different regions. This relationship was tested using seven different health behaviours and a consistent positive association with life satisfaction was found. In the second study (see Chapter 7) it will be possible to further investigate this relationship using a sample of working age women. This study will allow for testing of the consistency of the observed relationship using different measures of positive well-being. Life satisfaction is primarily a global cognitive evaluation of one's life as a whole and is not directly a measure of the amount of positive affect. It is plausible that one can be generally satisfied with their life as a whole, but have limited instances of positive emotion. Using state and trait measures of positive affect will allow further testing of this relationship. The following study will also be able to continue the study of cultural links using data from the UK and Japan. These countries represent each region used in the current study.

5.6 Summary and next steps

This chapter has presented findings from a large, international study investigating links between life satisfaction and health behaviours. This study investigated two of the main thesis aims, firstly to study the relationship between psychosocial factors (in this case life satisfaction) and behavioural pathways, and secondly to investigate this relationship in cross-cultural samples. The results of this study have shown that life satisfaction is related to smoking, exercise, sun protection, fruit consumption and fat intake but not to alcohol consumption or fibre intake. This provides evidence that protective psychosocial factors may be beneficial for health in part due to effects on performance of health behaviours. The following chapters will present further investigation of these two thesis aims, and also the third main aim to

study associations between psychosocial factors. The following studies will also investigate biological pathways and relationships with psychosocial factors.

CHAPTER 6: STUDY DESIGN AND METHODOLOGY: AN INVESTIGATION OF PSYCHOSOCIAL FACTORS AND BEHAVIOURAL AND BIOLOGICAL PATHWAYS RELATED TO HEALTH

6.1 Introduction

The results presented in chapters 7 and 8 were from data collected as part of the Daytracker project. The data presented in this thesis represents a small part of that study. The Daytracker study made use of a number of novel methods for collecting information about psychosocial factors, behaviour and biological during daily life, including the Day Reconstruction Method (DRM) The DRM is an online method of gathering time use information over a 24 hour period and this will be outlined in section 6.4.3. The original grant holders will analyse data relating positive well-being to cortisol, and therefore this analysis is not presented in this thesis. The Daytracker study was designed to include female participants only, this was for a number of reasons. The study only had resources to measure either men or women and as women tend to be under-represented in psychobiological research it was decided to focus on women. Further, the original studies with the day reconstruction method (as further described in section 6.3.2) were carried out with women and therefore results would be comparable. Finally, women in office employment tend to be more mixed across levels of role, and it order to recruit a sample across SES divisions it was felt that women would meet this requirement.

The Daytracker study is a naturalistic study assessing moods and biology during everyday life, and will allow for investigation of the links between biological responses and protective psychosocial factors. This thesis will focus on the protective psychosocial factors of positive well-being, social support and optimism in the Daytracker study, and investigate relationships between these factors, and also with health-related biology and behaviour. The literature presented in Chapter 1 on positive well-being, social support and optimism outlined the separate relationships these

factors may have with health-related biology and behaviour. However, this thesis will investigate the extent to which these factors are related and not distinct.

In the first study (see Chapter 5) the relationship between a specific measure of positive well-being, that is life satisfaction, and performance of health behaviours in a large, cross-cultural sample was tested. An overall protective effect was found, whereby higher levels of life satisfaction were associated with increased performance of health behaviours. In the Daytracker study, it will be possible to further investigate the relationships between health behaviours and an alternative protective psychosocial factor, that of social support. These findings will be extending by including a measure of biological activity, namely cortisol, and investigate relationships with social support.

Therefore the Daytracker study will add to the literature on protective psychosocial factors and health by undertaking a large sample naturalistic study. This will allow for assessment of the protective effects of positive well-being, social support and optimism during everyday work and leisure time of the participants. The first part of the analysis presented in Chapter 7 will focus on the relationships between social support and positive well-being, and between social support and biological and behavioural factors. Participants will be measured across two days, a working day and a weekend day (Friday – Saturday). As activities and experiences will vary widely across these two settings, measuring both days will allow for testing of the robustness of associations across different settings.

6.2 Participants

One hundred and ninety nine participants were recruited from University College London (UCL), via publically available email lists. Only women were included in this study, due to the requirements of the main grant holders from which this work was drawn. Inclusion criteria for the study were: full time employment status with hours worked between 8am and 8pm; age between 18 and 65 years; not taking any

medication which might interfere with cortisol output, and having access to the internet on the weekend (in order to complete the online DRM). Emails advertising the study were sent out to all female employees in randomly selected departments across UCL, this was sent out to approximately 500 women. This first contact contained only basic information about the study. Three hundred and twenty two women who were interested responded via email, and were then sent a detailed participant information sheet and screening form (see Appendix 2 and Appendix 3). All potential participants were asked to list any medications that they were regularly taking on this screening form, and the researcher team physician checked these medications to ensure that they were acceptable. After checking the returned screening form, potential participants were contacted by the researcher in order to arrange a suitable time for the two research visits (see below). Some potential participants were excluded in line with the exclusion criteria for this study, others did not get back in touch with the research team. Four women began the study but were not able to complete for various reasons (illness, failure to attend second research visit). This resulted in the final number of 199 participants.

6.3 Measures

6.3.1 Questionnaire

A questionnaire containing a range of psychosocial measures was completed by participants. Only those scales analysed in this thesis are described here. Reliability analyses for all scales are presented in table 6.1. These figures were calculated using Cronbach's Alpha measures of reliability from the data collected in this study. The measures are shown in Appendix 5.

TABLE 6.1 RELIABILITY STATISTICS

	Reliability co-efficient
Measure	
Life Orientation Test	.88
PANAS positive affect	.86
PANAS negative affect	.88
Purpose in life	.77
Personal growth	.72
Self-acceptance	.89
Environmental mastery	.79
Interpersonal Support Evaluation List	.87

6.3.1a Demographic information

Participants first completed demographic information, which included age and date of birth, marital status, ethnicity and religion. Level of educational attainment was measured by age of leaving full-time education and highest educational qualification attained. Job title was given and used to generate an occupational rank. Two researchers independently rated each job title as either higher or lower, for example administrative assistant was ranked as lower and professor was ranked as higher. The two rating lists were then compared and any inconsistencies were further investigated (for example by identifying banding of the job title in question). Number of hours worked from home and in work were measured. Finally, information about home life was collected, including how the home was paid for (mortgage/rent), number of rooms in the house, children living in the house and type of house lived in.

6.3.1b Optimism

The Life Orientation Test was used to assess optimism. This questionnaire is a measure of positive outlook on life (Scheier & Carver, 1992). Optimism is measured using the LOT-R a ten item self-report measure assessing generalised expectancies for positive and negative outcomes. Participants were asked to indicate their degree of agreement with statements such as 'In uncertain times, I usually expect the best' using a 5 point scale ranging from 0 (strongly disagree) to 4 (strongly agree). Four items are included as fillers leaving 6 active items. Scores on each of these items were summed and could range from 0 to 24, with higher scores indicating a higher level of optimism.

6.3.1c. Positive and negative affect

The Positive and Negative Affect Schedule (PANAS) is a 20 item measure containing 10 positive emotion adjectives and 10 negative emotion adjectives (Watson, Clark, & Tellegen, 1988). Participants are required to rate how much they had felt this way during the past week using a 5 item response scale, labelled very slightly/not at all, a little, moderately, quite a bit, or extremely. Negative adjectives included upset, scared and hostile and positive adjectives included interested, strong and inspired. Ratings on each scale were summed and could range from 10 to 50, with higher scores for the positive subscale indicating higher positive affect and higher scores on the negative subscale indicating higher negative affect. These two scales are designed as orthogonal factors rather than opposite ends of the same construct. The PANAS has been used extensively in previous research and has been reliably correlated with a range of health outcomes (e.g. Pressman & Cohen, 2005).

6.3.1d Eudaimonic well-being

Eudaimonic well-being was assessed with the Scales of Psychological Well-being (Ryff 1989), which consists of 6 sub-scales. It was decided to use only 4 of the 6 subscales from the original scale, due to a high participant burden in completing the extensive questionnaire used in the Daytracker Study. It was decided not to use the Positive Relations with Others scale as this is similar in design to other measures of social support used, such as the Interpersonal Support Evaluation List. The Autonomy subscale was also excluded as this overlapped with measures of control at work (this scale is not discussed as part of this thesis). The environmental mastery subscale measures ability to choose or adapt to situations based on one's personal needs, and is measured by items such as "in general I feel I am in change of the situation in which I live". The self-acceptance subscale measures having a positive attitude towards one's self whilst being aware of both good and bad aspects. This scale includes items such as "When I look at the story of my life, I am pleased with how things have turned out". The subscale of purpose in life is designed to measure having meaning and direction in one's life. This scale includes items such as "I enjoy making plans for the future and working to make them a reality". The final subscale which was included was personal growth and this scale measures continued growth and development of the self. This is measured by items such as "I think it is important to have new experiences that challenge how you think about yourself and the world". Each scale consists of 9 items which are rated on a 1 to 6 scale, these are then summed to produce scores ranging from 9 to 54, with a higher score on each scale indicating a higher level of well-being.

6.3.1e Structural social support

Structural social support was assessed with the Social Network Index (SNI). This is a structural measure of social integration that assesses number of network members (Cohen, Doyle, Skoner, Rabin, & Gwaltney, 1997). The SNI measures

contact with mother, father, mother-in-law, father-in-law, children, other relatives, friends, and assesses frequency of contact with each of these groups. Participants rate how often they see or talk to each relationship contact and one point is given for ratings of once every two weeks, once a week or more often. An additional point is given for being married. Scores can range from 0, indicating single marital status and no contact with any friends or relatives, to 8, indicating a large social network and high frequency of contact with network members. The Social Network Index has been used extensively including in an assessment of social support and the common cold (Cohen et al., 1997). Cronbach's alpha measures of reliability are not used for this measure because there is no *a priori* reason to expect that the presence of one type of a relationship, such as a partner would be associated with having another social network member, such as a colleague.

6.3.1f Functional social support

Functional social support was measured with the Interpersonal Support Evaluation List (ISEL), which was developed to measure the availability of multiple, independent support function (Cohen & Hoberman, 1983; Cohen & Wills, 1985). The ISEL was originally developed to measure the perceived availability of four types of social support; tangible support, appraisal support, self-esteem support and belonging support. For this study, a shortened 12 item version was used to reduce participant burden. This version of the ISEL was based on that used by Peirce et al (1996). Four items were used to measure belonging, appraisal and tangible support, self-esteem support was not measured. Belonging support is the perceived availability of a group to which one can identify with and be a part of, items included "If I wanted to have lunch with someone, I could easily find someone to join me". Tangible support is the perceived availability of material aid and included items such as "If I were ill, I could easily find someone to help me with my daily chores". Finally, appraisal support refers

to having somebody to discuss personal important issues with and was measured by items including “When I need suggestions on how to deal with a personal problem, I know someone I can turn to”. Each question was rated on a 4 point scale labelled ‘often’, ‘sometimes’, ‘not often’ and ‘never’ and scores for each scale were summed. A total score was used across all three subscales by summing each response, meaning that scores could range from 0 to 36, with higher scores indicating a higher level of social support.

6.3.1g Health behaviours

The health behaviour measures used in this study differed from those used in study 1 (see chapter 5). Measures used in the following study were not binary except for where explicitly stated in the analysis. Firstly, participants were required to rate how their health had been in the past month using a 5 point scale, ranging from excellent to poor and this was used as a self-rated health variable. Simple self-rated health indices of this type have been used extensively in previous research studies and have been shown to predict health status and mortality (Idler & Benyamini, 1997).

Physical activity was measured using the IPAQ (International Physical Activity Questionnaire), which is designed to measure physical activity in 18-65 year olds. The reliability and validity of this scale has been tested in a large cross-country sample and is used extensively in physical activity research (Craig et al., 2003). This scale includes assessment of walking, moderate and vigorous exercise and also sedentary behaviour. Participants rated how often they took part in moderate and vigorous activity on a four point scale, ranging from three or more times per week, to never. These variables were used as moderate exercise and vigorous exercise in this analysis, and could range from 0 (never) to 3 (3 times per week or more). Time spent walking was measured for both working and weekend days. Finally, participants were asked to rate the amount of time they spent per weekday and weekend day watching TV/videos and/or playing

computer games and this was used as a measure of sedentary behaviour. A combined variable consisting of both moderate and vigorous exercise was also used.

Smoking status was assessed by measuring current smoking status, with response options ‘yes, current smoker’, ‘yes, ex-smoker’ and ‘no, never smoked’. Ex-smokers were asked to indicate at what age they had stopped smoking, and how many cigarettes they smoked on average. Current smokers were asked how many cigarettes per day they usually smoked. A binary measure of current smoking status was used, so that 0 indicated currently a non-smoker and could include those who had previously smoked, and 1 indicated current smokers.

Alcohol consumption was first measured by asking participants to rate themselves as either ‘a non-drinker’, ‘a very occasional drinker (special occasions only)’, ‘an occasional drinker’ or a ‘regular drinker’. Those indicating occasional or regular drinking were then asked how many days in the previous 14 they had had an alcoholic drink, and on those days, how many drinks they had on average. Finally, participants were asked if they would like to reduce the amount of alcohol they drank using yes/no response options. This measure has been used in several large scale surveys of health behaviour, including the International Health and Behaviour Study (O'Donnell, Wardle, Dantzer, & Steptoe, 2006). Participants were grouped as non-drinkers, moderate drinkers or heavy drinkers for this analysis. Those who indicated that they did not drink alcohol were labelled 0 in this variable. Amount of alcohol consumed in an average two week period was first calculated by multiplying the number of days out of the past 14 when an alcoholic drink had been consumed by the number of alcoholic drinks consumed on each occasion. A value of 28 or greater was labelled as a heavy drinker for this analysis, and 27 or less as a moderate drinker. To analyse the relationship between social support and alcohol consumption a binary variable was created, comparing non and moderate drinkers with heavy drinkers.

Dietary measures included consumption of fruit and vegetables, with 8 options ranging from ‘five or more time a day’ to ‘never’, and also consumption of full fat, semi-

skimmed, skimmed and non-dairy milk, rated on a 7 point scale ranging from 'five or more times a day' to 'never'. However, for the purposes of this analysis only fruit and vegetable consumption was analysed. Participants who indicated that they ate fruit or vegetables 5 times per day or more were coded as 1 and those who ate fruit and vegetables less often were coded as 0.

6.3.2 Momentary assessment of mood: Ecological momentary assessment

A sampling diary was used to accompany cortisol measurement (see Appendix 6). Each time a cortisol sample was collected, participants completed the corresponding page in the sampling diary. This included a record of the time the sample was taken, in order to assess if the sample was taken at approximately the required time. For the waking sample, an additional question asked if there had been a delay between waking up and collecting the sample. Participants were asked to record where they were and what they were doing using a series of codes recorded on the back page of the diary, ranging from at the office to at the gym and from watching tv to working. Next, they completed a set of questions relating to how they had been feeling in the previous 30 minutes before the sample was collected, and these formed the EMA measures of mood (see below). Any interaction with another person was rated for pleasantness on a 5 point scale. Participants recorded whether or not they had consumed any caffeinated drinks, taken any medicines, eaten, consumed alcohol, taken exercise or smoked in the 30minutes preceding the saliva sample. Finally, after completing each saliva sample, participants recorded the time they went to bed, time they went to sleep, time they work up, time they got up and how they rated their sleep quality compared to a typical night.

The ratings for mood given in the sampling diary were used to construct the EMA happiness variable used in Chapters 7 and 8. Seven ratings were obtained during each of the 24 hour monitoring variables, with participants providing ratings for how

happy, in control, stressed, rushed, angry and tired they felt, and also whether they were experiencing pain. However, the analyses presented in chapter 7 focuses only on the happiness ratings. Further analyses using this data set will be able to investigate the other six emotions measured; at the time of writing this thesis it was not possible to include these variables. It was decided to focus only on the ratings given from 30 minutes after waking up on both days, therefore excluding ratings at 5pm and bedtime at the beginning of each sampling period, and then the ratings taken immediately after waking up. Ratings given on the evening of the leisure day period always occurred on a Friday night, which although is part of the weekend, can also be seen as part of the working week. Participants may have had lingering emotions associated with the Friday work day that would not have been representative of a true leisure evening. For the work day and the leisure day, happiness ratings from waking plus 30 minutes, 10am, 12noon and 3pm were averaged to create a mean happiness on work day and mean happiness on leisure day variable. These are referred to as 'EMA happiness work day' and 'EMA happiness leisure day'. Another variable was also created termed "very happy" for both the work and leisure day. This variable is calculated as the proportion of ratings as either 4 or 5 on the happiness scale and is expressed as a percentage. A score of 100 would indicate that that participant had rated themselves as either 4 or 5 at each time point. This measure is similar to that used in previous work by Steptoe, Wardle & Marmot (2005, 2006).

6.3.3 Momentary assessment of affect: Day Reconstruction Method

Patients were asked to systematically reconstruct activities and experiences of the previous day by first constructing a diary (initially, a rough version on paper for themselves as an aide memoir), consisting of a sequence of episodes, as if in a film. The patients were asked to write down the approximate times the episodes began and ended. Indications of the end of an episode might be going to a different location,

ending one activity or starting another, or a change in the people they were interacting with. They then described each episode by answering structured questions about the situation, when it occurred, what were they doing (check list of activities), who they may have been with and how they felt. After completing a structured diary, participants were asked to rate the feelings experienced (happy, tired, frustrated etc.) during each episode, on an affect scale ranging from 0 to 6. A rating of 0 meant one did not experience that feeling at all. A rating of 6 meant that this feeling was a very important part of the experience. Twelve different affective states were assessed for each episode, as summarised in figure 5.3. Participants were asked to choose the number between 0 and 6 that best described how they felt for each of the episodes listed in the 24 hours of monitoring.

The DRM provides a continuous sequence of activities with associated affect ratings for each participant and was completed after both the working day and the weekend day. This means that for every minute of the waking day, information is available about what activity every participant was engaged in and their associated moods. Episodes are marked by the beginning of a new activity, or the presence of a new set of people. Participants completed the DRM retrospectively in order to recover complete 24 hour representations of their sampling period. For this study, an online version of the DRM was used as this was thought to be an easy method for participants to use and meant the information was easily available through a Microsoft Access database (see figure 5.2 and 5.3 for screenshots of the online DRM used in this study).

In order to represent the levels of positive affect over the work and leisure days, it was necessary to compute mean values. However, a mean computed from averaging each DRM affect rating over the day would not be accurate, since it would weight each episode equally. For example, if an individual had a happiness rating of 6 for a 30-minute episode, and a happiness rating of 2 for a 3-hour episode, the mean of 4 would not reflect their actual experience. Duration-weighted means were therefore

computed to take account of these variations – in this example, the duration weighted mean would be the average of 2*3 and 6*0.5 divided by the total time (i.e. 2.57).

Three positive affect moods were included in the DRM: happy, feeling warm and friendly, and enjoying myself (see Figure 5.3). A composite positive affect measure was derived by averaging the duration-weighted scores for these three scales, with one measure for the working day and a second measure for the leisure day. Each could range from 0 – 6, with higher scores representing greater positive affect.

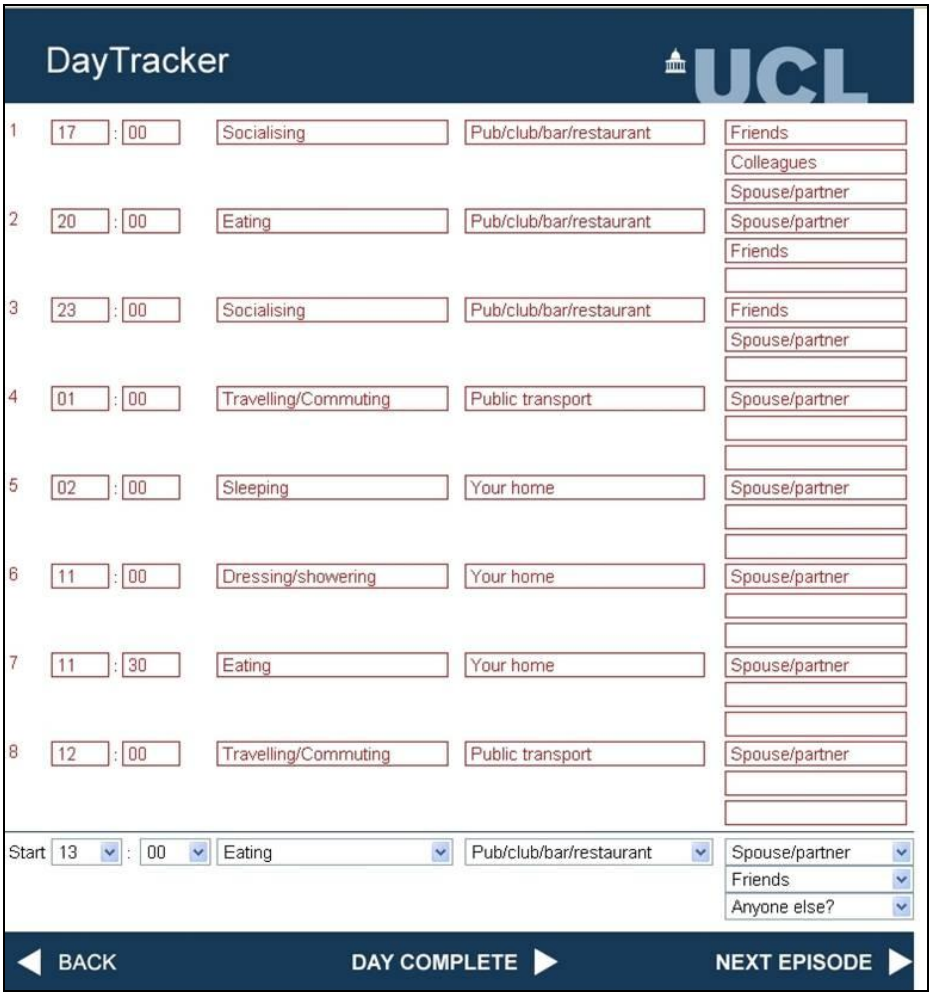


FIGURE 6.1 ONLINE DRM EPISODES

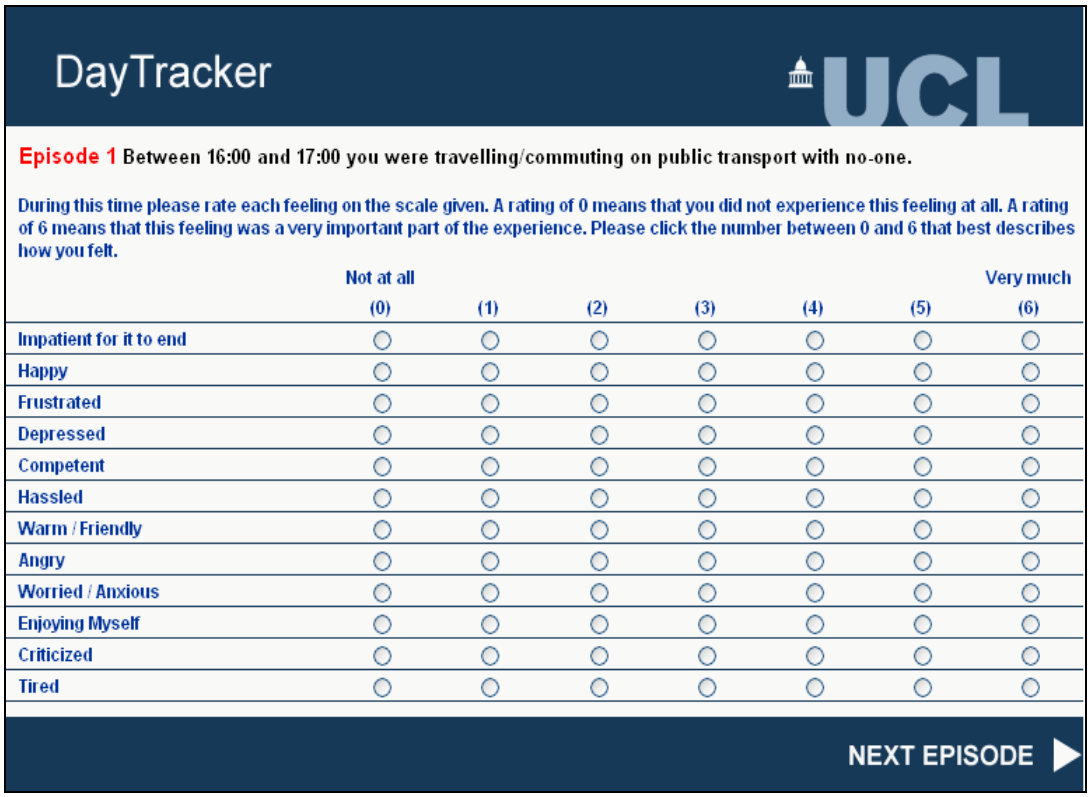


FIGURE 6.2 AFFECT RATINGS FOR ONLINE DRM

Clearly, the DRM can generate far richer data than this. There are several other affect measures, and it is possible to compute variations in mood over the day, affect scores associated with particular activities, and affect scores related to specific social interactions. But these aspects were beyond the scope of this thesis. The intention was to utilise the DRM to derive aggregate measures of positive affect associated with actual experiences over the study period.

6.3.4 Cortisol measurement

Cortisol was collected from saliva samples using Salivettes (Sarstedt, Leicester, UK). Cortisol was sampled at 7 time points throughout both 24 hour monitoring periods; at 5pm, bed-time, upon waking, 30 minutes after waking, 10am, 12noon and 3pm. Samples were returned to the research offices, and stored in a freezer at -80°C

until analysis which was carried out using a high sensitivity chemiluminscence assay at the Technical University, Dresden, Germany.

Three cortisol variables were used throughout this analysis: the cortisol awakening response; total cortisol output and slope of cortisol decline throughout the day. The CAR is the change in cortisol that occurs over the first over 20-30 minute following waking (Clow et al, 2004) and was assessed using the difference between the waking and 30 minute saliva samples. The CAR is critically dependent on the waking cortisol sample being obtained without substantial delay, since postponement can reduce the magnitude of the awakening response (Wright & Steptoe, 2005). Time of waking on day 1 was based on self-report, with an added measure for delay between waking and collecting the waking sample. Delaying the 'waking' sample by up to 15 minutes following objectively defined waking does not substantially influence the CAR (Kupper et al, 2005; Dockray et al, 2008). Individuals with delays >15 minutes were therefore excluded from CAR analyses, but all others were included. Data were available for 184 participants on the work day and 171 on the leisure day and are expressed in nmol/l. The cortisol awakening response was calculated as any change (increase) in cortisol levels between the waking and 30 minutes post waking samples, as in the methods used by Hellhammer et al (2006) and Clow et al (2009).

Total cortisol output can be computed using either area under the curve (AUC) measures, or mean cortisol levels throughout the day. Cortisol levels for each day were calculated using an area under the curve formula which provides a representation of total cortisol secretion for the day of interest. The following formula for AUC calculation for the total cortisol variable was used:

Work day AUC = (((cortwake + cortwake+30)/2)*t_2-t_1) + (((cortwake+30 + cort10am)/2)*t_3-t_2) + (((cort10am + cort12pm)/2)*t_4-t_3) + (((cort12pm + cort3pm)/2)*t_5-t_4), where t_1 = time of waking sample, t_2 = time of waking sample + 30 min, t_3 = time of 10 am sample, t_4 = time of 12 pm sample, t_5 = time of 3 pm sample. The resulting values

(in nmol/l/min) were skewed, so were log transformed before analysis. Data were available for 191 on the work day and 177 on the leisure day.

Finally, the slope of cortisol decline was calculated as the reduction in cortisol per hour between waking and the 3pm sample. The waking + 30 value was excluded the computation, since it can distort the curve because of the rise in cortisol over this time period. A regression method was used to derive these values, averaging the change in cortisol per minute between each pair of samples (waking and 10am; 10am – 12 pm; 12 pm – 3 pm). These values were also skewed, and were log transformed before analysis. Data were analysed for 191 participants from work day and 183 on the leisure day.

Adherence to the sampling protocol can be examined by looking at participants self-reported sampling times, taken from the sampling diary. Average times for each sample are shown in table 5.2. The largest variation in sampling time was for the bedtime sample on both the work and leisure day. Participants were not asked to alter their usual routine, and therefore a wide difference in bed time is to be expected. Participants tended to wake up earlier on the working day and the mean sampling times were closer to the protocol on the work day compared to the leisure day.

TABLE 6.2 AVERAGE CORTISOL SAMPLING TIMES

	Work day* (± minutes)	**Leisure day*** (± minutes)
5pm	17:23 ±35	17:23 ± 40
Bedtime	23:10 ±64	23:55 ± 83
Waking	6:55 ±52	7.58 ± 82
Wake +30	7:35 ±53	8:40 ± 81
10am	10:08 ±17	10:24 ± 48
12noon	12:10 ±.22	12:20 ± 46
3pm	15:11 ±24	15:18 ± 37

* Mean and standard deviations

6.4 Procedure

Participants completed measurements over two 24-hour periods, one beginning on a weekday evening and extending across the following working day (referred to as working day), and the other beginning on a Friday evening and extending across Saturday (referred to as leisure day; see figure 5.1). The start day was counter-balanced so that half the participants began their monitoring phase on the working day, and half began on the leisure day. The monitoring period for both the work and leisure day began at the same time for each participant, and was between 4pm and 7pm for all participants. This time was agreed with participants as the time they anticipated finishing work for the day. Participants attended the research office at this time and were taken to a research study room by the researcher.

At the beginning of the research appointment, the study was further explained and the participant and the researcher completed a consent form (see Appendix 4). Firstly, the researcher took a measure of height, after asking participants to remove shoes and socks, and any heavy clothing. Weight was measured using Tanita scales, which also provided an estimation of body fat percentage and a BMI calculation. After collection of height and weight measures, participants were fitted with an Actiheart monitor, which measures heart rate variability. Participants wore the monitor for the full 24 hour monitoring period, but these data are not discussed within this thesis.

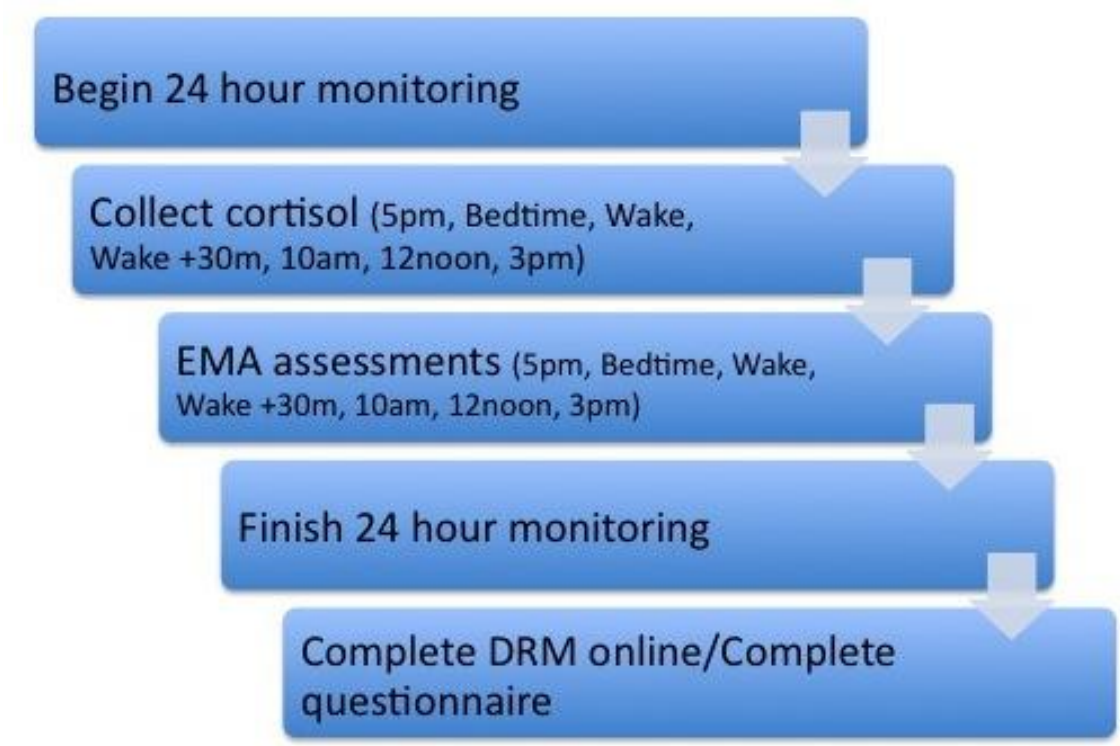


FIGURE 6.3 DIAGRAM OF DAYTRACKER PROCEDURE

The procedure for collection of saliva was explained next, using the sampling diary and salivettes. Each participant was given 7 salivettes labelled 1 thru 7, indicating the order in which samples should be collected. The sampling diary contained information about the times to take each tube, and this was explained in detail to participants. The first saliva sample was collected at the research appointment, which ensured that participants had understood the saliva sampling procedure. Participants were instructed not to eat or drink (with the exception of water) within 30 minutes of each sampling time, and not to brush their teeth before taking samples. Each saliva collection was accompanied by a page in the sampling diary, where participants completed EMA assessment of how they had been feeling in the previous 30 minutes. Information about potential confounding factors such as smoking and exercise was also collected on this page. Participants were asked to indicate if they had interacted with anybody prior to taking this sample, and if so, to indicate how pleasant this interaction had been. Saliva samples were to be collected at the end of the working

day, before bedtime, at waking, 30 minutes after waking, at 10am, 12noon and 3pm the following day. Care was taken to explain the importance of collecting the waking sample as soon as participants had woken up, before getting out of bed, and also not to eat, drink (apart from water) or brush teeth in between the waking and the waking plus 30 minutes sample. Participants were given two sealed plastic bags to store their samples in during the 24 hour monitoring period, and asked to store samples in the refrigerator once they had been collected.

Participants were given a questionnaire to complete, and were instructed that this could be completed at any time before the end of the second day of monitoring. Each scale within the questionnaire contained standardised instructions about how to complete the questions. The measures from the questionnaire that are included within this thesis are described in following section (see section 5.4.1). Finally, the Day Reconstruction Method was explained. An online version of the DRM (see measures section below) was used and this was demonstrated to participants using a computer in the research office. Participants were reminded that the 24 period for which they would complete the DRM would begin at the end of the working day and finish 24 hours later. The start time of this period was confirmed with each participant and recorded on the information given to participants. The DRM was to be completed at the end of the 24 hour period, by participants in their homes or in their offices. Types of episodes were described and typical lengths of episodes were explained. Any questions about any of the measures were answered by the researchers.

A follow-up appointment was confirmed with participants, firstly to collect the materials from the first day of monitoring, and a second research visit. These second visits occurred more than 2 days but less than 2 weeks after the first session. At the second research visit, participants were again fitted with the Actiheart monitor. The saliva sampling procedure was reviewed, and a new saliva kit given. Times for completion of the DRM were agreed with the participant and arrangements were made to collect completed study materials at a convenient time.

6.5 Data storage

All data collected were treated as confidential. All information collected was kept separate from consent forms, and all were kept in locked filing cabinets with restricted access. Data was anonymised and entered into a database which was password protected. Biological samples were stored anonymously.

6.6 Daytracker study

The Daytracker study is a large scale naturalistic investigation involving a team of researchers. This author was involved with this study from the initial design through data collection and data analysis. At the outset, this author was responsible for researching and collating questionnaire materials for the measurement of positive well-being and social support. This author carried out pilot testing of all materials (questionnaire, sampling diary, cortisol protocol, day reconstruction method) and revised materials as necessary. This author produced all participant materials, including study packs for each participant, and designed a comprehensive protocol for recruitment and scheduling of participants. This author was one of two main researchers collecting data for the Daytracker study, and therefore had a high involvement with participants. After completion of data collection, this author was jointly responsible for data entry, scoring of scales and data cleaning along with two other research staff.

6.7 Statistical analysis

All statistical analyses for the results presented in chapters 7 and 8 were performed using the statistical programme SPSS 14.0 (SPSS Inc). Analyses for results presented in chapter 5 were carried out in STATA, this was in order to take account of clustering by country and obtain accurate confidence intervals. For the first part of the

analysis, investigating association between social support and psychological well-being, descriptive analyses were first carried out. Univariate analysis of variance was used to investigate differences in continuous measures of social support and positive well-being and demographic factors, with chi-square being used for the categorical marriage variable. Pearson correlations were used to analyse univariate relationships between positive well-being variables. To investigate multivariate relationships between social support and positive well-being variables, multiple linear regression with each measure of positive well-being as the dependent variable was used. The regressions model is further detailed in chapter 7, section 7.5.

The second part of the analysis assessed the relationship between health behaviours and social support. Initially the relationship between health behaviour and demographic factors was analysed. Relationships between health behaviours and ethnicity and SES were analysed using chi-square or Fisher's exact test for those analyses with expected cell counts of less than 5. The relationships between age and health behaviour was analysed using univariate ANOVA. To test the multivariate relationship between categorical variables and social support (smoking, alcohol, fruit and vegetable consumption) logistic regression was used with health behaviours as the dependent variable and social support as predictor variables in separate models. This model is described in section 7.6. For the continuous variable of total exercise linear regression was used with exercise as the dependent variables and social support as the predictor variables.

The third section of the analysis assessed the relationship between social support and cortisol profiles. To assess the multivariate relationship between social support and cortisol a similar multiple linear regression model was used, with each measure of cortisol as the dependent variable. Predictors for this model are detailed in section 7.7. Data for each analysis was excluded using the casewise function in SPSS.

6.8 Summary and next steps

This chapter has presented the methodology used in the next chapter, which investigates the first of the two main thesis aims. These are firstly to test relationships between psychosocial factors and secondly the relationship between psychosocial factors and health behaviours and biology. The next chapter will present the findings from this study.

CHAPTER 7: AN INVESTIGATION OF PSYCHOSOCIAL FACTORS AND BEHAVIOURAL AND BIOLOGICAL PATHWAYS RELATED TO HEALTH

7.1 Participant Demographics

One hundred and ninety-nine participants completed data collection for the Daytracker study. However, some participants failed to complete some parts of the study, or their data had to be excluded due to errors in completion. Numbers of participants for each aspect of the data are shown in table 7.1. Demographic information about the participants in this study is displayed in table 7.2. Just under half the participants were married or in a marital-like relationship and the majority were of White ethnicity.

TABLE 7.1 DATA AVAILABILITY

Data type	N (%)
Total sample	199
SES	196
Questionnaire data	
Marital status	196
PANAS	195
Scales of Psychological Well-being	196
Social networks	199
Social support	195
Health behaviours	
Smoking	195
Drinking	191
Exercise moderate	194
Exercise vigorous	195
EMA work day	186
EMA leisure day	186
DRM work day	163
DRM leisure day	156
Cortisol work day	
CAR	180
Slope	192
Total	180
Cortisol leisure day	
CAR	177
Slope	188
Total	181

TABLE 7.2 PARTICIPANT DEMOGRAPHICS

	N (%)	Mean (sd)	Range
Demographic factors			
Age	197	33.75 (9.21)	20-61
Ethnicity (White)	160 (81.2)		
Married	96 (49)		

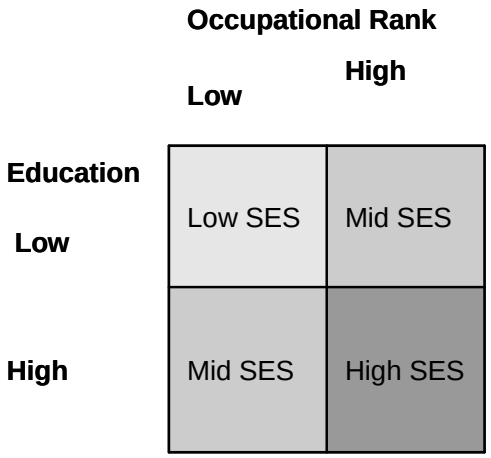
7.2 Socio-economic status measures

In order to determine which measure to use as a marker for socio-economic status, an analysis of education, personal income and occupational rank was conducted. The intention was to identify a socio-economic status marker that was not confounded by age. Descriptive statistics for educational attainment, occupational rank and personal income are displayed in table 7.3. Occupational rank did not vary with participant age, and neither did educational attainment. Personal income was significantly higher in older participants (see table 7.3) and therefore not an acceptable measure of socio-economic status.

TABLE 7.3 SOCIO-ECONOMIC STATUS MEASURES AND AGE.

Measure	**N (%)**	**Mean age (SD)**	**F**	***p***
Educational attainment			3.36	.068
Less than degree	71 (36)	32.86 (8.22)		
Degree or higher	126 (64)	35.35 (10.61)		
Personal income/year			19.03	<.001
<£25,000	64 (32.5)	29.38 (7.34)		
£25,000-£34,999	87 (44.2)	33.95 (8.29)		
>£35,000	46 (23.4)	39.46 (10.09)		
Occupational rank			1.82	.178
Lower	120	33.02 (9,20)		
Higher	76	34.83 (9.21)		

Using the measures of educational attainment and occupational rank, a composite variable was calculated to assess socio-economic status (see figure 7.1). Participants with both a low occupational rank and a lower level of education were allocated to the low SES level. Those with high occupational rank and low education, or high education and low occupational rank were allocated as mid-SES. Finally, those with both a high occupational rank and a high educational level were allocated as high-SES. Therefore, higher level of SES is indicated by a higher value in the following analyses. This measure did not vary with age ($F_{(2,193)}$=.38, *p*=.69) but was significantly different between personal income levels (χ^2=17.07, df=4, *p*<.005) suggesting that this was a useful marker of socio-economic status since it combines occupation and education in a fashion similar to the more traditional Hollingshead method. Data to calculate this variable was only available for 196 of the 199 total participants.



	N (%)
Low SES	51 (26)
Mid SES	88 (45)
High SES	57 (29)

FIGURE 7.1 CALCULATION OF COMPOSITE SOCIO-ECONOMIC STATUS MEASURE.

7.3 Social support

Descriptive statistics for the three social support variables are shown in table 7.4.

TABLE 7.4 DESCRIPTIVE STATISTICS FOR SOCIAL SUPPORT MEASURES

	N (%)	Mean (sd)	Range
Social support measures			
Functional support	196	26.5 (6.5)	0-36
Structural support	197	3.6 (1.4)	1-8
Marital status	196		
married/ marital-like relationship	96 (49)		
not married	100 (51)		

There were significant differences in functional social support levels in relation to marital status ($F_{(1,193)}$=.5.9, p<.05) and in structural social support by marital status ($F_{(1,194)}$=.44.4, p=.001). In both cases married participants had higher levels of social support compared to unmarried participants. Functional and structural measures of social support were positively associated (r=.46, n=196, p<.001). There were no differences in levels of functional or structural support between ethnic groups or between levels of socio-economic status (see table 7.5). There was a significant negative correlation between age and functional social support, indicating that younger participants rated themselves as having higher levels of perceived social support. Similarly, younger participants had higher levels of structural social support. There were no associations between marital status and age, ethnicity or SES.

TABLE 7.5 RELATIONSHIP BETWEEN SOCIAL SUPPORT AND COVARIATES

	Ethnicity	SES	Age
Demographic factors			
Functional support	$F_{(1,194)}$=2.61, p=.11	$F_{(2,192)}$=.714, p=.49	r=-.29, n=196, p<.001
Structural support	$F_{(1,195)}$=3.41, p=.07	$F_{(2,193)}$=.082, p=.92	r=-.20, n=197, p<.005
Marital status	Fisher's exact test p=.45	χ^2=3.0, df=2, p<.22	$F_{(1,194)}$=.089, p=.76

7.4 Positive well-being and optimism

Scores on the personal growth, purpose in life and environmental mastery subscales were similar, with the highest mean score for the personal growth scale (see table 7.6). Scores on the self-acceptance subscale were lower at 34.5 than the other scales. PANAS positive affect was higher than the negative affect score, showing that participants had a moderately high level of positive affect. Mean optimism score was at the midpoint of the range for this scale.

TABLE 7.6 POSITIVE WELL-BEING AND OPTIMISM DESCRIPTIVE STATISTICS

Affect measures	N	Mean	SD	Range
PWB				
Personal Growth	197	44.1	5.6	9-54
Purpose in life	197	41.1	6.9	9-54
Environmental mastery	197	39.3	7.1	9-54
Self-acceptance	197	34.5	9.2	9-54
PANAS				
Positive affect	195	33.1	7.1	10-50
Negative affect	195	19.5	7.1	10-50
LOT				
Optimism	197	11.9	6.3	0-24

7.4.1 Eudaimonic well-being

Purpose in life, environmental mastery and self-acceptance were not related to age, ethnicity or SES. Personal growth was related to age (r=-.18, n=197, p<.05), indicating that younger participants had higher scores on the personal growth subscale.

7.4.2 Positive and Negative Affect

There was no correlation between the PANAS positive and negative affect subscales (r=-.02, n=195, p=.80). PANAS positive and negative affect were not related to age. There were also no differences in the levels of positive or negative affect between ethnic groups or SES.

7.4.3 Optimism

Optimism was not related to age or ethnicity. However, a significant relationship was apparent with SES ($F_{(2,193)}$=12.3, p=.001; see figure 7.2) with greater optimism amongst those with higher SES.

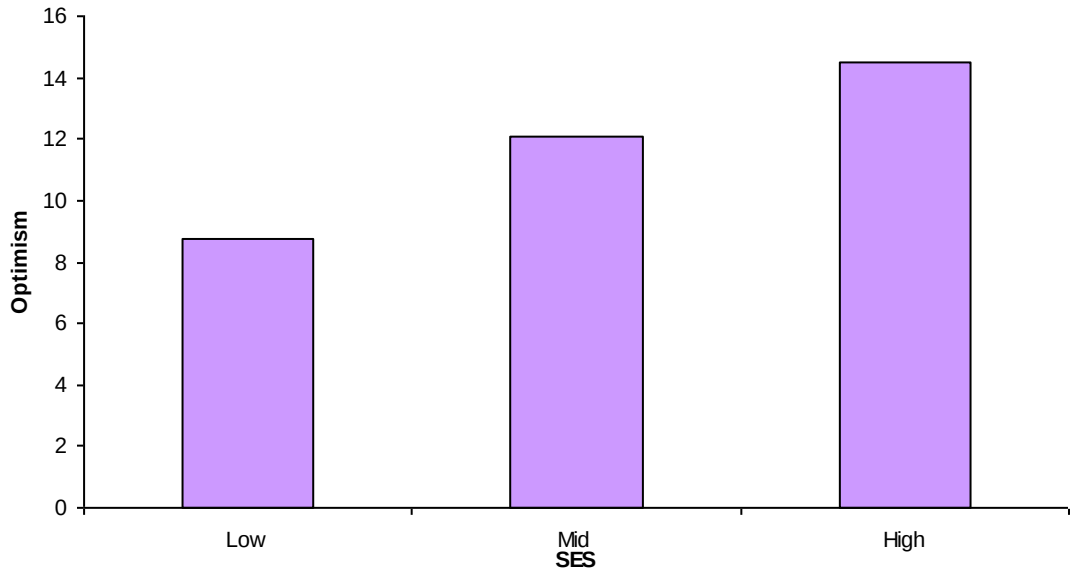


FIGURE 7.2 OPTIMISM AND SOCIO-ECONOMIC STATUS

7.4.4 Day Reconstruction Method

Due to missing and incomplete data, 133 participants were included in the DRM analyses. A comparison analysis was carried out between these 133 and the remaining 66 participants without DRM data. There were no differences in SES, age, ethnicity or marital status between these two groups. The mean DRM positive affect scores for

work and leisure days are shown in table 7.7, and these could range from 0 to 6. Repeated measures analysis of variance was carried out on the individuals with data available on both days. Mean DRM positive affect ratings varied between work day and leisure day ($F_{(1,132)}$=40.537, p<.001) so that ratings were higher on the leisure day compared to the work day (see table 7.7). The mean values for these 133 individuals were comparable to those of the complete sample. Mean DRM positive affect ratings on the leisure day were not related to age, SES or ethnicity. Ratings of happiness on the work day were marginally related to SES ($F_{(2,158)}$=3.059, p=.05). DRM positive affect ratings on the work day (r=-.205, n=162, p<.01), were also related to age, with younger participants having higher happiness ratings but there was no relationship on the leisure day (r=-.076, n=154, p=.347).

TABLE 7.7 DAY RECONSTRUCTION METHOD DESCRIPTIVE STATISTICS

	Complete Sample		Included in DRM analysis		
	N	**Mean (sd)**	**N**	**Mean (sd)**	**Range**
Mean DRM positive affect					
Work day	164	3.00 (1.14)	133	2.97 (1.09)	0-6
Leisure day	156	3.59 (1.14)	133	3.65 (1.11)	0-6

7.4.5 Ecological Momentary Assessment

As noted in chapter 6, EMA happiness scores were computed in two ways: as the mean value of the ratings over the day, and as the proportion of ratings on which participants gave a score of 4 or 5, reflecting the amount of time they were happy. Mean ratings of happiness were higher on the leisure day compared with the work day ($F_{(1,175)}$=75.919, p<001; see table 7.8). Age was not related to mean happiness on the leisure day (r=-.071, n=184, p=.336) or the working day (r=-.078, n=185, p=.289). There was no difference between levels of SES in happiness ratings on the work day ($F_{(2,\ 182)}$=.809, p=.448) or the leisure day ($F_{(2,\ 180)}$=1.17, p=.172), or between ethnic

groups on the work day ($F_{(1,183)}$=.127, *p=722*) or the leisure day ($F_{(1,182)}$=.271, *p*=603). In the second set of analyses, participants were significantly more likely to report being very happy on the leisure day compared with the work day ($F_{(1,175)}$=64.607, *p*<.001). As can be seen in Table 7.8, participants gave happiness ratings of 4 or 5 on half the EMA assessments on the leisure day, but only 28% of occasions on the work day. There was no relationship between proportion of very happy ratings and ethnicity, SES or age on either the work or leisure day.

TABLE 7.8 ECOLOGICAL MOMENTARY ASSESSMENT DESCRIPTIVE STATISTICS

	N (%)	Mean (sd)	Range
Mean happiness			
Work day	186	3.1 (.65)	1-5
Leisure day	186	3.5 (.69)	1-5
Proportion very happy			
Work day	186	28.2 (31.98)	0-100
Leisure day	186	50.6 (36.39)	0-100

7.5 Relationship between positive well-being and optimism measures

The four subscales from Ryff's Scales of Psychological Well-being were highly positively correlated with each other and with PANAS positive affect (see table 7.9). The Ryff subscales were strongly positively intercorrelated, with the weakest correlation between environmental mastery and personal growth. These findings suggest that there is some overlap between the subscales. PANAS positive affect showed a very similar pattern of correlations with each of the Ryff subscales. Interestingly, optimism was not related to any of the other positive well-being measures, suggesting that optimism may reflect a more global response style that is not associated with day-to-day affective state. DRM positive affect measures on the work day and the leisure day were positively related to each other and showed a similar pattern of correlations to the other positive well-being measures. However, DRM

positive affect on the leisure day was not related to personal growth in contrast to DRM positive affect on the working day. DRM positive affect on the work day was correlated with EMA happiness on the work day, and the same was true for both measures on the leisure day. The DRM measure comprises happiness, enjoyment and warmth whereas the EMA rating is for happiness only. The correlation between these measures on the work and leisure day suggests that momentary ratings of happiness are comparable to retrospective self-report measures of positive affect. Although the EMA ratings for both the work and the leisure day showed similar patterns of correlations with the other measures, there were some differences. EMA happiness on the work day was not related to PANAS positive affect, optimism or personal growth, but was related to all other measures of well-being. However, EMA happiness on the leisure day was related to PANAS positive affect and positive growth, but similarly was not related to optimism. The relationships between the questionnaire measures of well-being were positive and very strong, whereas the relationships between EMA and DRM measures, although significant, were less strong.

TABLE 7.9 CORRELATIONS BETWEEN POSITIVE WELL-BEING AND OPTIMISM MEASURES

Measure		Environ mastery	Personal growth	Purpose in life	Accepta-nce	Positive affect	Optimism	DRM leisure day	DRM work day	EMA work day mean	EMA leisure day mean
Personal growth	*r*	.405									
	p	.001*									
Purpose in life	*r*	.606	.666								
	p	.001*	.001*								
Self-acceptance	*r*	.610	.616	.680							
	p	.001*	.001*	.001*							
Positive affect	*r*	.341	.440	.462	.521						
	p	.001*	.001*	.001*	.001*						
Optimism	*r*	.089	-.028	.040	.100	-.085					
	p	.213	.698	.573	.160	.239					
DRM leisure day	*r*	.230	.132	.181	.254	.234	-.048				
	p	.004*	.103	.025	.001*	.004*	.557				
DRM work day	*r*	.220	.176	.229	.279	.245	-.056	.373			
	p	.005*	.025	.003*	.001*	.002*	.478	.001*			
EMA mean work day	*r*	.214	.111	.167	.279	.112	.025	.164	.524		
	p	.003*	.133	.023	.001*	.133	.738	.046	.001*		
EMA mean leisure day	*r*	.247	.167	.136	.371	.202	.051	.455	.246	.457	
	p	.001*	.024	.065	.001*	.006	.493	.001*	.002*	.001*	
EMA proportion work day	*r*	.256	.159	.241	.258	.215	.026	.243	.524	.837	.407
	p	.001*	.030	.001*	.001*	.003*	.723	.003*	.001*	.001*	.001*
EMA proportion leisure day	*r*	.223	.139	.137	.355	.194	.030	.498	.251	.407	.904
	p	.002*	.059	.064	.001*	.009	.687	.001*	.002*	.001*	.001*

7.5.1 Multivariate analysis

The following series of analyses were carried out in order to test hypotheses 7.1a, 7.1b, 7.1c and 7.1d. Briefly, these hypotheses predict that being married, having higher structural and higher functional support will be associated with higher measures of positive well-being. Finally, hypothesis 7.1d predicts that functional social support will be the strongest independent correlate of well-being. As outlined in the statistical analysis section, these hypotheses were tested using the 10 well-being measures as

the dependent variables, to determine if social support would be associated with levels of well-being. It was then possible to assess the contribution of each social support measure separately in models 3, 4 and 5. The final model tested hypothesis 7.1d, to assess whether effects for social support were independent of each other or due to underlying commonalities. The potentially confounding factors of age, ethnicity and SES were included in these models. PANAS negative affect was included as an additional factor, so as to discover whether social support is related to positive well-being or optimism independently of associations with negative affect. Therefore, age, ethnicity, SES, marital status, structural social support and functional social support were entered as predictors into the model and each measure of positive well-being (personal growth, purpose in life, environmental mastery, self-acceptance, positive affect, DRM positive affect, EMA happiness) and optimism were the dependent measures. Correlations between the independent variables were checked and these were acceptable (data not shown). The variables included in each model are shown in table 7.10. Because the SES status variable is a categorical variable with three levels (low, medium and high), Dummy variables were created to include in the regression analysis. The reference group was low SES. The regression analyses shown below were repeated including these dummy variables in place of the SES variable modelled as a continuous variable. However, there were no significant changes in effect between the analyses using the dummy variables and those using the SES variable (data not shown). Therefore, it was decided to continue with the use of the composite SES variable.

TABLE 7.10 VARIABLES INCLUDED IN THE REGRESSION MODELS

Regression Model	Measure	Hypothesis to be tested
Model 1	Age Ethnicity SES	
Model 2	Negative affect	
Model 3	Marital Status	7.1a
Model 4	Structural social support	7.1b
Model 5	Functional social support	7.1c
Model 6	Marital Status Structural social support Functional social support	7.1d

7.5.1.1 Personal growth

Model 1 shows that age was negatively associated with personal growth but that there was no relationship with ethnicity or SES (see table 7.11). Negative affect was also associated with personal growth, so that higher negative affect was associated with lower personal growth. In step 3, there was no relationship between marital status and personal growth, and age and negative affect remained significant. In Model 4, social networks were associated with personal growth after controlling for the effects of negative affect. Functional social support was positively associated with personal growth in model 5. The final step shows that functional social support remained significantly related to personal growth, and that the social network effect was no longer significant. Participants reporting greater social support also had higher scores on the personal growth scale. The final model was significant and accounts for 23% of the variance in personal growth.

TABLE 7.11 SOCIAL SUPPORT CORRELATES OF PERSONAL GROWTH (N=194)

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	β (SE)	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	-.159 (.072)	.028	-.151 (.069)	.031	-.151 (.069)	.031	-.123 (.070)	.082	-.052 (.067)	.437	-.046 (.068)	.499
Ethnicity	-.016 (.072)	.824	-.004 (.069)	.958	-.003 (.070)	.965	-.022 (.069)	.747	-.048 (.065)	.459	-.053 (.066)	.418
SES	.023 (.071)	.752	.019 (.069)	.780	.017 (.070)	.813	.020 (.069)	.775	.036 (.064)	.581	.045 (.065)	.496
Negative affect			-.258 (.069)	<.001	-.257 (.069)	<.001	-.226 (.070)	.002	-.170 (.067)	.012	-.165 (.068)	.016
Marital status					.021 (.070)	.760					-.067 (.073)	.363
Social network							.147 (.072)	.043			.021 (.082)	.797
Social support									.388 (.070)	<.001	.394 (.076)	<.001
R^2		.026		.092		.092		.111		.226		.230

TABLE 7.12 SOCIAL SUPPORT CORRELATES OF PURPOSE IN LIFE N=194

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	β (SE)	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	-.103 (.072)	.154	-.094 (.069)	.174	-.096 (.068)	.159	-.047 (.068)	.495	.023 (.065)	.722	.021 (.066)	.746
Ethnicity	.027 (.072)	.710	.040 (.069)	.560	.045 (.068)	.504	.009 (.068)	.895	-.009 (.063)	.892	-.007 (.063)	.908
SES	.100 (.072)	.166	.096 (.069)	.165	.071 (.068)	.297	.096 (.067)	.151	.119 (.063)	.058	.106 (.063)	.096
Negative affect			-.284 (.069)	<.001	-.281 (.068)	<.001	-.231 (.069)	.001	-.179 (.065)	.006	-.177 (.065)	.008
Marital status					.190 (.068)	.006					.093 (.070)	.190
Social network							.246 (.071)	.001			.043 (.079)	.586
Social support									.443 (.068)	<.001	.407 (.074)	<.001
R^2		.021		.102		.137		.156		.271		.283

7.5.1.2 Purpose in life

Model 1 shows that age, ethnicity and SES are not associated with purpose in life (see table 7.12). Negative affect was negatively related to purpose in life, so that a higher level of negative affect was negatively associated of a lower score on the purpose in life subscale. Marital status, social networks and functional social support were also independently associated with purpose in life. In the final model, only negative affect and functional social support remained significant after accounting for the effects of the other variables and this model explained 28.3% of the variance in purpose in life scores.

7.5.1.3 Environmental mastery

Age, ethnicity and SES were not significantly related to environmental mastery, (see table 7.13). Negative affect was significantly related to environmental mastery so that for every unit increase in negative affect there was a 0.5 decrease in scores on environmental mastery. The next three models showed that marital status, social networks and functional social support were associated with environmental mastery. The final step showed that only functional social support and negative affect remained significantly associated with environmental mastery after controlling for the effects of the other social support and demographic variables. This final model accounted for 40.6% of the variance in environmental mastery.

7.5.1.4 Self-acceptance

The first model shows that the demographic factors of age, ethnicity and SES were not significantly related to self-acceptance (see table 7.14). The second model shows that negative affect was negatively associated with self-acceptance. The third

model showed that marital status was also significantly related to self-acceptance, as were social networks and functional social support. In model 6, only negative affect and social support remained as significantly related to self-acceptance and this model explains 39.4% of the variance in self-acceptance scores.

7.5.1.5 Summary of positive well-being findings

The four Ryff subscales show a similar pattern of results across the multivariate analysis. Self-acceptance, environmental mastery, purpose in life and personal growth are each negatively related to PANAS negative affect. Marital status, social networks and functional social support were associated with self-acceptance, environmental mastery and purpose in life. However, marital status was not related to personal growth. In the final model, negative affect and functional social support were related to each of the Ryff subscales. These results show that functional social support is an important determinant of positive well-being, independent of age, negative affect, SES, marital status and structural social support.

7.5.1.6 PANAS Positive affect

The demographic factors were not related to PANAS positive affect shown in model 1, and this was also true for negative affect (model 2; see table 7.15). Marital status was marginally associated with positive affect, however, the overall model was not significant (*p*=.472*).* In the 4th model, social networks were associated with positive affect, and this model accounted for 8.5% of the variance in positive affect. Functional social support was also significantly associated with positive affect. The final model showed that after accounting for the effects of functional social support, social networks were no longer related to positive affect. This model was the best fit explaining 16.6% of the variance in positive affect.

TABLE 7.13 SOCIAL SUPPORT CORRELATES OF ENVIRONMENTAL MASTERY (N=194)

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	β (SE)	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	-.074 (.072)	.305	-.058 (.060)	.341	-.059 (.060)	.326	-.018 (.060)	.761	.023 (.059)	.697	.027 (.060)	.651
Ethnicity	-.074 (.072)	.304	-.048 (.060)	.426	-.045 (.060)	.457	-.074 (.059)	.213	-.083 (.057)	.149	-.087 (.058)	.133
SES	-.017 (.072)	.818	-.024 (.060)	.696	-.041 (.060)	.500	-.023 (.059)	.693	-.008 (.057)	.883	-.016 (.057)	.783
Negative affect			-.549 (.060)	<.001	-.547 (.060)	<.001	-.504 (.060)	<.001	-.475 (.059)	<.001	-.466 (.060)	<.001
Marital status					.132 (.060)	.029					.045 (.064)	.480
Social network							.205 (.062)	.001			.076 (.072)	.293
Social support									.310 (.062)	<.001	.271 (.067)	<.001
R^2		.010		.311		.328		.348		.397		.406

TABLE 7.14 SOCIAL SUPPORT CORRELATES OF SELF-ACCEPTANCE (N=194)

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	β (SE)	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	-.121 (.072)	.094	-.108 (.065)	.098	-.110(.064)	.088	-.054 (.063)	.395	.007 (.060)	.912	.013 (.061)	.836
Ethnicity	-.037 (.072)	.608	-.016 (.065)	.802	-.012 (.064)	.855	-.052 (.063)	.407	-.067 (.058)	.249	-.073 (.058)	.213
SES	.051 (.072)	.474	.046 (.065)	.480	.024 (.064)	.713	.046 (.062)	.455	.066 (.058)	.253	.058 (.058)	.321
Negative affect			-.431 (.065)	.001	-.428 (.064)	<.001	-.369 (.064)	<.001	-.328 (.060)	<.001	-.317 (.060)	<.001
Marital status					.172 (.064)	.008					.049 (.065)	.447
Social network							.281 (.065)	<.001			.099 (.072)	.173
Social support									.477 (.063)	<.001	.398 (.068)	<.001
R^2		.018		.203		.232		.274		.381		.394

TABLE 7.15 SOCIAL SUPPORT CORRELATES OF PANAS POSITIVE AFFECT (N=194)

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	β (SE)	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	.062 (.072)	.389	.063 (.073)	.386	.062 (.072)	.393	.120 (.071)	.094	.167 (.071)	.019	.181 (.071)	.012
Ethnicity	-.039 (.072)	.588	-.038 (.073)	.597	-.035 (.072)	.631	-.076 (.071)	.281	-.086 (.068)	.207	-.099 (.068)	.150
SES	.012 (.072)	.868	.012 (.072)	.871	-.006 (.072)	.930	.012 (.070)	.860	.029 (.068)	.671	.026 (.068)	.703
Negative affect			-.017 (.072)	.810	-.015 (.072)	.835	.047 (.072)	.511	.075(.070)	.286	.095 (.071)	.182
Marital status					.140 (.072)	.054					.002 (.076)	.974
Social network							.296 (.074)	<.001			.155 (.085)	.070
Social support									.412 (.074)	<.001	.350 (.079)	<.001
R^2		.006		.006		.026		.085		.147		.166

TABLE 7.16 SOCIAL SUPPORT CORRELATES OF OPTIMISM (N=194)

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	β (SE)	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	-.033 (.068)	.627	-.028 (.067)	.672	-.028 (.067)	.674	-.040 (.069)	.562	-.023 (.071)	.749	-.032 (.072)	.665
Ethnicity	-.007 (.068)	.920	.000 (.067)	.995	.000 (.067)	.997	.008 (.068)	.907	-.001 (.068)	.988	.007 (.069)	.914
SES	-.352 (.068)	<.001	.350 (.067)	<.001	.351 (.068)	<.001	.350 (.067)	<.001	.350 (.068)	<.001	.348 (.069)	<.001
Negative affect			-.151 (.067)	.025	-.152 (.067)	.025	-.164 (.069)	.018	-.146 (.070)	.039	-.158 (.071)	.028
Marital status					-.007 (.068)	.922					.024 (.077)	.758
Social network							.059 (.071)	.402			-.088 (.085)	.306
Social support									.017 (.074)	.818	.046 (.080)	.562
R^2		.111		.130		.125		.129		.125		.121

7.5.1.7 Optimism

The first model shows that SES was significantly related to optimism, so a lower level of SES was associated with a higher optimism score (see table 7.16). This model explains 11% of the variance in optimism. Adding negative affect to this model explained an additional 2.3% of the variance, and negative affect also shows a negative relationship with optimism scores. The third and fourth models showed that marital status, social networks and functional social support were not related to optimism. In the final model, SES and negative affect were the only variables significantly associated with optimism explaining 12.1% of the variance.

7.5.1.8 EMA happiness work day

Happiness over the working day as rated using EMA measures was not related to age, ethnicity or SES (see table 7.17). The second step of the model also showed that negative affect was not related to EMA happiness on the work day. Further, models 3, 4, 5 and 6 showed that none of the social support measures were associated with EMA happiness.

7.5.1.9 EMA happiness leisure day

Age and ethnicity were not related to happiness on the leisure day as assessed by EMA measures. There was also no association between happiness and SES (see table 7.18). Neither marital status nor social networks were related to happiness on the leisure day, as shown by models 3 and 4 respectively. Functional social support was significantly related to model 5, and negative affect also remained significant. However, SES was no longer marginally significant in this model. The final step of the model shows that functional support remained significantly positively related to happiness on

the leisure day, and that the effects of negative affect were diminished but marginally significant. This model explained 11.3% of the variance in EMA happiness on the leisure day.

7.5.1.10 EMA very happy work day

Age, ethnicity and negative affect were not significantly related to EMA very happy ratings on the work day, as shown in models 1 and 2 (table 7.19). Model 3 showed that marital status was not associated with very happy ratings on the work day, however, social networks (model 4) and functional social support (model 5) were. In both cases, a high level of social support was related to higher proportions of very happy ratings. The final model, which compared the contribution of all variables, shows that none of the social support variables were related to very happy ratings on the work day when controlling for other factors.

7.5.1.11 EMA very happy leisure day

Model 1 showed that SES was associated with very happy ratings on the leisure day, so that as SES level decreased, proportion of very happy ratings increased (see table 7.20). This effect remained significant after controlling for the effects of negative affect, as shown in model 2 this was also associated with very happy ratings on the leisure day. Marital status and social networks were not related to very happy ratings on the leisure day. However, there was a significant effect for functional social support. The final model shows that only negative affect remained associated with very happy ratings on the leisure day.

TABLE 7.17 SOCIAL SUPPORT CORRELATES OF EMA HAPPINESS ON WORK DAY (N=182)

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	β (SE)	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	-.088 (.074)	.238	-.086 (.074)	.249	-.088 (.074)	.237	-.057 (.074)	.443	-.045 (.076)	.553	.036 (.077)	.641
Ethnicity	-.048 (.074)	.516	-.050 (.074)	.499	-.044 (.074)	.556	-.069 (.074)	.350	-.069 (.074)	.355	-.074 (.075)	.327
SES	-.081(.074)	.281	-.086 (.074)	.248	-.096 (.074)	.197	-.089 (.073)	.224	-.078 (.074)	.294	-.083 (.074)	.262
Negative affect			-.137 (.074)	.066	-.132 (.074)	.075	-.100 (.075)	.185	-.100 (.076)	.190	-.082 (.077)	.291
Marital status					.097 (.074)	.195					.029 (.083)	.730
Social network							.161 (.077)	.038			.115 (.092)	.210
Social support									.151 (.079)	.057	.104 (.085)	.220
R^2		.015		.034		.043		.057		.051		.065

TABLE 7.18 SOCIAL SUPPORT CORRELATES OF EMA HAPPINESS ON LEISURE DAY (N=181)

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	β (SE)	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	-.073 (.074)	.328	-.064 (.073)	.377	-.065 (.073)	.373	-.043 (.074)	.559	.003 (.075)	.966	.005 (.076)	.952
Ethnicity	-.048 (.074)	.514	-.043 (.073)	.557	-.040 (.073)	.580	-.056 (.073)	.442	-.060 (.072)	.401	-.062 (.073)	.395
SES	-.140 (.074)	.059	-.138 (.073)	.058	-.148 (.073)	.044	-.138 (.072)	.058	-.121 (.072)	.092	-.125 (.073)	.088
Negative affect			-.206 (.073)	.005	-.207 (.073)	.005	-.181 (.074)	.016	-.149 (.074)	.046	-.146 (.076)	.056
Marital status					.080 (.073)	.273					.024 (.083)	.770
Social network							.119 (.076)	.116			.036 (.091)	.694
Social support									.229 (.078)	.004	.211 (.084)	.013
R^2		.026		.069		.075		.082		.085		.113

TABLE 7.19 SOCIAL SUPPORT CORRELATES OF EMA VERY HAPPY RATINGS WORK DAY (N=182)

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	β (SE)	***p P***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	-.115 (.074)	.122	-.113 (.074)	.127	-.116 (.074)	.119	-.078 (.074)	.294	-.062 (.076)	.419	.-048 (.077)	.528
Ethnicity	-.103 (.074)	.167	-.104 (.074)	.162	-.097 (.074)	.194	-.128 (.073)	.083	-.128 (.074)	.086	-.136 (.075)	.070
SES	-.026 (.074)	.723	-.030 (.074)	.689	-.041 (.074)	.578	-.034 (.073)	.640	-.019 (.073)	.795	-.025 (.074)	.734
Negative affect			-.088 (.074)	.237	-.082 (.074)	.226	-.042 (.074)	.577	-.040 (.075)	.593	-.017 (.076)	.826
Marital status					.110 (.074)	.140					.022 (.082)	.786
Social network							.202 (.077)	.009			.150 (.091)	.101
Social support									.194 (.079)	.015	.135 (.084)	.108
R^2		.023		.030		.042		.067		.061		.081

TABLE 7.20 SOCIAL SUPPORT CORRELATES OF EMA VERY HAPPY RATINGS LEISURE DAY (N=177)

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	β (SE)	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	-.136 (.074)	.067	-.127 (.072)	.080	-.127 (.072)	.079	-.106 (.073)	.147	-.069 (.075)	.362	-.065 (.076)	.398
Ethnicity	.001 (.074)	.986	.007 (.072)	.921	.009 (.072)	.897	-.006 (.072)	.936	-.005 (.072)	.947	-.009 (.073)	.903
SES	-.153 (.073)	.038	-.151 (.072)	.037	-.160 (.072)	.029	-.151 (.072)	.037	-.133 (.072)	.065	-.136 (.073)	.064
Negative affect			-.215 (.072)	.003	-.216 (.072)	.003	-.191 (.074)	.010	-.166 (.074)	.026	-.159 (.076)	.037
Marital status					.070 (.072)	.336					.015 (.083)	.856
Social network							.116 (.075)	.126			.062 (.091)	.494
Social support									.181 (.078)	.021	.155 (.084)	.067
R^2		.042		.088		.092		.074		.109		.113

7.5.1.12 DRM happiness work day

SES and age were associated with DRM happiness on the work day in the first step of the model, however, this step only explains 4% of the variance (see table 7.21). In the second step, negative affect, age and SES all had a significant negative relationship with DRM happiness on the work day, showing that having a higher level of negative affect, being older, and having a higher SES grouping were associated with a lower level of happiness on the work day. These variables remained significant in the third step of the model and marital status was not associated with DRM happiness on the work day. Functional social support was also significantly related to DRM happiness on the work day in model 5. However, in the final model, none of the social support measures were related to happiness on the work day.

7.5.1.13 DRM happiness leisure day

The first model of table 7.22 shows that SES was negatively associated with DRM measured happiness on the leisure day. In the second step, negative affect and SES are significantly related to happiness on the leisure day, both having a negative relationship with happiness. Marital status was not related to happiness on the leisure day in the third model. Social networks and functional social support were positively associated with happiness in models 4 and 5, and negative affect remained significant in both these models. When all the variables were included in the final stage of the model, only functional social support remained significantly associated with DRM happiness on the leisure day.

TABLE 7.21 SOCIAL SUPPORT CORRELATES OF DRM HAPPINESS ON WORK DAY (N=159)

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	β (SE)	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	-.197 (.078)	.012	-.210 (.076)	.006	-.211 (.076)	.006	-.187 (.077)	.016	.165 (.078)	.036	-.161 (.079)	.044
Ethnicity	.029 (.078)	.707	.040 (.076)	.597	.041 (.080)	.587	.024 (.076)	.757	.013 (.076)	.865	.009 (.077)	.907
SES	-.159 (.077)	.042	-.163 (.076)	.033	-.174 (.077)	.025	-.166 (.075)	.029	-.157 (.075)	.037	-.163 (.076)	.034
Negative affect			-.213 (.076)	.006	-.209 (.076)	.007	-.177 (.078)	.026	-.175 (.077)	.025	-.160 (.079)	.045
Marital status					.076 (.077)	.323					.016 (.085)	.849
Social network							.137 (.080)	.088			.078 (.094)	.410
Social support									.172 (.081)	.034	.139 (.087)	.113
R^2		.047		.088		.087		.099		.108		.102

TABLE 7.22 SOCIAL SUPPORT CORRELATES OF DRM HAPPINESS ON LEISURE DAY (N= 152)

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	β (SE)	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	-.061 (.081)	.454	-.064 (.080)	.422	-.064 (.080)	.426	-.016 (.081)	.841	.011 (.082)	.890	.035 (.083)	.674
Ethnicity	.055 (.081)	.496	.078 (.080)	.333	.078 (.080)	.334	.047 (.080)	.552	.048 (.079)	.539	.028 (.079)	.722
SES	-.163 (.081)	.045	-.155 (.079)	.051	-.156 (.079)	.051	-.143 (.078)	.068	-.123 (.078)	.115	-.115 (.078)	.143
Negative affect			-.220 (.079)	.006	-.221 (.079)	.006	-.175 (.080)	.030	-.169 (.079)	.035	-.139 (.081)	.087
Marital status					.012 (.079)	.879					-.076 (.084)	.372
Social network							.202 (.083)	.016			.171 (.095)	.075
Social support									.244 (.085)	.005	.195 (.090)	.032
R^2		.035		.083		.083		.118		.132		.151

7.5.1.14 Summary of positive affect and optimism findings

The multivariate analyses investigating the relationship between social support and measures of positive affect identified some interesting results. Negative affect was associated with EMA mean happiness on the work day and the leisure day, EMA very happy ratings on the leisure day, optimism, and DRM positive affect on both the work and leisure day. However, PANAS negative affect was not related to PANAS positive affect, suggesting that the relationship between these two variables is independent. In the final model, negative affect remained significantly associated with EMA mean happiness and very happy ratings on the leisure day, and DRM ratings on the work day. Socio-economic status was significantly negatively associated with optimism, EMA very happy ratings on the leisure day, EMA mean happiness on the leisure day, and DRM positive affect on both the work and leisure day. It is unclear why SES would be negatively related to DRM ratings on both days, but only with EMA ratings on the leisure day. SES and negative affect were the only significant correlates of optimism, which showed a very different pattern of results compared to the other positive well-being variables.

For the social support variables, marital status emerged as a significant correlate of self-acceptance, purpose in life and environmental mastery. There were no relationships between marital status and other positive well-being variables. Structural social support was related to PANAS positive affect, EMA very happy ratings on the work day and EMA mean happiness on the work day in model 5. Functional social support was significantly related to PANAS positive affect, EMA very happy ratings on both the work and leisure day, EMA mean happiness on both days, and DRM ratings on both days. In the final model, functional social support remained as an independent determinant of PANAS positive affect, EMA mean happiness on the leisure day, EMA very happy ratings on the leisure day and DRM positive affect on the leisure day. This pattern of results suggests

that the quality of social support is more important for explaining positive affect on weekend days as opposed to the working week.

7.6 Psychosocial aspects and health behaviours

The following set of analyses will investigate the second main aim of this thesis, which is to investigate the relationship between psychosocial factors and health behaviours and biology (see following section for biological analysis). The specific hypotheses to be tested are: 7.2a, 7.2b and 7.2c. Briefly, it was predicted that higher levels of social support would be associated with increased performance of healthy behaviours. Differences in rates of smoking, alcohol consumption, fruit and vegetable consumption, moderate exercise and vigorous exercise across marital status, structural and functional social support were investigated. The first phase of this section presents descriptive data before moving on to test the above hypotheses.

Most participants in this study were non-smokers, with over 80% reporting that they did not smoke regularly at the time of the study (see table 7.23). Participants tended to rate themselves as moderate drinkers, with only 12% reporting that they never drink and 6% rated as heavy drinkers. Moderate drinking can be seen as the healthy option for alcohol consumption as current research shows beneficial health effects for those who drink a small amount of alcohol compared to never or heavy drinkers. The majority of participants did not eat the recommended 5 portions of fruit and vegetables in a day, with only 27% eating 5 portions or more everyday. Most participants took part in moderate physical activity 1-3 times a week but almost 12% never did any physical activity to a moderate level. Most participants did not take part in vigorous activity such as running on a monthly basis and only 14.4% engaged in vigorous activity 3 or more times per week.

Adults are recommended to take 30 minutes of exercise five times per week and these results show that only one fifth of participants are meeting this target.

TABLE 7.23 PERFORMANCE OF HEALTH BEHAVIOURS

Health behaviours	N (%)
Smoking	
Non smoker	164 (84.1)
Current smoker	31 (15.9)
Alcohol	
Non drinker	23 (12)
Moderate drinker	156 (81.7)
Heavy drinker	12 (6.3)
Fruit and vegetable consumption	
Less than 5 per day	144 (73.1)
5 per day or more	53 (26.9)
Moderate exercise	
Never	23 (11.9)
1-3 times/month	51 (26.3)
1-2 times/week	77 (37.9)
3+ times/week	43 (22.2)
Vigorous exercise	
Never	79 (40.5)
1-3 times/month	39 (20)
1-2 times/week	49 (25.1)
3+ times/week	28 (14.4)

Smoking and eating fruit was associated, so that most of the participants who ate fruit and vegetables at least 5 times per day were non-smokers (see table 7.24). Unsurprisingly, there was a significant relationship between moderate and vigorous exercise. Smoking was not related to either vigorous or moderate physical activity.

Smoking status was significantly different between ethnic groups (see table 7.25), with white participants tending to smoke more than participants of other ethnic origin. Alcohol consumption was also different between ethnic groups. White Europeans were more likely to be non-drinkers and less likely to be moderate drinkers compared to other groups. Fruit and vegetable consumption was not related to ethnicity, SES or age. This

finding may be in contrast to other studies. However, this may be due to the comparatively small and homogenous sample used in this study. Participants engaging in moderate exercise tended to be younger than those never taking part in moderate exercise (see figure 7.3) and this was also true for those regularly undertaking vigorous exercise. There were no relationships between moderate or vigorous exercise and ethnicity or SES.

TABLE 7.24 RELATIONSHIP BETWEEN HEALTH BEHAVIOURS

Health behaviour		**Fruit/Veg**	**Alcohol**	**Moderate exercise**	**Vigorous exercise**
Smoking	χ^2	10.6	2.9	6.0	7.536
	p	.001	.633	.109	.057
Fruit/Veg	χ^2		2.2	5.3	7.124
	p		.323	.147	.068
Alcohol	χ^2			10.4	7.626
	p			.105	.267
Moderate	χ^2				7.186
exercise	*p*				<.001

TABLE 7.25 HEALTH BEHAVIOURS AND DEMOGRAPHIC VARIABLES

Demographic factors	**Ethnicity**	**SES**	**Age**
Smoking	Fisher's exact test $p<.05$	$\chi^2=3.51$, df=2, $p=.173$	$F_{(1,193)}=.721$, $p=.397$
Alcohol	$\chi^2=20.0$, df=2, $p<.001$	$\chi^2=4.55$, df=4, $p=.337$	$F_{(2,188)}=544$, $p=.581$
Fruit/Veg	Fisher's exact test $p=.149$	$\chi^2=.95$, df=2, $p=.622$	$F_{(1,195)}=.023$, $p=.880$
Moderate exercise	$\chi^2=5.56$, df=3, $p=.135$	$\chi^2=4.67$, df=6, $p=.586$	$F_{(3,190)}=4.16$, $p<.01$
Vigorous exercise	$\chi^2=4.72$, df=3, $p=.194$	$\chi^2=8.30$, df=6, $p=.217$	$F_{(3,178)}=2.71$, $p<.05$

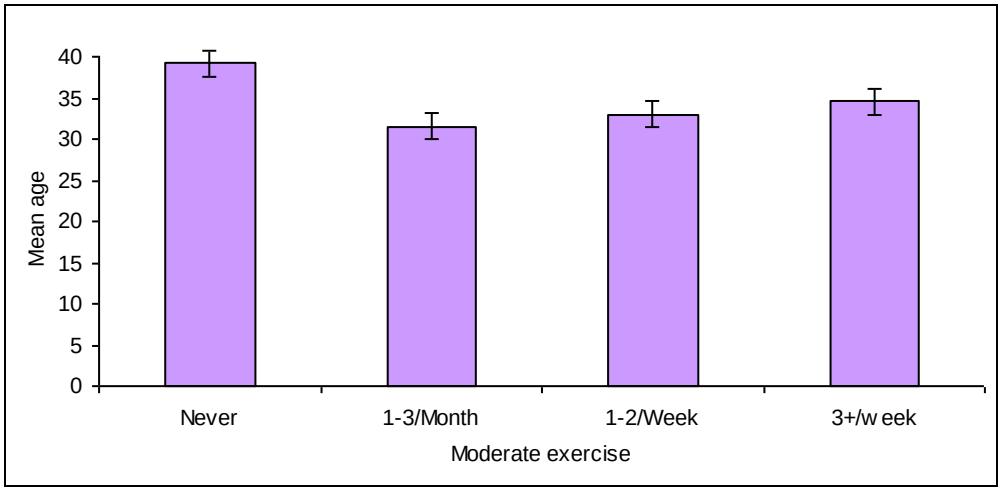


FIGURE 7.3 EXERCISE AND AGE ERROR BARS ARE STANDARD ERROR OF MEAN

To analyse the univariate relationship between social support and health behaviour Point-biserial correlations were used for smoking and fruit and vegetable consumption. For alcohol consumption and exercise Spearman's correlations were used. There were no associations between smoking, fruit and vegetable consumption or alcohol intake between level of functional social support, structural social support or marital status (see table 7.26). Moderate exercise was related to functional support, and examination of means shows that this difference was between those who never exercised (mean social support = 21.2) and those who exercised to a moderate level at least once per month (mean 27.5), once per week (mean 26.7) and 3 or more times a week (mean = 27.2). This relationship was also found for vigorous exercise.

TABLE 7.26 SOCIAL SUPPORT AND HEALTH BEHAVIOURS

Health behaviour	Functional social support	Structural social support	Marriage
Smoking	r_{pb} = .020 p=.784	r_s=.000, p=.999	Fisher's exact test = .332
Fruit/Veg	r_{pb} = .001 p=.984	r_s=.044, p=.540	Fisher's exact test p=.872
Alcohol	r_{pb} = .065, p=.376	r_s=.107, *p=.139*	χ^2=1.0, df=2, p=.604
Moderate exercise	r_{pb} =.182, p<.05	r_s=.006, p=.937	χ^2=1.1, df=3, p=.759
Vigorous exercise	r_{pb} =.140, p=.052	r_s=.024, p=.741	χ^2=.96 df=3, p=.260

r_{pb}= point-biserial correlation r_s= spearman's correlation

Hierarchical logistic regressions was used in order to test hypothesis 7.2a, 7.2b and 7.2c. Briefly, these hypotheses predicted that social support would be positively correlated with performance of healthy behaviours. For exercise, a composite total exercise variable was used which took into account both moderate exercise and vigorous exercise. This variable had 7 levels and was used as a continuous variable in linear regression analysis. Marital status was not associated with smoking status, with only ethnicity emerging having a significant relationship. For fruit and vegetable consumption, none of the predictor variables were significant. There was no relationship between alcohol or total exercise and marital status. Therefore, hypothesis 7.1a is not supported, as being married was not associated with increased performance of any healthy behaviour in this sample.

Structural social support was not associated with smoking status, with only ethnicity being related to support. Fruit and vegetable consumption was not associated with any of the variables entered into the model. There was no relationship between structural social support and alcohol consumption or total exercise level. The results of these analyses do not support hypothesis 7.1b, as structural social support was not associated with any measure of health behaviour.

Functional social support was not related to fruit and vegetable consumption or smoking status. However, ethnicity was associated with smoking status. Functional support was also not associated with amount of alcohol consumed. Functional social support was significantly associated with total exercise (see table 7.27) so that those with a higher level of support were more likely to take part in regular exercise (see figure 7.4). In the first and second model, age was significantly related to total exercise, so that younger participants were more likely to exercise. Ethnicity was not related to exercise in the first two models. The final regression model showed that functional social support was associated with total exercise, and this model accounted for 9.3% of the variance in exercise scores. Ethnicity was also significantly related to exercise in this final model. Therefore hypothesis 7.2c is partially accepted as there was a relationship between functional support and exercise, but not with the other health behaviours.

TABLE 7.27 MULTIVARIATE CORRELATES OF TOTAL EXERCISE (N=177)

	Model 1		**Model 2**		**Model 3**	
	β (SE)	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	-.147 (.072)	.041	-.149 (.072)	.040	-.085 (.074)	.252
Ethnicity	-.138 (.072)	.057	-.140 (.072)	.053	-.164 (.071)	.023
SES	.098 (.072)	.175	.099 (.072)	.171	.113 (.071)	.111
Negative affect			.053 (.072)	.460	.108 (.073)	.141
Functional support					.222 (.077)	.004
R^2		.049		.052		.093

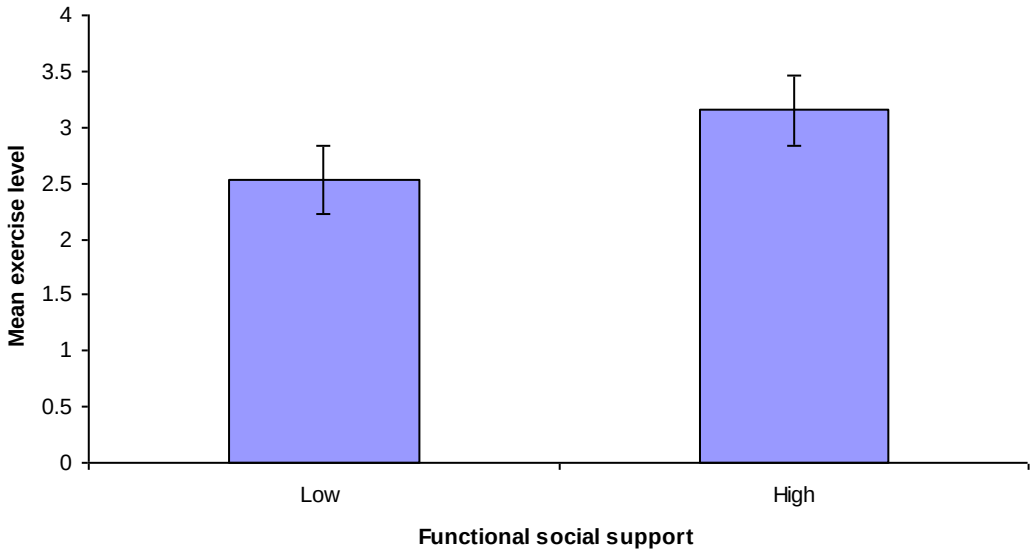


FIGURE 7.4 SOCIAL SUPPORT AND TOTAL EXERCISE LEVEL (BARS ARE STANDARD ERROR OF MEAN)

7.7 Psychosocial aspects and biological measures

This section of the chapter investigates the second main aim of the thesis, which is to test relationships between psychosocial factors and health behaviours (see previous section) and biology. The hypotheses to be tested in this section of the analysis are 7.2e, 7.2f and 7.2g. Briefly, these refer to relationships between social support measures and cortisol profiles, as measured using CAR, cortisol slope over the day and total cortisol output. It was predicted that higher levels of social support would be associated with more favourable cortisol profiles. The first part of this section will outline descriptive data relating to the cortisol variables, and will then move on to test the hypotheses mentioned above.

Participants collected saliva at 7 time points over each 24 hour monitoring period. One hundred and seventy three participants (85.25%) completed samples on both days of monitoring. Mean values for all participants show the typical diurnal pattern of cortisol release on both the working and leisure day sampling period (see figure 7.5).

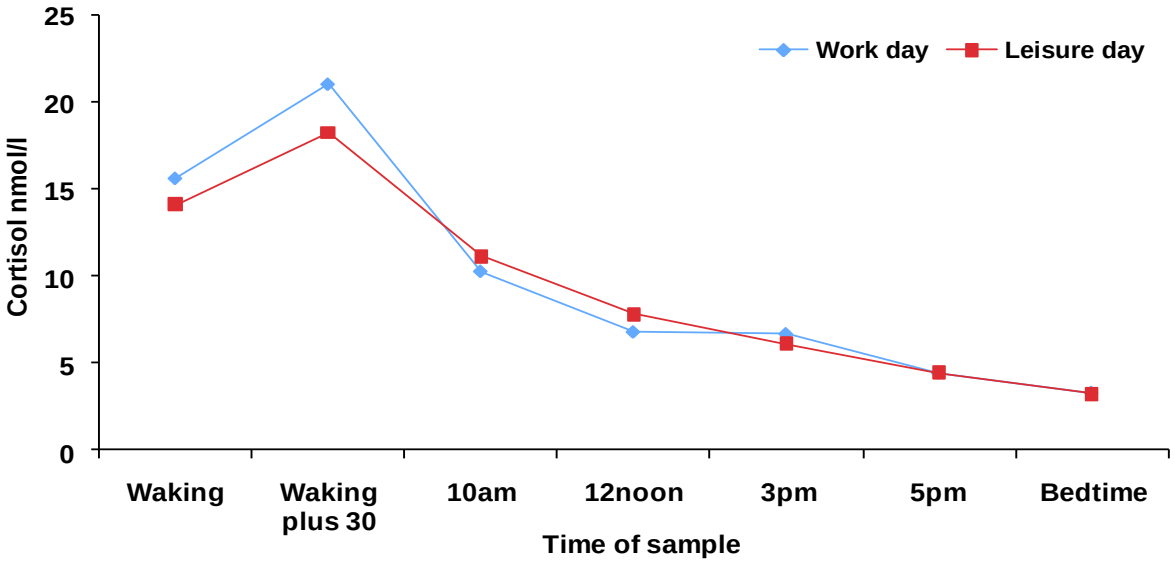


FIGURE 7.5 CORTISOL PROFILE FOR WORKDAY AND LEISURE DAY

As noted in chapter 6, cortisol was analysed using three measures: cortisol awakening responses (CAR); cortisol slope of decline, and total cortisol output over the day period (excluding the previous evening) using area under curve. There were no differences between cortisol awakening response or slope over the day between the workday and weekday sample. However, there was a significant difference between AUC measures on the work and leisure day (see table 7.28) so that the total cortisol output was greater on the work day ($F_{(1,173)}$=27.023, p<.001).

TABLE 7.28 CORTISOL MEASURES

	N	Mean (SD)	Range
Cortisol Measure			
Cortisol awakening response (Δnmol/l)	163		
Workday		6.47 (9.15)	-9.26-47.38
Weekend		4.82 (8.01)	-8.81-48.20
Total cortisol (nmol/l)	174		
Workday		7.12 (.41)	6.14-8.11
Weekend		6.96 (.38)	5.80-7.90
Cortisol slope (nmol/l/min)	182		
Workday		.02 (.02)	-0.03-0.09
Weekend		.02 (.03)	-0.03-0.10

In order to test the hypotheses, multiple regression analyses were carried out and adjusted for age, ethnicity, SES, time of waking (for CAR only), smoking and body mass index to examine potential relationships between social support and cortisol profiles. Three cortisol parameters were tested: the cortisol awakening response, the total cortisol output over the day as defined by area under the curve (AUC), and cortisol slope across the day. These analyses were repeated for both working and week day sampling periods. The first hypothesis concerned the relationship between marital status and CAR, total cortisol and cortisol slope. This hypothesis was partially supported, as evidence was found of lower total cortisol on the leisure day in married compared to unmarried participants (see table 7.29).

TABLE 7.29 MARITAL STATUS AS A CORRELATE OF TOTAL CORTISOL ON LEISURE DAY

	Model 1		Model 2		Model 3	
	β (SE)	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	-.182 (.080)	.024	-.182 (.081)	.025	-.173 (.080)	.032
Ethnicity	-.048 (.079)	.541	-.048 (.079)	.541	-.049 (.078)	.534
SES	.002 (.077)	.975	.003 (.077)	.974	.018 (.077)	.815
Smoking	043 (.078)	.582	.043 (.079)	.582	.041 (.078)	.596
BMI	-.097 (.081)	.238	-.097 (.082)	.239	-.113 (.081)	.167
Negative affect			.004 (.078)	.958	-.006 (.077)	.940
Marital status					-.162 (.077)	.038
R^2		.055		.055		.015

The second hypotheses referred to predicted relationships between structural social support and cortisol profiles. This hypothesis was not supported, as no significant relationships emerged between structural support and CAR, cortisol slope or total cortisol over the work or weekend day. The third hypothesis relates to functional support and cortisol profiles. This hypothesis was partially supported, as a relationship was found between functional social support and total cortisol output on the leisure day (see table 7.30 and figure 7.7). Table 7.30 shows that functional support was a significantly independently associated with total cortisol on the leisure day. However, this model was also not significant (p=.10).

TABLE 7.30 FUNCTIONAL SOCIAL SUPPORT AS A CORRELATE OF TOTAL CORTISOL LEISURE DAY

	Model 1		Model 2		Model 3	
	β (SE)	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	-.182 (.080)	.024	-.182 (.081)	.025	-.129 (.083)	.124
Ethnicity	-.048 (.079)	.541	-.048 (.079)	.541	-.059 (.079)	.457
SES	.002 (.077)	.975	.003 (.077)	.974	.026 (.077)	.740
Smoking	043 (.078)	.582	.043 (.079)	.582	.033 (.078)	.674
BMI	-.097 (.081)	.238	-.097 (.082)	.239	-.097 (.081)	.237
Negative affect			.004 (.078)	.958	.056 (.081)	.491
Social support					.167 (.084)	.049
R^2		.055		.055		.073

Finally, the contribution of marital status, structural and functional social support to predicting total cortisol on the leisure day (hypothesis 7.2g) was tested. In this final combined model (shown as model 3 in table 7.31), marital status and functional social support both remained significantly associated with total cortisol output on the leisure day. This model explained 10.8% of the variance in cortisol values and the complete model was significant (p=.035). Figure 7.6 shows the difference in cortisol level with married and unmarried participants, showing that unmarried participants had a higher cortisol output over the day after adjusting for age, BMI, smoking status, ethnicity and negative affect. However, there was no relationship between CAR or cortisol slope and marriage. Figure 7.7 shows the difference in cortisol output between those with high and low social support, to illustrate the findings from the multiple regression analysis. This shows that participants with high social support have higher cortisol during the morning period, with little difference in the afternoon levels. The standardised beta coefficients show that higher levels of social support were associated with higher overall cortisol.

TABLE 7.31 SOCIAL SUPPORT CORRELATES OF TOTAL CORTISOL LEISURE DAY

	Model 1		Model 2		Model 3	
	β (SE)	*p*	β (SE)	*p*	β (SE)	*p*
Age	-.182 (.080)	.024	-.182 (.081)	.025	-.111 (.083)	.184
Ethnicity	-.048 (.079)	.541	-.048 (.079)	.541	-.061 (.080)	.443
SES	.002 (.077)	.975	.003 (.077)	.974	.045 (.077)	.560
Smoking	043 (.078)	.582	.043 (.079)	.582	.034 (.077)	.660
BMI	-.097 (.081)	.238	-.097 (.082)	.239	-.118 (.081)	.151
Negative affect			.004 (.078)	.958	.051 (.081)	.531
Marital status					-.184 (.085)	.032
Social network					-.014 (.096)	.880
Social support					.207 (.089)	.021
R^2		.055		.055		.108

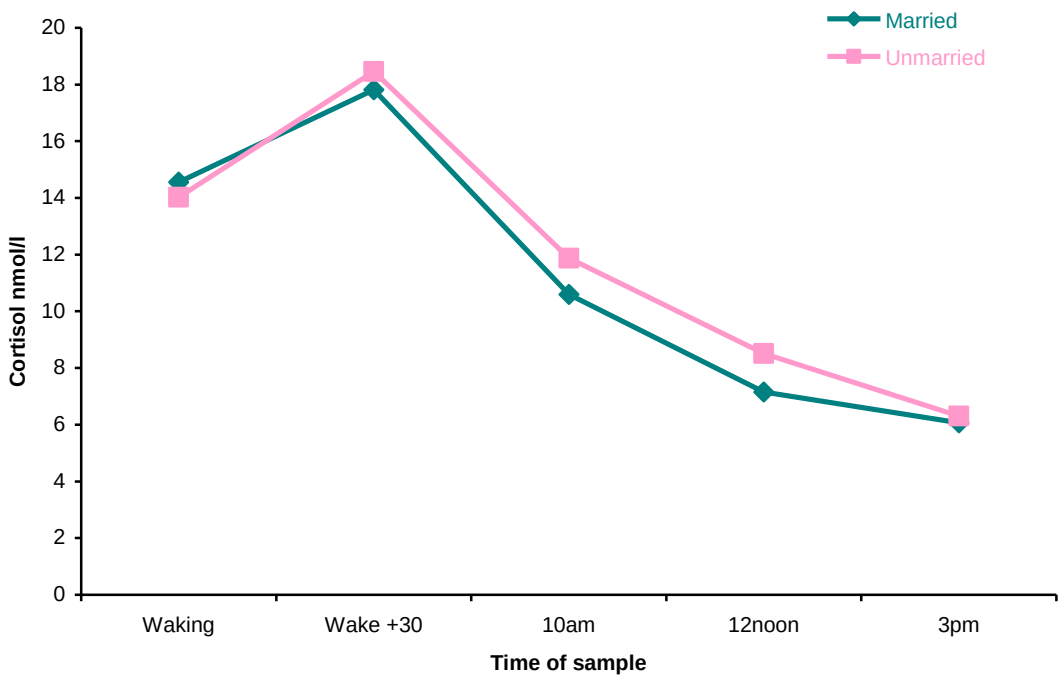


FIGURE 7.6 TOTAL CORTISOL OUTPUT AND MARITAL STATUS (ADJUSTED FOR AGE, ETHNICITY, SES, BMI, SMOKING AND NEGATIVE AFFECT.)

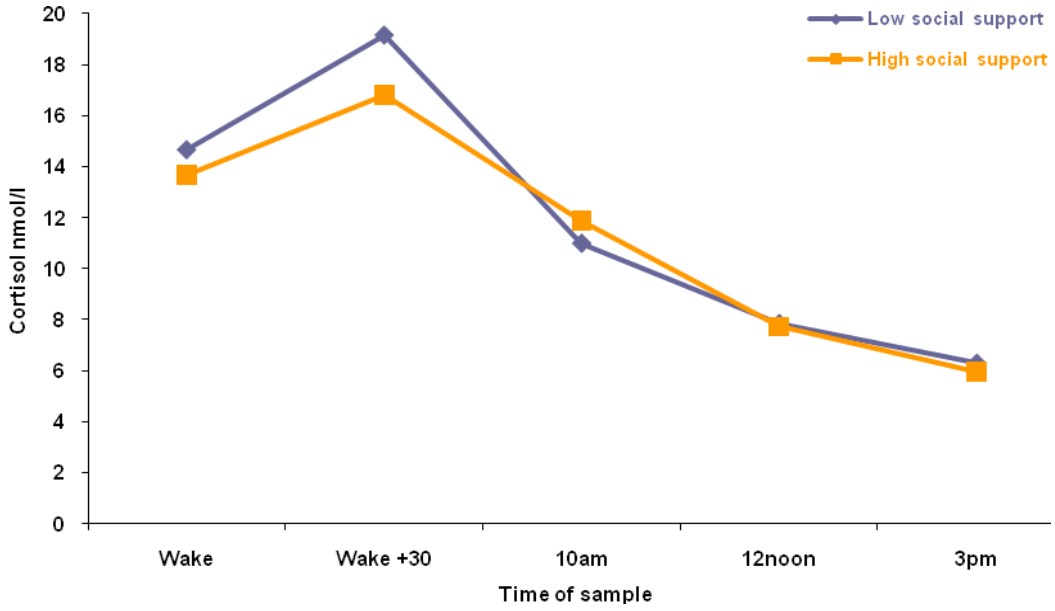


FIGURE 7.7 TOTAL CORTISOL OUTPUT AND SOCIAL SUPPORT (ADJUSTED FOR AGE, ETHNICITY, SES, BMI, SMOKING AND NEGATIVE AFFECT).

7.8 Positive affect moderation of social support

The next phase of the analysis was exploratory in nature and designed to test hypotheses 7.3a and 7.3b. These predicted that social support would be more strongly associated with health behaviours and cortisol for those who were less happy. In order to test these predictions, participants were split into high and low happiness groups. The first set of analyses concerning hypothesis 7.3a (for health behaviours), uses a median split of the PANAS positive affect variable. For the second hypothesis, a high and low affect variable was created based on overall DRM positive affect on the work and leisure day. Two different happiness variables were used as it is reasonable to predict that happiness measured on the corresponding day to the cortisol measurement might be related to cortisol levels. For health behaviours, however, it is more reasonable to assume that global happiness might be related to performance of health behaviours over time.

7.8.1 Positive affect, social support and health behaviours

This set of analyses was designed to test hypothesis 7.3a, that the relationship between social support and health behaviours would be stronger for those with lower positive affect. There was no difference in the relationship between marriage or social networks and smoking, drinking alcohol, fruit and vegetable consumption or total exercise for those high or low in positive affect. For functional social support, one significant model emerged (see table 7.32). Functional social support was significantly associated with total exercise, but only amongst participants with high positive affect. There was no relationship between functional support and exercise for those with low positive affect. This effect is contrary to the hypothesis, since the relationship was stronger in participants with high as opposed to low positive affect.

TABLE 7.32 FUNCTIONAL SOCIAL SUPPORT, HAPPINESS AND EXERCISE

	Happy n=90		**Unhappy n=82**	
	β (SE)	***p***	**β (SE)**	***p***
Age	-.057 (.106)	.593	-.047 (.121)	.697
Ethnicity	-.307 (.101)	.003	.048 (.115)	.678
SES	-.010 (.100)	.918	.152 (.109)	.169
Smoking	-.035 (.100)	.726	-.274 (.113)	.018
BMI	-.056 (.104)	.590	-.043 (.114)	.708
Negative affect	.176 (.106)	.099	-.006 (.110)	.954
Social support	.309 (.110)	.006	.160 (.124)	.199
R^2		.196		.145

7.8.2 Positive affect, social support and neuroendocrine measures

This set of analysis was designed to test hypothesis 7.3b, that the relationship between social support and neuroendocrine effects would be stronger for those with low positive affect. For this hypothesis, two sets of binary variable were created based on DRM positive affect, the first for the work day and the second for the leisure day. A multiple regression analysis was carried out after separating participants into happy and unhappy groups, based on the above variables. Participants were split on the work day variable for work day cortisol measures, and were split on the leisure day variable for leisure day cortisol.

There was no difference in the relationship between marital status and CAR for those in the happy or unhappy group, and this was also true for the cortisol slope measure, on either the working or the weekend day. However, an interesting relationship emerged when analysing the total cortisol for the work day and the leisure day (see tables 7.33 and 7.34). On the work day, there was a significant relationship between marriage and total cortisol output, but only for the unhappy participants. Married participants who were unhappy had higher total cortisol on the working day. Further, the opposite pattern was found for the leisure day. Married participants who were happy, had a lower cortisol output over the leisure day. These findings suggest an interesting interactive effect between marital status, happiness and health-related biology. Being married and happy was associated with lower cortisol output on the leisure day, whereas being unhappy and married was associated with higher cortisol output on the working day.

TABLE 7.33 MARITAL STATUS, HAPPINESS AND TOTAL CORTISOL WORKING DAY

	Happy n=84		Unhappy n=70	
	β (SE)	***p***	**β (SE)**	***p***
Age	-.371 (.113)	.001	-.042 (.129)	.748
Ethnicity	-.047 (.109)	.664	.037 (.127)	.772
SES	-.000 (.110)	.998	.085 (.124)	.495
Smoking	-.019 (.121)	.874	.000 (.127)	.999
BMI	-.047 (.114)	.680	.007 (.126)	.954
Negative affect	-.004 (.109)	.972	.111 (.123)	.371
Marital status	.056 (.116)	.631	.256 (.122)	.040
R^2		.162*		.092

*p<.05

TABLE 7.34 MARITAL STATUS, HAPPINESS AND TOTAL CORTISOL LEISURE DAY

	Happy n=67		Unhappy n=87	
	β (SE)	***p***	**β (SE)**	***p***
Age	-.183 (.135)	.181	-.196 (.111)	.081
Ethnicity	-.100 (.121)	.412	-.119 (.112)	.290
SES	-.055 (.117)	.640	-.055 (.117)	.640
Smoking	-.019 (.121)	.874	-.038 (.110)	.731
BMI	-.061 (.136)	.656	-.136 (.115)	.239
Negative affect	-.108 (.126)	.395	.036 (.110)	.744
Marital status	-.422 (.124)	.001	.015 (.110)	.893
R^2		.215*		.089

*p<.05

For structural social support, there was no difference in the relationship with total cortisol output on either the working or the leisure day for happy or unhappy participants. There was a significant relationship between social networks and CAR on the leisure day, but only for happy participants. This shows that a larger social network is related to a

higher CAR but only in those who were happy. There was no relationship with CAR on the working day. For cortisol slope, a larger social network was associated with a steeper slope in unhappy participants. This finding suggests that social networks are beneficial but only in those were not happy, which was consistent with the hypothesis.

TABLE 7.35 SOCIAL NETWORK, HAPPINESS AND CORTISOL SLOPE WORK DAY

	Happy n=90		**Unhappy n=72**	
	β (SE)	***p***	**β (SE)**	***p***
Age	-.234 (.111)	.038	-.136 (.122)	.271
Ethnicity	-.073 (.114)	.522	.026 (.123)	.835
SES	-.026 (.108)	.813	-.189 (.118)	.640
Smoking	.021 (.107)	.847	.021 (.120)	.865
BMI	.013 (.112)	.911	.145 (.120)	.231
Negative affect	-.139 (.110)	.209	.111 (.118)	.348
Structural support	-.006 (.117)	.961	.313 (.121)	.012
R^2		.085		.162

TABLE 7.36 SOCIAL NETWORK, HAPPINESS AND CAR ON LEISURE DAY

	Happy n=65		**Unhappy n=84**	
	β (SE)	***p***	**β (SE)**	***p***
Age	-.208 (.138)	.138	.020 (.123)	.873
Ethnicity	-.113 (.126)	.375	-.173 (.120)	.154
SES	.176 (.116)	.136	.031 (.114)	.785
Smoking	-.018 (.126)	.886	-.101 (.122)	.411
BMI	.233 (.141)	.105	.051 (.122)	.680
Time of waking	-.075 (.142)	.597	-.125 (.122)	.307
Negative affect	.497 (.123)	<.001	-.062 (.114)	.587
Structural support	.290 (.135)	.036	.122 (.121)	.317
R^2		.277*		.066

*p<.05

For functional social support, there was no relationship with CAR or cortisol slope on either the working or weekend day. However, for participants who were less happy, functional support was related to higher cortisol over the leisure day (see table 7.37). This is contrary to the prediction.

TABLE 7.37 FUNCTIONAL SOCIAL SUPPORT, HAPPINESS AND TOTAL CORTISOL ON LEISURE DAY

	Happy n=66		**Unhappy n=88**	
	β (SE)	***p***	**β (SE)**	***p***
Age	-.259 (.150)	.089	-.095 (.110)	.393
Ethnicity	-.040 (.137)	.770	-.096 (.105)	.362
SES	-.014 (.130)	.916	.056 (.104)	.596
Smoking	-.054 (.134)	.688	.016 (.106)	.884
BMI	.076 (.143)	.599	-.159 (.109)	.147
Negative affect	.038 (.133)	.777	.136 (.109)	.215
Functional support	-.014 (.135)	.919	.328 (.115)	.006
R^2		.055		.169*

*p<.05

7.9 Discussion.

This study aimed to investigate: the relationship between psychosocial factors; the relationships between social support and cortisol profiles and health behaviours and the effect of positive affect on the relationship between social support, health behaviour and cortisol. Three measures of social support were assessed: functional social support which is a measure of perceived availability of practical, belonging and appraisal support; structural social support which is a more objective measure of the size of one's social network, and finally marital status. These three measures were used in this study as

previous research has identified separate effects for each when analysing their relationship with psychosocial factors, and biological and behavioural outcomes.

7.9.1 Social support and demographic factors

Participants who were married had higher reported levels of both structural and functional social support compared to those who were single. This finding can indicate two things, either that being married increases access to available sources of social support, which can be through both the marriage partner but also by increasing social contacts via friends and extended family, or that the presence of a marital partner is accounting for the increased ratings of functional social support. Ethnicity and SES were not related to the social support measures, showing that there is no difference in either structural or functional social support between ethnic groups or different status groups. Age was related to both structural and functional support, but was not related to marital status. Older participants were significantly more likely to have lower levels of both these types of social support compared to younger participants. Previous research suggests that the saliency of social support may vary across the life span, both in terms of the types of social support needed and the source of support. For example, young adults tend to prefer to receive social support from friendship groups whereas older adults rely on romantic partners or family members (Allen, Ciambrone, & Welch, 2000). The stage model of life satisfaction argues that important aspects of social support at one age may be irrelevant at an older age (George, Okun, & Landerman, 1985). Rook (2000) suggested that a reduction in social interaction and social activity is consistently associated with increased age. However, this does not necessarily mean an associated decrease in well-being, as the need for social support can also vary with age. Previous studies comparing social support across the life course are sparse and tend to focus on older adults, in contrast to the

sample from this thesis, which was of working age women. If social support is found to diminish with age, this could have negative consequences for mental and physical health, and quality of life. However, this depends on the assumption that the relationship between social support and affect is constant across the life course, an issue which it was possible to examine in this study. These effects will be discussed in section 7.9.3.

7.9.2 Summary of positive well-being findings

The personal growth subscale of Ryff's Scales of Psychological Well-being was negatively related with age, so that a higher score on this scale was associated with a younger age. Personal growth measures how much one feels one is making progress and reaching desired outcomes, and therefore the negative relationship with age may be related to a more optimistic outlook in younger participants. Low scores on this scale indicate an inability to change or grow, and therefore it may be expected to correlate negatively with age, as younger participants imagine the development of their lives. This negative association with age is in line with previous research, which has reliably shown a negative relationship between age and personal growth (Ryff, 1989; Ryff, 1991). However, previous work has also found that purpose in life is also negatively related to age and that environmental mastery is positively related to age (Ryff, 1989; Ryff, 1991; Ryff & Keyes, 1995). These studies compared three age groups, young (18-29), midlife (30-64) and older (65 years or more), which represent a vastly wider age range than in this study and may account for the discrepancy in findings.

Positive affect as measured by PANAS was not related to age, ethnicity and SES, and was also not related to PANAS negative affect. Previously there has been much debate about whether positive and negative affect are two ends of the same scale, or whether they in fact represent two distinct aspects of well-being. The findings in this thesis

support the latter approach, as it was found that there was no correlation between positive and negative affect, suggesting that participants can report independent levels of positive and negative emotion. Rafaelli & Revelle (2006) suggested that whilst positive and negative affect could be considered separable, they were not independent. This issue can be further investigated by examining the relationships between positive and negative affect and biological correlates, such as cortisol profiles. It will be possible to use this method in Chapter 8 and this thesis will discuss this issue further within that study.

Previous research has suggested that happier people tend to have a higher income and be of higher SES although this finding is not consistent (e.g. Dolan, Peasgood, & White, 2008). However, no relationship was found between PANAS positive affect and SES in this study. This could be because prior studies have focussed on more cognitive measures of affect such as life satisfaction, which may be more closely tied with income and socio-economic status. Some studies have reported a U-shaped relationship between happiness and age (Gerdtham & Johannesson, 2002) with happiness being higher in older and younger people. Life satisfaction has been shown to increase with age (Diener & Suh, 1998) whereas evidence regarding other measures of positive affect is contradictory (e.g. Charles, Reynolds, & Gatz, 2001; Mroczek & Kolarz, 1998).

Optimism as measured by the LOT was not related to age or ethnicity. However, a significant relationship with SES did emerge, so that a higher level of optimism was related to a higher SES grouping. Few studies have previously investigated the role of SES in optimism. One study conducted a re-analysis of four datasets measuring optimism and SES and found that each reported a relationship between optimism and higher SES (Taylor & Seeman, 1999). However, when this analysis was repeated for the negative and positive worded items of the LOT separately, the relationship only remained significant for the negative worded items. This suggests that SES is relevant for predicting pessimistic expectancies about the future, but is not useful for predicting positive expectations. A

recent study has also replicated this finding, concluding that lower SES is reliably associated with predicting more negative events in the future, with minimal effects for SES and positive events (Robb, Simon, & Wardle, 2009).

Happiness as rated by momentary methods provided some interesting results. Mean happiness ratings were significantly higher on the leisure day compared to the work day for both mean EMA happiness and very happy ratings. There were no relationships between either EMA happiness measure and age, SES or ethnicity. A similar pattern of results emerged for the DRM happiness measure, with ratings being significantly higher on the leisure compared to the work day. However, happiness on the work day was higher in younger participants and those in a lower SES group. The explanation for this relationship is unclear, but demands at work could be implicated. For example, older participants might be expected to have higher status jobs which have a higher level of responsibility or work load, which may negatively impact upon happiness during the working day.

Overall the relationships between each of the positive well-being variables and demographic variables are fairly similar. For example, age was not related to PANAS positive affect, DRM ratings of happiness on the leisure day, mean EMA or very happy ratings on either day, or the purpose in life, environmental mastery and self-acceptance subscales. However, there was a negative relationship between personal growth and age, and also DRM happiness ratings on the leisure day and age. This suggests that these two subscales are measuring different facets of positive well-being in comparison to the other methods. The EMA ratings and PANAS positive affect were not correlated with any of the demographic factors, suggesting that these scales may be tapping similar aspects of well-being. The optimism scale was positively correlated with SES, showing that a higher level of optimism is associated with a higher SES status. This relationship was not replicated for any of the other positive well-being variables, again suggesting that optimism is measuring a different aspect of well-being. This can be further tested by examining the relationships

between each of the positive well-being variables and social support. Despite the relationship between social support and age as discussed in section 7.9.1, showing a negative effect of age on structural and functional measures of social support, there were limited relationships between age and well-being. This supports previous work suggesting that despite reductions in social network or perceived social support in later life, there is not necessarily an associated reduction in well-being.

7.9.3 Relationship between social support and positive well-being

The relationship between social support and positive well-being was investigated, in order to assess whether higher social support would be related to higher levels of positive affect. The results of this analysis is shown in table 7.38.

Hypothesis 7.1a predicted that marital status would be associated with higher levels of well-being across all measures. This hypothesis was partly supported as it was found that marital status was only associated with higher purpose in life, environmental mastery and self-acceptance measures of eudaimonic well-being, and marginally related to PANAS positive affect. There were no relationships between marriage and optimism or any of the momentary assessments of affect. This suggests that marriage might be more related to eudaimonic measures of well-being as opposed to global levels of positive affect or ratings of happiness across the day. There was no relationship between marriage and momentary measures on the work or leisure day, despite the assumption that participants might spend more of their time with their partners on the leisure day compared to the work day, and that this might increase ratings of happiness.

TABLE 7.38 SUMMARY OF FINDINGS FOR RELATIONSHIP BETWEEN SOCIAL SUPPORT AND WELL-BEING (✓ SIGNIFICANT RELATIONSHIP, × NON-SIGNIFICANT RELATIONSHIP, FSS FUNCTIONAL SUPPORT SIGNIFICANT IN COMBINED MODEL, * SIGNIFICANT AFTER BONFERRONI CORRECTION)

	Marriage (hypothesis 7.1a)	**Structural support (hypothesis 7.1b)**	**Functional support (hypothesis 7.1c)**	**Combined model (hypothesis 7.1d)**
Personal growth	×	✓	✓*	FSS
Purpose in life	✓	✓*	✓*	FSS
Environmental mastery	✓	✓*	✓*	FSS
Self acceptance	✓	✓*	✓*	FSS
PANAS positive affect	×	✓*	✓*	FSS
Optimism	×	×	×	×
EMA mean work day	×	✓	×	×
EMA mean leisure day	×	×	✓*	FSS
EMA very happy work day	×	✓	✓	×
EMA very happy leisure day	×	×	✓	×
DRM work day	×	×	✓	×
DRM leisure day	×	✓	✓*	FSS

Hypothesis 7.1b predicted that structural social support would be related to all measures of well-being and this was partially supported. Structural support was related to the four Ryff subscales, PANAS positive affect, EMA work day ratings, marginally to DRM work day ratings and also to DRM leisure day happiness. It is interesting to note that structural support was associated with happiness on the leisure day as measured by DRM, but not as measured by EMA. This suggests that the two types of assessment have differences in the type of affect they are measuring. It is not clear why structural support should be related to affect as measured by EMA but not DRM on the work day. The DRM affect ratings are specifically related to activities that are being carried out, whereas the EMA ratings are made at specific time points. In addition, the DRM ratings are a composite

of happy, warm and enjoy which may reflect a different pattern of feelings compared to the single response item of “happy” on the EMA measure.

Hypothesis 7.1c predicted that functional social support would be related to higher level of well-being across all measures. This hypothesis was supported as well-being was higher for all measures except optimism. Further, Hypothesis 7.1d predicted that functional support would be the strongest correlate of psychological well-being when entered into a regression model with structural social support and marriage. This hypothesis was well supported, as functional support emerged as an independent determinant of 8 of the 12 well-being variables, whereas marriage or structural support were not independently related to any of the variables in the combined model. Functional social support was the most useful of the three social support variables in predicting levels of positive well-being. Independent relationships were found for personal growth, purpose in life, environmental mastery, self-acceptance, positive affect, EMA mean happiness on leisure day and DRM happiness on the leisure day. Before controlling for the effects of structural social support, functional support was also a significantly related to EMA very happy ratings on the work day and on the leisure day, and DRM ratings on the work day. All positive well-being variables showed some relationship with the social support measures. However, there was no relationship between social support and optimism, supporting the notion that optimism is a separate construct than positive well-being.

Social relationships are a central aspect of human existence and it is not surprising to find that people with higher social support report higher levels of well-being. Previous research has consistently reported links between happiness and general social support (Pinquart & Sorenson, 2000) and also numbers of friends (Baldassare, Rosenfield & Rook, 1984; Lee & Ishii-Kuntz, 1987; Mishra, 1992; Philips, 1967; Requena, 1995). Workplace social support has also been related to higher levels of happiness (Staw, Sutton, & Pelled, 1994). In a study examining very happy people, Diener & Seligman (2002) reported that

the happiest participants also had the highest quality social relationships. Both the quality and the quantity of friends were found to be predictors of positive well-being in a large scale review (Pinquart & Sorenson, 2000). Conversely, social isolation is related to increased feelings of depression and anxiety and lower ratings of happiness (Lee & Ishii-Kuntz, 1987; Peplau & Perlman, 1982; Seligman, 1991). However, this study did find interesting differences between the relationship of three different measures of social support and well-being.

No significant relationships were found between marriage and positive affect, personal growth, EMA ratings or DRM ratings of happiness. This is in contrast to previous work which has demonstrated a steady positive relationship between being married and having a higher level of well-being. For example, Diener et al (1999) reported that married people were happiest in comparison to those who were single, divorced or widowed. This finding has been replicated cross-culturally, suggesting that it is a robust finding (e.g. Diener, Gohm, Suh, & Oishi, 2000; Mastekaasa, 1994). It has even been suggested that satisfaction with marriage and family life is the strongest predictor of happiness (Myers, 1999, 2000). However, in this study it was only possible to compare being married with not being married and it is possible that some of the participants in this study were in unhappy marriages. A stressful marital situation can be as negative as not being married (Glenn & Weaver, 1984) and is associated with a wide range of adverse health outcomes (Orth-Gomer, et al 2000). This study only included female participants, and this could explain the lack of a relationship between marriage and positive well-being. Previous studies have suggested that the protective effects of marriage are stronger for men compared to women (Ross, Mirowsky, & Goldsteen, 1990) and differences in levels of positive well-being could be implicated in this relationship. However, other studies have found the relationship between happiness and marriage to be comparable for men and women (e.g. Stack & Eshleman, 1998). In the regression model for PANAS positive affect, marital status was

not significant (beta = .140, *p*=.054). This is supported by previous research such as The Chicago Health Ageing and Social Relations study, which found a lack of predictive relationship between marital status and happiness after controlling for demographic factors (Cacioppo et al., 2007).

As noted earlier, it was also found that when including both structural and functional measures of social support in the final step of each regression, any previously significant effects of structural social support were diminished. This suggests that in explaining the relationship between social support and positive well-being, functional support is more important. Previous studies of social support have tended to focus on either structural or functional measures, and have not carried out a robust test independent of each measure independent of the other (Uchino, 2004). It was found that structural social support was related to personal growth, positive affect, DRM happiness on the leisure day and very happy ratings on the work day before controlling for functional social support. Although these findings suggest a role for structural aspects of social support, they also point to functional social support as being the more salient measure of social support. The results of these analyses suggest that the impact of structural social support on well-being may be mediated through functional aspects of support. For example, having a wider social network has beneficial effects on well-being as this enhances the experiences of social support. When entered into the same regression model, functional social support explains much of the variance associated with structural measures, and is therefore more proximal to affective outcomes. It is likely that whilst structural support identifies certain types of social connection, this measure does not capture the experience of social support. Functional support may be the process through which structural support operates, and is therefore a mediator of social experience.

There were also interesting differences in the relationship between social support and momentary measures of happiness. EMA mean ratings of happiness were associated

with functional social support on the leisure day but not on the work day, and this was replicated with the DRM ratings. Neither measure of happiness was associated with social support on the work day. However, the very happy EMA ratings were significantly associated with functional social support in the final multivariable model on both the work and the leisure day. This pattern of results suggests that different factors are important in affecting happiness ratings on work compared to leisure days. Structural measures of social support are concerned with quantitative assessments regarding the numbers of social network members. Having a large social network does not confer quality of social relationship, for example, it is possible to have a spouse, parents, parents-in-law, children and other social contacts without feeling a close bond or a satisfying relationship. Functional measures are concerned with the qualitative aspects of social relationships and therefore provide a more sensitive estimate of "closeness" and relationship satisfaction. Having a higher level of functional social support may be related to happiness ratings on the weekend day but not on the work day due to these differences. On the working day, participants are less free to spend their time how they choose and are more constrained by the demands of their job and working situation. However, on the leisure day participants choose their own social interactions and activities, which may include a greater amount of contact with close social contacts.

Finally, it is interesting to note that no relationship was found between optimism and any measure of social support, in direct contrast to previous research. It has been suggested that optimistic individuals are more attractive as social contacts and that optimism may be instrumental in initiating new social relationships. Optimists have been found to be liked more than pessimists (Carver, Kus, & Scheier, 1994) to have longer friendships (Geers, Reilley, & Dember, 1998) and to have greater levels of social support (Park & Folkman, 1997). There is also evidence that optimism protects against negative aspects of social support, with a reduction in negative social interactions for optimists

(Lepore & Ituarte, 1999). Social networks may mediate the link between optimism and adaptation to stressful events (Dougall, Hyman, Hayward, McFeeley, & Baum, 2001). Optimism has been related to both overall levels of social support (Park & Folkman, 1997) and also higher levels at stressful times (Dougall et al, 2001). A prospective study found that optimists were more likely to increase levels of perceived social support when starting college although there was no difference in change of social network size (Brissette, Scheier, & Carver, 2002). The mean optimism score in this study (12) was comparatively low compared to previous published results, for example a study using the Whitehall II sample reported a mean of 15.6 (Steptoe et al, 2006), and a sample of healthy adults a mean of 17 (Burke, Joyner, Czech, & Wilson, 2000). Other studies using LOT-R have failed to report the mean value and therefore comparison is not possible (e.g. Lai et al, 2008). This may explain the lack of a relationship with social support, although it is unclear why the mean optimism score for this study was so low. The Cronbach's alpha for this scale was .80 indicating a high level of internal reliability.

7.9.4 Social support and health behaviours

The relationship between social support and health behaviours was investigated to test hypotheses 7.2a, 7.2b and 7.2c. Hypothesis 7.2a predicted that being married would be associated with less smoking, less heavy drinking, increased exercise and increased fruit and vegetable consumption, and hypothesis 7.2b predicted that the same set of relationships would be found for structural support. However, these hypotheses were not supported as no relationship was found between marital status or structural social support and any of the health behaviour measures. Previous work has identified a link between marital status and health behaviours, so that being married was associated with decreased negative health behaviours such as smoking and alcohol (Umberson, 1987). Social

support is thought to have a beneficial effect on health behaviours due to both increases in the provision of health-information and also indirectly through increased life meaning (Uchino, 2006). Kaplan et al (1994) has reported that health behaviours represent one of the few empirically tested pathways that partly explain the association between social support and mortality. The sample in this study were relatively young and healthy, and it may be that social support is more important for predicting health behaviours in an older or unhealthy sample. Life stress can also affect the relationship between health behaviours and social support. For example, Steptoe et al (1996) reported interaction effects between social support, smoking and alcohol in students in a control or exam-stress group. For smoking, female participants with a high level of social support did not increase numbers of cigarettes smoked from baseline to exam, whereas those with low social support had a significantly increased rate of smoking during the exams. There was no relationship for the students with no exams. For alcohol consumption, those with higher social support had higher alcohol consumption at baseline compared to those with low support, but by exam-stress follow up, this effect had reversed so that the low social support group were drinking more than the high support group. This study also measured exercise but found no interaction effects with social support. These findings suggest that provision of social support may differentially impact upon performance of health behaviours based on life stress. Some studies have suggested that specific aspects of social support may be relevant in predicting performance of health behaviours. For example, a scale was developed to measure perceived availability of support specifically in relation to diet and exercise behaviours (Sallis, Grossman, Pinski, Patterson, & Nader, 1987). This specific scale was found to predict performance of the relevant behaviour, whereas standard measurements of social support were not related. This suggests that the scales used in this study may not have been sensitive enough to pick up any potential relationship between social support and health behaviour.

Although found no relationship was found between structural social support or marriage and exercise, there was a significant effect for functional social support. Functional support was positively associated with increased performance of both moderate and vigorous activity. The lack of relationship with social network suggests that exercise is not dependent upon numbers of social contacts but more on the quality of perceived social support. This could be due to comparing oneself with others and being influenced via social norms. Previous studies have identified links between structural aspects of support, including frequency of contract, size of network and homogeneity of network, to increases in physical activity (Gillett, 1988; Spanier & Allison, 2001). Intervention studies have also provided support for a relationship between social support and physical activity, so that time spent exercising with a friend or an exercise "buddy" was associated with increased time spent exercising (Kahn et al., 2002). However, previous studies investigating links between social support and physical activity have tended not to compare the roles of different types of social support. It is probable that functional social support was related only to exercise as people often engage in exercise for social reasons, for example exercising together with friends. The motivation for exercising may therefore be particularly related to social reasons, whereas other health behaviours may be more motivated by individual choices.

7.9.5 Social support and cortisol profiles

The relationship between social support and cortisol profile was investigated, using three measures of cortisol; CAR, cortisol slope, and total cortisol over the day to test hypotheses 7.2d, 7.2e and 7.2f. Marital status was associated with lower total cortisol output on the leisure day, but there were no relationships with other cortisol measures. No relationships were found between structural social support and CAR, total cortisol or

cortisol slope on either the work or leisure day and therefore no support for hypothesis 7.2e. Functional social support was related to higher total cortisol on the leisure day, there were no other relationships with cortisol, including CAR and cortisol slope. Interestingly, it was found that marriage was related to lower cortisol on the leisure day, whereas functional social support was related to higher cortisol on the leisure day. These effects remained in a combined model.

Previous findings relating social support to cortisol profiles have been contradictory. In previous work, this author analysed differences in cortisol profiles and social isolation using data from the Whitehall II cohort (Grant et al, 2009). It was found that participants with a high level of social isolation had a significantly greater CAR and also a greater total cortisol output in comparison to those with mid or low social isolation. Social network diversity has also been associated with elevated AUC cortisol and a steeper diurnal cortisol slope in a cohort of middle aged adults, with emotional social support also being related to cortisol slope (Cohen et al., 2006). Significantly, these results were found after controlling for a number of covariates including time of waking up, BMI, smoking status, SES and ethnicity. Emotional support frequency, instrumental support and social ties have also been associated with elevated cortisol levels in men but not in women (Seeman et al, 1994). Social support provided by either a stranger or a friend attenuated cortisol response to a laboratory stressor (Kirschbaum et al, 1995), however this effect was only found for male participants in support of findings from Seeman and colleagues. Other laboratory studies with male participants have found that presence of a friend reduced the cortisol response to stress compared to being alone (Heinrichs et al, 2003). Therefore previous studies have found effects to be stronger for male participants, suggesting the lack of significant findings in this study could be due to differential effects of social support for males and females, as both naturalistic and experimental studies have reported effects for men but not for women. However, a prospective study with breast

cancer patients did find an association between functional support measures and lower mean cortisol level, with no effect for structural measures or cortisol slope (Turner-Cobb et al, 2000). The results of this study may be specific to patients with serious illness, as the availability of functional social support could be particularly beneficial to groups undergoing major life stress. The participants in this study were all full-time employed women, and although some may have been experiencing stressful life events, it is likely that the sample as a whole had a more stable life at the time of the study compared to a patient group.

The only relationship found in this study between cortisol and functional social support was for total cortisol on the leisure day. In contrast to other studies, the results in this thesis showed that a higher level of social support was related to higher cortisol. Structural social support was not related to total cortisol on the leisure day, suggesting that numbers of network members are not important in understanding the relationship between support and weekend day cortisol. The explanation of this result is unclear, although there are some possibilities. Participants reporting higher levels of functional social support may have more positive interactions and experiences during the leisure day leading to higher levels of enjoyment and arousal. This in turn may lead to an higher overall cortisol level. This relationship may be due to a higher number of activities on the leisure day for participants with a higher level of perceived social support. Previous studies have not looked for a difference in the relationship between social support and cortisol level on both a work day and a leisure day. Evidence suggests that the cortisol awakening response varies between work and leisure days (e.g. Scholtz et al, 2004; Kunz-Ebrecht et al, 2004). Further research is needed in this area to determine if the finding that higher social support is related to higher total cortisol on the leisure day is reliable and not due to extraneous factors.

Previous research has suggested that marital status is associated with more favourable cortisol profiles, and this study found partial support for this. In this sample,

marriage was related to lower total cortisol on the leisure day, with no effects for the work day. Previous studies have often assessed the contribution of the quality of the marital relationship in assessing relationships with health. Negative marital interactions have been associated with altered cortisol profiles (Kiecolt-Glaser et al, 2003; Kiecolt-Glaser et al., 1997). Presence of a partner during laboratory based stress tasks have also been found to reduce the cortisol response to stress (Ditzen et al., 2007; Heinrichs et al, 2003; Kirschbaum et al, 1995). These effects have been found to be greater for women than men (Kiecolt-Glaser & Newton, 2001). Positive relationship functioning predicted higher morning cortisol and a steeper slope over the day in a naturalistic study of mothers (Adam, 2001). A large review of marital status and health related biology suggested that a complex pattern of relationships was important in understanding this pathway (Kiecolt-Glaser & Newton, 2001). Aspects of marriage include marital quality, marital relationship functioning, marital interaction and positive and negative dimensions of marriage. These also interact with individual differences such as personality factors and hostility. These findings suggest that it may not be enough to examine the simple presence of a marital partner on ambulatory cortisol profiles, and that the quality of the relationship must be considered. However, a difference was found in mean cortisol levels between married and unmarried participants, without taking into account marital functioning and quality. In a comparison of married and unmarried women in America, mean urinary cortisol levels were not different between the two groups (Englert et al., 2008). However, the unmarried group had significantly higher variation in their cortisol levels, showing that they had more extreme levels compared to married women.

7.9.6 Positive well-being, social support, optimism and health-related biology and behaviour

Recent evidence has suggested that positive well-being and social support may be part of a broad constellation of protective psychosocial factors, which may interact in their associations with health-related biology and behaviour (e.g. Steptoe et al, 2008a). There is now accumulating evidence that positive well-being is associated with decreased mortality and morbidity across a range of diseases and findings have suggested independent relationships between positive well-being and health-related biology and behaviour, which may mediate these associations. Similar results have been reported between aspects of social support and health outcomes, and both neuroendocrine and behavioural aspects have been suggested as mediators of this relationship. The third aim of this chapter was to extend these findings by investigating whether positive affect was important in explaining any relationship between social support and cortisol or health behaviours. It was hypothesized that social support would be more beneficial for those with lower positive affect.

The results of these analyses were generally rather inconsistent. It was found that functional social support was related to exercise but only for participants with high positive affect. This was the only relationship between social support and health behaviours that was moderated by positive affect, and is in contrast to the hypothesis. Physical activity is thought to increase positive affect and has been related to higher levels of affect in a range of studies (e.g Spence et al, 2005; Schnor et al, 2005). It is interesting that this relationship was only found for functional social support, suggesting that the quality of perceived social support is important.

It was found that being married was related to higher total cortisol on the working day, but only amongst unhappy participants. By contrast, this study found that being married was related to lower cortisol on the leisure day, but only amongst happy

participants. This demonstrates that it is important in future studies to consider the interaction between happiness and social support when analysing pathways that may mediate the link between protective psychosocial factors and health. However, this study did not find support for the hypothesis that social support would be more beneficial for those with lower happiness. As reviewed in section 7.9.5, previous studies have suggested that the quality of the marital relationship is important in determining the health protective effects of being married. Although the measure of happiness that was used is not specifically related to the marital relationship, it does suggest that marriage and affect interact to protect against stressful events. Being married was related to higher cortisol on the work day for unhappy participants, but no relationship was observed for happy participants. This suggests that marriage interacts with affect to exert effects on health-related biology. Being married was only related to a lower cortisol profile for participants who were also happy, suggesting that marriage itself is not enough to explain this relationship. Marital status may affect coping styles that are employed, which in turn are affected by happiness. Some studies have suggested that happiness is contagious, and found that happier people tend to have happier friends, and that this extends to three degrees of separation (Fowler & Christakis, 2008). In this case it may be more likely to make use of available social support, and it can be perceived as more useful. However, for unhappy people, who are also more likely to have unhappy network members, social support may be of limited benefit.

On the leisure day, a higher total cortisol level was associated with functional social support but only for participants with a lower level of happiness. Uchino (2006) suggested that there were two main pathways that may explain the link between social support and future health outcomes. The first, as discussed in section 7.9.4, is the behavioural link, which suggests that higher levels of social support are associated with increased healthy behaviours and decreased risky behaviour. The second pathway describes the influence

of psychological aspects, such as depression and feelings of control, as mediators between social support and health outcomes. Social support has been reliably linked with psychological processes (e.g. Barrera, 2000) although House (2001) suggested that more work is needed to further understand the explanatory power of this pathway. The findings of this study suggest that the psychological pathway explaining links between social support and positive health outcomes is complex. It was predicted that social support would be more salient for those with lower levels of positive affect, which would be demonstrated by stronger relationships between social support and behaviour and biology for those with lower affect. However, these results did not consistently support this hypothesis.

It is not possible to evaluate the direction of the relationship between social support and affect using this data, as it was only possible to carry out cross sectional analyses. However, it is likely that effects are complex and reciprocal. Higher levels of affect may lead to increased contact with network members, and also higher evaluation of the quality of those relationships. Lower affect, on the other hand, may be associated with more negative interaction with network members and feelings that social relationships are unsatisfactory. This thesis used a measure of perceived social support, which is subject to respondent appraisals of the type and quality of support received. Appraisals of this sort may be affected by happiness or negative affect. An alternative is to use measures of received support, and studies have tended to find a lack of correlation between these two types of support. It would be interesting to further evaluate the role of affect on social support and health using different measures of social support to test the consistency of the association found in this study.

7.9.7 Strengths & limitations

There are a number of strengths for the Daytracker study. Firstly, it was possible to compare a number of different methods for assessing positive well-being, including both hedonic and eudaimonic definitions, and momentary assessments. Previous studies have tended to focus on single assessments of well-being and have not been able to provide comparisons across a range of measures. Similarly, many previous assessments of social support have focussed either on structural or functional measures, and have not compared the two. Uchino (2004) suggested that social support research would benefit from systematic studies including more than one definition of social support. It was possible to include measures of social network, functional social support and also marital status. Additionally, in the Daytracker study it was possible to compare the effects of social support on well-being across work and leisure days. Finally, it was possible to assess three measures of cortisol, CAR, total cortisol output and cortisol slope.

However, there were also a number of limitations to this study. Firstly, the data presented in this chapter is cross-sectional in nature and therefore it is not possible to assess causal pathways. As outlined in the discussion, it was only possible to include a measure of married or single, without a finer measurement for marital quality. Including a measure of relationship quality may have identified important links with well-being, cortisol and behaviour. This study is also limited by the reasonably homogeneous sample. All participants were female and therefore it is not possible to examine any gender differences, or to generalise these results to other samples. Most participants were of white ethnic origin, and any attempt to identify ethnic differences was subject to limitations of power, possibly obscuring other interesting effects. The sample was also of a relatively young age and was generally healthy. Perhaps due to the sample used here, there was limited variability in socio-economic status. If there had been a wider range of SES scores then relationships between SES and social support, positive well-being, biology and

behaviour may have been found. Overall, this means that comparing these results to other samples should be done with caution.

There were also some limitations with the design of the Daytracker study more generally. Firstly, participants began their 24 hour monitoring period at the end of a working day, and at the end of a Friday. The participants were followed for one working day and one leisure day in order to examine different effects for working and weekend days. It was necessary to begin the monitoring in the evening due to constraints with the heart rate monitoring devices. This reduced the usability of the evening portion of the data, and therefore it was not possible to obtain a cortisol profile for a consecutive period, from waking up to going to bed on the same day. This was particularly relevant for the Friday evening data, which formed part of the leisure day sampling. Although Friday night may typically be thought of as the beginning of the weekend, it is also the end of the working week and therefore any measures of affect or biology may be attributable to either of these factors. Because of this, it was decided to analyse data from the day portions of both the work and leisure day sampling period. Secondly, it was only possible to measure participants on one work day and one leisure day. It is not possible to assume that these two days were an accurate reflection of a typical work and leisure day for every participant, as unique events may have occurred altering patterns of affect and/or cortisol measures. There are also some limitations with regards to the measures used within the Daytracker study. Previous literature suggests that the quality of marital relationships are important when assessing relationship with both well-being and health related-biology and behaviour. Including a measure of marital harmony would have allowed for investigation of this area more fully. Secondly, the health behaviour measures were limited and could be extended to include additional measures of diet, for example calorie and fat intake.

7.9.8 Summary and next steps

The results presented in this chapter suggest that social support is related to a number of positive well-being measures. Functional social support emerges as the most important correlate of positive well-being compared with structural social support and marital status. Functional social support was related to higher levels of exercise, with no relationships found for any other health behaviours. Being married was related to lower cortisol on the leisure day, whereas functional social support was related to higher cortisol on the leisure day. Finally, the contribution of positive affect in explaining the relationship between social support, biology and behaviour was assessed. These results suggest that protective psychosocial factors may display a complex relationship with each other that is relevant for understanding associations with health outcomes. This study therefore concludes that social support and positive well-being may be protective as part of a wider network of protective psychosocial factors, and that functional social support and marital status may affect exercise and cortisol profiles. However, the relationships found in this study were small and did not extend across all measures of cortisol or health behaviour. The following chapter of this thesis will investigate some of these findings in a sample from Japan. This will allow testing of the thesis aims in a sample from a very different culture to that used in this study.

CHAPTER 8: PSYCHOSOCIAL FACTORS AND BEHAVIOURAL AND BIOLOGICAL PATHWAYS TO HEALTH: JAPANESE STUDY.

"*People everywhere are likely to prefer the desirable to the undesirable and the pleasant to the unpleasant*". (Uchida, Norasakkunkit, & Kitayama, 2004, pg 223).

8.1 Introduction

A modified version of the Daytracker study was carried out with a relatively small sub-sample of Japanese participants. This has allowed investigation of differences in affect, social support and associated relationships with health-related biology and behaviour in a cross-cultural sample. Japan differs from the UK in a number of significant ways, such as being a collectivist nation compared to the individualism valued in the UK. However, Japan is also an economically advanced country with a comparable level of wealth. Therefore it was decided to include a Japanese sample in this thesis, as participants from the UK and Japan would be similar in terms of economic wealth of their country, but differ in terms of social values. There may also be some important differences in the two specific samples used in this study, such as difference in area of residence. The UK sample work in central London, whereas the Japanese sample work in a smaller, more rural university. Further, there may also be important differences in the occupational opportunities for women in the two different areas. These limitations will be presented in the discussion of this chapter. The study sample was drawn from Kurume University, on Kyushu, in Japan. This university was selected as research investigating links between psychosocial factors and biology is rare within Japan, and this research team is one of the few with capabilities to collect and analyse saliva samples.

The aims and hypotheses of the following chapter have been developed according to the results presented in the current chapter. The first aim was to investigate to test whether the observations made in Chapter 7 in the UK Daytracker sample could be replicated in the Japanese sample.

The second aim of the study was to compare levels of positive well-being, health behaviours and cortisol in the UK and Japanese samples to identify if there are similar patterns that may suggest a link between positive well-being and these pathways.

Specific hypotheses to be tested are:

8.1a Being married will not be associated with optimism or EMA positive affect, but will be associated with PANAS positive affect.

8.1b Functional social support would be positively related to all measures of happiness.

8.1c In combined regression models, functional social support would be an independent determinant of positive affect.

8.2a Marital status would not be associated with health behaviours.

8.2b Functional social support would be positively related to exercise, but not be related to smoking, alcohol consumption or fruit and vegetable consumption.

8.2c Marital status would be associated with lower cortisol on the leisure day, with no relationships for CAR or cortisol slope

8.2d Functional social support will be associated with higher cortisol on the leisure day, with no relationships for CAR or cortisol slope.

The second aim of the study was to investigate differences between the UK and Japanese samples in the pattern of positive affect, health behaviour and biology. We

know from previous studies within-countries that positive affect is inversely associated with some health behaviours (as shown in chapter 5) and with cortisol output over the day (Steptoe et al, 2005; 2008a). The question that was investigated here is whether countries that differ in positive affect will show similar differences in health behaviour and cortisol. There is evidence to suggest that positive affect will be lower in Japan than the UK (Steptoe et al; 2007). So, it was hypothesised that these differences would be associated with the same behavioural and neuroendocrine effects as observed within-samples. Therefore, it was hypothesised that:

8.3 EMA positive affect, PANAS positive affect and the Subjective Happiness Scale (SHS) measures of happiness would be lower in Japanese than UK women working in comparable settings.

8.4 There would be higher levels of smoking, less physical activity and lower fruit and vegetable consumption in Japan. This is line with the findings presented in Chapter 5.

8.5 The Japanese sample would have higher cortisol output over the day than UK women.

8.6 The possibility of differences in the CAR and cortisol slope was also tested. Here predictions are less clear, since a smaller CAR has been related to positive affect in some studies of younger people (Lai et al, 2005; Steptoe et al, 2007), but not so consistently in middle-aged and older adults (Steptoe et al, 2005; 2008).

8.2 Methods

8.2.1 Participants

Fifty-eight women employed at Kurume University, Kyushu, Japan participated in the Japanese Daytracker study. There were some differences in recruitment compared with the UK study. Some participants did not have regular access to email and therefore flyers advertising the study were addressed to all female staff and sent via the internal university email. Kurume University has two main sites, the first covering medical studies and the second all other courses and staff at both sites were included in the study. Those who responded to the fliers made contact with a Japanese research assistant who then took details to complete the screening form. If eligible to take part (based upon the exclusion criteria outlined in section 6.2, chapter 6) research interviews were scheduled. These took place at either site, depending on the workplace of each participant. For the first part of the analyses described below, the full sample of 58 women were included. However, for the comparison between the UK and the Japanese sample, 6 women were excluded, as described in section 8.3 below.

8.2.2 Measures

The Japanese study mirrored the measures used in the UK study as far as possible. However, Japanese participants were not required to complete the DRM. This was decided for a number of reasons including difficulty of designing and implementing an online version in Japanese, and also to reduce participant burden. It was decided that it was more beneficial to include the ecological momentary assessment measures of happiness over the day as these would provide momentary sampling data with minimum participant burden. Translation of materials was carried out by Dr Yoichi Chida, a Japanese postdoctoral research fellow working on the Daytracker Study. Materials were

then checked and back-translated by Japanese colleagues to ensure there were no inconsistencies (see Appendices 7-10). Unfortunately it was not possible to include the Social Network measures in the Japanese study. This was due to worries over time burden from the Japanese research team, who were concerned that participants would be less likely to take part if the questionnaire was extensive. This led to exclusion of a number of scales from the UK Daytracker questionnaire.

Demographic information was generally the same for the Japanese questionnaire as the UK version; however, there were some alterations to ensure that response options were appropriate. Assessment of personal income was again split into three groups, reflecting low, standard and higher pay ranges in Japanese Yen. Health behaviours and functional social support were direct translations from the UK version (see section 5.4.1e of Chapter 6 for a description of these methods), as was the happiness measure. This scale is described below. Standardised Japanese versions were available for Life Orientation Test (optimism) and PANAS (positive and negative affect) These measures are described in section 6.4 of chapter 6.

8.2.2.1 Subjective Happiness Scale

The Subjective Happiness Scale (SHS) was used as an additional measure of global subjective happiness (Lyubomirsky & Ross, 1999). This is a four item scale, with two items asking participants to rate their happiness generally and in relation to other (see Appendix 5 for UK version and Appendix 9 for Japanese). The other two items describe a situation, and require participants to rate to what extent the description refers to their character. The four items are rated on a 7 point scale, ranking from 0 “not at all” to 6 “a great deal”. These are summed leading to scores which can range from 0 (very unhappy)

to 24 (very happy). This scale has been used extensively across different samples (e.g. Lyubomirsky & Tucker, 1998).

8.2.3 Procedure

The Japanese study was supervised by Professor Akira Tsuda from the Department of Human Sciences at Kurume University. This author was based at Kurume University for a 10 week period in 2007 to set-up the study and train research staff. During this time, This author worked closely with a Japanese research assistant who assisted in all aspects of the study. All research interviews were carried about by this colleague, who was fluent in both Japanese and English. The researcher was present at the interviews carried out during a research trip stay at Kurume to assist with any queries from the research assistant or participants. The study protocol followed that of the UK Daytracker study (see Chapter 5) as closely as possible. At the beginning of the research visits, the consent form was completed and any questions about the study were answered. Height and weight were measured, although it was not possible to use Tanita scales to gain estimates of BMI or body fat percentage. The cortisol sampling procedure was then explained and the first cortisol sample collected. The saliva kits were identical to those used in the UK study. However, because the study period coincided with the height of summer, small freezer boxes were given to participants to carry the samples when they were not in a fridge. The sampling diary was an identical copy of that used in the UK, with the obvious exception that all instructions were in Japanese. The Daytracker (Japan) questionnaire was explained to participants and arrangements were made to collect completed materials from day 1 of the study. The second research visit was similar in format, with the exception of height and weight measures.

As with the UK Daytracker Study, the start day (work day or leisure day) was randomised so that half the participants had their first monitoring day on the work day and half on the leisure day. All participants began data collection at the end of their working day, which ranged between 4pm and 7pm. Arrangements were made to collect saliva samples and study materials after each monitoring period has ended. In the UK, participants wore a heart monitor to collect activity and heart rate variability data. However, this monitor was not used in the Japanese study.

8.3 Data analysis

The first stage of the analyses, which aims to investigate the consistency of associations between social support and positive well-being and optimism, and social support with cortisol and health behaviours in the Japanese sample used the full 58 participants. For the second phase of the analysis, a subsample of the UK Daytracker study (the same sample used in Chapter 8) was used. In order to provide a meaningful comparison study between the UK and Japanese samples, it was necessary for participants from each site to be comparable across demographic measures. This is particularly true for age, as previous research shows age related differences in affect and health-related biology and behaviour. Therefore participants from both countries were first excluded if they did not have acceptable cortisol samples for both the work day and the leisure day period. This resulted in the exclusion of 6 Japanese and 16 UK participants. The complete UK group was significantly older than the Japanese group (mean age UK = 33.7, Japan = 38.6, $F_{(1.255)}$=11.04, p<.005), and also there were considerably more participants in the UK (UK= 199, Japan = 58). Therefore, random number generation in Microsoft Excel was used in order to exclude some of the UK participants who were aged younger than the Japanese mean age (38). This resulted in a final group of 52 Japanese

and 136 UK participants, who did not differ in age on average. These were the groups used in the primary analyses described below. However, the primary results related to positive affect and cortisol were the same when the complete UK sample was included in the analyses (data not shown).

8.4 Statistical analysis

All statistical analyses were performed using the statistical programme SPSS 14.0 (SPSS Inc). For the first part of the analysis, which replicates the analysis in chapter 7, the same statistical techniques were used. Univariate analysis of variance was used to investigate differences in continuous measures of social support and positive well-being and demographic factors, with chi-square being used for the categorical marriage variable. Pearson correlations were used to analyse univariate relationships between positive well-being variables. To investigate multivariate relationships between social support and positive well-being variables, hierarchical linear regression was used with each measure of positive well-being as the dependent variable. In chapter 7, both mean EMA rating and a "very happy" EMA measure were used. Previous studies (Steptoe, Wardle & Marmot, 2005) have identified biological differences amongst the happiest of participants. However, the percentage of participants in the Japanese study reporting themselves to be very happy was extremely low, and therefore using this variable was not statistically sound. The regression models are further detailed in this chapter in section 8.9. The second phase of this section was to assess the relationship between health behaviours and social support. First the relationship between health behaviours and demographic factors was analysed. Relationships between health behaviours and ethnicity and SES were analysed using chi-square or Fisher's exact test for those analyses with expected cell counts of less than 5. The relationships between age and health behaviours were analysed using univariate

ANOVA. To test the multivariate relationship between categorical variables and social support (smoking, alcohol, fruit and vegetable consumption) logistic regression was used with health behaviours as the dependent variable and social support as predictor variables in separate models. A binary alcohol variable was used which compared non- and moderate drinkers with heavy drinkers. A continuous total exercise was also created variable which took into account both moderate and vigorous exercise. Linear regression was used with exercise as the dependent variables and social support as the predictor variables. The third section of this analysis assessed the relationship between social support and cortisol profiles. To assess the multivariate relationship between social support and cortisol a similar multiple linear regression model, was used with each measure of cortisol as the dependent variable.

The second section of this chapter aimed to compare the levels of positive well-being, cortisol and health behaviours in the UK and Japanese samples. Descriptive statistics are presented and between-country differences were analysed using univariate ANOVA for positive well-being and cortisol. Comparison of health behaviours were analysed using chi-square or Fisher's exact tests as appropriate. Finally, these differences were analysed using analysis of covariance.

8.5 Results

Japanese participants were aged 38 on average, higher than the UK average of 33. BMI was very low in Japan, being just 16 on average, which is under the recommended minimum. Only one third of participants were married, in contrast to almost half of the UK sample. This could suggest that unmarried women make up a higher percentage of employed females, with married women tending to stay at home in a more traditional role within the family. Only included full time employees were included in this study to keep the

sample as similar as possible to the UK study, and it could be that if women with part time work had been included there would have been a higher number of married participants. The majority of the sample had a degree level qualification, compared to 64% of the UK sample. This shows that the Japanese sample had a slightly lower level of education compared to the UK sample. However, division by occupational rank is similar between the two countries. To measure occupational rank, occupation title was collected, and two researchers (one author one Japanese researcher) ranked job titles as high or low. These were then compared and any anomalies were checked and verified. Two thirds of the Japanese sample were of a lower occupational rank based on job title, compared to 60% of the total UK sample.

TABLE 8.1 PARTICIPANT DEMOGRAPHICS

	Japan	
Demographic factors	**N (%)**	**Mean (sd)**
Age	58	38.56 (11.53)
Body Mass Index	58	16.77 (2.05)
Married	19 (32.8)	
Educational attainment		
less than degree	25 (43.1)	
degree or higher	33 (56.9)	
Occupational rank		
Lower	38 (65.5)	
Higher	20 (34.5)	

8.6 Socio-economic status measures

In Chapter 7 the method used to calculate the SES variable for the Daytracker (UK) study was described. This process was repeated for the total Japanese sample used in

this phase of the analysis. Using the measures of educational attainment and occupational rank, composite variable was calculated to assess socio-economic status (see table 8.2). However, unlike the situation in the UK, age was significantly different across SES groups in the Japanese sample ($F_{(2,55)}$=7.62, p<.01). In the lowest SES group the mean age was 45 (SD 10.0), for the middle group was 34 (SD 9.8) and for the highest SES group was 32 (SD 9.4). SES varied with personal income level in the Japanese sample (χ^2=15.03, df=4, p<.01).

TABLE 8.2 CALCULATION OF COMPOSITE SOCIO-ECONOMIC STATUS MEASURE

	Japan N (%)
Low SES	23 (39.7)
Mid SES	17 (29.3)
High SES	18 (31)

8.7 Social support

The mean social support score for Japanese participants was 23, compared to 26 in the total UK sample (see table 8.3). This indicates that Japanese women have slightly lower perceived levels of functional social support. This is coupled with lower numbers of married participants, suggesting an overall lower level of support in the Japanese sample.

TABLE 8.3 DESCRIPTIVE STATISTICS FOR SOCIAL SUPPORT MEASURES

Social support measures	N (%)	Mean (sd)	Range
Functional support	57	23.26 (6.9)	0-36
Marital status			
married/ marital-like relationship	19 (32.8)		
not married	39 (67.2)		

TABLE 8.4 RELATIONSHIP BETWEEN SOCIAL SUPPORT AND COVARIATES

Demographic factors	SES	Age
Functional support	$F_{(2,54)}$=.028, *p*=.97	*r*=-.15, n=57, *p*=26
Marital status	χ^2=1.0, df=2, *p*=.60	$F_{(1.56)}$=14.7, *p*<.001

There was a significant difference in age across levels of marital status; married participants were aged 46 on average compared to 35 for unmarried participants. There was no difference in SES between functional support levels or marital status, or between functional social support and age. There was no difference in levels of functional support between marital status groups ($F_{(1.55)}$=1.45, *p*=233). This is in contrast to the UK sample, were levels of functional support were significantly higher for married participants.

8.8 Positive well-being measures

As in the UK Daytracker study, positive affect was assessed both by questionnaire using the PANAS, and with EMA over the work and leisure days (see table 8.5). However, Japanese participants did not complete the DRM or the Scales of Psychological Well-being. PANAS positive affect was higher than negative affect in this sample. There was no relationship between age and positive affect but there was a negative correlation between

negative affect and age, so that younger participants had higher levels of negative affect. This is in contrast to what might be expected, as negative affect often increases with age. There was no relationship between SES and positive or negative affect. The mean optimism score was at the midpoint of the scale, indicating that most participants were moderately optimistic. Age and SES were not related to optimism.

TABLE 8.5 PANAS POSITIVE AFFECT DESCRIPTIVE STATISTICS

Affect measures	Range	N	Mean (sd)	Age	SES
PANAS					
Positive affect	10-50	58	27.7 (6.9)	r=-.05, n=58, p=70	$F_{(2.55)}$=.537, p=.58
Negative affect	10-50	58	22.1 (8.3)	r=-.33, n=58, p<.05	$F_{(2.56)}$=.049, p=.95
LOT					
Optimism	0-24	58	12.5 (4.6)	r=-.25, n=58, p=09	$F_{(2.55)}$=1.21, p=.33

EMA assessments of mean happiness were higher on the work day (2.2) compared to the weekend day (3.0) and this difference was significant ($F_{(1.57)}$=37.7, p<.001; see table 8.6). This shows that, as in the UK sample, participants were happier on the leisure day in comparison to the working day. The rating scale for the EMA assessments ranged from 1 through to 5, with 2 indicating that participants were not happy. Therefore the mean level of 2.2 indicates that participants are generally not happy over the working day. The mean level in the UK sample was 3.1, which represents a large increase in comparison to the Japanese rating.

TABLE 8.6 ECOLOGICAL MOMENTARY ASSESSMENT DESCRIPTIVE STATISTICS

	N (%)	Mean (sd)	Range	Age	SES
Mean happiness					
Work day	58	2.2 (.76)	1-5	r=.13, p=.308	$F_{(2.55)}$=1.26, p=.28
Leisure day	58	3.0 (.81)	1-5	r=-.08, p=.53	$F_{(2.55)}$=.68, p=.50

8.9 Relationship between positive well-being, optimism and social support

In order to assess the relationship between social support measures and positive well-being in the Japanese sample, the linear regression analysis described in section 7.5 of chapter 7 was used. The models used are shown in table 8.7.

TABLE 8.7 REGRESSION MODELS

Regression Model	Measure
Model 1	Age SES
Model 2	Negative affect
Model 3	Marital Status
Model 4	Functional social support
Model 5	Marital Status Functional social support

8.9.1 Social support correlates of PANAS positive affect

Age, SES and negative affect were not related to PANAS positive affect (see table 8.8). There was also no relationship between marital status and PANAS positive affect. However, functional social support was significantly associated with PANAS positive affect, such that higher ratings of social support were related to higher PANAS positive affect scores. This relationship remained significant in the final, combined model.

8.9.2 Social support correlates of optimism

Age and SES were not related to optimism (see table 8.9) although there was a relationship between negative affect and optimism scores. This showed that a low score on the negative affect scale, which indicates low negative affect, was associated with a higher optimism score. Being married was not related to optimism as shown in model 3,

and negative affect remained significantly associated with optimism. Model 4 showed that functional social support was strongly related to optimism scores, so that higher support was related to higher optimism. This relationship was also significant in model 5. This represents a different finding to the UK study, where functional support was not related to optimism scores.

8.9.3 Social support correlates of EMA happiness work day

Age was marginally positively related to EMA happiness on the work day, such that being older was associated with higher scores (see table 8.10). SES was also related to happiness on the work day, so that a higher SES was related to higher happiness. Models 3 and 4 showed that there was no association between negative affect or marriage and EMA happiness on the work day. There was also no relationship between functional social support and happiness on the work day.

8.9.4 Social support correlates of EMA happiness leisure day

EMA happiness on the leisure day was not associated with age or SES (see table 8.11). Model 3 shows a significant negative relationship between negative affect and EMA happiness on the leisure day, such that low levels of negative affect were related to higher happiness ratings. However, being married was not related to happiness on the leisure day. Model 4 showed a positive relationship between functional social support and happiness on the leisure day, and this was also significant in model 5.

TABLE 8.8 SOCIAL SUPPORT CORRELATES OF PANAS POSITIVE AFFECT (N=53)

	Model 1		Model 2		Model 3		Model 4		Model 5	
	β (SE)	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	-.028 (.150)	.853	-.030 (.162)	.854	-.042 (.190)	.825	.119 (.169)	.484	.103 (.195)	.599
SES	.052 (.150)	.730	.051 (.153)	.739	.045 (.162)	.780	.110 (.151)	.470	.102 (.158)	.520
Negative affect			-.005 (.145)	.972	-.006 (.147)	.967	.179 (.162)	.276	.178 (.164)	.283
Marital status					.020 (.161)	.901			.027 (.159)	.868
Social support							.347 (.154)	.029	.348 (.156)	.030
R^2		.005		.005		.005		.092		.092

TABLE 8.9 SOCIAL SUPPORT CORRELATES OF OPTIMISM (N=56)

	Model 1		Model 2		Model 3		Model 4		Model 5	
	β (SE)	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	.175 (.146)	.234	.016 (.145)	.915	.016 (.170)	.924	.200 (.139)	.157	.171 (.161)	.293
SES	-.111 (.146)	.450	-.171 (.137)	.217	-.171 (.145)	.243	-.069 (.124)	.582	-.082 (.130)	.531
Negative affect			-.403 (.130)	.003	-.403 (.131)	.003	-.163 (.134)	.228	-.165 (.135)	.227
Marital status					-.001 (.144)	.993			.049 (.130)	.708
Social support							.496 (.127)	<.001	.498 (.128)	<.001
R^2		.060		.202		.202		.385		.387

TABLE 8.10 SOCIAL SUPPORT CORRELATES OF EMA HAPPINESS WORK DAY (N=56)

	Model 1		Model 2		Model 3		Model 4		Model 5	
	β (SE)	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	.282 (.142)	.052	.250 (.153)	.108	.244 (.180)	.180	.238 (.167)	.160	.236 (.193)	.228
SES	.330 (.142)	.024	.317 (.145)	.032	.315 (.153)	.044	.307 (.149)	.044	.306 (.156)	.056
Negative affect			-.082 (.137)	.553	-.082 (.139)	.555	-.095 (.161)	.557	-.095 (.162)	.560
Marital status					.009 (.152)	.953			.004 (157)	.981
Social support							-.029 (.152)	.850	-.029 (154)	.852
R^2		.106		.112		.112		.112		.112

TABLE 8.11 SOCIAL SUPPORT CORRELATES OF EMA HAPPINESS LEISURE DAY (N=56)

	Model 1		Model 2		Model 3		Model 4		Model 5	
	β (SE)	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***	**β (SE)**	***p***
Age	-.025 (.149)	.869	-.141 (.154)	.364	-.034 (.179)	.850	-.017 (.162)	.917	.081 (.185)	.662
SES	.133 (.149)	.375	.089 (.146)	.543	.142 (.152)	.355	.146 (.144)	.316	.191 (.150)	.209
Negative affect			-.294 (.138)	.038	-.286 (.138)	.043	-.138 (.156)	.380	-.132 (.156)	.399
Marital status					-.178 (.152)	.246			-.164 (.150)	.279
Social support							.307 (148)	.043	.298 (.147)	.048
R^2		.021		.097		.120		.165		.184

8.10 Social support and health behaviours

The following set of analyses will investigate hypotheses 7.2a, 7.2b and 7.2c. These hypotheses aim to examine associations between health behaviours and social support and, briefly, these predict that social support will be associated with increased performance of healthy behaviours. Differences in rates of fruit and vegetable consumption were investigated, moderate exercise and vigorous exercise across marital status, structural and functional social support. Because of the very low numbers of smokers and heavy drinkers (see table 7.12), the associations between social support and these health behaviours were not analysed. A new variable was used to assess fruit and vegetable consumption, because the proportion of participants eating the recommended 5 portions were day was very low (5.2%). Therefore, a comparison of those who ate fruit at least 3 times per day compared to once per day or less was carried out. It was expected that a positive association would be found between higher social support and fruit and vegetable consumption and performance of exercise. The first phase of this section presents descriptive data before moving on to test the above hypotheses.

There was only one current smoker in the Japanese sample. This rate is very low, and would certainly have been higher if the sample had included men. Also, the sample used in this thesis lived in a more rural area of southern Japan, and it is possible that if the study were repeated in a more industrialised area different rates would be apparent. The majority of participants were moderate drinkers, with only 7% being heavy drinkers. Japanese women tend to drink lower amounts of alcohol due to the types of alcoholic beverages consumed and this is reflected in these results. The majority of participants did not eat fruit or vegetables more than 3 times per day. The Japanese are typically thought to be a healthy eating nation, although this is not reflected in consumption of fruit and vegetables in this sample. However, other dimensions of diet had been included, such as low fat intake, low calorie intake and

eating oily fish it is likely that different results would have emerged. The majority of participants did not take part in regular exercise, using either the moderate or vigorous exercise variable. This suggests that Japanese participants are more sedentary. However, it is possible that participants engaged in more gentle forms of exercise that were not captured by these variables, such as walking or light cycling.

TABLE 8.12 PERFORMANCE OF HEALTH BEHAVIOURS

Health behaviours	N (%)
Smoking	
Non smoker	57 (98.3)
Current smoker	1 (1.7)
Alcohol	
Non drinker	23 (39.7)
Moderate drinker	31 (53.4)
Heavy drinker	4 (6.9)
Fruit and vegetable consumption	
Less than 3 per day	47 (81)
3 per day or more	11(19)
Moderate exercise	
Never	33 (56.9)
1-3 times/month	9 (15.5)
1-2 times/week	11 (19.0)
3+ times/week	5 (8.6)
Vigorous exercise	
Never	44 (75.9)
1-3 times/month	5 (8.6)
1-2 times/week	5 (8.6)
3+ times/week	4 (6.9)

TABLE 8.13 HEALTH BEHAVIOURS AND DEMOGRAPHIC VARIABLES *

Demographic factors	Age
Fruit/Veg	$F_{(1,56)}$=.079, p=.78
Moderate exercise	$F_{(3,54)}$=.508, p=.67
Vigorous exercise	$F_{(3,54)}$=.622, p=.60

*Because of low numbers in the groups, it was not appropriate to analyses differences within SES groups using chi-square analysis.

Logistic regression was used to analyse social support as a determinant of fruit and vegetable consumption. Marital status was not related to fruit and vegetable consumption. Linear regression was used to analyse social support predictors of total exercise. Marital status was also not associated with total exercise. Functional social support was not associated with fruit and vegetable consumption or total exercise. This is in contrast to findings from the UK sample, where functional social support was related to exercise, so that those with higher levels of social support were more likely to take part in regular exercise but this was not the case in the Japanese sample (data not shown).

8.11 Social support and cortisol

The hypotheses to be tested in this section of the analysis are 8.2e, 8.2f and 8.2g. These refer to relationships between social support measures and cortisol profiles, as measured using CAR, cortisol slope over the day and total cortisol output. It was predicted that marriage would be associated with lower cortisol on the leisure day, and functional support would be associated with higher cortisol on the leisure day. The first part of this section will outline descriptive data relating to the cortisol variables, and will then move on to test the hypotheses mentioned above.

As in the UK study, participants collected saliva at 7 time points over each 24 hour monitoring period. Mean values for all participants show the typical diurnal pattern of cortisol release on both the working and leisure day sampling period (see figure 8.1).

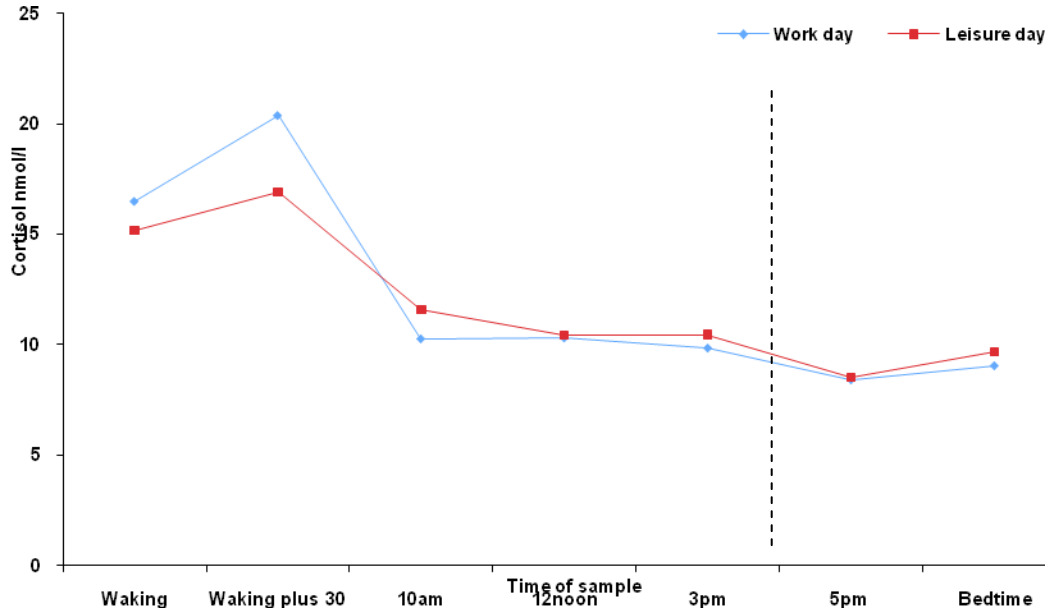


FIGURE 8.1 CORTISOL PROFILE FOR WORKDAY AND LEISURE DAY

As in the UK study, cortisol was analysed using three measures: cortisol awakening responses (CAR); cortisol slope of decline, and total cortisol using area under curve. The total cortisol measure and the slope of decline are based on values from the second portion of the sampling day, and exclude the 5pm and bedtime values collected at the beginning of the study. There was a significant difference between the CAR on the working and weekend day ($F_{(1,46)}$=4.96, p<.05), with levels being higher on the work day compared to the weekend day. As can be seen in table 8.14, the mean CAR was 4.12 nmol/l on the working day and only 1.31 on the leisure day. Total cortisol was also significantly greater on the work day compared to the weekend day ($F_{(1,46)}$=27.69, p<.001). However, the slope of decline was not different between the two sampling days ($F_{(1,52)=.}$47, p=.49).

TABLE 8.14 CORTISOL MEASURES

	N	Mean (SD)
Cortisol Measure (nmol/l)		
Cortisol awakening response		
Workday	52	4.12 (7.27)
Weekend	50	1.31 (6.93)
Total cortisol		
Workday	52	7.43 (.26)
Weekend	50	7.22 (.25)
Cortisol slope		
Workday	57	.01 (.01)
Weekend	53	.01 (.01)

In order to test the hypotheses, multiple regression analyses were carried out, adjusted for age, SES, time of waking (for CAR only), smoking, negative affect and body mass index to examine potential relationships between social support and cortisol profiles. Three cortisol parameters were tested: the cortisol awakening response, the total cortisol output over the day as defined by area under the curve (AUC), and cortisol slope across the day. These analyses were repeated for both working and leisure day sampling periods. The first hypothesis concerned the relationship between marital status and CAR, total cortisol and cortisol slope. Marital status approached significance as a correlate of CAR on the working day (see table 8.15), such that being married was associated with a smaller CAR. However, there was no relationship between marital status and slope of decline or total cortisol output on either the working or leisure day. In the UK sample, it was found that marital status was related to lower total cortisol on the leisure day, with no relationship for CAR on the working day. In both cases, being married was associated with lower levels of cortisol although in Japan this effect was apparent on the working day (and was limited to the CAR) and in the UK on the leisure day.

TABLE 8.15 MARITAL STATUS AS A CORRELATE OF CAR ON THE WORKING DAY

	Model 1		Model 2		Model 3	
	β (SE)	***P***	**β (SE)**	***P***	**β (SE)**	***P***
Age	-.059 (.164)	.719	-.070 (.178)	.695	.217 (.231)	.353
SES	.150 (.161)	.354	.146 (.164)	.379	.287 (.177)	.112
Smoking	-.054 (.141)	.702	-.051 (.144)	.727	-.124 (.146)	.400
BMI	.146 (.151)	.341	.144 (.153)	.353	.123 (.150)	.414
Waking time	-.317 (.142)	030	-.321 (.145)	.032	-.381 (.144)	.011
Negative affect			-.025 (.152)	.867	-.028 (.148)	.851
Marital status					-.360 (.192)	.067
R^2		.140		.141		.204

The second hypothesis relates to functional support and cortisol profiles. The relationship between functional social support and CAR on the leisure day was approaching significance (see table 8.16). This finding suggests that there was a trend for higher levels of social support to be associated with lower CAR on the leisure day. However, there was no relationship between functional social support and cortisol slope of decline or total cortisol output on either the work or leisure day (data not shown). In the UK sample, functional social support was associated with a higher level of cortisol on the leisure day, but there was no relationship with CAR on the leisure day.

TABLE 8.16 SOCIAL SUPPORT CORRELATE OF CAR ON LEISURE DAY

	Model 1		Model 2		Model 3	
	β (SE)	***P***	**β (SE)**	***P***	**β (SE)**	***P***
Age	-.255 (.177)	.156	-.269 (.189)	.162	-.319 (.195)	.052
SES	-.170 (.170)	.324	-.173 (.172)	.322	-.240 (.172)	.169
Smoking	.008 (.150)	.960	.012 (.153)	.727	.018 (.149)	.902
BMI	-.204 (.165)	.224	-.203 (.167)	.231	-.167 (.163)	.313
Waking time	.057 (.164)	728	.059 (.165)	.725	.074 (.161)	.647
Negative affect			-.034 (.156)	.828	-.203 (.177)	.256
Social support					-.311 (.168)	.071
R^2		.140		.141		.204

8.12 Comparison of UK and Japanese data

The next phase of the analysis compared level of positive affect in the UK and Japanese samples, and relationships with health-related biology and behaviour. As noted in the data analysis section above, this analysis used a subsample of the UK participants, and also excluded 6 Japanese participants who had missing cortisol data. The final sample sizes for each measure is shown in table 8.17. The total UK sample size was 136 and the total Japanese sample was 52.

TABLE 8.17 DATA AVAILABILITY

	N (%)	
	UK sample	**Japanese sample**
Data type		
Total sample	136	52
Questionnaire data		
Marital status	133	52
PANAS	134	52
Social support	136	51
Lyubomirsky Happy Scale	134	52
Health behaviours		
Smoking	134	52
Drinking	131	52
Exercise moderate	134	52
Exercise vigorous	135	52
Fruit/Vegetables	136	51
EMA work day	128	52
EMA leisure day	129	52
Cortisol work day		
CAR	129	52
Slope	136	52
Total	136	52
Cortisol leisure day		
CAR	122	47
Slope	122	49
Total	128	47

8.13 Socio-economic status measures

In Chapter 7 the method used to calculate the SES variable for the Daytracker (UK) study was described. This process was repeated for the UK subsample and also the Japanese sample used in this chapter. Using the measures of educational attainment and occupational rank, a composite variable was calculated to assess

socio-economic status (see table 8.18 Socio-economic status did not vary with age in the UK sample ($F_{(2,132)}$=.43, *p*=.65). However, there was a significant association between age and SES in the Japanese sample ($F_{(2,4)9}$=9.07, *p*<.001), such that older participants had a higher level of SES. SES varied with personal income level in the UK (χ^2=19.97, df=4, p<.005) and in the Japanese samples (χ^2=13.79, df=4, p<.01).

TABLE 8.18 CALCULATION OF COMPOSITE SOCIO-ECONOMIC STATUS MEASURE

	UK N(%)	Japan N (%)
Low SES	29 (21.5)	22 (42.3)
Mid SES	64 (47.4)	15 (28.8)
High SES	42 (31.1)	15 (28.8)

8.14 Participant Demographics

Although the Japanese participants used in this sub-sample were slightly older on average, this difference was not significant between the two samples after manipulation of this variable as described in section 8.3 (see table 8.19). The Japanese participants had significantly lower BMI compared with the UK sample and the average BMI was below the recommended minimum of 18 ($F_{(1,177)}$=112.56, *p*<.001). Half the UK participants were married compared with only 34% of the Japanese. This difference could be accounted for by a higher number of co-habiting couples in the UK who were not married, as this is more socially acceptable in the UK compared to Japan. Very low rates of cohabitation have been reported amongst unmarried Japanese (Tsuya & Bumpass, 2004). However, it was not possible to test this prediction as participants were only asked to rate if they were married or in a marital like relationship. It has been suggested that the percentage of Japanese women who will never marry is on the increase and, at the same time, the age for marrying is also rising (Retherford, Ogawa, & Matsukura, 2001). In both countries there were more

participants who had a degree compared to those who did not. However, more of the UK participants had a degree level education compared with the Japanese ($F_{(1,185)}$=4.95, p<.05). Educational attainment in the Japanese sample was reasonably evenly split between those with and without a degree. Participants were also divided based on occupational rank, and the results were fairly comparable. Nearly two thirds of the UK sample were in the lower occupational group and just over two thirds of the Japanese.

TABLE 8.19 PARTICIPANT DEMOGRAPHICS.

	UK		**Japan**		**Comparison**
Demographic factors	**N (%)**	**Mean (sd)**	**N (%)**	**Mean (sd)**	
Age	136	36.04 (9.10)	52	38.62 (11.28)	$F_{(1,186)}$=2.62 p=.107
Body Mass Index	129	23.61 (4.31)	52	16.90 (2.13)	$F_{(1.177)}$=112.5 p<.001
Married	66 (49.6)		18 (34.6)		
Educational attainment					
less than degree	37 (27.4)		23 (44.2)		$F_{(1,185)}$=4.95, p<.05
degree or higher	98 (72.6)		29 (55.8)		
Occupational rank					
Lower	85 (63)		36 (69.2)		$F_{(1,185)}$=.461, p=.424
Higher	50 (37)		16 (30.8)		

8.15 Affect

Descriptive statistics for affect measures are displayed in table 8.20. The mean PANAS affect score in the UK was 6 points higher than in Japan and this difference was significant ($F_{(1,\ 184)}$ =22.00, p<.001). This shows that UK participants rated themselves as happier most of the time. There was also a significant difference in the level of negative affect between the two countries, such that Japanese participants had higher negative affect ($F_{(1,184)}$=5.86 p<.05). These findings show that not only do Japanese participants have higher negative affect, they also have lower positive affect.

However, there was no difference in happiness ratings on the SHS. The SHS asks participants to rate how happy they feel compared to others, and how happy they feel generally. The PANAS on the other hand required participants to rate how much they experienced many types of positive affective state. Finally, there was no difference in levels of optimism between the Japanese and the UK samples. The optimism scale reflects beliefs about future events, and therefore measures a different type of positive well-being compared to PANAS positive affect and SHS. This finding shows that whilst Japanese participants have lower rates of positive affect, they do not have a difference in levels of optimism.

TABLE 8.20 AFFECT DESCRIPTIVE STATISTICS

		UK		Japan		Comparison
Affect measures	**Range**	**N**	**Mean (sd)**	**N**	**Mean (sd)**	
PANAS Positive affect	10-50	134	33.0 (7.4)	52	27.5 (7.1)	$F_{(1, 184)}$= 22.00, *p*<.001
SHS happiness	0-24	134	15.6 (5.1)	52	14.4 (4.5)	$F_{(1, 184)}$= 2.13, *p*=.146
Optimism	0-24	136	11.7 (6.3)	52	12.0 (4.4)	$F_{(1, 186)}$= .066, *p*=.798
PANAS Negative affect	10-50	134	19.60 (6.81)	52	22.48 (8.3)	$F_{(1, 184)}$= .5.86 *p*<.05

Happiness as measured by EMA was significantly lower on both the work day ($F_{(1, 179)}$=52.87, *p*<.001) and the leisure day ($F_{(1, 181)}$=20.49, *p*<.001) in the Japanese compared to the UK sample (see table 8.21). In both counties affect on the leisure day was higher than on the working day. However, happiness amongst the Japanese on the leisure day was more comparable with the UK work day ratings. These results suggest that Japanese participants have a significantly lower profile of happiness as measured by momentary assessment on both working and leisure days. These results are also shown in figure 8.2.

TABLE 8.21 EMA HAPPINESS DESCRIPTIVE STATISTICS

		UK		Japan		Comparison
	Range	**N**	**Mean (sd)**	**N**	**Mean (sd)**	
Mean happiness						
Work day	1-5	129	3.0 (.64)	52	2.2 (.77)	$F_{(1, 179)}$=52.87, *p*<.001)
Leisure day	1-5	131	3.4 (.72)	52	2.9 (.80)	$F_{(1, 181)}$=20.49, *p*<.001)

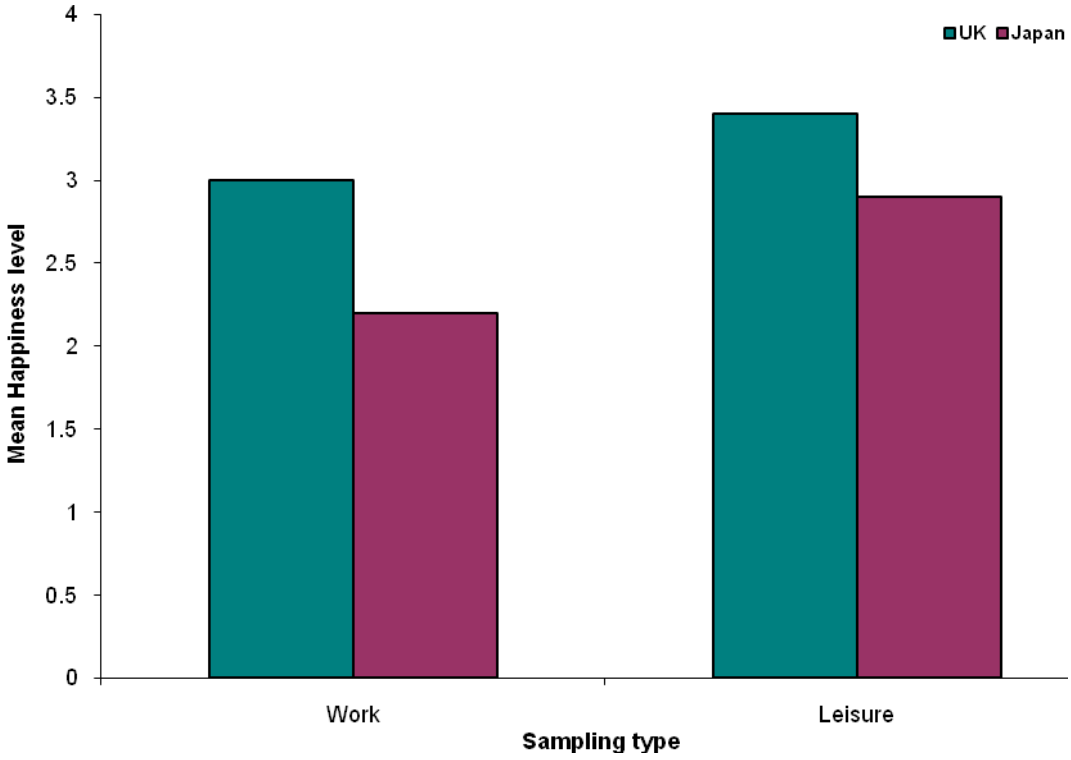


FIGURE 8.2 EMA MEAN HAPPINESS RATINGS UK AND JAPAN

8.16 Health behaviours

Nearly all Japanese participants were non-smokers with only one person reporting herself to be a current smoker (see table 8.22). This represents a significant difference in smoking between countries, with 17% of the UK sample being current smokers. There were also more non-drinkers amongst the Japanese sample, although the percentage of heavy drinkers was comparable (χ^2=18.41, df=2, p<.001). In the Japanese sample, 40% were non-drinkers, compared to only 12% of the UK sample. This may reflect cultural differences in levels of smoking and drinking between the two

countries, particularly as this sample included only women. Almost no Japanese participants (94%) consumed the recommended 5 portions of fruit and vegetables daily, compared with 73% of UK participants and this represented a significant difference between countries (χ^2=11.64, df=1, p<.001). However, this study did not include other measures of a healthy diet, and a different pattern of results may have emerged if fat in the diet, or eating recommended levels of oily fish had been examined. The majority of the Japanese sample never took part in moderate or vigorous exercise, with only 7% falling into each category and 75% never took any vigorous exercise. In the UK, more participants took part in vigorous activity. More than half of the Japanese participants did not take part in moderate exercise, which is very different to 12% of the UK sample. The difference in rates of moderate exercise was significant between countries (χ^2=42.55, df=3, p<.001) and this was also the case for vigorous exercise (χ^2=16.36, df=3, p<.001).

TABLE 8.22 PERFORMANCE OF HEALTH BEHAVIOURS

	UK	Japan	Comparison
	N (%)	N (%)	
Health behaviours			
Smoking			
Non smoker	110 (82.1)	51 (98.1)	Fisher's exact test
Current smoker	24 (17.3)	1 (1.9)	*p*<.005
Alcohol			χ^2=18.41, df=2, p<.001
Non drinker	15 (12.2)	21 (40.4)	
Moderate drinker	106 (80.9)	28 (53.8)	
Heavy drinker	9 (6.5)	3 (5.8)	
Fruit and vegetable consumption			χ^2=11.64, df=1, p<.001
Less than 5 per day	100 (73.5)	49 (94.2)	
5 per day or more	36 (25.9)	2 (3.8)	
Moderate exercise			χ^2=42.55, df=3, p<.001
Never	16 (11.9)	30 (57.7)	
1-3 times/month	34 (25.4)	7 (13.5)	
1-2 times/week	53 (39.6)	11 (21.2)	
3+ times/week	31 (23.1)	4 (7.7)	
Vigorous exercise			χ^2=16.36, df=3, p<.001
Never	57 (42.2)	39 (75)	
1-3 times/month	27 (20)	4 (7.7)	
1-2 times/week	33 (24.4)	5 (9.6)	
3+ times/week	18 (13.3)	4 (7.7)	

8.17 Biological measures

Cortisol profiles for both samples are shown in figure 8.3 (work day) and 8.4 (leisure day). As in Chapter 7, cortisol was analysed using three measures: total cortisol output; cortisol slope over the day; and cortisol awakening response. Cortisol values on waking did not differ between UK and Japanese participant on either the work or the leisure day (see table 8.23). Japanese participants had a lower CAR compared to the UK participants on both the work ($F_{(1, 187)}$=7.66, p<.01) and the leisure day ($F_{(1, 167)}$=6.77, p<.05; see table 8.23). On the leisure day the CAR for Japanese participants was rather flat showing a smaller rise in response to waking up. There was a significant difference in cortisol levels between the UK and Japanese samples, with the Japanese participants having a higher total cortisol on both the work ($F_{(1, 186)}$=15.98, p<.001) and the leisure day ($F_{(1, 186)}$=15.98, p<.001). The cortisol slope was steeper for the UK participants on both the work ($F_{(1, 189)}$=15.73, p<.001) and the leisure day ($F_{(1, 181)}$=16.09, p<.001), indicated by the higher value. Within-country analysis showed a significant difference between total cortisol on work compared with leisure days (UK $F_{(1, 129)}$=28.98, p<.001; Japan $F_{(1, 46)}$=27.69, p<.001).

TABLE 8.23 CORTISOL MEASURES

	UK		Japan		Comparison
	N	Mean (SD)	N	Mean (sd)	
Cortisol Measure					
Cortisol awakening response					
Workday	129	8.22 (9.6)	52	4.12 (7.2)	$F_{(1, 187)}$=7.66, p<.01)
Weekend	122	4.93 (8.3)	47	1.35 (7.1)	$F_{1, 167)}$=(6.77, p<.05)
Total cortisol					
Workday	136	7.17 (.43)	52	7.43 (.26)	$F_{(1, 186)}$=15.98, p<.001)
Weekend	128	6.97 (.40)	47	7.22 (.25)	$F_{(1, 173)}$=15.51, p<.001)
Cortisol slope					
Workday	136	.016 (.02)	52	.009 (.01)	$F_{(1, 189)}$=15.73, p<.001)
Weekend	134	.021 (.02)	49	.010 (.01)	$F_{(1, 181)}$=16.09, p<.001)

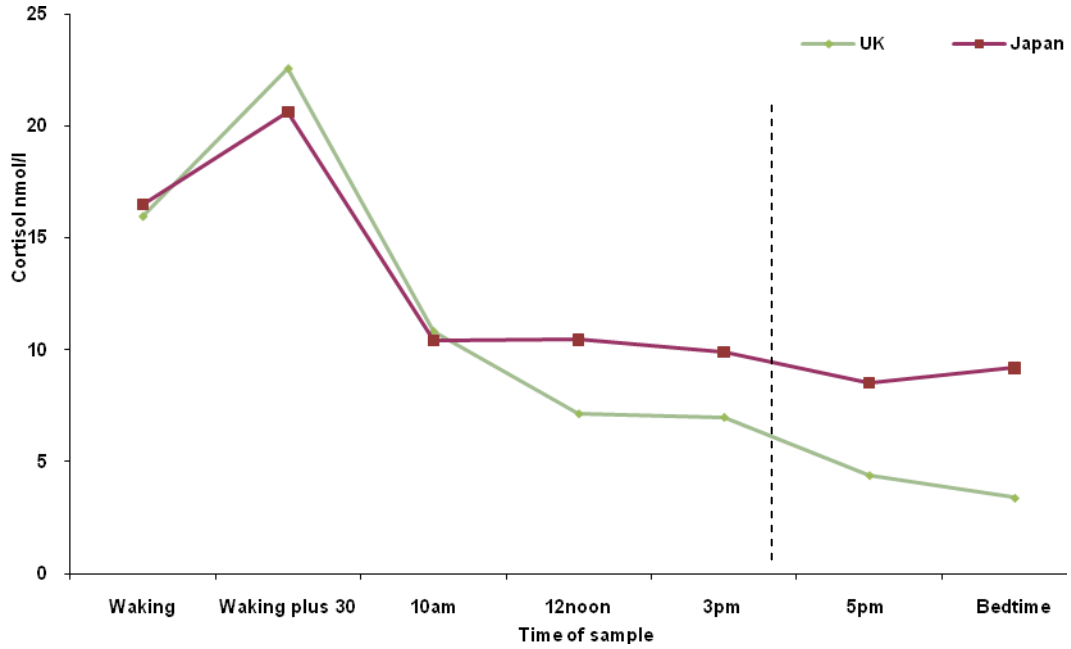


FIGURE 8.3 CORTISOL PROFILE UK AND JAPAN WORK DAY

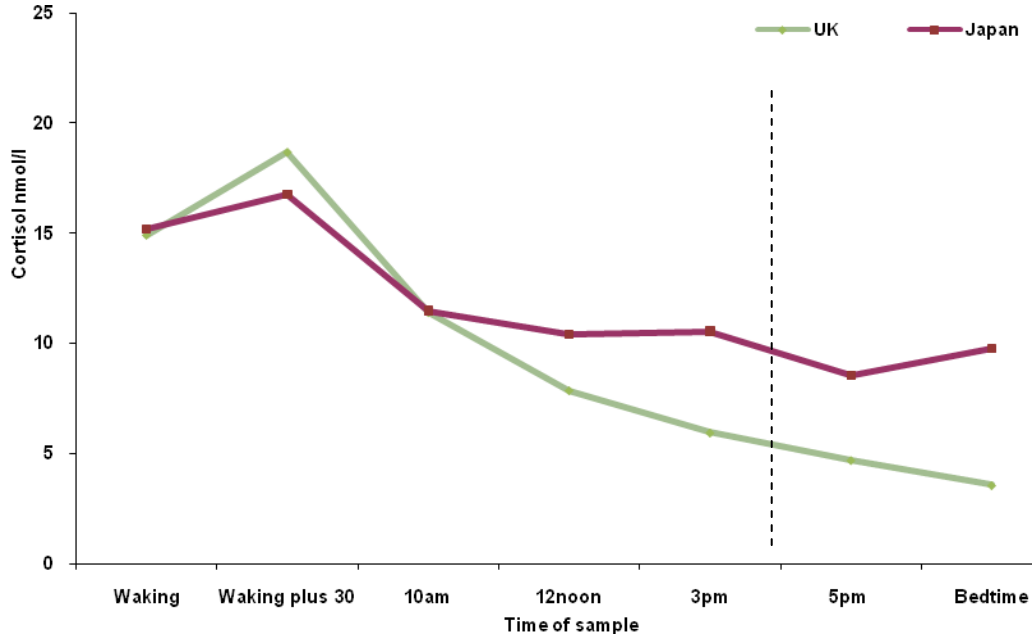


FIGURE 8.4 CORTISOL PROFILE FOR UK AND JAPAN LEISURE DAY

Initial analyses presented in table 8.23 are univariate ANOVA comparisons. Analysis of covariance was also performed, using each cortisol measure as the dependent variable and adding age, SES, negative affect, BMI, smoking status and

social support as covariates. Work day total cortisol remained significantly different between the UK and Japan after controlling for these covariates ($F_{(1, 166)}$=10.30, p<.01) and this was also the case for total cortisol on the leisure day ($F_{(1,155)}$=5.81, p<.05). The slope of decline over the day also remained significantly different between countries on the work day ($F_{(1, 166)}$=4.33, p<.05) and the leisure day ($F_{(1, 161)}$=7.63 p<.01). However, for the CAR, the difference between countries only remained significant for the leisure day ($F_{(1, 166)}$=4.33, p<.01) and not the working day ($F_{(1, 149)}$=1.08, p=.30).

8.18 Discussion

8.18.1 Relationship between positive well-being and social support

The first section of this chapter investigated the relationship between marital status and functional social support with well-being measures in a Japanese sample. This was an extension of the analysis carried out in chapter 7 using the Daytracker UK data. Based on the results of chapter 7, it was predicted that marital status would be related to PANAS positive affect but not with optimism or EMA measures of happiness. In the UK sample, marital status was related to measures of eudaimonic well-being, but not to momentary assessments measured by EMA or DRM or PANAS positive affect. The Japanese study replicated this, as marital status was not related to optimism, EMA happiness or PANAS positive affect. It is probable that there was a lack of statistical power in the Japanese sample, as the number of married participants was quite low (n=18). It was also predicted that marital status would not be related to performance of health behaviours, which was supported in the Japanese sample. Finally, it was hypothesized that being married would be associated with lower cortisol on the leisure day. This was not supported, as no relationship between marriage and total cortisol, or any of the other social support and cortisol variable, was found. Taken together, these findings suggest that marriage in the Japanese sample is associated with a similar

range of emotional factors and health behaviours compared to the UK sample but shows a different relationship with biology.

TABLE 8.24 SUMMARY OF RELATIONSHIP BETWEEN SOCIAL SUPPORT AND POSITIVE AFFECT AND OPTIMISM (✓ SIGNIFICANT RELATIONSHIP, × NON-SIGNIFICANT RELATIONSHIP, FSS FUNCTIONAL SUPPORT SIGNIFICANT IN COMBINED MODEL)

	Marriage (hypothesis 1a)	**Functional support (hypothesis 1b)**	**Combined model (hypothesis 1c)**
PANAS positive affect	×	✓	FSS
Optimism	×	✓	FSS
EMA mean work day	×	×	×
EMA mean leisure day	×	✓	FSS

These findings are somewhat surprising given the literature in this area. Marriage in Japan has very different meanings and responsibilities compared to the UK, and has also changed significantly within the last 50 years (Holloway, Suzuki, Yamamoto, & Mindnich, 2006). Traditionally, marriage in Japan was a practical living option rather than a romantic union (Inoue & Ehara, 1999). Married couples were most likely to live with the husband's parents, and the children were raised in this household, making three-generation families most common. However, in the recent past, this trend has shifted with more young Japanese seeking emotional, romantic and sexual fulfilment in a marriage partner (Research Institute for Hi-Life, 2001). Whereas grandparents living within the home used to make a significant contribution to the childcare demands, mothers are now more likely to stay at home and less likely to pursue long-term careers (Yamamoto, 2001).

Opportunities for men and women in Japan are still significantly different. For example, in 1999 only 33% of women completed a university level education, compared with 50% of men. This is also demonstrated by parental wishes for their

offspring, with 80% of parents wanting their sons to go to university compared with only 50% wanting the same for their daughters. This difference also extends to employment, with men being more likely to be employed full time in comparison with women, and also in more high status occupations (Ogasawara, 2001). The gender gap in employment may be entirely explained by women leaving work after marriage, and during child-rearing years with few women returning to full time work after having children (White, 2002). Overall, this represents significant differences in the socio-demographic and qualitative correlates of marriage for women in Japan and the UK. Based upon the findings of chapter 7, it was expected that functional social support to be positively related to all measures of well-being with the exception of optimism. Further, it was expected that higher rates of functional support would predict exercise levels, and also cortisol on the leisure day. These findings partially supported these predictions. Firstly, it was found that functional support was positively related to PANAS positive affect, optimism and also EMA ratings on the leisure day. However, there was no relationship for EMA mean happiness on the work day or very happy ratings. Functional support was not related to exercise, or any of the other health behaviour measures. Finally, although functional support was not related to total cortisol on the leisure day, there was a significant relationship with CAR on the leisure day, indicating that higher levels of social support predicted a lower cortisol response to waking.

Overall, this presents a different set of findings to the UK study and suggests that functional support may have differential benefits and costs across cultures. However, it was found that marriage shared a similar pattern of relationships with positive well-being measures between the two samples. Marriage appears to be related to eudaimonic measures of well-being, but not momentary or more hedonic type measures. It is unfortunate that it was not possible to include the Scales of Psychological Well-being in the Japanese sample, as it would have been interesting to compare these findings. Being married was associated with lower total cortisol on the

leisure day in the UK sample, but was associated with a flatter cortisol awakening response on the working day. This suggests that the benefits or stresses of being married may have differential effects of neuroendocrine outcomes. The lower overall cortisol on the leisure day suggests a protective effect for married participants in the UK sample. However, the flatter cortisol response to waking in the Japanese sample may be predictive of future negative health outcomes. For example, a blunter CAR has been associated with a range of health problems (Kudielka & Kirschbaum, 2003). Other studies have suggested that a flat CAR is associated with increased perceived stress (Schulz et al, 1998; Steptoe et al, 2000). In relation to the literature reviewed above, it is possible that married women in Japan are more likely to have higher levels of perceived stress than married women in the UK. It is also likely that this stress would be more likely to manifest on working days, when the morning routine is busier and time dependent when compared with the leisure day.

Some studies in Japan have found links between social support and health behaviours. For example, a prospective study investigating stroke and CHD incidence and mortality, reported higher rates of exercise, lower rates of sedentary behaviour and lower smoking amongst both men and women with higher levels of social support (Ikeda et al, 2008). However, alcohol intake was not different between levels of social support. Further, this study found that whilst women were more likely to report receiving emotional support than men, protective effects of social support were only found amongst men. Other studies have supported this, reporting that the stress buffering effects of social support on depression were only significant in men. Protective effects of social support, particularly marriage, on various types of mortality have been reported to be stronger for men than for women (e.g. Berkman & Breslow, 1983). It is possible that this is due to associated differences in mediating pathways, which include both neuroendocrine measures and health behaviours. Therefore, if it was possible to extend this study to include men, stronger relationships between social support and health-related biology and behaviour may have been apparent.

The Japanese sample was drawn from a rural area of southern Japan. Rural areas are characterised by tight networks of relationships particularly between middle-aged women, which are reciprocal and mutually beneficial. Women in Japan may be more likely to maintain emotionally intimate relationships with friends, and in this cultural context, this can lead to stress due to increased feelings of having to reciprocate support received and feelings of indebtedness. However, having multiple social roles was found to be a protective factor against stroke incidence in one study (Honjo, Iso, Inoue, & Tsugane, 2008) but this effect was only found for working, higher educated women. This finding suggests that social roles within the home can increase psychological resilience and provides evidence that social support can act as a buffer against negative health outcomes. This study also reported higher rates of smoking and alcohol consumption in working women with a single social role.

Cultural differences in willingness to seek and use social support in stressful situations have been identified (Kim, Sherman, Ko, & Taylor, 2006; Sasaki & Kim, 2008; Taylor et al, 2004). This research has tended to show that people from a more collectivist nation, such as Japan, are more cautious in seeking support due a shared assumption that one should not burden network members with problems as this increases feelings of obligation and stress for the support giver. A series of studies have been carried out comparing Asian Americans with European Americans and the findings of these support this assumption. For example, Asian Americans were less likely to report seeking support as a means for dealing with stress than European Americans. Gender differences have also been identified, suggesting that Asian American females were more likely to seek social support compared to males (Kim et al, 2006). A series of studies designed to examine why Asian Americans seek social support less than European Americans found that Asians reported a higher level of unsolicited support, suggesting that support was automatically available; secondly a belief that one should take care of one's own problems and thirdly concerns about

negative effects to relationships by increasing burden (Kim et al, 2006; Taylor et al, 2004).

Further, studies have suggested that while social support is beneficial in collectivist cultures, there are important differences in how people seek and receive social support across cultures (Kim, Sherman, & Taylo, 2008). For example, in Western cultures, social support may be operationalised through explicit seeking and receiving, whereas in Asian cultures a more implicit model of social support may be apparent (Taylor et al, 2007). Explicit support refers to actively seeking out and using network members to discuss problems and share stressful experiences. Examples of using implicit support include thinking about close friends and being in the company of others without actually discussing problems, and is similar, but not the same as, perceived social support. This theory was tested by measuring cortisol reactions to the Trier Psychosocial Stress Test. Taylor et al (2007) hypothesized that cortisol responses would be lower for Asian Americans using implicit support, but for European Americans would be lower using explicit support and the findings of the study supported this. Further, Taylor et al (2007) found that when using the alternative form of support (implicit for Europeans and explicit for Asians) cortisol levels were higher than in the control group where no support was suggested. This finding has been extended to explain how European Americans and Koreans (in Korea) deal with daily life stressors (Kim et al, 2008). European Americans used explicit support whereas Koreans used implicit support.

Kim and colleagues have also presented some interesting findings relevant to social support and well-being. European Americans' use of explicit support was associated with life satisfaction, whereas for Koreans both explicit and implicit social support was positively associated with life satisfaction. However, use of explicit support was also associated with increased feeling of regret and shame, showing a negative correlate of social support specific to Asian cultures. Other studies have suggested that social support would have a stronger relationship with well-being in Asian cultures in

comparison to western cultures. This theory is based on the difference between independent cultures where the self is valued based on difference from others and interdependent cultures where the self is judged on comparisons with others. This theory suggests that well-being in western cultures should depend more on achieving independence, whereas in Asian cultures will depend more on relationships with others. Empirical findings have supported these theories, with life satisfaction in Euro-Americans being predicted by self-esteem, but for Asians being predicted by both self-esteem and relational harmony (Kwan, Bond & Singelis, 1997). Further, social support was more strongly related to positive affect amongst Japanese and Filipino samples than European Americans, and this relationship remained after controlling for self-esteem. This shows that perceived emotional support has significant benefits for positive affect over and above associated increases in self-esteem caused by higher levels of social support. However, this theory suggests that social support is more important for predicting positive affect in Asian as opposed to western cultures. In contrast to this, it was found that functional social support was related to more of the positive well-being variables in the UK compared to the Japanese sample. In the Japanese sample, functional social support was strongly related to optimism, so that higher levels of support were associated with higher levels of optimism. This was in contrast to the findings from the UK study, where support was not related to optimism. Later analyses in this chapter showed no difference in the mean level of optimism between the two samples. In the UK, optimism emerged as a quite separate facet of psychological well-being in comparison to other measures of affect. It was related to SES whereas other measures of affect were not. Optimism was also not correlated with any of the other affect variables.

8.18.2 Positive well-being and health-related biology and behaviour

The final set of hypotheses investigated in this chapter concerned levels of positive well-being and health-related biology and behaviour in the UK and the Japanese samples. Here, it was predicted that the UK sample would have higher levels of positive well-being, lower levels of cortisol and increased performance of healthy behaviours. Partial support for this hypothesis was found in terms of positive well-being and health behaviours, with differences in the expected direction for PANAS positive affect and negative affect, EMA measures of positive affect, fruit and vegetable consumption and rates of exercise. However, there were no differences in levels of optimism or happiness measures by SHS. Not smoking and drinking lower amounts of alcohol were higher in the Japanese sample in comparison to the UK. For cortisol measures, the results supported the predictions made in this thesis. All cortisol measures were lower for the UK sample compared to the Japanese.

As indicated by the quotation at the beginning of this chapter, it is likely that attaining happiness and positive well-being is a desirable outcome for people everywhere. However, the crucial difference across different cultural contexts is what constitutes happiness and positive experience (Diener & Suh, 2000; Kitayama, Markus, & Kurokawa, 2000). There may be considerable variation in the meaning, motivation and predictors of happiness in different cultures (Uchida et al, 2004). Generally, happiness in Western cultures is considered a personal achievement that is controlled by the individual, who is motivated to experiences that maximise positive affect. In Eastern cultures, happiness and positive affect is more closely tied with social relationships, specifically the self in relation to others. Happiness in these cultures could be considered to arise from social harmony (Kitayama et al, 2000). This extensive research base suggests that the actual experience of affect should not alter between countries, but that the meaning of positive affect may vary. The results of this study showed a clear difference in measures of momentary positive affect across both a working day and a leisure day and also a difference in PANAS positive affect. In both

cases, positive affect was significantly lower in the Japanese sample compared with the UK. This finding suggests that levels of positive affect are consistently higher in Western cultures when measured using both momentary and retrospective measurement. The difference in levels of affect cannot be explained by a tendency for one sample to over or under rate their responses, as there was no difference in mean levels of optimism or SHS happiness between the two countries. Previous studies have also supported this, with consistent evidence that subjective well-being is higher in individualistic societies (e.g. Diener et al, 1995). However, Oishi (2000) argued that this difference in reported affect is unlikely to be accounted for by increased positive affect in Western countries, but more likely to be the result of increased memory of positive events. Momentary ratings of affect should have been made at the time specified within the sampling diary, and therefore it cannot be differences in memory that are explaining this difference. Therefore, the Japanese participants either experienced fewer happy events, or at least they tend to interpret these events as neutral, rather than happy occasions.

This predicted difference in the motivation and predictors of happiness may explain the pattern of positive well-being scores identified between countries. Although a clear difference in momentary affect and PANAS affect was found, there was no difference in SHS happiness or optimism. This suggests that these measures are tapping different underlying aspects of happiness that are predicted by opposing factors. Optimism is considered more of a personality variable and refers to a belief in positive outcomes in the future. Mean optimism scores between the two countries were extremely similar, suggesting that optimism is a stable trait that is unaffected by differences in cultural values. PANAS positive affect requires participants to remember how many times they had experienced particular types of emotion in the previous two weeks. Therefore this measure also constitutes the active memory of particular instances of positive affect. This is further support for the work of Oishi (2000) who suggested that Asians are less likely to be motivated to remember positive occasions.

One way of assessing the accuracy of reported levels of affect between two samples is to measure factors which should correlate with well-being. For example, studies have suggested a link between positive well-being and lower cortisol profiles (e.g. Steptoe et al, 2005). If the Japanese sample has a lower pattern of positive affect ratings, and also higher cortisol profiles, this suggests that levels of affect are indeed lower in this sample. If the difference in reported levels of affect was explained by differences in remembering instances of affect, response bias or some other culturally determined factor, then aspects such as cortisol profiles should be similar between the two countries. The results of this study showed that the Japanese sample had consistently lower positive well-being ratings, coupled with consistently higher total cortisol, flatter CAR and a flatter cortisol slope.

Measurement of cortisol in psychophysiological research is limited in Japanese research settings, and few studies have been published which report cortisol data for healthy participants. There are no studies which compare levels of positive well-being and cortisol. However, studies have confirmed a relationship between depression and cortisol in Japanese samples (e.g. Takebayashi et al., 1998) and also reported a cortisol rise after a stressful situation (Takai et al., 2004). These findings suggest that cortisol levels respond to psychological stress in Japanese participants in the same ways as UK and other country samples. Therefore, differences in the pattern of cortisol secretion cannot explain these results.

8.18.3 Strengths and limitations

The results presented in this chapter represent a unique and significant contribution to the understanding of positive well-being, social support and relationships with health-related biology and behaviour in two different samples. It was also possible to compare positive affect measured using standard retrospective assessment and momentary measures of affect using EMA. It was also possible to

include measures of positive well-being. This study first presented results comparing the relationship between social support and positive well-being in the Japanese sample, and it was possible to discuss differences between this sample and the UK sample as presented in chapter 7. Further, the associations between social support and health behaviours and neuroendocrine activity were analysed.

The main limitation with the Japanese Daytracker study is the exclusion of the Social Network Index, Day Reconstruction Method and Ryff's Scales of Psychological Well-being. These measures were excluded at the request of the Japanese research team who were concerned over the amount of time participants would need to invest in the study. It was not possible to examine relationships between structural social support and affect, biology or behaviour in the Japanese sample and compare these to the UK Daytracker Study. This has meant that this study was unable to assess the relative importance of the different types of social support in the two samples. It is possible that structural support has a very different meaning in the Japanese cultural context, in which collectivism is valued compared to western cultures. The UK study in chapter 7 reported some interesting differences in the assessment of affect as measures by Ecological Momentary Assessment and DRM. EMA measures were a single response item of "happiness" whereas the DRM affect score in the UK was a composite variable of 3 types of positive affect. It would have been interesting to examine any potential differences in these two types of affect. For the Ryff scales, it would have been particularly informative to investigate differences in the level of eudaimonic well-being between these two samples. Previous studies have identified differences in reported levels of positive affect and subjective well-being, but have not investigated eudaimonic well-being. In the UK sample, marital status was related to these measures but not to momentary assessments of affect. This study was unable to test the consistency of this relationship between the two samples.

There were also some limitations with the Japanese sample. The SES measure was correlated with age in the Japanese sample, but there was no difference in the UK

sample. This may suggest that the two samples differ on the basis of demographic variables, which may have an effect on the results within each country. However, the age of each sample was no different after exclusion of some participants. Secondly, the Japanese sample was significantly smaller than the UK sample. The size of the sample meant that some statistical analyses were inappropriate, for example it was not possible to carry out health behaviour analysis with smoking and alcohol consumption in the Japan sample, and may have contributed to a lack of variation within some measures. For example, only one Japanese participant was a smoker and therefore it was not possible to examine differences between rates of smoking and social support between countries. If it had been possible to increase the Japanese sample then a more representative split may have been apparent. The Japanese sample was drawn from a rural university in southern Japan and therefore may not be representative of other more urban areas. Larger districts such as Tokyo and Osaka are now becoming increasingly westernised, so using a rural sample can be considered a strength of this study due to reduced impact of westernisation.

Although significantly different levels of smoking and alcohol health behaviours were found in Japan compared with the UK, it is likely that these differences are primarily due to cultural factors and are not accounted for by psychosocial correlates. According to WHO statistics for 2004, 26% of females in the UK are smokers, compared to just 13.4% of Japanese women. When examined in relation to male rates of smoking, the cultural differences are even more apparent. Rates of smoking in the UK are comparable between men and women, with 27% of men smoking and 26% of women. However, the gender disparity in smoking in Japan is far greater, with 52.8% of men smoking compared with just 13.4% of women. Similar statistics are available for heavy drinking, with 10% of UK females classified as heavy drinkers compared with 4.9% of Japanese women.

8.18.4 Conclusion

This study aimed to investigate the relationships between social support and positive well-being, health-related biology and behaviour in a Japanese sample. It also aimed to assess levels of positive well-being in Japan and the UK to identify associated differences in cortisol and health behaviour. Relationships between marriage and positive well-being were comparable between the two country samples, and this is somewhat surprising given previous research in this area, which has identified significant differences in the meaning and responsibilities of marriage between the two countries. Interestingly, it was found that functional social support was significantly correlated with optimism in the Japanese sample in contrast to the UK sample, but other relationships were similar. Analysis of positive well-being variables suggested that Japanese participants were consistently less happy compared with the UK sample. However, there were no associated differences in optimism of happiness measured by the SHS scale. This scale requires participants to rate themselves in relation to others. Therefore, the lack of difference in levels of SHS happiness between the two samples is particularly interesting. Previous research suggested that absolute happiness is not likely to be different between countries, but does offer explanations for differences in reported affect. Finally, levels of cortisol were also significantly higher in the Japanese sample. This suggests that lower levels of positive well-being combine with negative biological pathways in Japan, and vice versa in the UK sample. Overall, this study has provided evidence that functional social support was most strongly related to positive well-being and optimism. However, there were differences in the relationship between social support, health behaviour and biology between the two samples. For example, social support was not related to exercise and there was no relationship between cortisol and social support in the Japanese sample, although both of these relationships were significant in the UK sample.

CHAPTER 9: FINAL DISCUSSION

This thesis has presented a series of three studies investigating the relationship between protective psychosocial factors and health-related biology and behaviour. Broadly, the three studies tested associations between aspects of positive well-being and social support with neuroendocrine measures and performance of healthy behaviours. This thesis also presented a cross-cultural analysis both in chapter 5 and chapter 8 to test the consistency of observed associations in different samples. The associations between different types of protective psychosocial factors were investigated in chapters 7 and 8 in order to assess whether there may be important interdependent relationships that may act together to affect health-related biology and behaviour. There are many different biological and behavioural pathways which may mediate the link between psychosocial factors and future health outcomes. The studies presented in this thesis have focussed on the neuroendocrine system by measurement of cortisol, and performance of health behaviours. The results of each study have been discussed within chapters 5, 7 and 8 and therefore this chapter will present a more general discussion of the overall results in terms of the aims of thesis. First, the aims, hypotheses and findings of each study will be reviewed and this will be followed with a comparison of the results across all studies. The strengths and limitations of the thesis as a whole will be discussed in order to critically discuss the contribution of this thesis to existing literature. The ideas for future studies informed by the results of the work are also included here. Finally, the main points and key messages arising from this thesis are summarised.

9.1 Thesis aims

The three studies in this thesis were carried out with the following aims:

1) To test the relationship between three types of protective psychosocial factors
2) To evaluate the association between protective psychosocial factors and health-related behaviours and biology
3) To test the consistency of observed associations in cross-cultural samples

9.1.1 Findings across the three studies

The first aim of this thesis was to investigate the relationship between psychosocial factors, to examine if these may be protective as part of a wider network of psychosocial aspects. This aim was tested in studies 2 and 3, using different operational definitions of three psychosocial factors; social support, positive well-being and optimism. These studies found that social support was related to certain aspects of positive well-being, including positive affect as measured by PANAS, momentary affect and eudaimonic well-being in the second study. Further, these analyses showed that functional social support was more strongly related to positive well-being constructs compared to structural support and marital status. Whilst there were a number of findings which supported the hypothesis that social support would be related to positive well-being, and to optimism, there were also findings that did not support this prediction. For example, there was no relationship between social support and optimism in either the UK or the Japanese samples. Therefore, the findings of this thesis can only provide tentative support for this hypothesis, and suggest that more work is needed to further untangle this complex relationship.

The second aim of the thesis was to investigate the relationship between protective psychosocial factors, health behaviour and biology. This aim was tested by

each of the three studies presented in this thesis. The first study found a relationship between life satisfaction and five health behaviours: not smoking, taking exercise, eating fruit regularly, reducing fat intake and using sun protection. This relationship was not altered when controlling for beliefs about the importance of each behaviour to health, which has been shown to be a powerful predictor of health behaviour. The second and third studies investigated both health behaviours and biology. The second study found that exercise was related to functional social support, but found no other relationships between social support and health behaviours. Marriage and functional social support were found to relate to cortisol measures. In the final study, social support was not related to exercise, and there was no significant relationship between marriage or social support and cortisol. These findings suggest that the relationship between psychosocial factors, health behaviours and cortisol may be small and only significant in specific relationships. Therefore, in terms of the second aim, this thesis concludes that psychosocial factors may be related to health behaviours (as shown in studies 1 and 2) but the relationship with biology is less clear.

The final aim of the thesis was to test the consistency of observed associations in cross-cultural sample, to examine the effects of historical, political and social factors. The first study found reasonably consistent patterns between life satisfaction and health behaviours in the three geopolitical regions studies. The third study presented a comparison of UK and Japanese samples and found that higher levels of positive well-being were apparent in the UK, along with increased performance of health behaviour and a more favourable cortisol profile. However, studies two and three found some interesting differences in results. For example, in the Japanese sample, social support was related to optimism, but there was no association in the UK sample. Taken together, these findings suggest that there are important cultural factors influencing the relationship between psychosocial factors, and also the relationship between psychosocial factors and health behaviour.

9.1.2 International Health Behaviour Survey

The specific hypotheses tested in the IHBS were:

- life satisfaction would be positively associated with increased performance of healthy behaviours
- relationships between life satisfaction and health behaviours would vary across geopolitical regions
- if the relationship between life satisfaction and health behaviours was explained by health-related motives, the relationship would diminish when including health beliefs into each model

The findings presented in chapter 5 largely support these hypotheses. Higher life satisfaction was associated with not smoking, reducing fat intake, taking regular exercise, wearing sunscreen and eating more fruit and vegetables but was not associated with alcohol consumption or eating more fibre. These relationships varied across geopolitical regions: Smoking and exercise were associated with life satisfaction in all regions; sun protection in Western Europe & USA and Central & Eastern Europe; fruit consumption in Central & Eastern Europe and Pacific Asia and fat avoidance in Central & Eastern Europe only. Alcohol consumption and fibre intake were not associated in any of the 3 regions. Finally, health beliefs did not explain the association between life satisfaction and health behaviours. This suggests that other factors explain the positive link between life satisfaction and increased performance of prudent health behaviours.

9.1.3 Daytracker Study UK

The specific hypotheses tested in chapter 7 were:

- marital status would be associated with higher levels of positive well-being, as measured by PANAS positive affect, Scales of Psychological Well-being and momentary assessments.
- Structural social support would be positively related to PANAS positive affect and the Scales of Psychological Well-being. Structural support would not be related to momentary assessments of affect.
- Functional social support would be associated with higher levels of PANAS positive affect, optimism, Scales of Psychological Well-being and EMA and DRM momentary assessments.
- Functional social support would emerge as the strongest independent correlate of PANAS positive affect, optimism, EMA and DRM ratings when entered into a combined model.
- Marital status would be associated with more prudent health behaviours.
- Structural social support will be positively associated healthy behaviours.
- Functional support would be positively related to fruit and vegetable consumption and exercise, and inversely related to smoking and alcohol consumption.
- Marital status would be associated with a more favourable cortisol profile, as measured by total cortisol output, slope and CAR, on both the work and leisure day.
- Structural social support would not be related to CAR or cortisol slope, but will be related to total cortisol output.
- Functional social support would be related to a lower total cortisol output but not with CAR or cortisol slope.
- When entered into a combined model, functional social support would be independently related to cortisol.

- Relationships between marital status, structural social support, functional social support and health-related behaviours would be stronger for those with high positive affect.
- Relationships between marital status, structural social support, functional social support and neuroendocrine function would be stronger for those with high positive affect.

These hypotheses were partly supported by the results presented in chapter 7. Being married was associated with higher levels of eudaimonic well-being but was not related to momentary assessments of affect. Structural social support was related to eudaimonic well-being and PANAS positive affect in line with the predictions. However, structural support was also related to EMA assessments on the work day and DRM assessments on both days contrary to the predictions. Functional support was related to all measures of well-being with the exception of optimism and was also an independent correlate of eudaimonic well-being, PANAS positive affect, EMA ratings on the leisure day, and DRM ratings on the leisure day. These findings supported the hypotheses presented in this thesis.

Being married and having a greater social network were not associated with increased performance of any of the health behaviours that were assessed. This was contrary to the prediction and the findings of previous research in this area (e.g. Kaplan et al, 1994). However, functional social support was related to increased exercise so that those with higher levels of support took part in more exercise compared to those with lower functional support. These findings suggest significant differences in the relationship between different types of social support and health-related behaviours. It was found that having a larger social network and a marital partner were not important for increased performance of health behaviours, but that the quality of the support relationship was more important. However, it was predicted that functional support would also be associated with lower rates of smoking, less heavy alcohol consumption

and increased fruit and vegetable consumption. The lack of findings for these health behaviours suggest that other factors are important.

Being married was related to a lower total cortisol output on the leisure day, but was not related to other measures of cortisol on either the work or the leisure day. Structural support was not related to any cortisol measures. Functional social support was related to higher cortisol levels on the leisure day, in direct contrast to the relationship with marriage. It is interesting that marital status and functional support show opposite relationships with total cortisol on the leisure day, and the explanation for this finding is not clear. Higher levels of functional support may be related to increase arousal and activity across the leisure day, leading to a higher level of cortisol.

Finally, it was predicted that relationships between social support and health-related biology and behaviour would be stronger for those with lower positive well-being. This hypothesis was not supported, as the findings were contradictory. Functional social support was related to exercise but only for participants with higher PANAS positive affect. Being married was related to higher cortisol on the work day for unhappy participants, but was related to lower cortisol on the leisure day for married participants. This suggests that the interaction between social support and positive affect is important for determining associated relationships with health-related biology and behaviour.

9.1.4 Daytracker Study Japan

The specific hypotheses tested in chapter 8 were:

- Being married would not be associated with optimism or EMA positive affect in Japan, but would be associated with PANAS positive affect.
- Functional social support would be positively related to all measures of happiness in Japan.

- In combined regression models, functional social support would be an independent determinant of positive affect.
- Marital status would be not associated with health behaviours
- Functional social support would be positively related to exercise, but not be related to smoking, alcohol consumption or fruit and vegetable consumption.
- Marital status would be associated with lower cortisol on the leisure day, with no relationships for CAR or cortisol slope
- Functional social support would be associated with higher cortisol on the leisure day, with no relationships for CAR or cortisol slope.
- EMA positive affect, PANAS positive affect and SHS happiness would be lower in Japanese than UK women.
- There would be higher levels of smoking, less physical activity and lower fruit and vegetable consumption in Japan.
- The Japanese sample would have lower cortisol output over the day.
- The possibility of differences in the CAR and cortisol slope was also tested, with predictions for this hypothesis being less clear.

In the Japanese sample, marriage was not associated with any of the positive well-being variables. This is mostly in line with the findings from the UK sample, where marriage was only related to eudaimonic measures of well-being. Functional social support showed some similar relationships with positive well-being in the two samples. PANAS positive affect was associated with functional support in the UK and in Japan, as were EMA ratings on the leisure day. However, in Japan functional support was also related to optimism and was not related to EMA very happy ratings as it was in the UK.

There were no relationships between health behaviours and marriage or functional social support in the Japanese sample. This is generally in line with findings from the UK, although this thesis did find evidence that functional support was related to increased exercise in the UK sample. There was no relationship between social

support and cortisol in the Japanese sample. This is in contrast to the UK sample, where marriage was related to lower cortisol on the leisure day, and functional support was related to higher total cortisol on the leisure day.

9.2. Comparison of findings relating to health behaviours

Performance of health behaviours was presented in chapters 5, 7 and 8. Rates for health behaviours given in chapter 5 for Western Europe & USA show a different pattern compared to those from the UK sample in chapter 7. In chapter 4, 24% of the sample were smokers, compared to only 16% in chapter 7. Thirty-five per cent of those from this region were heavy drinkers in chapter 5, compared to only 6% in chapter 8. About 50% of participants from chapter 7 took part in exercise at least once per week, which was considerably lower than the 71% from Western Europe and the USA in chapter 5. Similarly, the pattern of results from chapter 8 compared to those from the Pacific Asia region in chapter 5 was very different. Only 1 of the Japanese sample in chapter 8 was a smoker compared to 11% from the region as a whole in chapter 5, and 26% of the sample from chapter 8 were exercising once per week compared to 66% in the regional sample from chapter 5. One reason for these inconsistencies is the difference in countries included in each analysis. Chapter 5 presents results from the whole of Western Europe & the USA, whereas 57 includes only UK participants. Similarly, results from chapter 4 include other countries from the Pacific Asian region, whereas chapter 8 only includes Japanese participants. However, the most obvious reason for the difference in rates of health behaviour is perhaps the samples used in each study. The sample included within chapter 5 were university students, aged on average 20.5 compared with full-time female employees that were included in chapters 7 and 8, with an average age of 33.7 for the UK and 38.5 in Japan. Therefore participants from the Daytracker studies were significantly older than those included

within chapter 5 they had very different lifestyles and responsibilities, and were at a different stage of life than the students in chapter 5.

The results presented in chapter 5 showed a consistent pattern of relationships between life satisfaction and health behaviours. The relationship between social support and health behaviours was assessed in chapter 7 and chapter 8, and no relationships were found with the exception of functional social support and exercise. Chapter 8 also analysed relationships between social support and health behaviours in those with high and low positive affect. Only one difference was found, namely that functional social support was associated with increased exercise for happy participants. The three sets of analyses all assessed the relationship between health protective behaviours and psychosocial factors. However, the first study only focussed on life satisfaction but the analyses presented in chapters 7 and 8 focussed on aspects of social support.

There are many ways that social support may affect health behaviours, such as increased general well-being leading to an increased desired to maintain a healthy lifestyle but also through pressures from social contacts. However, social networks do not always lead to increased levels of healthy behaviours, as smoking amongst peers has been identified as a consistent predictor of smoking in a long term twin study (White, Byrnes, Webster, & Hopper, 2008). There has also been recent evidence suggesting that obesity can be spread through social networks (Christakis & Fowler, 2007). The findings from the studies suggest that life satisfaction and social support show differential relationships with health behaviours. This is perhaps not surprising, given the differences in samples and measures between the studies. Chapter 5 assessed the relationship between health behaviours and life satisfaction, which is a cognitive assessment of well-being, relating to how satisfied participants are with their life as a whole. If this thesis was able to assess the relationship between life satisfaction, social support and health behaviour within the same sample, it is possible that different results may have emerged.

9.3 Comparison of Daytracker UK and Daytracker Japan

9.3.1 Positive well-being measures

Although the data presented in chapter 8 are not directly comparable to those from chapter 5, due to the use of regional divisions in chapter 5 and country divisions in chapter 8, it is possible to identify some interesting results. Levels of positive well-being measured by momentary assessment and PANAS were consistently higher in the UK sample compared with the Japanese sample, but there were no differences in optimism or the SHS measure of happiness. The results presented in chapter 5 showed that the Pacific Asia region had lower overall levels of life satisfaction compared to the Western Europe & USA region. The results from each chapter suggest a similar pattern of results, in that participants from the Pacific Asia region have lower levels of positive well-being when assessed using a variety of different measures. (Inglehart & Klingemann, 2000) found that levels of positive well-being measured using ratings of life satisfaction and ratings of happiness were higher in Britain compared with Japan. A large database comparing levels of happiness and life satisfaction in 44 countries, reported a mean level of life satisfaction of 6.4 in Japan and 7.1 in the UK (Veenhoven, 2009). This represents a difference of 20 places in the whole country ranking for happiness. Past research has suggested that happiness is only related to income amongst those with lower earnings, with estimates that once a country has reached a target of 15,000 USD per head, happiness is not related to income. The results of the studies are in support of this, as the two countries have a similar level of wealth, with Japan ranking 2nd in terms of GDP and the UK 6th. Therefore it seems unlikely that variation in wealth may explain this finding.

Another possibility is differences in the understanding, or meaning of words used to measure happiness, between countries. It is possible that the concept of happiness varies from language to language and therefore elicits different ratings.

However, data are available on happiness levels for people who live in countries where more than one language is spoken. One such example is Switzerland, which has French, German and Italian speakers. Each three groups of speakers had comparable happiness ratings, and higher ratings compared to their language equals in France, Germany and Italy (Inglehart & Klingemann, 2000).

The results presented here showed a consistent pattern of lower positive well-being for Japan than the UK. This included measures of life satisfaction, positive affect and momentary happiness. Life satisfaction is typically considered a cognitive aspect of subjective well-being, with happiness conceptualised as a more affective experience. However, the Japanese participants did not differ in levels of optimism compared to the UK participants, suggesting that this is measuring a different aspect of well-being. The Pacific Asia region used in chapter 5 contains life satisfaction data for Japan as well as Thailand, Korea and Taiwan. Although this may present variability in the ratings between countries, previous studies have suggested happiness to be comparable across Japan, Taiwan and Korea (data for Thailand not included; Inglehart & Klingemann, 2000). This study used an index of happiness based on percentage happy and percentage satisfied with their lives. As reviewed in chapter 8, literature in this area suggests that the meaning of happiness may vary across countries, with particular differences being apparent between Western and Eastern countries. Generally, these studies argue that these cultural differences in meaning may lead to variations in remembering happy events, or when completing standardised questionnaires, suggesting that Eastern countries have a lower overall level of happiness. One relevant argument here is the motivations governing happiness between the two cultures, and social acceptability of happiness. Uchida et al (2004) argued that in the West, individual pursuit of happiness is related to personal attributes such as success and pride, and therefore individuals are likely to affirm these attributes. This affirmation may serve to alienate social relations, due to feelings of envy and perceptions of arrogance. In Eastern cultures, where happiness is thought to

depend more on social harmony, this personal affirmation would be counter-productive for happiness (Diener, Suh, Smith, & Shao, 1995). Therefore, quest for independence may be one aspect of the motivation for happiness between the two cultures. If this argument is correct, the pursuit of happiness in the West should be based on independent goals, whereas in the East, happiness should be related to interdependent goals. This has been supported in a study measuring goals and happiness (Oishi & Diener, 2001). Life satisfaction was assessed at baseline amongst European Americans and Asians, and participants were also required to list 5 important goals they hoped to achieve in the following month. At follow-up one month later, life satisfaction was again measured along with achievement of those goals. Amongst European Americans, life satisfaction increase was related to achievement of independent goals, whereas for Asians, achievement of goals that were less independent was related to increase in life satisfaction.

In chapters 7 and 8 the levels of trait and state measurement of affect in both the UK and in Japan were compared. Using EMA and DRM measures in the UK sample, positive affect was found to be higher on the work day compared to the leisure day. PANAS positive affect was positively correlated with both EMA and DRM measures of positive affect on the work and leisure day as shown in table 7.9, chapter 7. Further, a similar pattern of relationships between PANAS positive affect and momentary assessments of mood with structural and functional social support was found. Functional social support was related to both PANAS positive affect and all momentary measures of mood (see table 7.38). This was partially replicated in chapter 8, as functional support was related to PANAS positive affect and EMA happiness, but only on the leisure day.

9.3.2 Social support findings

The work undertaken in this thesis has added to the previous literature investigating relationships between social support and health-related biology and behaviour in a number of important ways. Firstly, the majority of previous studies tended to focus only on one aspect of social support, with researchers including measures of either structural social support or functional social support. It has been suggested that the area of social support and health research would benefit from increased study of the effects of both of these types of social support within the same study. This will allow for more detailed understanding of the relationship between different types of social support and how they differentially impact on health outcome. Structural and functional support may have very different effects on both biological and behaviour pathways that mediate the protective relationship that has been established between social support and future health outcome. In chapter 7, structural social support was not related to either cortisol or health behaviour, whereas functional support was related to cortisol and to exercise.

This thesis also included marital status as an indicator of social support, but this did not emerge as an independent correlate of health behaviours. However, being married was associated with lower overall cortisol on the leisure day in chapter 7, and also to a flatter CAR on the working day in the Japanese sample (see chapter 8). These two findings suggest an important protective effect for those who are married. Previous findings have tended to offer support for a positive benefit of marriage on performance of health behaviour. This thesis did not find any evidence that being married was associated with increased exercise, consumption of fruit and vegetables or decreased smoking and alcohol consumption. One reason for this could be due to the effect of marital interaction and couple dynamics affecting health behaviours. Studies have suggested a strong correlation between spousal partners' performance of health behaviours, and suggest that the similarity of health status between partners is largely attributable to shared health behaviour (Wilson, 2002). Spousal influence has

reportedly led to health enhancing behavioural change, such as stopping smoking (Umberson, 1992). This type of behavioural diffusion can be tested using intervention studies, which aim to capitalise on influence between couples to lead to increased behaviour change. However, evidence from these studies suggests that while including partners does have a positive impact, this only lasts for a short period of time after the intervention. This has been reported in studies focussing on weight loss, medication adherence and smoking cessation (Black, Gleser, & Kooyers, 1990; Lichtenstein & Glasgow, 1992; Palmer, Baucom, & McBride, 2000). Therefore, when assessing the relationships between marital status and performance of health behaviour, it may be important to consider the associated health behaviours of the spouse.

There has been recent emerging evidence suggesting that positive well-being and social support may be beneficial for future health outcomes as part of a wider constellation of health protective psychosocial aspects (e.g. Steptoe et al, 2008a). The findings from chapters 7 and 8, which investigated the relationships between aspects of social support and different measures of positive well-being, have added valuable work to the literature in this area. Table 9.1 shows the relationships between social support and positive well-being variables measured in both samples. For PANAS positive affect, functional social support was an independent correlate in both samples, showing that this is a consistent relationship. The average reported level of positive affect was significantly lower in the Japanese sample (see table 8.20 chapter 8). However, this did not affect the relationship with functional support. PANAS positive affect measures experience of a range of positive moods over the previous two weeks. It is interesting that only functional support was related to positive affect measured in this way, suggesting that the experience of support is relevant in both the UK and Japanese samples. In terms of the momentary assessment of happiness, functional support was an independent correlate of affect in both countries, but only on the leisure day. This shows that experience of social support was only relevant for happiness on the leisure day, and this may be due to increased freedom of activity and ability to

choose who to be with. On the work day it is more likely that one has less choice about who to spend time with, this will largely be constrained to work colleagues.

TABLE 9.1 RELATIONSHIP BETWEEN SOCIAL SUPPORT AND WELL-BEING VARIABLES

	Marriage (hypothesis 1a)		**Functional support (hypothesis 1c)**		**Combined model (hypothesis 1d)**	
	UK	**Japan**	**UK**	**Japan**	**UK**	**Japan**
PANAS positive affect	✓ (.054)*	×	✓	✓	FSS	FSS
Optimism	×	×	×	✓	×	FSS
EMA mean work day	×	×	✓ (.057)*	×	×	×
EMA mean leisure day	×	×	✓	✓	FSS	FSS
EMA very happy work day	×	×	✓	×	×	×
EMA very happy leisure day	×	×	✓	×	FSS (.067)*	×

Interestingly but perhaps not surprisingly, the results show a consistent pattern for affect ratings to be lower on the work day than on the leisure day. This was the case for both EMA and DRM ratings in the UK sample and EMA ratings in the Japanese sample. This finding has a number of important implications including the effect of mood states on work. There has been interest in this area for a number of years, following the seminal paper relating dispositional, or trait, affect as a predictor of job satisfaction (Staw, Bell & Clausen, 1986). Further research identified important links between state measures of affect and experiences within the workplace (e.g. Brief, Butcher, & Roberson, 1995). The impact of emotions within the work place was developed into a comprehensive theory known as the Affective Events Theory (Weiss & Cropanzano, 1996). This theory argues that both trait and state mood can influence attitudes towards one's job and also behaviour at work. Higher status jobs may have more frequency of events that can lead to momentary positive mood such as

satisfaction or pride, but also to higher trait affect such as receiving positive feedback from a manager.

It would be interesting to examine the relationship between affect on the work and leisure day within participants. This would have allowed for testing of whether those with higher positive affect on the work day also had higher positive affect on the leisure day. It is possible that some people are more stimulated during the working day, and thrive in their work environment, but have fewer opportunities for positive emotion during their days off. However, it may be a more plausible argument that those with higher happiness at work also tend to be happier at the weekend. This would suggest a correlation with trait measures of happiness such as PANAS positive affect. There are other factors that may interact with happiness on the work day and the leisure day, such as feelings of being in control. Being happy at work may be related to control within the day, as being able to plan one's own workload and tasks to be completed have been linked with increased job satisfaction (Furnham & Drakeley, 1993). However, for those with family commitments, control may be lower on the leisure day due to taking care of others or social engagements that cannot be altered. Therefore the relationship between control and happiness may be different for the work day and the leisure day.

EMA ratings of happiness on the work day were significantly lower for the Japanese sample in comparison to the UK sample. One reason for this could be hours spent at work. Whilst it is widely regarded as fact that UK employees have a longer work day compared to other European countries, it is also a commonly held assumption that the Japanese have an incredibly long work day. Therefore this could be one explanation for the difference in levels of happiness on the work day between the two countries. However, ILO data showing the number of hours worked on average does not support this theory. Although this data may not be directly comparable to the samples used in this thesis, it does provide evidence that Japanese and UK women on

average work similar hours. Therefore, time spent at work may not explain lower rates of happiness on the work day in Japan compared with the UK.

Examination of the pattern of affect between the two countries suggests that the Japanese women had lower affect on average across all measures, with the exception of optimism and the SHS happiness measure. It is also possible to examine the percentage of the population who are employed in each country. In 2008 in Japan, 42% of women were employed compared to 62% of men, which represents a substantial difference in employment rates between men and women. In the UK of the same year, 46% of women were employed compared with 56% of men, so while more men are employed compared with women, there is less difference in the UK.

9.3.3 Positive well-being findings

Within this thesis, it was possible to investigate different methods of measuring affect. These included retrospective assessment using standardised questionnaires such as PANAS, and momentary assessment using both ecological momentary assessment and the day reconstruction method. There are a number of advantages to using momentary assessment of mood as opposed to the more traditional retrospective measurement. Standardised questionnaires, which are designed to measure trait affect, are influenced by both memory and perception. Current mood state is also a dominant influence on reporting previous mood (Stone & Shiffman, 2002). Judgements of life satisfaction, which would not be thought to vary widely from week to week, have also been shown to be affected by current mood state, or even other transient influences such as the weather (Krueger & Schkade, 2008). This can lead to errors in completion of assessments that result in an inaccurate picture of trait affect. However, momentary assessments require participants to rate how they are feeling at that given moment and may therefore represent a more accurate profile of affect. Momentary assessments can be completed a number of times over the assessment period, as

required by the researchers' aims and objectives. Ecological momentary assessment has been used successfully within a variety of domains including psychopharmacology (Moskowitz & Young, 2006) and industrial psychology (Beal & Weiss, 2003).

In chapter 7 the day reconstruction method was used as well as EMA measures. The DRM is a relatively new measure and therefore there are currently few published studies that have utilised this measure. One study investigated the reliability of momentary affect measurement using the DRM and compared this to a standard measure of life satisfaction (Krueger & Schkade, 2008). Krueger & Schkade (2008) found reliability between assessments one week apart using both measures. Interestingly, this study reported mean "net affect", which was operationalised as positive affect minus negative affect, during various social interactions. Participants had higher levels of positive affect during interactions with friends, followed by spouse/partner. Lowest levels of positive affect were apparent when interacting with one's boss and one's work colleagues. This supports the findings from the study that was presented in this thesis, that DRM affect was higher on the leisure day compared to the working day. It is possible that this could be in part due to increased interactions with friends and partners on the weekend days in comparison to the working day. It would be possible to test this prediction using DRM ratings over the evening periods, which were excluded from this analysis.

However, EMA data is also subject to participant compliance. Participants will be instructed at which times they should complete EMA assessments of mood, and compliance with these times is essential for building an accurate picture of momentary mood. It is not possible to guarantee that participants will complete ratings at the times specified by researchers. Missing assessments, and then completing more than one rating at the same time, means that EMA ratings can be subject to the same biases as standard retrospective assessment of mood. Hufford (2007) reported findings from 8 studies that investigated compliance in EMA assessment. Paper diaries indicated 88% compliance with sampling protocol, whereas electronic compliance found that

participants were only compliant in 54% of assessments. Compliance was low even when reminders where used, and participants admitted back-filling diaries.

Stone, Shiffman, Schwartz, Broderick, & Hufford (2003) were able to compare participant rated compliance with objective assessment of compliance. Covert photosensors were included in paper diaries, which were able to record times when diaries were opened by sensitivity to light. Reported compliance was 90%, but actual compliance was significantly lower at 11%. The most worrying finding from this study was that participants had, in some cases, filled in ratings ahead of the times stated. This means that participants were estimating their future mood state. In this study attempts were made to encourage participants to be compliant with the sampling protocol. At the research visit, the researcher stressed the importance of being honest in reporting sampling times, even if the time the sample was taken differed from the required time. In this way the researchers were able to exclude cortisol and EMA data for participants who fell outside of the requested sampling time. However, despite these measures it is still possible that some participants did not adher to the sampling protocol and this may have impacted on the results. Taking a saliva sample outside of the requested time would have distorted the cortisol profiles and could potentially have effects of the cortisol findings presented in this thesis.

9.4 Implications of main thesis findings

Research investigating psychosocial factors and future health outcomes has implications across a wide variety of settings. Consistent findings reporting a protective relationship between psychosocial factors and health are relevant for healthcare and public health policy. Research in this area can be used to inform an evidence-based approach to social policy. A key researcher in this area is Richard Layard, whose 2005 book “Happiness: Lessons from a New Science”, states “there is a paradox at the heart of our lives” (Layard, 2005). As nations have increased in wealth over the past 50

years there has been no associated increase in levels of happiness. Layard concludes that happiness is therefore not related to increasing wealth, and suggests that public policy should be more focussed on greater happiness for the greatest number of people. Layard argues that some of the correlates of happiness have increased, such as health and income. However, other aspects have deteriorated, such as family relationships. The followers of the field of happiness economics argue that governments can legislate for happiness. However, others argue that increasing happiness cannot be controlled by the state, as sustained happiness is more about long-term goal setting and over-coming difficulty than instant gratification. The findings of chapters 7 and 8 showed that happiness was consistently related to social support. In turn, social support was linked with favourable cortisol profiles in terms of awakening cortisol and total cortisol output on the leisure day. This is in line with previous research in this area. There is also evidence that positive well-being is linked with reduced cortisol (e.g. Steptoe, Wardle & Marmot, 2005). Increasing happiness and perception of social support is one way to reduce the burden of illness. Further research in this area may identify specific recommendations for how this can be achieved. However, this study does not show any interaction between positive affect and social support, or difference in the benefits of high social support among happy compared with less happy individuals. This might have been expected from the Layard perspective as social relationships have been identified as one important determinate of happiness. Whilst support for this aspect of Layard's argument was found, there were no associated benefits for cortisol or health behaviour measures.

One obvious implication of these findings is the development of interventions designed to increase feelings of positive well-being and perception of social support. The ENRICHD (Enhanced Recovery in Coronary Heart Disease) study was designed to alleviate clinical depression and target low perceived social support in an attempt to improve outcome after myocardial infarction. The intervention aimed to increase perception of available support by altering the environmental, behavioural and

cognitive aspects linked with a perception of low availability of support. This included social ties, social integration and an account of participants' need and satisfaction with different types of support. Although the main results were not significant (Berkman et al, 2003), a follow-up of 2481 patients found that increasing levels of perceived social support were associated with decreased mortality after 4.5 years, but only for those without clinical depression (Lett et al, 2007). The findings of this intervention therefore suggest that increasing levels of perceived social support are effective at increasing favourable outcome in an unhealthy population. The findings of both chapter 7 and 8 reported that functional social support was consistently related to aspects of positive well-being. In chapter 7 functional support was independently related to eudaimonic well-being, positive affect and EMA and DRM happiness on the leisure day. In chapter 8, this thesis found that functional support was related to positive affect, optimism and EMA happiness on the leisure day, which suggests that these findings are consistent across cultures. Therefore interventions studies designed to increase levels of perceived social support may also be effective at increasing overall levels of positive well-being. This may lead to an increased positive effect on future health outcomes. The ENRICHD study was carried out with unwell patients who had existing low levels of social support. Therefore it is not possible to extend these findings to healthy populations, or those with average levels of support, for whom the benefits of social support interventions may not be so marked. Overall, the results of the three studies presented in this thesis suggest consistent links between aspects of positive psychosocial factors and health-related biology and behaviour. Taken together with the preliminary findings from the ENRICHD trial, this suggests that interventions could be developed to increase positive well-being and social support. These may result in positive changes to the pathways that mediate the relationship between protective psychosocial factors and long term health outcomes.

9.5 Future directions for study

The findings from the studies reported in this thesis highlight a number of possibilities for future research. Firstly, the results presented in the three results chapters utilise between-person analysis, for example examining differences in levels of health behaviour for those with differing levels of social support. An alternative method would be to analyse within-person effects, which would allow for a different area of investigation. In the Daytracker study, within-person analysis could be used to identify differences in the relationship between social support and positive well-being for individual participants. Using these methods would hold constant other factors such as age, SES, ethnicity for each participant. It would also be possible to investigate comparisons between affect on the work and leisure day within participants and this may add some interesting findings.

There are a number of further analyses that could be carried out using the DRM data. This thesis has made use of only a very small section of the capability of this measure. In chapter 7 data relating to mean levels of positive affect experienced over the day on the work day and on the leisure day was presented, weighted for duration. However, it is also possible to analyse affect in relation to the types of activity that are being carried out at the time of the affect rating, and to identify patterns in this data. Another relevant analysis plan would be to make use of the information regarding who was involved in each episode. When completing the DRM, participants are required to say what they are doing but also who they are with. This can range from no-one to strangers through to partner/spouse. It would then be possible to investigate reported levels of affect in relation to category of person involved, such as no tie, weak tie or strong tie. It may also be possible to generate an overall measure of time spent with a friend or partner over each monitoring period to investigate whether contact with social support providers is also linked to affect. There are a number of further possibilities that can be investigated using the rich DRM data. However, for the purposes of the thesis aims of this thesis, it was decided to use mean levels of affect.

Traditional social support research has examined the impact of structural social support and functional social support, which can be conceptualised as quantitative and qualitative measures respectively. However, a more recent aspect of social support research concerns the rapid proliferation of online social networking sites, such as Facebook, Twitter and MySpace. These sites have been defined as "web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system" (Boyd & Ellison, 2008). This aspect of social networks represents a new and interesting research area, which differs from traditional types of social network by increased sharing of personal information. Facebook was founded in 2004, and is now the second most trafficked website (Facebook, 2009). The site is available in 50 languages and has 250million active users worldwide. The average user has 120 friends, with whom they share updates about current activities, and upload photos and videos.

A large-scale research project has set up a database using network data from a class of college students in the US (Lewis, Kaufman, Gonzalez, Wimmer, & Christakis, 2008), and this can be analyzed in a variety of ways useful to the field of social support research. This resource will add to the available traditional measures of structural social support, which have been criticized for constraining the maximum network size. The database developed by Lewis and colleagues allows researchers to investigate multiple and dynamic network ties. The only method of sharing data with another user on Facebook is to enter a friendship relationship, but there is no opportunity to distinguish between strong and weak ties. Lewis et al have set up three types of friendship ties in order to address this limitation. It is possible to examine "friends", "picture friends" and "room, dorm and group mates". This final category has been developed with the college. Using databases such as this and other information from social networking sites allows social support researchers to investigate across a

number of domains. For example, networks ties, network density and heterogeneity of network contacts.

There is already a growing number of studies investigating the relationships between use of social networking sites and well-being. Studies suggest that online connections mirror relationships in offline life (e.g. Subrahmanyam, Greenfield, Kraut, & Gross). Ellison et al (2007) have found evidence of a relationship between use of social networking sites and social capital, which can be defined as the benefits one receives from social relationships (Lin, 1999). This relationship was only significant for those with low self-esteem, suggesting that these websites may be more beneficial for those with lower positive well-being. Other work has identified links between homogeneity of Facebook friends and subjective well-being. For European Americans, number of European American Facebook friends was positively related to life satisfaction at two times points (Seder & Oishi, 2009). However, for non European Americans, numbers of European American friends was not related to life satisfaction. In fact, as the number of same race friends increased for European Americans, life satisfaction also increased. There was no associated increase for non-European Americans. These findings suggest that racial/ethnic homogeneity of online social network members may be an important factor in assessing relationships with positive well-being.

Facebook and other similar sites are most used by young adults in the age range of 18-25. This group can be considered as in a phase of emerging adulthood, and are therefore subject to a number of stressors associated with their developmental stage. It is possible that use of social networking sites may offer an advantageous route to increasing social capital and positive well-being, through enhancing offline relationships and increases social network members (Steinfield et al, 2008). However, an increased amount of time spent online is not always linked with increased well-being. Time spent online for non-communicative purposes has been negatively related to well-being self-esteem, although instant messaging and chatroom use did have a

positive effect (Rohall, Cotton, & Morgan, 2002). Increased communication through online methods has also been related to decreased rates of depression in college students (Morgan & Cotten, 2003). However, there has also been evidence that using the internet to cope with adverse events such as stress can be associated with higher levels of depression and social anxiety, and lower rates of family cohesion (Gordon, Juang, & Syed, 2007). At this stage, studies utilising this new aspect of social support have not assessed potential relationships with physical health outcomes. However, as the evidence reviewed in this section has suggested, this may be an important new resource. Use of social networking sites is now prolific, at least amongst under-35s, and therefore must represent a significant new area of social support research.

The main aims of this thesis were to investigate relationships between protective psychosocial factors and health-related biology and behaviour. These studies focussed on social support in chapters 7 and 8, and life satisfaction in chapter 5. It was only possible to use cross-sectional analysis within this thesis due to limitations of time and research protocols. Therefore it is not possible to make any assumptions about the direction of the relationships reported here. An interesting method for future study would be to design an intervention study, such as the ENRICHD study as reviewed in section 8.4 above. That study focussed on increasing perception of social support, and assessed effects on mortality after MI. However, another method would be to measure the effects of increasing positive affect on the neuroendocrine system. Baseline level of cortisol and positive affect would be collected before an intervention would take place, in order to provide pre-intervention data. It would then be desirable to randomise participants into a control or intervention group. Interventions that can increase positive affect include listing three good things that happen each day and the cause of those events, writing a letter of gratitude to thank someone and identifying and using individual strengths (Seligman, Steen, Park, & Peterson, 2005). However, some interventions do not show a significant increase in positive affect in comparison to that of a control group. Some interventions are more efficacious at increasing affect related

to control groups, and any study would need to consider which intervention to include. After measuring cortisol levels at pre-test, during the intervention, and post-intervention, it would be possible to identify firstly is positive affect had been increased, and secondly if any increases were associated with changes in neuroendocrine measures.

9.6 General thesis limitations

The two final studies of this thesis included female only samples, and this represents a major limitation of this work. There is extensive evidence suggesting differential effects for the benefits of social support for men and women. Firstly, in terms of marital status, consistent gender differences have been identified in the sources of social support, types of support relationship and benefit of support for married men and women in terms of health outcomes (Cutrona, 1996). The evidence suggests that men tend to rely on support from marital partners as opposed to other network members in comparison with women, and also that support from wives impacts more on husbands' health than vice versa. Finally, married women are more likely to attempt to change their husbands' health behaviours than husbands to instigate change for their wives (Umberson, 1992). Work on marital quality and marital interaction also suggests a difference in health-related benefits of men and women (Kiecolt-Glaser & Newton, 2001). Although measures of marital quality were not included in this study, this evidence does suggest that social support within the marital relationship can impact on mediating pathways in different ways for men and women. Including only women in the Daytracker studies may explain the lack of relationship between marital status and health behaviours, if this pathway is more relevant for married men. It is possible that women are influenced more by other sources of social support, although only one relationship was found, between functional support and exercise. Women may also be motivated to perform healthy behaviours due to other

factors such as concerns over appearance, as each of the measures of health behaviour that was included impacts on weight and ageing.

As noted above, previous studies have suggested an important relationship between marital harmony and health-related biology and behaviour. The protective effects of being married are stronger for men than women (Berkman & Breslow, 1983) and evidence suggests that this may be due to negative effects of marital disharmony for women. For example, marital strain has been linked with development of ulcers for women (Medalie, Stange, Zyzanski, & Goldbourt, 1992), and a greater number of reported physical symptoms for women in low satisfaction marriages (Levenson, Carstensen, & Gottman, 1993). However, other studies have reported evidence of protective effects on self-reported health for women who reported high role quality (Barnett, Davidson & Marshall, 1991). Being in a discordant marital relationship has more negative health effects than not being married at all (Glenn & Weaver, 1991) and there are also detrimental effects for those going through separation or divorce. The measure of marital status in the sample used in this thesis consisted of those who were married as well as those who indicated that they were in a "marital-type relationship" and therefore included co-habiting couples. This means that "married participants" could have included those who had been in a serious relationship for a relatively short period of time, and those who had begun living together recently. Being married may confer different health effects compared to merely living together as partners. For example, research has shown that cohabiting couples are as likely to report distress as single adults, and have poorer health compared to married couples (Hughes & Gove, 1981; Ren, 1997). Therefore this represents a major limitation of the current work, and findings may have been markedly different if a more specific measure of marital status had been used. The beneficial effects of marriage may only become apparent after a certain amount of time, and similarly negative effects may not be apparent in the early stages of relationships.

The samples included in studies 2 and 3 consisted of women working at universities. Although for the purpose of this thesis, a homogenous working group was considered useful, it would also be interesting and beneficial to carry out this study with other groups of women. This could include shift workers such as health care staff, and women working in other professions such as retail. The sample included from the universities did offer a diverse range of job titles, ranging from facilities, administration, academic professors, scientific workers and managers, it is possible that groups of workers from other companies may differ. For example, demographic factors such as age and education may not be comparable between universities and other sectors.

Chapters 7 and 8 relied on collection of saliva by participants during their day-to-day lives. Whilst this increased the ecological validity of this study, and allowed this thesis to capture momentary assessments of affect within naturalistic settings, it also allowed for error due to lack of compliance with the sampling procedure. Estimation of the daily cortisol profile is reliant on participants providing accurate reports about the time of saliva collection. Especially important is the issue of waking up, and when to take the sample after becoming awake. Any delay between waking up and collecting the first saliva sample can have a significant impact on the cortisol awakening response and the cortisol slope over the day (Broderick et al, 2004). Although some control was added for this issue, in that this thesis excluded participants who indicated that there was a delay between waking up and collecting the first sample, this is not a failsafe measure. The timing of saliva collections was designed to be simple for participants whilst allowing capture of an accurate ambulatory cortisol profile. Samples were collected at 5pm, when participants should still be at the office on both sampling day; bed-time, waking, and 30 minutes after waking, when most participants would be within their own homes with the saliva kit easily accessible and 10am, 12noon and 3pm which on the work day at least should allow for collection within the office. As well as compliance with the sampling protocol in terms of time of collection, it was important for participants to adhere to other guidelines for saliva collection. This includes not eating

or drinking between the waking and waking plus 30 samples, not cleaning their teeth before samples, and recording if they had taken part in exercise, smoked or consumed alcohol. It is probable that not all participants accurately recorded these instances, and this may have impacted upon the cortisol profiles. However, as shown by the research reviewed in chapter 5, evidence suggests that participants are generally reliable with saliva collections. For example, only 21% of participants did not comply with the sample times for one or more salvia collection, with 26% being non-compliant for just one sample (Kudielka et al, 2003).

There are other factors that may affect the reliability of the cortisol estimates presented in the studies of this thesis. The HPA axis responds sensitively to both internal and external factors that can lead to differences in cortisol. Due to participant constraints it was only possible to measure cortisol on one work day and one weekend day. However, recent research has suggested that it may be necessary to collect cortisol samples over more than one day in order to obtain a reliable estimate. This was assessed in a comprehensive study that measured CAR over 6 consecutive days (Hellhammer et al, 2007). This study reported that CAR measured on a single day was largely affected by situational and state factors, and concluded that measurement over two consecutive work days was necessary for reliable estimates to be gathered. Hellhammer et al also found differences in the factors which affected CAR on the work and weekend days. Work day CAR was more affected by state factors whereas weekend CAR was more affected by trait factors. It is perhaps not surprising that different factors are related to CAR on the work and weekend days, as work days tend to follow similar patterns amongst working participants. Work days are characterised by a morning commute, a period of work, an evening commute and a period of leisure in the evening. However, wide variability in weekend activities would be expected. Some participants might be very physically active on the weekends, followed by social engagements in the evenings. Others may follow a quieter weekend routine involving periods of relaxation. These findings suggest that it is a more robust procedure to

obtain cortisol measures over more than one day, at least for measurement of CAR. However, it is also likely that situational factors affect total cortisol output and cortisol decline over the day.

The Daytracker Japan study consisted of a rather small sample size, of 58 women. Originally it had been intended to collect data from 100 women, but due to a number of factors this was not possible. Data collection is continuing, and therefore it will be possible to investigate these issues amongst a larger sample at a future time. The small sample size may have lead to a lack of power which means that effects could have been obscured. The small sample size was a particular problem with the health behaviour analyses, as there were very small numbers included in some groups. This meant that it was not possible to carry out analyses with alcohol, smoking or fruit and vegetable consumption. Due to the sample size, there may have been a lack of variability within both positive well-being and social support scores. Despite these constraints, this study has identified some interesting findings with the Japanese sample.

There are factors that may be important in explaining the relationship between social support, positive well-being and health-related biology and behaviour. This thesis controlled for a number of these factors, such as age, socio-economic status and negative affect, in the statistical analyses of this thesis. However, one aspect that could also be important is the role of children and domestic responsibilities. Having children living at home would have a significant impact on morning routines of the participants included within this thesis. Whereas those with no children at home would be free to plan their morning routine without too much consideration for others, those with children will, depending on their age, need to get them ready for school, dress and/or feed them. This can lead to increased rushing and decreased feelings of control in the mornings on work days. Having children would also have a significant impact on weekend activities. Those without children may be free to sleep for longer in the mornings and plan their day with no constraints. Work and family have long been

identified within the literature as “greedy institutions” leading to conflict and added stress as time in limited, and women may not be able to satisfy the needs of both (Coser, 1974). However, some theorists argue that occupying different social roles (such as mother, wife, employee) is beneficial and associated with increased sense of purpose and meaning in life (Waldron, Weiss, & Hughes, 1998). Other studies have identified health benefits for women with multiple roles (Waldron & Jacobs, 1989). Therefore it would have been interesting to examine the effect of social roles and analyse differences between parents and non-parents in terms of well-being and associated relationships with health-related biology and behaviour. However, this thesis has covered an extensive area and it is unfortunately not possible to include all parameters.

9.7 Conclusion

Recent evidence has suggested that positive psychosocial factors including positive affect, positive well-being and social support may be relevant for future health outcomes. Traditionally, research in this area has focussed on the impact of negative psychosocial correlates, in particular depression and anxiety. These negative factors have been consistently linked with higher rates of mortality and morbidity. Protective psychosocial aspects have now been shown to be independently related to a range of factors including health, illness and disability in a range of samples. One recent paper has suggested that positive well-being and social support may be part of a wider “constellation” of protective factors, and that when combined these confer a protective effect for health (Steptoe et al, 2008a, O’Donnell et al, 2008) . There are two broad pathways that may explain the relationship between psychosocial factors and health. The first is that positive factors may be associated with more prudent behavioural aspects such as not smoking and taking exercise. This may also be relevant for unhealthy populations, as positive affect after illness may lead to increased medication

adherence. The second possibility is that positive psychosocial factors may be mediated through biological pathways, which include neuroendocrine, inflammatory and immune responses. This thesis has added to the work in this area by investigating the impact of protective psychosocial factors on health-related behaviour and biology. The findings presented in this thesis support the hypothesis that psychosocial factors may act in combination to offer a protective effect for health. However, findings relating protective psychosocial factors and health behaviour and biology are less clear. Whilst this thesis has found some support for this relationship, a number of non significant results were reported. This underlies the importance of further investigation in the area of positive well-being and social support, and how these factors might interact to affect future health outcome.

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Appendix 1 – International health behaviour survey

HEALTH AND BEHAVIOUR SURVEY

This survey is designed to find out about behaviours and attitudes related to health. It consists of a number of sections in which you will be asked about various aspects of your lifestyle. Please be as honest as possible; there are no right or wrong answers. All the replies we receive will be anonymous and confidential, and will be used for research purposes only.

Age: _____	Male / Female
How tall are you ?	_____
How much do you weigh ?	_____
What is your main field of study ?	_____
Are you married?	[ ] YES [ ] NO
Do you have any children ?	[ ] YES [ ] NO
During college term time, do you live	[ ] At home with your parents or family? [ ] In college accommodation, or a rented room or apartment? [ ] Other (please specify)
In general, would you say that your health is	[ ] Excellent [ ] Very good [ ] Good [ ] Fair [ ] Poor
All things considered, how satisfied are you with your life as a whole?	[ ] Very satisfied [ ] Moderately satisfied [ ] No feelings either way [ ] Moderately dissatisfied [ ] Very dissatisfied

SECTION A

This section of the survey concerns various aspects of your lifestyle. Please read each question carefully, and put a tick or cross in the box next to the answer that is right for you.

Smoking

1. Please read all the following statements carefully and tick the box next to the one that best describes you.

a)	I have never smoked a cigarette, not even a puff	[ ]
b)	I have only ever tried one or two cigarettes	[ ]
c)	I used to smoke sometimes, but I don't now	[ ]
d)	I don't smoke cigarettes, but smoke a pipe or cigars	[ ]
e)	I smoke cigarettes, but not as many as one per day	[ ]
f)	I usually smoke between 1 and 10 cigarettes per day	[ ]
g)	I usually smoke between 10 and 20 cigarettes per day	[ ]
h)	I usually smoke more than 20 cigarettes per day	[ ]
	Would you like to reduce the amount you smoke?	[ ] YES [ ] NO

Eating

2.	How often do you eat breakfast?	[ ] Almost every day [ ] Sometimes [ ] Rarely or never
3.	How many meals do you eat each day? How many between-meal snacks do you eat each day?	_____ _____
4.	How often do you eat a meal that includes meat (beef, pork, lamb, veal, bacon, hamburgers, sausages etc) ?	[ ] At least once a day [ ] Every 2 or 3 days [ ] About once a week [ ] Less than once a week [ ] Never
5.	How often do you eat fruit ?	[ ] At least once a day [ ] Every 2 or 3 days [ ] About once a week [ ] Less than once a week [ ] Never
6.	Do you add salt to your meals?	[ ] Usually [ ] Sometimes [ ] Very occasionally [ ] Never
7.	Do you make a conscious effort to avoid eating foods that contain fat and cholesterol? If 'YES' what foods do you try to avoid ? _____	[ ] YES [ ] NO
8.	Do you make a conscious effort to eat foods that are high in fibre? If 'YES' what foods do you try to eat ? _____	[ ] YES [ ] NO
9.	Are you trying to lose weight ?	[ ] YES [ ] NO
10.	Are you dieting to lose weight ?	[ ] YES [ ] NO
11.	Do you consider yourself to be	[ ] Very overweight [ ] Slightly overweight [ ] About right [ ] Slightly underweight [ ] Very underweight

Sleep

12. On average, how many hours of sleep do you get in a 24 hour period ?	_____

Alcohol

13. The next questions are about drinking alcohol, including beer, wine, spirits and any other alcoholic drink

Would you describe yourself as	[ ] A non-drinker [ ] A very occasional drinker (special occasions only) [ ] An occasional drinker [ ] A regular drinker
If you are an "occasional" or "regular" drinker:	
On how many days over the past two weeks (14 days) did you have a drink ?	_____
On the days that you did drink, how many drinks did you have, on average ?	_____
Would you like to reduce the amount that you drink ?	[ ] YES [ ] NO

Physical activity

14.

Over the past 2 weeks (14 days), have you taken any exercise, (eg sport, physically active pastime)?	[ ] YES [ ] NO
If 'YES', what activity did you do? _____	
How many times over the past 2 weeks did you take exercise ?	_____
Would you like to increase the amount that you exercise ?	[ ] YES [ ] NO

Other behaviours

16.	When driving or riding in the front seat of a car do you wear a seat belt?	[ ] All of the time [ ] Some of the time [ ] Never [ ] I don't ride in cars
17.	If you do drive a car, do you travel within the speed limit?	[ ] All of the time [ ] Most of the time [ ] Some of the time [ ] Little of the time
	Over the last year, how many times did you drive when you felt that you had perhaps had too much to drink ?	[ ] Never ..... times
18.	Do you brush your teeth?	[ ] Twice or more a day [ ] About once a day [ ] Less than once a day [ ] Seldom or never
19.	Do you suffer from any health problems that have led you to visit a doctor or health clinic in the past four weeks? If 'YES', please give details:_____ _____	[ ] YES [ ] NO
20.	Have you taken any treatment (pills or medicines) over the past four weeks? (Eg. Painkillers for headache, vitamins, antibiotics)	[ ] YES, prescribed by a doctor [ ] YES, bought in a shop [ ] NO

21. **WOMEN only to answer question 21**

Do you know how to examine your own breasts for lumps ?	[ ] YES [ ] NO
If 'YES', about how many times a year do you examine your breasts for lumps?	[ ] Never [ ] 1-2 times per year [ ] 3-10 times per year [ ] More than 10 times
How long has it been since you had a cervical (Pap) smear test?	[ ] I have never had a smear test [ ] Less than one year [ ] 1 - 3 years [ ] More than 3 years

22. **MEN only to answer question 22**

Do you know how to examine your own testicles for lumps?	[ ] YES [ ] NO
If 'YES', about how many times a year do you examine your testicles for lumps?	[ ] Never [ ] 1-2 times per year [ ] 3-10 times per year [ ] More than 10 times

SECTION B

In this section, we are interested in how important you feel the following health measures are. Please circle the appropriate number.

		Of very low importance									**Of very great importance**
1.	To take regular exercise	1	2	3	4	5	6	7	8	9	10
2.	Not to eat too much animal fat	1	2	3	4	5	6	7	8	9	10
3.	To eat enough fibre	1	2	3	4	5	6	7	8	9	10
4.	To keep your body weight within the normal range	1	2	3	4	5	6	7	8	9	10
5.	To eat enough fruit	1	2	3	4	5	6	7	8	9	10
6.	Not to smoke	1	2	3	4	5	6	7	8	9	10
7.	Not to add too much salt	1	2	3	4	5	6	7	8	9	10
8.	To eat breakfast almost every day	1	2	3	4	5	6	7	8	9	10
9.	To get seven or eight hours sleep on most nights	1	2	3	4	5	6	7	8	9	10
10.	To brush your teeth regularly	1	2	3	4	5	6	7	8	9	10
11.	To wear a seatbelt when travelling in a car	1	2	3	4	5	6	7	8	9	10
12.	Never to drive after drinking alcohol	1	2	3	4	5	6	7	8	9	10
13.	To drive within the speed limit most of the time	1	2	3	4	5	6	7	8	9	10
14.	Not to drink too much alcohol	1	2	3	4	5	6	7	8	9	10
15.	To use sunscreen when you sunbathe	1	2	3	4	5	6	7	8	9	10
16.	To lose weight	1	2	3	4	5	6	7	8	9	10
17.	To make deliberate efforts to control or Avoid stress	1	2	3	4	5	6	7	8	9	10
19.	For women to examine their breasts at least once a month for possible signs of cancer	1	2	3	4	5	6	7	8	9	10
20.	For women to have a regular cervical smear test	1	2	3	4	5	6	7	8	9	10
21.	For men to examine their testicles at least once a month for possible signs of cancer	1	2	3	4	5	6	7	8	9	10

These questions concern your feelings about your life in general

		Strongly Disagree				Strongly Agree
1.	There is little I can do to change many of the important things in my life	1	2	3	4	5
2.	I often feel helpless in dealing with the problems in my life	1	2	3	4	5
3.	Whether or not I am able to get what I want is in my own hands	1	2	3	4	5
4.	What happens to me in the future mostly depends on me	1	2	3	4	5
5.	I have little control over the things that happen to me	1	2	3	4	5
6.	I can do just about anything I really set my mind to	1	2	3	4	5

These questions are about your background

1. What is your religion?

[ ] Buddhist
[ ] Christian (Catholic)
[ ] Christian (Protestant)
[ ] Hindu
[ ] Jewish
[ ] Moslem
[ ] Sikh
[ ] Other .....
[ ] No religion

2. Would you describe your family background as:

[ ]	Wealthy	(within the highest 25% in your country in terms of wealth)
[ ]	Quite well-off	(within the 50 - 75 % range for your country)
[ ]	Not very well off	(within the 25 - 50 % range for your country)
[ ]	Quite poor	(within the lowest 25% in your country in terms of wealth)

3. Does your family have

[ ] No car
[ ] One car
[ ] More than one car

4. Please give us an idea about the education of your mother and father:

Mother:	[ ]	No education	Father:	[ ]	No education
	[ ]	Primary school		[ ]	Primary school
	[ ]	High school		[ ]	High school
	[ ]	College/University		[ ]	College/University
	[ ]	I do not know		[ ]	I do not know

SECTION C

This section concerns what you know about various health problems. Across the page you will see a series of illnesses or health problems. Down the page are listed some factors that might influence them. For each health problem, put a cross in the box if you believe that it is influenced by the factor shown. For example, if you believe that heart disease is influenced by smoking, you should put a cross into the first box on the first line.

	Heart Disease	Lung cancer	Mental illness	Breast cancer	High blood pressure
Smoking	[ ]	[ ]	[ ]	[ ]	[ ]
Alcohol	[ ]	[ ]	[ ]	[ ]	[ ]
Exercise	[ ]	[ ]	[ ]	[ ]	[ ]
Stress	[ ]	[ ]	[ ]	[ ]	[ ]
Heredity	[ ]	[ ]	[ ]	[ ]	[ ]
Eating fat	[ ]	[ ]	[ ]	[ ]	[ ]
Being overweight	[ ]	[ ]	[ ]	[ ]	[ ]
Eating fibre	[ ]	[ ]	[ ]	[ ]	[ ]

Appendix 2: Daytracker Study Participant Information Sheet

UCL PSYCHOBIOLOGY GROUP
DEPARTMENT OF EPIDEMIOLOGY AND PUBLIC HEALTH

The Daytracker Study

The Biology of Everyday Life
PARTICIPANT INFORMATION SHEET (Confidential)

You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What is the purpose of the study?
We are trying to understand how our activities and emotions relate to biological function in everyday life. We believe that positive wellbeing is associated with good health, while more negative emotional states may contribute to ill health. In previous work, we have found that different behaviours and emotions have distinct biological profiles. In this study, we would like to build on our previous findings with some new measures. This research study is part of an international collaboration, funded in part by the National Institute on Aging in the USA, and in part by the World Health Organisation. The study is being carried out in UCL by Professors Andrew Steptoe, Jane Wardle and Sir Michael Marmot from the Department of Epidemiology and Public Health.

Who can take part?
This study is being carried out with healthy women aged 18 to 65 years old who are working full-time. Volunteers should not pregnant, or be on any regular medicines or medications except for oral contraceptives or hormone replacement treatment. If you have suffered from a serious illness such as heart disease or cancer over the past two years, you will not be suitable for the study.

What will happen during the study?
The study involves taking measurements over two 24 hour periods, one during the week and the second on Friday to Saturday. These two study periods will not follow directly one after another but should take place within 10 days of each other. After the first 24 hour study period, you will be asked to complete a questionnaire. This questionnaire includes measures of lifestyle factors such as smoking and physical activity, and measures of work stress, financial strain and social support. This information will help us interpret the biological results we collect. It is completely confidential, and results will not be available to anyone outside the study group and will only be used anonymously.

On the first 24-hour study day, you will need to come to the Department of Epidemiology and Public Health situated in 1-19 Torrington Place after work (between 4 and 6pm). When you arrive in the building, one of our team members will take you to an office on the 3rd floor. If you

happen to have a cold or flu or have had to take any medicines shortly before, please get in touch so that we can reschedule the appointment.

We will first of all measure your height and weight. To do these measurements, you will need to be barefoot. Next, we will fit you with a small electronic device that will measure your heart rate over the next 24 hours. This involves using two adhesive pads to stick electrodes on the left side of your chest, just above the heart. This device is not uncomfortable, and once it has been fitted you should not be able to feel it.

We will also ask you to give us some samples of saliva over the next 24 hours, so that we can measure levels of stress hormones. The saliva samples are taken by chewing gently on a cotton roll for two minutes, then putting the wet cotton roll into a test tube. We want to collect two saliva samples in the evening, then 5 more over the next day. After you have been shown how to take the saliva samples, you can go off and spend the evening, night, and the next day as normal. You will be able to bath or shower as normal while you are wearing the heart monitor.

We will ask you to return to the Department 24 hours later. At that point, we will collect the heart monitor and test tubes from you, and then ask you to complete a computerised interview called the 'Day Reconstruction Interview'. This involves providing details of what you were doing over the previous 24 hours, and how you felt at different times of the day and evening. It is quite a detailed procedure which will take 30-60 minutes to complete. The computerised questionnaire can also be done from your home or other personal computer before you come to the office.

The second 24-hour study is exactly the same, except that it will start on Friday after work, and go on until the early evening on Saturday. You will not need to come in on Saturday, but can take of the chest electrodes yourself and keep the samples until the following Monday. After you have finished the measurements on Saturday, we would like you to complete the computerised interview as before. If you have a computer at home, you can do it there, or else back at UCL on Monday.

What if I change my mind during the study?
If at any point for any reason you do not want to carry on, then you may stop. There are no consequences of withdrawal from the study, other than forfeiting the honorarium payment (see below).

What happens to the information?
All the information we get from this study about you, including your name, will be confidential and will only be used for research purposes. The data will be collected and stored in accordance with the Data Protection Act. The data we collect from all volunteers will be combined, and it will not be possible to identify any individual within published results.

What happens at the end of the study?
Provided you have completed all the parts of the study successfully we will give you an honorarium of £60. When the study is complete and all the results are analysed, we will send you a summary of our findings.

Can I take part if I am pregnant?

There are no risks to taking part in the study because you are pregnant. However, because pregnancy has effects on some of the hormones that we will be measuring, we do not wish pregnant women to participate.

We hope you are able and willing to take part in our study. If you have any questions, please contact Nina Grant, Psychobiology Unit, Department of Epidemiology and Public Health, 1-19 Torrington Place, London WC1E 6BT. Tel. 020 7679 1702 (internal 41702). E-mail: nina.grant@ucl.ac.uk

Appendix 3: Daytracker study screening form

Daytracker Screening

This form must be kept in a secure location.

1. Name

2. D.O.B.

3. Are you on any medications? ○ Yes ○ No

⇩

If yes, ask what the medications are for and list below. People using oral contraceptives or hormone replacement therapies are eligible for inclusion. Use of most other medication will make the person ineligible. This includes all psychoactive medicines, anti-inflammatories (incl. regular use of NSAIDS and steroidal medications).

_____

_____

4. Do you have any serious illness/disease , or have you had any serious illness/disease in the last two years? *(includes If yes, this person is not eligible* ○ Yes ○ No
5. Could you be pregnant? *If yes, this person is not eligible* ○ Yes ○ No
6. Do you have access to a computer and internet access on the weekends? ○ No ○ Yes
7. When was your last menstrual period? (note if post-menopausal). _____

9a. Who is your employer? _____
9b. What is your job title? _____

10. Do you do most of your work between 8 a.m. and 8 p.m.? ○ No ○ Yes

11. First research session scheduled for? _____

Second research session scheduled for? _____
13. Email address _____

Posted?
a confirmation of the date, time and address of the first session
the information sheet

Appendix 4: Daytracker study consent form

UCL PSYCHOBIOLOGY GROUP
DEPARTMENT OF EPIDEMIOLOGY AND PUBLIC HEALTH

Confidential

Informed Consent Form

Project title: Daytracker Study: The Biology of Everyday Life

Have you read the information sheet about this study?	Yes / No
Have you had the opportunity to ask questions and discuss the study?	Yes / No
Have you received satisfactory answers to all your questions?	Yes / No
Have you received enough information about the study?	Yes / No
Do you understand that you are free to withdraw from the study at any time, without giving a reason for withdrawal?	Yes / No
Do you agree with the publication of the results of this study in appropriate outlets?	Yes / No
Do you agree to take part in this study?	Yes / No

Signature of participant:

Signature of investigator:

Date:

If you have any further questions about the study, please contact:
Dr. Samantha Dockray
Psychobiology Group, Department of Epidemiology and Public Health, UCL
1-19 Torrington Place, London WC1E 6BT
Tel.: 020 7679 1805 E-mail: s.dockray@public-health.ucl.ac.uk

If you wish to complain about any aspect of the way you have been approached or treated during the course of the study, you should email the Chair of the UCL Committee for the Ethics of Non-NHS Human Research (gradschoolhead@ucl.ac.uk) or send a letter to: The Graduate School, North Cloisters, Wilkins Building, UCL, Gower Street, London WC1E 6BT.

Appendix 5: Daytracker UK Questionnaire

Daytracker Study

Questionnaire

Date_____Project ID_____

SECTION A

This section has a series of questions that ask about you and your current situation.

Today's date? / /

1. What is your date of birth? DD/MM/YYY / /

2. What is your marital status at the moment?

- ○ Currently married & living together, or living with someone in marital-like relationship
- ○ Single
- ○ Separated / Divorced / Formerly lived with someone in a marital-like relationship
- ○ Widowed

3. To which of these ethnic groups do you consider you belong?

○	White British	○	White and Black Caribbean	○	Indian
○	White Irish	○	White and Black African	○	Pakistani
○	Any other white background	○	White and Asian	○	Bangladeshi
○	Caribbean	○	Any other Mixed background	○	Any other Asian background
○	African	○	Chinese	○	Any other
○	Any other Black background				

4. What is your religion?

○	Buddhist	○	Jewish	○	Agnostic
○	Christian (Catholic)	○	Moslem	○	No religion
○	Christian (Protestant)	○	Sikh	○	Other? *(please specify)*
○	Hindu	○	Atheist		

5. What is your job/job title?

_____

6. How many hours a week do you work at your place of employment, on average?

_____ *hours*

7 How many hours a week do you work at home, on average?

_____ *hours*

8. How old were you when you finished full-time education? _____ *years*

9. What educational qualifications do you have? Please mark the circle next to your highest qualification.

- ○ None
- ○ CSEs or equivalent
- ○ GCSEs, O Levels, etc or equivalent
- ○ A levels
- ○ HNC/HND
- ○ GNVQ
- ○ Modern apprenticeship
- ○ Diploma
- ○ Degree
- ○ Postgraduate (e.g. MBA, Ph.D)
- ○ Other (please specify)

_____

10. Do you live in a: (please mark the circle)

- ○ Hous
- ○ Flat
- ○ Bed-sit
- ○ Hostel or Hall of Residence
- ○ Other *(please specify)* _____

11. How is your home paid for?

- ○ Owned outright or being bought with a mortgage or loan
- ○ Rented (Local authority)
- ○ Rented (Private landlord)
- ○ Rent-free
- ○ Other *(please explain)* _____

12 How many people live in your home (APART from you)?

_____ *people*

13. How many rooms (EXCLUDING kitchen, bathrooms and toilets) do you have in your home?

_____ *rooms*

14. Do you have children?

No ○

Yes ○

15. ↳ If 'yes', how many?

16. ↳How many of your children live with you? _____

_____

SECTION B

This section includes questions that ask about your neighbourhood and neighbours.

1. How long have you lived in your neighbourhood?

_____ *years*

These questions are about the neighbourhood in which you live. Listed below are a series of problems that can arise in any area. Please mark the circle that indicates how much of a problem the following are for you.

		Not a problem	**Some problem**	**Serious problem**
2.	Litter in the streets	○	○	○
3.	Smells and fumes	○	○	○
4.	Safely walking around after dark	○	○	○
		Not a problem	**Some problem**	**Serious problem**
5.	Problems with dogs	○	○	○
6.	Noise from traffic or other homes	○	○	○
7.	Lack of entertainment (cafes, cinemas, leisure/community centres, etc.)	○	○	○
8.	Traffic and road safety	○	○	○
9.	Places to shop	○	○	○
10.	Vandalism (breaking/smashing public property, spray-painting graffiti, etc.)	○	○	○
11.	Disturbance by neighbours or youngsters	○	○	○

How likely is it that your neighbours could be relied on to do something if...

		Very unlikely	Unlikely	Neither likely nor unlikely	Likely	Very likely
12.	Children were missing school and hanging around on street corners?	○	○	○	○	○
13.	Children were spray painting graffiti on a local building?	○	○	○	○	○
14.	Children were showing disrespect to an adult?	○	○	○	○	○
15.	A fight broke out in front of your home?	○	○	○	○	○
16.	The school closest to your home was threatened with budget cuts?	○	○	○	○	○

SECTION C

The next set of questions are about your work. For each question, please indicate the one answer that best describes your job or the way you deal with problems occurring at work. Please answer each question as accurately as you can.

		Often	Sometimes	Seldom	Never
1.	Do you have to work very fast?	○	○	○	○
2.	Do you have to work very intensively?	○	○	○	○
3.	Do you have enough time to do everything?	○	○	○	○
4.	Do you have a choice in deciding HOW you do your work?	○	○	○	○
5.	Do you have a choice in deciding WHAT you do at work?	○	○	○	○
6.	Do different groups at work demand things from you that you think are hard to combine?	○	○	○	○
7.	Does your work demand	○	○	○	○

		Often	Sometimes	Seldom	Never
	a high level of skill and expertise?				
8.	Does your job require you to take the initiative?	○	○	○	○
9.	Do you have the possibility of learning new things through your work?	○	○	○	○
10.	Do you do the same thing over and over again?	○	○	○	○
11.	Is your job boring?	○	○	○	○
12.	Others make decisions concerning my work.	○	○	○	○
13.	I have a good deal of say in decisions about work.	○	○	○	○
14.	I have a say in my own work speed.	○	○	○	○
15.	My working time can be flexible.	○	○	○	○
16.	I can decide when to take a break.	○	○	○	○
17.	I have a say in choosing with whom I work.	○	○	○	○
18.	I have a great deal of say in planning my work environment.	○	○	○	○
19.	Does your job provide you with a variety of interesting things to do?	○	○	○	○
20.	Do you get praised for your work?	○	○	○	○
21.	Do you consider your job very important?	○	○	○	○
22.	Do your colleagues consider your job very	○	○	○	○

		Often	Sometimes	Seldom	Never
	important?				
23.	How often are your colleagues willing to listen to your work-related problems?	○	○	○	○
24.	How often is your immediate superior willing to listen to your problems?	○	○	○	○

About your job in general; how satisfied have you been with the following?

		Very satisfied	Satisfied	Dissatisfied	Very dissatisfied
25.	Your usual take home pay.	○	○	○	○
26.	Your work prospects.	○	○	○	○
27.	The help and support you get from your colleagues.	○	○	○	○
28.	The help and support you get from your superiors.	○	○	○	○
29.	The way your abilities are used.	○	○	○	○
30.	The interest and skill involved in your job.	○	○	○	○

For each of the following items, indicate the most accurate response for each statement , using the response choices listed.

		No	Yes, but not at all distressed	Yes, somewhat distressed	Yes, rather distressed	Yes, very distressed
31.	I have constant time pressure due to a heavy work load.	○	○	○	○	○
32.	I have many interruptions and disturbances in my job.	○	○	○	○	○
33.	I have a lot of responsibility in my job.	○	○	○	○	○
34.	I am often pressured to work overtime.	○	○	○	○	○

35.	Over the past few years, my job has become more and more demanding.	○	○	○	○	○
36.	I am treated unfairly at work.	○	○	○	○	○
37.	I have experienced or expect to experience an undesirable change in my work situation.	○	○	○	○	○
38.	My job security is poor.	○	○	○	○	○

For each of the following items, indicate the most accurate response for each statement, using the response choices listed just below. Please note that the responses are different to those of the questions above.

		Yes	No, but not at all distressed	No, somewhat distressed	No, rather distressed	No, very distressed
39.	I receive the respect I deserve from my superiors and colleagues.	○	○	○	○	○
40.	Considering all my efforts and achievements, I receive the respect and prestige I deserve at work	○	○	○	○	○

Please indicate how much you agree or disagree with each statement.

		Strongly Disagree	**Disagree**	**Agree**	**Strongly Agree**
41.	As soon as I get up in the morning I start thinking about work problems.	○	○	○	○
42.	When I get home, I can easily relax and 'switch off' work.	○	○	○	○
43.	People close to me say I sacrifice too much for my job.	○	○	○	○
44.	Work rarely lets me go, it is still on my mind when I go to bed.	○	○	○	○
45.	If I postpone something that I	○	○	○	○

		Strongly Disagree	Disagree	Agree	Strongly Agree
	was supposed to do today I'll have trouble sleeping at night.				

SECTION D

The next set of questions concern the types of difficulty that can arise because of economic problems. Please indicate what is true for you at the present time:

At the present time:		**No difficulty**	**With some difficulty**	**Very great difficulty**
1.	Are you able to afford furniture or household equipment that needs to be replaced?	○	○	○
2.	Do you have enough money for the kind of food you and your family should have?	○	○	○
3.	Do you have problems in paying your bills?	○	○	○
4.	Are you able to afford to replace major items (such as a car) when you need to?	○	○	○
5.	Do you have enough money for the leisure activities you and your family want?	○	○	○
6.	Are you able to afford a home suitable for you and your family?	○	○	○
7.	At the end of the month, do you have: *(please circle)*	Some money left over	Just enough to make ends meet	Not enough to make ends meet

8. What is the total current yearly amount you receive from your wage, benefit allowances, annual salary or other sources (e.g. investments) (before tax is deducted)? Please mark one circle.

○	Less than £9,999	○	£25,000 - £34,999
○	£10,000 - £14,999	○	£35,000 - £49,999
○	£15,000 - £19,999	○	£50,000 - £69,999
○	£20,000 - £24,999	○	More than £70,000

9. How many people (including yourself) contributed to your household finances? (*e.g. partner, children, parents)* ____ *people*

10. What total income (including your own) has your household received in the last 12 months?

○	Less than £9,999	○	£35,000 - £49,999
○	£10,000 - £14,999	○	£50,000 - £69,999
○	£15,000 - £19,999	○	£70,000 - £99,999
○	£20,000 - £24,999	○	£100,000 - £199,999
○	£25,000 - £34,999	○	More than £200,000

Section E

The next series of questions ask you to think about your sleeping preferences. Please circle the response for each question that best describes you in general.

1. Considering your own "feeling best" rhythm, at what time would you get up if you were entirely free to plan your day?

○ 5:00-6:30a.m.
○ 6:30-7:45 a.m.
○ 7:45-9:45 a.m.
○ 9:45-11:00 a.m.
○ 11:00 a.m.-12:00 (noon)

2. Considering your own "feeling best" rhythm, at what time would you go to bed if you were entirely free to plan your evening?

○ 8:00-9:00 p.m.
○ 9:00-10:15 p.m.
○ 10:15 p.m.-l2:30a.m
○ 12:30-1:45 a.m
○ l:45-3:00 a.m.

3. Assuming normal circumstances, how easy do you find getting up in the morning?

○ Not at all easy

- ○ Slightly easy
- ○ Fairly easy
- ○ Very easy

4. How alert do you feel during the first half hour after having awakened in the morning?

- ○ Not at all alert
- ○ Slightly alert
- ○ Fairly alert
- ○ Very alert

5. During the first half hour after having awakened in the morning, how tired do you feel?

- ○ Very tired
- ○ Fairly tired
- ○ Fairly refreshed
- ○ Very refreshed

6. You have decided to engage in some physical exercise. A friend suggests that you do this one hour twice a week and the best time for them is 7:00-8:00 a.m. Bearing in mind nothing else but your own "feeling best" rhythm, how do you think you would perform?

- ○ Would be in good form
- ○ Would be in reasonable form
- ○ Would find it difficult
- ○ Would find it very difficult

7. At what time in the evening do you feel tired and, as a result, in need of sleep?

- ○ 8:00-9:00 p.m.
- ○ 9:00-10:15 p.m.
- ○ 10:15 p.m.-12:30a.m.
- ○ 12:30-l:45 a.m.
- ○ 1:45-3:00 a.m.

8. You wish to be at your peak performance for a test which you know is going to be mentally exhausting and lasting for two hours. You are entirely free to plan your day, and considering your own "feeling best" rhythm, which ONE of the four testing times would you choose?

- ○ 8:00-10:00 a.m.
- ○ ll:00a.m.-1:00 p.m.
- ○ 3:00-5:00 p.m.
- ○ 7:00-9:00 p.m.

9. One hears about "morning" and "evening" types of people. Which ONE of these types do you consider yourself to be?

- ○ Definitely a morning type
- ○ More a morning than an evening type
- ○ More an evening than a morning type
- ○ Definitely an evening type

10. When would you prefer to rise (provided you have a full day's work) if you were totally free to arrange your time?

- ○ Before 6:30 a.m.
- ○ 6:30-7:30 a.m.
- ○ 7:30-8:30 a.m.
- ○ 8:30 a.m. or later

11. If you always had to rise at 6:00 a.m., what do you think it would be like?

- ○ Very difficult and unpleasant
- ○ Rather difficult and unpleasant
- ○ A little unpleasant but no great problem
- ○ Easy and not unpleasant

12. How long a time does it usually take before you "recover your senses" in the morning after rising from a night's sleep?

- ○ 0-10 minutes
- ○ 11-20 minutes
- ○ 21 -40 minutes
- ○ More than 40 minutes

13. Please indicate to what extent you are a morning or evening active individual.

- ○ Definitely morning active (morning alert and evening tired)
- ○ To some extent, morning active
- ○ To some extent, evening active
- ○ Definitely evening active (morning tired and evening alert

SECTION F

The next series of questions relate to your usual sleep habits in the *past month only*. Your answers should indicate the most accurate response for the *majority* of days and nights in the past month. Please tick one answer for each question.

1. How often in the past month did you…

		Not at all	1 – 3 days	4 – 7 days	8-14 days	15-21 days	22-31 days
1.	Have trouble falling asleep?	○	○	○	○	○	○

2.	Wake up several times per night?	○	○	○	○	○	○
3.	Have trouble staying asleep (including waking up too early).	○	○	○	○	○	○
4.	Wake up after your usual amount of sleep feeling tired and worn out?	○	○	○	○	○	○

SECTION G

1. In general, how would you say that your health has been in the past month?

○	○	○	○	○
Excellent	Very good	Good	Fair	Poor

How often do you take part in sports or activities that are mildly energetic, moderately energetic or vigorous? (Mark one circle only for each item)

		Three times or more a week	Once to twice a week	About once to three times a month	Never / hardly ever
2.	Mildly energetic *(e.g. walking, woodwork, weeding, hoeing, bicycle repair, general housework)*	○	○	○	○
3.	Moderately energetic *(e.g. cycling, dancing, scrubbing, dancing, golf, decorating, lawn mowing, leisurely swimming*)	○	○	○	○
4.	Vigorous *(e.g. running, hard swimming, tennis, squash, digging, cycle racing)*	○	○	○	○

Please now think about the *past week.* On average, for how long did you walk outside your home/workplace? Please enter the time in hours and minutes, for example, 1 hour 30 minutes, instead of 90 minutes. *(If you did not walk, please enter zero (0) in each box).*

5.	on each weekday	_____ *hours*	_____ *minutes*
6.	on each weekend day	_____ *hours*	_____ *minutes*

7. Have you ever smoked cigarettes regularly? *(Please mark only*

one circle)

○ No, never
○ Yes, ex-smoker

8. ↳ How old were you when you stopped smoking cigarettes regularly? _____

9. ↳ About how many cigarettes a day did you usually smoke? _____

○ Yes, current smoker

10. ↳ About how many cigarettes a day do you usually smoke? _____

The next questions are about drinking alcohol, including beer, wine, spirits and any other alcoholic drink.

11. Would you describe yourself as:

○ a non-drinker
○ an occasional drinker
○ a very occasional drinker *(special occasion only)*
○ a regular drinker

12. If you are an occasional or regular drinker: On how many days over the past two weeks (14 days) did you have a drink?

_____ *days*

13. On the days that you did drink, how many drinks did you have, on average?

_____ *drinks*

14. Would you like to reduce the amount you drink?

○ Yes ○ No

15. How often, on average, do you eat a portion of fruit or vegetables? (One serving is the equivalent of one apple or a small bowl of salad)

○ Five or more times a day
○ Three or more times a day
○ At least once a day
○ Every 2 or 3 days
○ About once a week
○ Less than once a week
○ Less than once a month
○ Never

16 How often, on average, do you use each of the following foods?

		Full-fat Milk	**Semi-skimmed milk**	**Skimmed milk**	**Non-dairy / soy milk**
	Five or more times a day	○	○	○	○
	Three or more times a day	○	○	○	○
	At least once a day	○	○	○	○
	Every 2 or 3 days	○	○	○	○

	Less than once a week	○	○	○	○
	Less than once a month	○	○	○	○
	Never	○	○	○	○

Think about your leisure activities during a typical week.

On a weekday…

17. How many hours a day do you spend watching TV/ videos, and playing computer games?

_____ *hours*

On a weekend day…

18. How many hours a day do you spend watching TV/ videos, and playing computer games?

_____ *hours*

Section H

For each of the following items, indicate how often you have felt like this in the past week by circling the number for each item, using the response choices listed just below.

1	**2**	**3**	**4**	**5**	**6**	**7**
Strongly disagree	Disagree	Slightly disagree	Neutral	Slightly agree	Agree	Strongly agree

1.	I have so much in life to be thankful for.	1	2	3	4	5	6	7
2.	If I had to list everything that I felt grateful for, it would be a very long list.	1	2	3	4	5	6	7
3.	When I look at the world, I don't see much to be grateful for.	1	2	3	4	5	6	7
4.	I am grateful to a wide variety of people.	1	2	3	4	5	6	7
5.	As I get older I find myself more able to appreciate the people, events, and situations have been part of my life history.	1	2	3	4	5	6	7

6.	Long amounts of time can go by before I feel grateful to something or someone.	1	2	3	4	5	6	7

SECTION I

Please circle a number indicating how much you agree or disagree with each statement.

		Disagree						**Agree**
1.	When I make plans I follow through with them.	1	2	3	4	5	6	7
2.	I usually manage one way or another.	1	2	3	4	5	6	7
3.	I feel proud that I have accomplished things in my life.	1	2	3	4	5	6	7
4.	I usually take things in my stride.	1	2	3	4	5	6	7
5.	I am friends with myself.	1	2	3	4	5	6	7
6.	I feel that I can handle many things at a time.	1	2	3	4	5	6	7
7.	I am determined.	1	2	3	4	5	6	7
8.	I have self-discipline.	1	2	3	4	5	6	7
9.	I keep interested in things.	1	2	3	4	5	6	7
10.	I can usually find something to laugh about.	1	2	3	4	5	6	7
11.	My belief in myself gets me through hard times.	1	2	3	4	5	6	7
12.	I can usually look at a situation in a number of ways.	1	2	3	4	5	6	7
13.	My life has meaning.	1	2	3	4	5	6	7
14.	When I am in a difficult situation, I can usually find my way out of it.	1	2	3	4	5	6	7
15.	I have enough energy to do what I have to do.	1	2	3	4	5	6	7

SECTION J

We are interested in how people respond when they confront difficult or stressful events in their lives. There are many ways to try and deal with stress.

The next series of questions asks you what you usually do and feel when you experience a stressful event. Different people do different things when faced with a stressful event, but please think about what *you usually do.* For each of the following items, indicate how you usually respond to a stressful event using the response choices listed just below. Try to rate each item separately from the other items.

1	**2**	**3**	**4**
I haven't been doing this at all.	I've been doing this a little bit.	I've been doing this a medium amount.	I've been doing this a lot.

1.	I've been turning to work or other activities to take my mind off things.	1	2	3	4
2.	I've been concentrating my efforts on doing something about the situation I'm in.	1	2	3	4
3.	I've been saying to myself “this isn't real."	1	2	3	4
4.	I've been using alcohol or other drugs to make myself feel better.	1	2	3	4
5.	I've been getting emotional support from others.	1	2	3	4
6.	I've been giving up trying to deal with it.	1	2	3	4
7.	I've been taking action to try to make the situation better.	1	2	3	4
8.	I've been refusing to believe that it has happened.	1	2	3	4
9.	I've been saying things to let my unpleasant feelings escape.	1	2	3	4
10.	I’ve been getting help and advice from other people.	1	2	3	4

		1	2	3	4
		I haven't been doing this at all.	I've been doing this a little bit.	I've been doing this a medium amount.	I've been doing this a lot.
11.	I've been using alcohol or other drugs to help me get through it.	1	2	3	4
12.	I've been trying to see it in a different light, to make it seem more positive.	1	2	3	4
13.	I've been criticizing myself.	1	2	3	4
14.	I've been trying to come up with a strategy about what to do	1	2	3	4
15.	I've been getting comfort and understanding from someone.	1	2	3	4
16.	I've been giving up the attempt to cope.	1	2	3	4
17.	I've been looking for something good in what is happening.	1	2	3	4
18.	I've been making jokes about it.	1	2	3	4
19.	I've been doing something to think about it less, such as going to movies, watching TV, reading, daydreaming, sleeping, or shopping.	1	2	3	4
20.	I've been accepting the reality of the fact that it has happened.	1	2	3	4
21.	I've been expressing my negative feelings.	1	2	3	4
22.	I've been trying to find comfort in my religion or spiritual beliefs.	1	2	3	4
23.	I've been trying to get	1	2	3	4

	advice or help from other people about what to do.							
	1	**2**	**3**	**4**				
	I haven't been doing this at all.	I've been doing this a little bit.	I've been doing this a medium amount.	I've been doing this a lot.				
24.	I've been learning to live with it.				1	2	3	4
25.	I've been thinking hard about what steps to take.				1	2	3	4
26.	I've been blaming myself for things that happened.				1	2	3	4
27.	I've been praying or meditating.				1	2	3	4
28.	I've been making fun of the situation.				1	2	3	4

SECTION K

For each of the following statements and/or questions, please circle the point on the scale that you feel is most appropriate in describing you.

1. In general, I consider myself:

1	**2**	**3**	**4**	**5**	**6**	**7**
not a very happy person						a very happy person

2. Compared to most of my peers, I consider myself:

1	**2**	**3**	**4**	**5**	**6**	**7**
less happy						more happy

3. Some people are generally very happy. They enjoy life regardless of what is going on, getting the most out of everything. To what extent does this characterisation describe you?

1	**2**	**3**	**4**	**5**	**6**	**7**
Not at all						a great deal

4. Some people are generally not very happy. Although they are not depressed, they never seem as happy as they might be. To what extent does this characterisation describe you?

1	2	3	4	5	6	7
not at all						a great deal

SECTION L

These questions concern your religious/spiritual beliefs. Circle the answer below that best answers the question for you.

		Strongly disagree	Disagree	Agree	Strongly agree
1.	Religious faith is extremely important to me.	○	○	○	○
2.	I pray or meditate daily.	○	○	○	○
3.	I look to my religion as providing meaning and purpose in my life.	○	○	○	○
4.	I consider myself active in organised religion (going to church, temple, mosque etc.)	○	○	○	○

5. Do you believe there is a life after death?

○ Yes ○ No ○ Undecided

6. How often do you go to religious services?

○ More than once a week ○ Once or twice a month ○ Once or twice a year

○ Every week or more often ○ Every month or so ○ Never

7. To what extent do you consider yourself a religious person?

○ Very religious ○ Slightly religious

○ Moderately religious ○ Not religious at all

8. To what extent do you consider yourself a spiritual person?

○ Very spiritual ○ Slightly spiritual

○ Moderately spiritual ○ Not spiritual at all

Because of my religious or spiritual beliefs:

		Always or almost always	Often	Seldom	Never	Not applicable
9.	I have forgiven myself for things that I have done wrong.	○	○	○	○	○
10.	I have forgiven those who hurt me.	○	○	○	○	○
11.	I know that God forgives me.	○	○	○	○	○

SECTION M

Most people have disagreements in their marital/marital-like relationships. Please indicate below the approximate extent of agreement or disagreement between you and your partner for each item below.

○ I am not in a marital / marital-like relationship. *Please go to Section N on page 30.*

If you are in a marital / marital-like relationship, please complete the following questions.

How long have you been in this relationship?
_____years

		Always agree	Almost always agree	Sometimes agree	Hardly ever agree	Never agree
1.	Handling family matters	○	○	○	○	○
2.	Matters of recreation	○	○	○	○	○
3.	Religious matters	○	○	○	○	○
4.	Demonstrations of affection	○	○	○	○	○
5.	Friends	○	○	○	○	○

6.	Sex relations	○	○	○	○	○
7.	Conventionality (correct or proper behavior)	○	○	○	○	○
8.	Philosophy of life	○	○	○	○	○
9.	Ways of dealing with parents or in-laws.	○	○	○	○	○
10.	Aims, goals, and things believed important	○	○	○	○	○
11.	Amount of time spent together	○	○	○	○	○
12.	Making major decisions	○	○	○	○	○
13.	Household tasks	○	○	○	○	○
14.	Leisure time interests and activities	○	○	○	○	○
15.	Career decisions	○	○	○	○	○
16.	How often do you or your partner leave the house after a fight?	○	○	○	○	○
17.	In general, how often do you think that things between you and your partner are going well?	○	○	○	○	○
		All the time	**Most of the time**	**Sometimes**	**Hardly ever**	**Never**
18.	Do you confide in your partner?	○	○	○	○	○

19.	How often do you and your partner "get on each other's nerves?"	○	○	○	○	○
20.	How often do you and your partner quarrel?	○	○	○	○	○
21.	Do you ever regret that you began this relationship?	○	○	○	○	○

22.	Do you kiss your partner?	○ Yes	○ No
23.	Do you and your partner engage in outside interests together?	○ Yes	○ No
24.	If so, how often?		

How often do you and your partner:

		Never	**Less than once a month**	**Once or twice a month**	**Once or twice a week**	**Once a day**	**More often**
25.	Have an interesting chat?	○	○	○	○	○	○
26.	Laugh together?	○	○	○	○	○	○
27.	Calmly discuss something?	○	○	○	○	○	○
28.	Work together on a project?	○	○	○	○	○	○

Indicate if the items below were problems in your relationship during the past **FEW WEEKS.**

29.	Being too tired for sex	○ Yes	○ No
30.	Not showing love	○ Yes	○ No

31. Please mark one circle that best describes the degree of happiness in your relationship.

○	○	○	○	○	○	○
Very unhappy	Somewhat unhappy	Fairly happy	Mostly happy	Very happy	Extremely happy	Perfect

32. Which one of the following statements best describes how you feel about the future of your relationship? *(please tick the circle for the most appropriate statement)*

- ○ I want desperately for my relationship to succeed, and would go to almost any length to see that it does.
- ○ I want very much for my relationship to succeed, and will do all I can to see that it does.
- ○ I want very much for my relationship to succeed, and will do my fair share to see that it does.
- ○ It would be nice if my relationship succeeded, but I can't do much more than I'm doing now to help it succeed.
- ○ My relationship can never succeed, and there is no more that I can do to keep the relationship going.

SECTION N

For each of the following statements and/or questions, please circle the point on the scale that you feel is most appropriate in describing you.

		Often	**Sometimes**	**Not often**	**Never**
1.	If I wanted to go on a trip for a day (for example, to the seaside), I would have a hard time finding someone to go with me.	○	○	○	○
2.	I feel that there is no one I can share my most private worries and fears with.	○	○	○	○
3.	If I were ill, I could easily find someone to help me with my daily chores.	○	○	○	○
4.	There is someone I can turn to for advice about handling problems with my family.	○	○	○	○

5.	If I decide one afternoon that I would like to go to a film that evening, I could easily find someone to go with me.	○	○	○	○
6.	When I need suggestions on how to deal with a personal problem, I know someone I can turn to.	○	○	○	○
7.	I don't often get invited to do things with others.	○	○	○	○
8.	If I had to go out of town for a few weeks, it would be difficult to find someone who would look after my house/flat (the plants, pets, etc.).	○	○	○	○
9.	If I wanted to have lunch with someone, I could easily find someone to join me.	○	○	○	○
10.	If I was stranded 10 miles from home, there is someone I could call who could come and get me.	○	○	○	○
11.	If a family crisis arose, it would be difficult to find someone who could give me good advice about how to handle it.	○	○	○	○
12.	If I needed some help in moving to a new house or flat, I would have a hard time finding someone to help me.	○	○	○	○

SECTION O

Please indicate how often you feel the way described in each of the following statements.

		Often	**Sometimes**	**Not often**	**Never**
1.	I feel in tune with people around me.	○	○	○	○
2.	I lack companionship.	○	○	○	○
3.	There is always someone I can turn to.	○	○	○	○
4.	I feel alone.	○	○	○	○
5.	I feel part of a group of friends.	○	○	○	○
6.	I have a lot in common with people around me.	○	○	○	○

7.	I feel I am no longer close to anyone.	○	○	○	○
8.	My interests and ideas are shared by those around me.	○	○	○	○
9.	I am an outgoing person.	○	○	○	○
10.	There are people I feel close to.	○	○	○	○
11.	I feel left out.	○	○	○	○
12.	My social relationships are superficial.	○	○	○	○
13.	I feel no one really knows me well.	○	○	○	○
14.	I feel isolated from others.	○	○	○	○
15.	I can find companionship when I want it.	○	○	○	○
16.	There are people who really understand me.	○	○	○	○
17.	I am unhappy being so withdrawn.	○	○	○	○
18.	People are around me but not with me.	○	○	○	○
19.	There are people I can talk to.	○	○	○	○

SECTION P

The next series of questions ask about how often you speak to family and friends. Please mark the circle next to your answer to each question.

1. If your mother is living, how often do you see or talk on the phone to her?

○ Mother is not living ○ Once a month ○ Once a week

○ Never ○ Once every two weeks ○ Every day

2. If your father is living, how often do you see or talk on the phone to him?

○ Father is not living ○ Once a month ○ Once a week

○ Never ○ Once every two weeks ○ Every day

3. If you are married or living with your partner, and if your mother-in-law is living, how often do you see or talk on the phone to her?

○ Mother-in-law is not living ○ Once every two weeks ○ Every day

○ Never ○ Once a week ○ Not

applicable

- ○ Once a month

4. If you are married or living with your partner, and if your father-in-law is living, how often do you see or talk on the phone to him?

- ○ Father-in-law is not living
- ○ Once every two weeks
- ○ Every day
- ○ Never
- ○ Once a week
- ○ Not applicable
- ○ Once a month

5. If you have children, how often do you see or talk on the phone to your children?

- ○ Do not have children
- ○ Once a month
- ○ Once a week
- ○ Never
- ○ Once every two weeks
- ○ Every day

6. Are there other relatives who you feel close to?

- ○ Yes
- ○ No

7. If Yes, how often do you see or talk on the phone to these relatives?

- ○ Never
- ○ Once every two weeks
- ○ Every day
- ○ Once a month
- ○ Once a week
- ○ Not applicable

8. Do you have friends who you feel close to (i.e., people you feel at ease with, can talk to about private matters, and can call on for help)?

- ○ Yes
- ○ No

9. If Yes, how often do you see or talk on the phone to these friends?

- ○ Never
- ○ Once every two weeks
- ○ Every day
- ○ Once a month
- ○ Once a week
- ○ Not applicable

SECTION Q

Below is a list of statements of how people might think and feel. For each of the following sentences*, indicate how much you agree* with the statement by ticking the most honest and accurate response. Try not to let your response to one statement influence your other responses.

	I agree a lot	**I agree a little**	**I neither agree nor disagree**	**I disagree a little**	**I disagree a lot**

1.	In uncertain times, I usually expect the best.	○	○	○	○	○
2.	It's easy for me to relax.	○	○	○	○	○
3.	If something can go wrong for me, it will.	○	○	○	○	○
4.	I'm always optimistic about my future.	○	○	○	○	○
5.	I enjoy my friends a lot.	○	○	○	○	○
6.	It's important for me to keep busy.	○	○	○	○	○
7.	I hardly ever expect things to go my way.	○	○	○	○	○
8.	I don't get upset too easily.	○	○	○	○	○
9.	I rarely count on good things happening to me	○	○	○	○	○
10.	Overall, I expect more good things to happen to me than bad.	○	○	○	○	○

Section R

Below are a number of words that describe different feelings and emotions. Read each word and then indicate how much you felt that way during the past week by ticking the appropriate box for that word.

		very slightly / not at all	**a little**	**moderately**	**quite a bit**	**extremely**
1.	interested	○	○	○	○	○
2.	upset	○	○	○	○	○
3.	scared	○	○	○	○	○
4.	proud	○	○	○	○	○
5.	ashamed	○	○	○	○	○

6.	determined	O	O	O	O	O
7.	active	O	O	O	O	O
8.	distressed	O	O	O	O	O
9.	strong	O	O	O	O	O
10.	hostile	O	O	O	O	O
11.	irritable	O	O	O	O	O
12.	inspired	O	O	O	O	O
13.	attentive	O	O	O	O	O
14.	afraid	O	O	O	O	O
15.	excited	O	O	O	O	O
16.	guilty	O	O	O	O	O
17.	enthusiastic	O	O	O	O	O
18.	alert	O	O	O	O	O
19.	nervous	O	O	O	O	O
20	jittery	O	O	O	O	O

SECTION S

Below is a list of the ways you might have felt or behaved in the past week. For each of the following items, indicate how often you have felt like this in the past week by circling one response, using the response choices listed just below.

1	2	3	4
Rarely or none of the time (less than 1 day)	Some or a little of the time (1-2 days)	Occasionally / a moderate amount of time (3-4 days)	Most or all of the time (5-7 days)

1.	I was bothered by things that don't usually bother me.	1	2	3	4
2.	I did not feel like eating; my appetite was poor.	1	2	3	4
3.	I felt that I could not shake off the blues even with help from my family or friends.	1	2	3	4
4.	I felt that I was just as good as other people.	1	2	3	4
5.	I had trouble keeping my mind on what I was doing.	1	2	3	4
6	I felt depressed.	1	2	3	4

7.	I felt that everything I did was an effort.	1	2	3	4
8.	I felt hopeful about the future.	1	2	3	4
9.	I thought my life had been a failure.	1	2	3	4
10.	I felt fearful.	1	2	3	4
11.	My sleep was restless.	1	2	3	4
12.	I was happy.	1	2	3	4
13.	I talked less than usual.	1	2	3	4
14.	I felt lonely.	1	2	3	4
15.	People were unfriendly.	1	2	3	4
16.	I enjoyed life.	1	2	3	4
17.	I had crying spells.	1	2	3	4
18.	I felt sad.	1	2	3	4
19.	I felt that people dislike me.	1	2	3	4
20.	I could not get going.	1	2	3	4

SECTION T

Below are some statements which describe people's beliefs and attitudes, and the way they might react to some situations. Tick 'True' if the statement applies to you or describes you in general, if the statement does not describe you, tick the False column.

		True	False
1.	I have often met people who were supposed to be experts who were no better than I.	○	○
2.	I have often had to take orders from someone who did not know as much as I did.	○	○
3.	A large number of people are guilty of bad sexual conduct.	○	○
4.	I think a great many people exaggerate their misfortunes in order to gain the sympathy and help of others.	○	○
5.	I have at times had to be rough with people who were rude or annoying.	○	○
6.	Most people make friends because friends are likely to be useful to them.	○	○

7.	It takes a lot of argument to convince most people of the truth.	○	○
8.	People often disappoint me.	○	○
9.	People generally demand more respect for their own rights than they are willing to allow for others.	○	○
10.	Most people are honest chiefly because they are afraid of being caught.	○	○
11.	Most people will use somewhat unfair means to gain profit or an advantage rather than to lose it.	○	○
12.	I think most people would lie to get ahead.	○	○
		True	**False**
13.	There are certain people who I dislike so much that I am inwardly pleased when they are in trouble for something they had done.	○	○
14.	I am often inclined to go out of my way to win a point with someone who has opposed me.	○	○
15.	When people do me a wrong, I feel that I should pay them back if I can, just for the principle of the thing.	○	○
16.	I strongly defend my own opinions as a rule.	○	○
17.	Some of my family has habits that bother and annoy me very much.	○	○
18.	I am not easily angered.	○	○
19.	No one cares much what happens to me.	○	○
20.	It is safer to trust nobody.	○	○
21.	I can be friendly with people who do things which I consider wrong.	○	○
22.	Most people inwardly dislike putting themselves out to help other people.	○	○
23.	I don't blame people for trying to grab everything they can get in this world.	○	○
24.	I don’t blame a person for taking advantage of people who leave themselves open to it.	○	○
25.	It makes me impatient to have people ask my advice or otherwise interrupt me when I am	○	○

	working on something important.		
26.	I would certainly enjoy beating criminals at their own game.	○	○
27.	I don't try to cover up my poor opinion or pity of people so that they won't know how I feel.	○	○

SECTION U

For each of the following items, indicate how often you have felt like this in the past week by marking one circle for each item, using the response choices listed just below.

1	2	3	4	5	6
Strongly disagree	Moderately disagree	Slightly disagree	Slightly agree	Moderately agree	Strongly agree

1.	In general I feel I am in charge of the situation in which I live.	1	2	3	4	5	6
2.	I am not interested in activities that will expand my horizons.	1	2	3	4	5	6
3.	I live life one day at a time and don't really think about the future.	1	2	3	4	5	6
4.	When I look at the story of my life, I am pleased with how things have turned out.	1	2	3	4	5	6
5.	The demands of everyday life often get me down.	1	2	3	4	5	6
6.	I don't want to try new ways of doing things – my life is fine the way it is.	1	2	3	4	5	6
7.	I tend to focus on the present, because the future nearly always brings me problems.	1	2	3	4	5	6
8.	In general, I feel confident and positive about myself.	1	2	3	4	5	6
9.	I do not fit very well with the people and community around me.	1	2	3	4	5	6
10.	I think it is important to have new experiences that challenge how you think about yourself and the world.	1	2	3	4	5	6
11.	My daily activities often seem trivial and unimportant to me.	1	2	3	4	5	6

12.	I feel like many of the people I know have gotten more out of life than I have.	1	2	3	4	5	6
13.	I am quite good at managing the many responsibilities of my daily life.	1	2	3	4	5	6
14.	When I think about it, I haven't really improved much as a person over the years.	1	2	3	4	5	6
15.	I don't have a good sense of what it is I'm trying to accomplish in life.	1	2	3	4	5	6
16.	I like most aspects of my personality.	1	2	3	4	5	6
17.	I often feel overwhelmed by my responsibilities.	1	2	3	4	5	6
18.	I have the sense that I have developed a lot as a person over time.	1	2	3	4	5	6
19.	I used to set goals for myself, but now that seems like a waste of time	1	2	3	4	5	6
20.	I made some mistakes in the past, but I feel that all in all everything has worked out for the best.	1	2	3	4	5	6
21.	I generally do a good job of taking care of my personal finances and affairs.	1	2	3	4	5	6
22.	I do not enjoy being in new situations that require me to change my old familiar ways of doing things.	1	2	3	4	5	6
23.	I enjoy making plans for the future and working to make them a reality.	1	2	3	4	5	6
24.	In many ways, I feel disappointed about my achievements in life.	1	2	3	4	5	6
25.	I am good at juggling my time so that I can fit everything in that needs to get done.	1	2	3	4	5	6
26.	For me, life has been a continuous process of learning, changing and growth.	1	2	3	4	5	6
27.	I am an active person in carrying out the plans I set for myself.	1	2	3	4	5	6
28.	My attitude about myself is probably not as positive as most people feel about themselves.	1	2	3	4	5	6
29.	I have difficulty arranging my life in a way that is satisfying to me.	1	2	3	4	5	6
30.	I gave up trying to make big improvements or changes in my life a long time ago	1	2	3	4	5	6

1	2	3	4	5	6
Strongly disagree	Moderately disagree	Slightly disagree	Slightly agree	Moderately agree	Strongly agree

31.	Some people wander aimlessly through life, but I am not one of them.	1	2	3	4	5	6
32.	The past had its ups and downs, but in general, I wouldn't want to change it.	1	2	3	4	5	6
33.	I have been able to build a home and lifestyle that is much to my liking.	1	2	3	4	5	6
34.	There is truth to the saying that you can't teach an old dog new tricks.	1	2	3	4	5	6
35.	I sometimes feel as if I've done all there is to do in life.	1	2	3	4	5	6
36.	When I compare myself to friends and acquaintances, it makes me feel good about how I am.	1	2	3	4	5	6

That was the final section in this questionnaire; please check you have completed all the sections before returning it to us. If you have any comments, or you would like to add anything to what you have told us, please add them in the space below.

Thank you very much for taking the time to participate in this research project, we appreciate the contribution you have made to our research on wellbeing and health.

Additional comments.

Appendix 6: Daytracker Sampling Diary

If you have questions at any time,
please contact one of our researchers on
020 7679 1702 (business hours)
nina.grant@ucl.ac.uk.

Daytracker Study

Sampling Diary

Project ID			Date	

Project ID _____

THE SALIVA SAMPLES.

Your saliva sampling day is _____.

Over the course of tonight and tomorrow you will be collecting saliva samples at 7 different times. Please collect the samples at the times listed below. It may be helpful to set an alarm on your watch or phone to remind you. Each time you collect a sample, pl
ease answer the questions in this booklet. There are separate questions (one set per page) for each sample.

You will need to place the tube for the waking sample (Tube 3) and this booklet next to your bed before you go to sleep tonight.

Your honesty is very important to us in analysing the data. Please write down the actual collection time, even if it is different to the designated time, and answer the questions as accurately as possible.

Instructions.

1.	Do not eat or drink anything, or brush your teeth for 15 minutes before you collect the sample.
2.	Remove the small plastic cap, and place the cotton swab in your mouth, avoiding touching it with your hands.
3.	Gently chew on the swab until it is soaked, this will usually take about 2 minutes. While you are doing this, answer the questions for this sample in this booklet.
4.	Once the swab is soaked, place it back in the tube, trying not to use your hands. Put the cap on securely, and place the tube in the plastic bag provided.
5.	Store the bagged tube in a cold place or in a refrigerator.

Sample Time	Tube No.	Instructions
At your first visit	1	You will collect this sample at your first visit to the research office.
Bedtime	2	Take this sample just prior to going to bed.
Waking	3	This first sample should be collected as soon as you wake up, and before you get out of bed.
Waking plus 30 minutes	4	Take this sample 30 minutes after your awakening sample. Do not have any caffeinated drinks, brush your teeth or eat before you collect this sample.
10 a.m.	5	
12 Noon	6	
3 p.m.	7	

CODES FOR LOCATIONS AND ACTIVITIES

We need to know where you are and what you are doing each time you collect a sample.
In order to make collecting this information as simple as possible, we need you to use the codes listed below. Please write the code for the location and activity in the space provided next to the question on each page.

LOCATION

1	Your home		**8**	Entertainment venue
2	Work		**9**	Outside, public area
3	Friend's/family member's home		**10**	Classroom
4	Private car / taxi		**11**	Church
5	Public transport		**12**	Sports facility / gym
6	Shops / supermarket		**13**	Doctor / dentist
7	Pub / club / bar / restaurant		**14**	Somewhere else

ACTIVITY

A	Travel / commuting		**K**	Child care
B	Shopping		**L**	Praying/worshipping/meditation
C	Doing housework		**M**	Watching TV
D	Eating		**N**	Computer / internet / email
E	Socialising		**O**	On the phone
F	Nap / resting		**P**	Exercising
G	Relaxing		**Q**	Dressing / showering
H	Sexual activity		**R**	Waiting
I	Working		**S**	Cinema / theatre / concert
J	Preparing food		**T**	Sleeping
			U	Other

Project ID _____

TUBE 1 : RESEARCH OFFICE VISIT

1.	*What is the time now?*		a.m. / p.m.
2.	*What was the exact time you collected the sample?*		a.m. / p.m
	For the next two questions, please use the codes for location and activity that are listed on the last page.		
3.	*Where are you?*	4. *What are you doing?*	

In the last 30 minutes how much did you feel…..

	Not at all				Very much
In control	1	2	3	4	5
Tired	1	2	3	4	5
Happy	1	2	3	4	5
Frustrated or angry	1	2	3	4	5
Rushed	1	2	3	4	5
Stressed	1	2	3	4	5
Pain	1	2	3	4	5
If you talked with others, how pleasant was the interaction?					
Not applicable ○	1	2	3	4	5

In the last 30 minutes, but before you collected your sample did you….

Brush your teeth	No	Yes
Drink any tea, coffee or other caffeinated drinks	No	Yes
Take any medicines	No	Yes
Eat a meal	No	Yes
Drink any alcohol	No	Yes
Do any exercise?	No	Yes
Smoke any cigarettes?	No	Yes

YOUR NEXT RESEARCH OFFICE VISIT

If the sampling day begins on Monday, Tuesday, Wednesday or Thursday:
At the end of the weekday sampling period you will be coming back to the research office. At the research office we will collect your saliva samples from you, and remove your heart rate monitor. We will also collect this sampling diary from you.

You should come to the research office at

_____ on _____.

We will meet you in the lobby of 1-19 Torrington Place, and then we will go to the research office. Please remember to bring all the saliva samples you have collected, in the bag provided and this sampling diary to your visit.

At the research office you will complete a computerised questionnaire which will take approximately 40 minutes. If you would prefer to complete this questionnaire from your own computer before you arrive at the research office you are welcome to do so, please just let us know. If you do this, you will still need to meet us at 1-19 Torrington Place so we can collect your heart rate monitor and samples, but this would only take a few minutes.

If you choose to do this, please do not begin the questionnaire until _____p.m.

If the sampling period begins on a Friday:
You can remove the heart rate monitor yourself at _____ p.m.
The monitor can be removed easily by following the instructions in this booklet. At this time you can also complete the on-line computerised questionnaire (**www.daytracker.co.uk**) which will take approximately 40 minutes.

Keep your saliva samples in the bag provided in your fridge until Monday. On Monday, please return the heart rate monitor, this sampling diary and all the saliva samples to one of our researchers. We will meet you in the lobby of 1-19 Torrington Place to collect your research kit. You can arrange the time to meet by phoning Ext.41805.

Project ID _____

NOTES / COMMENTS

Please use the space provided below to record any other notes or comments you would like us to know about the sampling period.

Thank you for taking the time to complete this diary, we appreciate the contribution you have made to our research on well-being on health.

When placing the cotton swab back into the tube, please take care not to remove the smaller, inner tube. The cotton swab should be placed inside this inner tube and not into the larger tube, as shown in the two pictures below:

Project ID _____

THE HEART RATE MONITOR

The heart rate monitor was fitted to you in our research lab, and you do not need to do anything to it. Please do not move the patches or the monitor.

The monitor is safe to wear while showering, but it should not be immersed in water for a long period of time, such as in swimming or bathing.

The monitor is attached to you with a permeable, hypoallergenic patch. Under usual circumstances this patch will not come off. However, if the patch comes off, we've provided a replacement in your Sampling Kit. The instructions on how to attach a new patch are below .

To reappply the patch:

1.	The new patch will be placed in exactly the same place as the old patch.
2.	Unclip the monitor from the old patch by gently pressing the button on the side and lifting it away from the patch.
3.	Remove the old patch and any residue; clean the area with the steriwipe provided.
4.	Rub the area of skin dry with a paper towel.
5.	Remove the larger portion of the backing strip from the new patch and place the patch onto the skin in the same place as the old patch. Smooth down the patch, including around the edges.
6.	Now you can replace the monitor. Reattach the monitor to the patch by gently pressing the small button on the side of the lead, and placing the small hole on the monitor onto the stud on the patch. The larger round part is attached to the patch in the centre of your chest and the small square part is attached to the electroed on the side of your chest. Once the stud is inside the monitor, check to see it's properly attached.

If you did need to replace the patch, please note the time that you did this here_____.

The heart rate monitor will usually flash but if it stops flashing, please continue to wear it until the end of your smapling period.

TUBE 2 : AT YOUR BEDTIME

1.	*What is the time now?*					a.m. / p.m.	
2.	*What was the exact time you collected the sample?*					a.m. / p.m	
	For the next two questions, please use the codes for location and activity that are listed on the last page.						
3.	*Where are you?*		4. *What are you doing?*				
	In the last 30 minutes how much did you feel.....						
		Not at all					*Very much*
4.	In control	1	2	3	4	5	
5.	Tired	1	2	3	4	5	
6.	Happy	1	2	3	4	5	
7.	Frustrated or angry	1	2	3	4	5	
8.	Rushed	1	2	3	4	5	
9.	Stressed	1	2	3	4	5	
10.	Pain	1	2	3	4	5	
11.	If you talked with others, how pleasant was the interaction?						
	Not applicable O	1	2	3	4	5	
	In the last 30 minutes, but before you collected your sample did you....						
12.	Brush your teeth				No	Yes	
13.	Drink any tea, coffee or other caffeinated drinks				No	Yes	
14.	Take any medicines				No	Yes	
15.	Eat a meal				No	Yes	
16.	Drink any alcohol				No	Yes	
17.	Do any exercise?				No	Yes	
18.	Smoke any cigarettes?				No	Yes	

Project ID _____

TUBE 3 : AS SOON AS YOU WAKE UP

1.	*What is the time now?*	a.m. / p.m.
2..	*What was the exact time you collected the sample?*	a.m. / p.m
2a.	Was there a delay between waking up and collecting your first sample?	
		Yes / No
2b.	If yes, how long?	

For the next two questions, please use the codes for location and activity that are listed on the last page.

3. *Where are you?* _____ **4.** *What are you doing?* _____

In the last 30 minutes how much did you feel…..

		Not at all				*Very much*
4.	In control	1	2	3	4	5
5.	Tired	1	2	3	4	5
6.	Happy	1	2	3	4	5
7.	Frustrated or angry	1	2	3	4	5
8.	Rushed	1	2	3	4	5
9.	Stressed	1	2	3	4	5
10.	Pain	1	2	3	4	5
11.	If you talked with others, how pleasant was the interaction?					
	Not applicable O	1	2	3	4	5

In the last 30 minutes, but before you collected your sample did you….

	Brush your teeth	**No**	**Yes**
	Drink any tea, coffee or other caffeinated drinks	**No**	**Yes**
	Take any medicines	**No**	**Yes**
	Eat a meal	**No**	**Yes**
	Drink any alcohol	**No**	**Yes**
	Do any exercise?	**No**	**Yes**
	Smoke any cigarettes?	**No**	**Yes**

ABOUT YOUR DAY

Now we'd like to know a few more things about your day. Please answer the questions below as accurately as you can.

1.	What time did you go to bed last night?
2.	What time do you think you went to sleep last night?
3.	What time did you wake up this morning?
4.	What time did you get out of bed this morning?
5.	How typical was your sleep last night? Compared to your sleep on most other nights, yesterday was

O	O	O	O	O
Much Better	Better	Typical	Somewhat Worse	Much Worse

Project ID _____

TUBE 5 : AT 10 A.M.

1.	*What is the time now?*					a.m. / p.m.
2.	*What was the exact time you collected the sample?*					a.m. / p.m
3.	*For the next two questions, please use the codes for location and activity that are listed on the last page.*					
	Where are you?		*What are you doing?*			
	In the last 30 minutes how much did you feel…..					
		Not at all				*Very much*
4.	In control	1	2	3	4	5
5.	Tired	1	2	3	4	5
6.	Happy	1	2	3	4	5
7.	Frustrated or angry	1	2	3	4	5
8.	Rushed	1	2	3	4	5
9.	Stressed	1	2	3	4	5
10.	Pain	1	2	3	4	5
11.	If you talked with others, how pleasant was the interaction?					
	Not applicable ○	1	2	3	4	5
	In the last 30 minutes, but before you collected your sample did you….					
12.	Brush your teeth			No		Yes
13.	Drink any tea, coffee or other caffeinated drinks			No		Yes
14.	Take any medicines			No		Yes
15.	Eat a meal			No		Yes
16.	Drink any alcohol			No		Yes
17.	Do any exercise?			No		Yes
18.	Smoke any cigarettes?			No		Yes

TUBE 6 : AT 12 NOON

1.	*What is the time now?*					a.m. / p.m.
2.	*What was the exact time you collected the sample?*					a.m. / p.m
	For the next two questions, please use the codes for location and activity that are listed on the last page.					
3.	*Where are you?*		4. *What are you doing?*			
	In the last 30 minutes how much did you feel…..					
		Not at all				*Very much*
4.	In control	1	2	3	4	5
5.	Tired	1	2	3	4	5
6.	Happy	1	2	3	4	5
7.	Frustrated or angry	1	2	3	4	5
8.	Rushed	1	2	3	4	5
9.	Stressed	1	2	3	4	5
10.	Pain	1	2	3	4	5
11.	If you talked with others, how pleasant was the interaction?					
	Not applicable ○	1	2	3	4	5
	In the last 30 minutes, but before you collected your sample did you….					
	Brush your teeth			No		Yes
	Drink any tea, coffee or other caffeinated drinks			No		Yes
	Take any medicines			No		Yes
	Eat a meal			No		Yes
	Drink any alcohol			No		Yes
	Do any exercise?			No		Yes
	Smoke any cigarettes?			No		Yes

Project ID _____

TUBE 7 : 3 P.M.

1.	*What is the time now?*	a.m. / p.m.
2.	*What was the exact time you collected the sample?*	a.m. / p.m
	For the next two questions, please use the codes for location and activity that are listed on the last page.	
3.	*Where are you?*	4. *What are you doing?*

In the last 30 minutes how much did you feel…..

		Not at all				*Very much*
4.	In control	1	2	3	4	5
5.	Tired	1	2	3	4	5
6.	Happy	1	2	3	4	5
7.	Frustrated or angry	1	2	3	4	5
8.	Rushed	1	2	3	4	5
9.	Stressed	1	2	3	4	5
10.	Pain	1	2	3	4	5
11.	If you talked with others, how pleasant was the interaction?					
	Not applicable ○	1	2	3	4	5

In the last 30 minutes, but before you collected your sample did you….

12.	Brush your teeth	**No**	**Yes**
13.	Drink any tea, coffee or other caffeinated drinks	**No**	**Yes**
14.	Take any medicines	**No**	**Yes**
15.	Eat a meal	**No**	**Yes**
16.	Drink any alcohol	**No**	**Yes**
17.	Do any exercise?	**No**	**Yes**
18.	Smoke any cigarettes?	**No**	**Yes**

TUBE 4 : 30 MINUTES AFTER YOU WAKE UP

	What is the time now?	a.m. / p.m.
	What was the exact time you collected the sample?	a.m. / p.m
	For the next two questions, please use the codes for location and activity that are listed on the last page.	
	Where are you?	*What are you doing?*

In the last 30 minutes how much did you feel…..

		Not at all				*Very much*
	In control	1	2	3	4	5
	Tired	1	2	3	4	5
	Happy	1	2	3	4	5
	Frustrated or angry	1	2	3	4	5
	Rushed	1	2	3	4	5
	Stressed	1	2	3	4	5
	Pain	1	2	3	4	5
	If you talked with others, how pleasant was the interaction?					
	Not applicable ○	1	2	3	4	5

In the last 30 minutes, but before you collected your sample did you….

	Brush your teeth	**No**	**Yes**
	Drink any tea, coffee or other caffeinated drinks	**No**	**Yes**
	Take any medicines	**No**	**Yes**
	Eat a meal	**No**	**Yes**
	Drink any alcohol	**No**	**Yes**
	Do any exercise?	**No**	**Yes**
	Smoke any cigarettes?	**No**	**Yes**

Appendix 7: Daytracker Japan Consent Form

研究対象者スクリーニング用紙

この用紙は、安全な場所に保管されなければならない。

1. 氏　名

2. 生年月日　西暦　　年　　月　　日

3. あなたは、薬物を服用していますか？　○ はい　○ いいえ

もし「はい」なら、服用薬物が何か尋ね、下に列挙する。経口避妊薬やホルモン補充療法の方は、研究対象者とする。その他薬物（向精神薬、抗炎症薬など）服用している方のほとんどは、研究対象外とする。

4. あなたは、現在、何か重い病気にかかっていたり、最近２年間、罹っていた病歴がありますか？
（もし「はい」なら、その方は研究対象外とする）　○ はい　○ いいえ

5. あなたは、現在妊娠している可能性がありますか？（もし「はい」なら、その方は研究対象外とする）　○ はい　○ いいえ

6. あなたの最終月経はいつでしたか？（もし、閉経した方なら、閉経した年齢を聞く）

7. 久留米大学でのあなたの仕事はなんですか？

8. 最初の調査セッションは？（調査日時の決定）

２回目の調査セッションは？（調査日時の決定）

9. 郵便住所

メールアドレス

Appendix 8: Daytracker Japan Screening Form

研究対象者スクリーニング用紙

この用紙は、安全な場所に保管されなければならない。

1. 氏　名

2. 生年月日　西暦　　年　　月　　日

3. あなたは、薬物を服用していますか？　○ はい　○ いいえ

もし「はい」なら、服用薬物が何か尋ね、下に列挙する。経口避妊薬やホルモン補充療法の方は、研究対象者とする。その他薬物（向精神薬、抗炎症薬など）服用している方のほとんどは、研究対象外とする。

4. あなたは、現在、何か重い病気にかかっていたり、最近２年間、罹っていた病歴がありますか？
（もし「はい」なら、その方は研究対象外とする）　○ はい　○ いいえ

5. あなたは、現在妊娠している可能性がありますか？（もし「はい」なら、その方は研究対象外とする）　○ はい　○ いいえ

6. あなたの最終月経はいつでしたか？（もし、閉経した方なら、閉経した年齢を聞く）

7. 久留米大学でのあなたの仕事はなんですか？

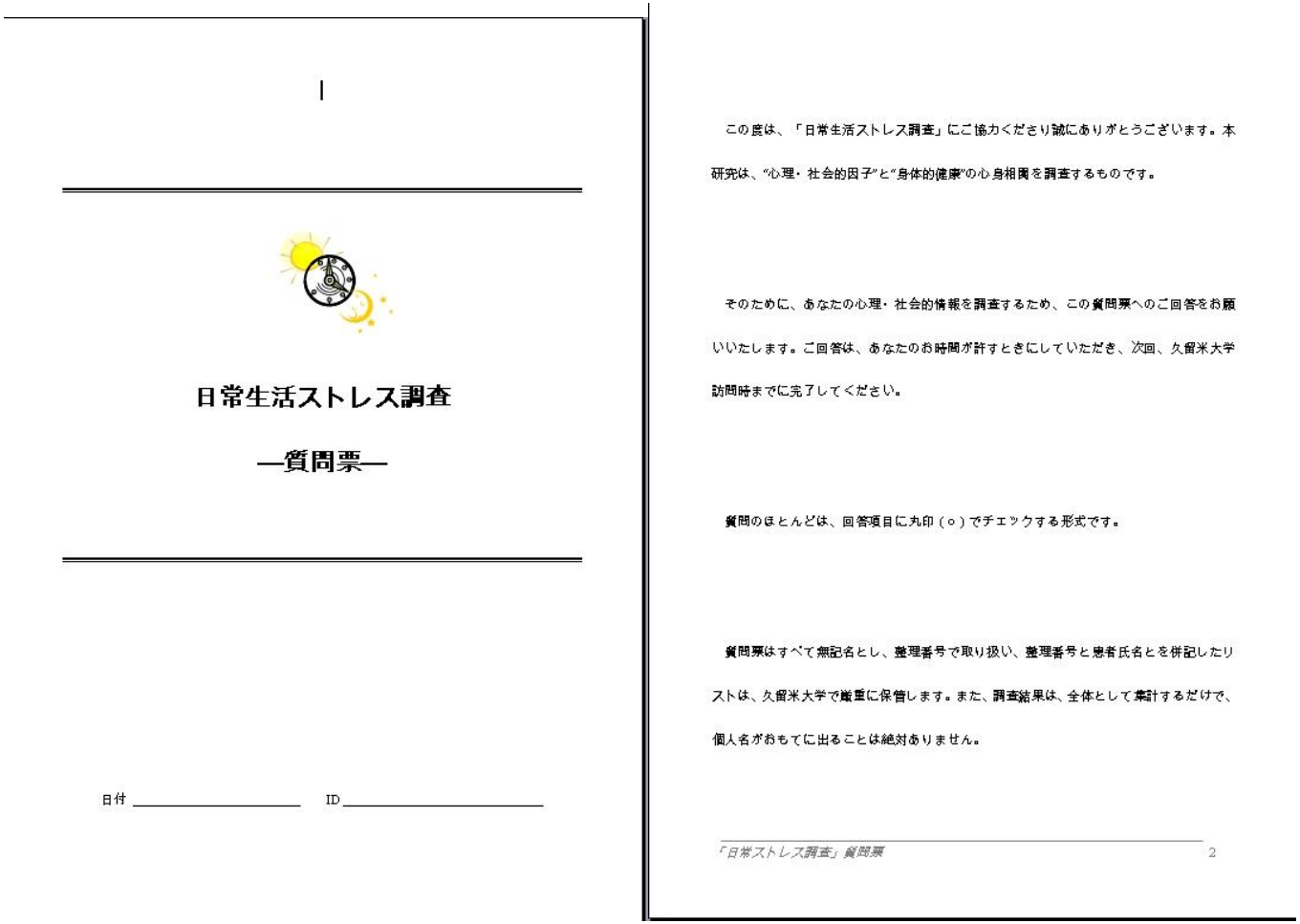
8. 最初の調査セッションは？（調査日時の決定）

２回目の調査セッションは？（調査日時の決定）

9. 郵便住所

メールアドレス

Appendix 9: Daytracker Japan questionnaire



日常生活ストレス調査

—質問票—

日付 _____ ID _____

この度は、「日常生活ストレス調査」にご協力くださり誠にありがとうございます。本研究は、"心理・社会的因子"と"身体的健康"の心身相関を調査するものです。

そのために、あなたの心理・社会的情報を調査するため、この質問票へのご回答をお願いいたします。ご回答は、あなたのお時間が許すときにしていただき、次回、久留米大学訪問時までに完了してください。

質問のほとんどは、回答項目に丸印（○）でチェックする形式です。

質問票はすべて無記名とし、整理番号で取り扱い、整理番号と患者氏名とを併記したリストは、久留米大学で厳重に保管します。また、調査結果は、全体として集計するだけで、個人名がおもてに出ることは絶対ありません。

質問項目A

この項目では、あなたの現状についておたずねします。

	今日の日付は？ 西暦　　年 /　　月 /　　日					
1.	あなたの性別は？何歳ですか？ 男 ・ 女　　満　　歳					
2.	あなたの今の婚姻関係は？					
	○	現在、結婚相手と同居している。あるいは、内縁関係の相手と同居している。				
	○	独身				
	○	別居 / 離婚 / 内縁関係の相手と以前同居していた				
	○	死別				
3.	あなたの宗教は何ですか？（主な信仰宗教１つに丸印（○）をつけてください）					
	○	仏教	○	ヒンズー教	○	無宗教
	○	日本神道	○	ユダヤ教	○	唯物論
	○	キリスト教（カトリック）	○	イスラム教	○	その他（　　）
	○	キリスト教（プロテスタント）	○	シーア教		

4.	あなたのお仕事は何ですか？	
5.	あなたは平均週に何時間職場で仕事をしていますか？	
		時間 / 週
6	あなたは平均週に何時間家で仕事をしていますか？	
		時間 / 週
7.	あなたが最終学歴を修了したのは何歳の時ですか？	歳時
8.	あなたの最終学歴（学位）はどれですか？	
	○ 中卒	○ 大卒（学士）
	○ 高卒	○ 大学院卒（修士）
	○ 高専卒	○ 大学院卒（博士）
	○ 専門学校卒	○ その他 _____
	○ 短大卒	

9.	あなたが住んでいる住宅の物件形態はどれですか？	
	○	一軒家
	○	マンション、アパート
	○	その他（右欄にご記入ください）

10.	あなたの住居の支払いはどうなってますか？	
	○	支払い済み物件、あるいは、ローン購入
	○	賃貸
	○	無料
	○	その他（右欄にご記入ください）

11	あなたを除いて、自宅に何人の人が住んでますか？		
			人

12.	台所、浴室、トイレを除いて、自宅にいくつ部屋がありますか？		
			部屋

13.	あなたには子供がいますか？	
	いいえ	○
	はい	○
14.	もしはいなら、何人子供がいますか？	人
15.	また、何人の子供と同居してますか？	人

質問項目 B

この項目では、あなたのお仕事についておたずねします。それぞれの質問事項で、あなたの仕事、あるいは職場でのあなたの問題解決手段についてもっとも当てはまるものに丸印（○）を付けてください。それぞれの質問事項について、出来るだけ正確なご回答をお願いします。

		よくある	時々	まれに	まったくない
1.	あなたは、非常に急いで仕事をしなければなりませんか？	○	○	○	○
2.	あなたは、とても集中して仕事をしなければなりませんか？	○	○	○	○
3.	あなたは、全てのことをするのに十分な時間を持っていますか？	○	○	○	○
4.	あなたには、自分の仕事のやり方を決める権限がありますが。	○	○	○	○
5.	あなたには、何の仕事をするか決める権限がありますか？	○	○	○	○
6.	あなたは、職場で何人かの人達から仕事を頼まれたら、一緒に処理するのはむずかしいと思いますか？	○	○	○	○
7.	あなたの仕事は、高い技能と専門知識を求められますか？	○	○	○	○
8.	あなたの仕事は、あなたに率先して物事を進めることを求めますか？	○	○	○	○
9.	あなたは、自分の仕事を通じて、新しいことを学ぶことが出来ますか？	○	○	○	○
10.	あなたは、何度も同じ事を繰り返しますか？	○	○	○	○
11.	あなたの仕事は、退屈ですか？	○	○	○	○

職場でのあなたの立場について：次のような事項がどれくらい当てはまりますか？

		よくある	時々	まれに	まったくか、ほとんどない
12.	他の人にあなたの仕事の決定権がある。	○	○	○	○
13.	あなたは、仕事に関する決定にたくさん意見する。	○	○	○	○
14.	あなたは、自分の仕事の速さについて意見する。	○	○	○	○
15.	あなたの仕事時間は、融通（ゆうずう）がきく。	○	○	○	○
16.	あなたは、いつ休憩するか決められる。	○	○	○	○
17.	あなたは、誰と仕事を組んでするか意見する。	○	○	○	○
18.	あなたは、職場環境を整えることにたくさん意見する。	○	○	○	○
19.	あなたの仕事には、さまざまおもしろい仕事が含まれている。	○	○	○	○
20.	あなたは、自分の仕事を評価していますか？	○	○	○	○
21.	あなたは、自分の仕事が非常におもしろいと思っていますか？	○	○	○	○
22.	あなたの同僚は、あなたの仕事をおもしろいと思っていますか？	○	○	○	○
23.	あなたの同僚は、どれくらい、あなたの仕事に関する問題を聞いてくれますか？	○	○	○	○
24.	あなたの直属の上司は、どれくらい、あなたの問題を聞いてくれますか？	○	○	○	○

あなたの仕事全般について：あなたは次の事項にどれくらい満足していますか？

		とても満足している	満足している	満足してない	まったく満足してない
25.	あなたの手取り賃金	○	○	○	○
26.	あなたの仕事の将来性	○	○	○	○
27.	あなたの同僚からの援助・サポート	○	○	○	○
28.	あなたの上司からの援助・サポート	○	○	○	○
29.	あなたの能力の使われ方	○	○	○	○
30.	あなたの仕事に関連した面白味、技能	○	○	○	○

次のそれぞれの質問事項について、もっとも正しい対応を選択してください。

		あてはまらない	あてはまるが、全く悩んでいない	あてはまっており、いくらか悩んでいる	あてはまっており、かなり悩んでいる	あてはまっており、非常に悩んでいる
31.	仕事の負担が重く、常に時間に追われている。	○	○	○	○	○
32.	邪魔が入って中断させられることの多い仕事だ。	○	○	○	○	○
33.	責任の重い仕事だ。	○	○	○	○	○
34.	しばしば、残業をせまられる。	○	○	○	○	○
35.	肉体的にきつい仕事だ。	○	○	○	○	○
36.	過去数年、だんだん仕事の負担が増えてきた。	○	○	○	○	○
37.	上司からふさわしい評価を受けている。	○	○	○	○	○
38.	同僚からふさわしい評価を受けている。	○	○	○	○	○
39	困難な状況に直面すれば同僚から充分な支援が受けられる。	○	○	○	○	○
40	職場で公平に扱われていない。	○	○	○	○	○
41	昇進の見込みは少ない。	○	○	○	○	○
42	職場で、好ましくない変化を経験している。もしくは今後そういう状況が起こりうる。	○	○	○	○	○
43	失職の恐れがある。	○	○	○	○	○
44	現在の職は、自分が受けた教育やトレーニングの程度を充分反映している。	○	○	○	○	○
45	自分の努力と成果を全て考え合わせると、私は仕事上ふさわしい評価と人望を受けている。	○	○	○	○	○

		あてはまらない	あてはまるが、全く悩んでいない	あてはまっており、いくらか悩んでいる	あてはまっており、かなり悩んでいる	あてはまっており、非常に悩んでいる
46	自分の努力と成果を全て考え合わせると、私の仕事の将来の見通しは適当だ。	○	○	○	○	○
47	自分の努力と成果を全て考え合わせると、私のサラリー / 収入は適当だ。	○	○	○	○	○

それぞれの事項についてあなた自身にどの程度あてはまるか、該当する選択しに丸印 (○) をつけて下さい。

		全く違う	違う	その通りだ	まったくその通りだ
48	時間的なプレッシャーを感じやすい。	○	○	○	○
49	朝起きるとすぐ、仕事の問題を考え始める。	○	○	○	○
50	家に帰ると、すぐにリラックスでき、仕事のことを全て忘れてしまう。	○	○	○	○
51	私をよく知る人は、私は仕事のために自分を犠牲にしすぎているという。	○	○	○	○
52	仕事のことが頭から離れず、寝床に入ってもそのことばかり考えている。	○	○	○	○
53	今日中にやるべき事をやむを得ず明日に延ばさなければならないとしたら、夜眠れない。				

質問項目C

この質問項目は、経済的問題で生じるさまざまな苦境に関するものです。現在のあなたに当てはまるものに丸印(○)を付けてください。

	現時点に関して	**難しくない**	**いくらか難しい**	**大変難しい**
1.	あなたには、取り替えなければならない家具や住宅の備品を買う余裕がありますか？	○	○	○
2.	あなたには、あなたとあなたの家族に必要な食事を買う十分なお金がありますか？	○	○	○
3.	あなたは、あなたへの請求書の支払いに問題を抱えてますか？	○	○	○
4.	あなたには、必要なときに、大事な物品(たとえば、車など)を取り替える経済的余裕がありますか？	○	○	○
5.	あなたには、あなたとあなたの家族に必要な娯楽(レジャー)をする十分なお金がありますか？	○	○	○
6.	あなたには、あなたとあなたの家族に合った家を買う余裕がありますか？	○	○	○
7.	今月末、あなたにはお金が残っていますか？：(丸印(○)をつけてください)	次月へ繰り越せるお金が残っている	ちょうどでお金は残っていない	今月の出費にお金が見合わない、不足している

8.	あなたの賃金、定期ボーナス、臨時ボーナス、その他収入源(投資益など)を含め、あなたの現在の年収(税収前)はいくらですか？適切なものひとつに丸印(○)を付けてください。			
○	２００万円未満	○	５００万円以上７００万円未満	
○	２００万以上３００万円未満	○	７００万円以上１，０００万円未満	
○	３００万円以上４００万円未満	○	１，０００万円以上１，４００万円未満	
○	４００万円以上５００万円未満	○	１，４００万円以上	

9.	あなたの家庭収入は、あなたも含め何人によって支えられていますか？(たとえば、結婚相手、子供、両親など)	人

10.	最近１年間のあなたの家庭収入(あなた自身の収入も含め)は、合計いくらですか？			
○	２００万円未満	○	７００万円以上１，０００万円未満	
○	２００万以上３００万円未満	○	１，０００万円以上１，４００万円未満	
○	３００万円以上４００万円未満	○	１，４００万円以上２，０００万円未満	
○	４００万円以上５００万円未満	○	２，０００万円以上４，０００万円未満	
○	５００万円以上７００万円未満	○	４，０００万円以上	

質問項目 D

この質問項目は、最近１ヶ月間のあなたの睡眠習慣に関するものです。最近１ヶ月間の日中と夜間の主な反応についてもっとも適切な回答を選んでください。回答は、それぞれの質問につき１つです。

1. 最近１ヶ月、あなたはどれくらい、、、、、？

		まったくない	1〜3日	4〜7日	8〜14日	15〜21日	22〜31日
1.	入眠困難がありましたか？	○	○	○	○	○	○
2.	夜間何度か起きてしまいましたか？	○	○	○	○	○	○
3.	眠りを持続しにくかったですか？（早朝覚醒（かくせい）を含め）	○	○	○	○	○	○
4.	ふつうに眠って起きた後でも、疲れが残り、消耗していますか？	○	○	○	○	○	○

質問項目 E

1. 最近１ヶ月間のあなたの健康具合（ぐあい）は、おおよそどうでしたか？

○	○	○	○	○
最高	とても良い	良い	まあまあ	悪い

あなたは、軽い、中程度、激しいスポーツや運動にどれくらい参加していますか？（それぞれの項目につき１つだけ印を付けてください）

		毎週3回以上	毎週1〜2回	毎月約1〜3回程度	まったくないかほとんど常
2.	軽い運動 *（例えば、散歩、庭仕事、軽い土いじり、自転車の修理、日曜大工）*	○	○	○	○
3.	中程度の運動 *（例えば、サイクリング、ダンス、ゴルフ、軽い水泳、耕したりする畑仕事）*	○	○	○	○
4.	激しい運動 *（例えば、ランニング、激しい水泳、テニス、自転車競争、掘ったりする畑仕事）*	○	○	○	○

最近１週間の出来事について考えてください。あなたは、自宅や職場以外で平均どれくらい歩きましたか？たとえば、９０分ではなく、１時間３０分というふうに「時間」と「分」でお答えください。（もしあなたが全く歩いていなかったら、０でお答えください）

5.	平日		*時間*		*分*
6.	週末		*時間*		*分*

7.	あなたは、これまで喫煙を習慣にしたことがありますか？（１つだけに丸印（○）をしてください）	
	○　いいえ、喫煙を習慣としたことはありません	
	○　はい、以前喫煙者でした	
8.	↳ あなたが喫煙をやめたのは、何歳の時ですか？	才
9.	↳ 平均１日何本たばこを吸っていましたか？	本
	○　はい、現在喫煙者です	
10.	↳ 平均１日何本たばこを吸いますか？	本

この質問は、ビール、ワイン、その他すべてのアルコール飲料の飲酒に関するものです。

11.	あなたは自身について		
○	まったく飲酒しない	○	つきあい程度
○	まれに、特別な行事・催事のみで飲酒	○	常飲する

12.	もしあなたの飲酒が、「つきあい程度」、あるいは「常飲する」であれば、最近２週間（１４日間）で何日飲酒しましたか？	
		日
13.	あなたが飲酒した日、平均何杯飲みましたか？	
		杯
14.	あなたは、飲酒する量を減らしたいですか？	
		○ はい　○ いいえ

15.	あなたは、フルーツや野菜を平均どれくらいの頻度食べていますか？（摂取１回分は、リンゴ１個、あるいは小さいサラダボール１つぐらいとお考えください）		
○	１日５回以上	○	週に１回
○	１日３回以上	○	週１回未満
○	１日少なくとも１回	○	月１回未満
○	２，３日おきに１回	○	全くない

16	あなたは、平均どれくらいの頻度で、次の食品を摂取していますか？				
		全脂肪牛乳	低脂肪牛乳	脱脂肪牛乳	豆乳
	１日５回以上	○	○	○	○
	１日３回以上	○	○	○	○
	１日少なくとも一回	○	○	○	○
	２，３日おきに１回	○	○	○	○
	週１回未満	○	○	○	○
	月１回未満	○	○	○	○
	全くない	○	○	○	○

	通常のあなたの娯楽活動（レジャー）について	
	平日では	
17.	あなたは、１日何時間、テレビやビデオをみたり、コンピューター・ゲームをして過ごしますか？	*時間*
	週末では	
18.	あなたは、１日何時間、テレビやビデオをみたり、コンピューター・ゲームをして過ごしますか？	*時間*

質問項目 F

この質問項目は、最近１週間のあなたの気持ちに関するものです。それぞれの項目に対し適切な番号を選択してください。

1	2	3	4	5	6	7
全くそうは思わない	そうは思わない	あまりそうは思わない	どちらでもない	まあまあそう思う	そう思う	全くそう思う

1.	わたしには、感謝することが人生でとても多くある。	1	2	3	4	5	6	7
2.	もし私が、感謝することをすべて書き出すとしたら、それはとても長いリストになるだろう。	1	2	3	4	5	6	7
3.	わたしは、世界に目を向けたら、感謝することはあまり見つけないだろう。	1	2	3	4	5	6	7
4.	わたしは、幅広くさまざまな人たちに感謝する。	1	2	3	4	5	6	7
5.	わたしは、年を取るにつれ、自分の人生で関わった人たち、出来事、状況に感謝できるようになってきた。	1	2	3	4	5	6	7
6.	わたしは、物事や人に感謝するまで長い時間かかる。	1	2	3	4	5	6	7

質問項目 G

それぞれの項目について、あなたがどれくらい認めるのか、それとも認めないのか番号に丸印（○）を付けてください。

		いいえ						はい
1.	わたしは、計画を立てるとき、すべてを仕上げる。	1	2	3	4	5	6	7
2.	わたしは、たいてい複数のやり方で物事を処理する。	1	2	3	4	5	6	7
3.	わたしは、人生で何かを成し遂げる自信がある。	1	2	3	4	5	6	7
4.	わたしは、たいてい苦もなく物事を処理する。	1	2	3	4	5	6	7
5.	わたしは自分が大好きだ。	1	2	3	4	5	6	7
6.	わたしは、一度に多くの物事を処理できると思う。	1	2	3	4	5	6	7
7.	わたしには、決断力がある。	1	2	3	4	5	6	7
8.	わたしには、自制心がある。	1	2	3	4	5	6	7
9.	わたしには、物事への好奇心がある。	1	2	3	4	5	6	7
10.	わたしは、たいてい笑いを誘うことを何か見つける。	1	2	3	4	5	6	7
11.	わたしの内にある信念は、困難な時期を乗り越えている。	1	2	3	4	5	6	7
12.	わたしは、たいてい色々な視点から状況を見る。	1	2	3	4	5	6	7
13.	わたしの人生には、意味がある。	1	2	3	4	5	6	7
14.	わたしは、困難な状況に直面したら、たいてい解決できる。	1	2	3	4	5	6	7
15.	わたしには、しなければならないことをするエネルギーが十分ある。	1	2	3	4	5	6	7

質問項目 H

この項目では、あなた自身についてもっとも当てはまると感じる段階に印を付けてください。

1. おおよそ、わたしは自分について思う：

1	2	3	4	5	6	7
あまり幸福ではない人間						とても幸福な人間

2. 自分の知り合いのほとんどと較べ、わたしは自分について思う：

1	2	3	4	5	6	7
もっと不幸						もっと幸福

3. 全般的に、とても幸福な人たちがいる。彼らは、何があろうが関わらず、すべてのことを最大限利用して人生を楽しんでいる。この状況はあなたにどれくらい当てはまっていますか？

1	2	3	4	5	6	7
全く当てはまらない						大変当てはまっている

4. 全般的に、あまり幸福ではない人たちがいる。彼らは憂うつではないが、決して幸福そうではない。この状況はあなたにどれくらい当てはまっていますか？

1	2	3	4	5	6	7
全く当てはまらない						大変当てはまっている

質問項目 I

この項目は、あなたの宗教心 / スピリチュアル (霊性) に関するものです。適切な回答を選択してください。

		全くそうは思わない	そうは思わない	そう思う	全くそう思う
1.	宗教的信仰はわたしにとって極めて重要だ。	○	○	○	○
2.	わたしは、毎日祈りか瞑想をする。	○	○	○	○
3.	わたしは、自分の宗教により人生の意味や目的を悟ったと思う。	○	○	○	○
4.	わたしは、自分のことを宗教活動 (寺、教会、モスクへ通うなど) に熱心だと思う。	○	○	○	○

5.	あなたは、死後の世界があることを信じますか？					
	○	はい	○	いいえ	○	わからない

6.	あなたは、どれくらいの頻度で宗教施設に行きますか？					
	○	週に２回以上	○	月に１回か２回	○	年に１回か２回
	○	毎週かそれ以上	○	毎月ぐらい	○	まったくない

7.	あなたは、自分をどれくらい宗教的な人間と思いますか？			
	○	とても宗教的	○	少し宗教的
	○	まあまあ宗教的	○	全く宗教的ではない

8.	あなたは、自分をどれくらいスピリチュアル (霊的) な人間と思いますか？			
	○	とても霊的	○	少し霊的
	○	まあまあ霊的	○	全く霊的ではない

わたしの宗教的信仰、あるいは霊的信念ゆえ：

		いつも、あるいはほとんどいつも	よく	まれに	全くない	回答不可
9.	わたしは、自分が犯した悪行について自分を許している。	○	○	○	○	○
10.	わたしは、自分を傷つけた人達を許している。	○	○	○	○	○
11.	わたしは、神仏が自分をお許しになっていると思う。	○	○	○	○	○

この質問項目では、あなたがストレスのかかる事件に直面したとき、たいてい何をなし、どう感じるかについてお訊きします。ストレスのかかる事件に直面したとき、人それぞれ違った対処の仕方をしますが、ここでは、あなたが普段どう行動するかについて考えてください。次のそれぞれの事項について、あなたの普段の対処様式を選択してください。また、それぞれの事項は独立した単独のものとしてお答えください。

1	2	3	4
わたしは、全くそうしない	わたしは、少しそうする	わたしは、まあまあそうする	わたしは、よくそうする

1.	わたしは、宗教や霊的信仰に救いを求める。	1	2	3	4
2.	わたしは、祈ったり、瞑想する。	1	2	3	4

質問項目 J

ほとんどの人は、自分たちの結婚相手 / 内縁関係の相手と意見の相違を持っています。以下のそれぞれの事項について、自分と相手との間でどれくらいの意見の一致や相違があるかお答えください。

○	わたしは、現在結婚関係 / 内縁関係にない。３０ページの質問項目１４へお進みください。

もしあなたが、結婚関係 / 内縁関係にある場合、次の質問にお答えください。

あなたが、この関係になってどれくらいになりますか？＿＿＿＿＿＿＿＿＿＿年

		いつもそうである	ほとんどいつもそうである	時々そうである	ほとんどない	全くない
1.	家庭問題の対処	○	○	○	○	○
2.	娯楽関係	○	○	○	○	○
3.	宗教関係	○	○	○	○	○
4.	気持ちの出し方	○	○	○	○	○
5.	交友関係	○	○	○	○	○
6.	性生活	○	○	○	○	○
7.	伝統・しきたり（行儀）	○	○	○	○	○
8.	人生観	○	○	○	○	○
9.	両親や義理の両親への対応の仕方	○	○	○	○	○
10.	目的、目標、重要と思う事柄	○	○	○	○	○
11.	一緒に過ごす時間の長さ	○	○	○	○	○

		いつもそうである	ほとんどいつもそうである	時々そうである	ほとんどない	全くない
12.	重大決定	○	○	○	○	○
13.	家事	○	○	○	○	○
14.	娯楽についての関心、活動	○	○	○	○	○
15.	経歴・進路決定	○	○	○	○	○
16.	けんかの後、あなたか相手が家を出ることがよくある。	○	○	○	○	○
17.	一般に、あなたと相手との間の物事はうまくいっていると思いますか？	○	○	○	○	○
18.	あなたは、相手を信頼していますか？	○	○	○	○	○
19.	あなたと相手には、互いの神経に触るようなことがどれくらいありますか？	○	○	○	○	○
20.	あなたと相手は、どれくらいけんかをしますか？	○	○	○	○	○
21.	あなたは、この関係になったことをこれまで後悔していますか？	○	○	○	○	○
22.	あなたは、相手を抱擁（ほうよう）したり、キスしますか？				○ はい	○いいえ
23.	あなたと相手は、興味・関心以外のことでも、一緒になってやりますか？				○ はい	○いいえ
24.	もしそうなら、何回ですか？					

あなたと相手は、どのくらいの頻度でしますか：

		全くない	月1回未満	月1回か2回	週1回か2回	毎日1回	もっと多く
25.	おもしろいおしゃべり	○	○	○	○	○	○
26.	一緒に笑う	○	○	○	○	○	○
27.	何かについて冷静に話し合う	○	○	○	○	○	○
28.	１つの計画を一緒になって取り組む	○	○	○	○	○	○

最近２・３週間で、次にあげた事項について夫婦間に問題があったかどうかお答えください。

29.	性生活にとても疲れている	○ はい	○いいえ
30.	愛情を示さない	○ はい	○いいえ

31. あなたの夫婦関係の幸福度を示す選択肢に丸印（○）を付けてください。

○	○	○	○	○	○	○
とても不幸	いくぶん不幸	まあまあ幸福	だいたい幸福	とても幸福	極めて幸福	最高

32. あなたの夫婦関係の将来について、最も適切な選択肢を１つ選んでください。*（選択肢に丸印○をつけてください）*

○	わたしは、夫婦関係をうまくいかせたいとぜひ思うし、これを果たすためならどれくらい時間がかかっても努力するだろう。
○	わたしは、夫婦関係をうまくいかせたいととても思うし、この件でわたしで出来ることはすべてするだろう。
○	わたしは、夫婦関係をうまくいかせたいととても思うし、この件でわたしがすべき適当な分担は果たすだろう。
○	わたしの夫婦関係がうまくいけばいいが、この件でわたしが現在していること以外にすべきことはない。
○	わたしの夫婦関係は決してうまくいかないし、この件でわたしが出来ることは残っていない。

質問項目 K

次の記載や質問について、あなた自身に最も当てはまると思うものに丸印(○)をつけてください。

		たびたび	時々	あまりない	全くない
1.	もしわたしが日帰り旅行(たとえば、海辺へ)に行きたくなったら、一緒に行ってくれる人を誰か見付けるのは大変だ。	○	○	○	○
2.	わたしは、個人的な心配や不安を共有してくれる人は誰もいないと感じる。	○	○	○	○
3.	もしわたしが病気になったら、わたしの身の回りのことを世話してくれる人を誰か見付けるのはたやすい。	○	○	○	○
4.	わたしには、自分の家族の問題について相談できる人が誰かいる。	○	○	○	○
5.	もしわたしが夕方に映画に行こうとその日の午後に決めたとしたら、一緒に行ってくれる人を誰か見付けるのはたやすい。	○	○	○	○
6.	わたしが個人的問題の対処について助言が必要なとき、それを聴きに行く人が誰かいる。	○	○	○	○
7.	わたしは、誰かと一緒に何かしようと誘われることがあまりない。	○	○	○	○
8.	もしわたしが2ー3週間街を離れないといけないとしたら、自分の自宅を管理(生け花やペットの世話など)してくれる人を誰か見付けるのは難しい。	○	○	○	○
9.	もしわたしが誰かとランチをとりたいと思ったら、一緒に行ってくれる人を見付けるのはたやすい。	○	○	○	○
10.	もしわたしが家から10キロ離れた場所に置き去りにされたら、わたしを拾って送り届けてくれるよう電話できる人が誰か	○	○	○	○

	いる。				

		たびたび	時々	あまりない	全くない
11.	もし家庭問題が起こったら、それを解決するいいアドバイスをくれる人を誰か見付けるのは難しい。	○	○	○	○
12.	もしわたしが新しい家やアパートに引っ越すのを誰かに手伝って欲しいとき、手伝ってくれる人を誰か見付けるのは難しい。	○	○	○	○

質問事項 L

次のそれぞれの事項について、あなたはどれくらいの頻度感じますか？

		たびたび感じる	どちらかといえば感じる	どちらかといえば感じない	決して感じない
1.	わたしは、周囲の人たちと調子よくいっている。	○	○	○	○
2.	わたしは、人とのつきあいがない。	○	○	○	○
3.	わたしには、頼りにできる人がいる。	○	○	○	○
4.	わたしは、ひとりぼっちである。	○	○	○	○
5.	わたしは、親しい仲間達の中で欠くことが出来ない存在である。	○	○	○	○
6.	わたしは、自分の周囲の人たちと共通点が多い。	○	○	○	○
7.	わたしは、今、だれとも親しくしていない。	○	○	○	○
8.	わたしの興味と考えは周囲の人たちと同じである。	○	○	○	○
9.	わたしは、外出好きの人間である。	○	○	○	○

		たびたび感じる	どちらかといえば感じる	どちらかといえば感じない	決して感じない
10.	わたしには、親密感の持てる人達がいる。	○	○	○	○
11.	わたしは、無視されている。	○	○	○	○
12.	わたしの社会的なつながりはうわべだけのものである。	○	○	○	○
13.	わたしをよく知っている人はだれもいない。	○	○	○	○
14.	わたしは、他の人達から孤立している。	○	○	○	○
15.	わたしは、望むときにはいつでも、人とつきあうことができる。	○	○	○	○
16.	わたしには、わたしを本当に理解してくれる人達がいる。	○	○	○	○
17.	わたしは、たいへん引っ込み思案なのでみじめである。	○	○	○	○
18.	わたしには、知人はいるが、わたしと同じ考えの人はいない。	○	○	○	○
19.	わたしには、話しかけることのできる人達がいる。	○	○	○	○

質問項目 M

この項目では、人の考え方や感じ方を列挙しています。次のそれぞれの事項について、もっとも適切な選択肢に丸印（○）をつけてください。それぞれの事項は独立したものですので、他の回答に関係なく答えていくようにしてください。

		全くそう思う	まあまあそう思う	どちらでもない	まあまあそうは思わない	全くそうは思わない
1.	はっきりしないときでも、ふだんわたしは最も良いことを期待している。	○	○	○	○	○
2.	わたしは、たやすくリラックスできる。	○	○	○	○	○
3.	何かわたしにとってうまくいかなくなる可能性があれば、それはきっとそうなるものだ。	○	○	○	○	○
4.	わたしは自分の将来についていつも楽観的である。	○	○	○	○	○
5.	わたしには、たくさんの友人がいる。	○	○	○	○	○
6.	忙しくあり続けることはわたしにとって大切である。	○	○	○	○	○
7.	わたしは物事が自分の思い通りにいくとはほとんど思っていない。	○	○	○	○	○
8.	わたしは、非常にたやすく取り乱してしまうようなことはない。	○	○	○	○	○
9.	良いことがわたしに起こるなんてほとんど当てにしていない。	○	○	○	○	○
10.	概して、わたしは悪いことよりも良いことの方が自分の身に起こると思う。	○	○	○	○	○

質問項目 N

	下記に、さまざまな気持ちや感情に関する言葉を並べています。最近１週間におけるあなたの気持ちについて、最も当てはまる選択肢に丸印（○）をつけなさい。					
		まれ／全くない	少し	まあまあ	多い	極めて多い
1.	好奇心のある	○	○	○	○	○
2.	うろたえた	○	○	○	○	○
3.	おびえた	○	○	○	○	○
4.	誇らしい	○	○	○	○	○
5.	恥じた	○	○	○	○	○
6.	きっぱりとした	○	○	○	○	○
7.	活気のある	○	○	○	○	○
8.	苦悩した	○	○	○	○	○
9.	強気な	○	○	○	○	○
10.	敵意のある	○	○	○	○	○
11.	いらだった	○	○	○	○	○
12.	気合いの入った	○	○	○	○	○
13.	思いやりのある	○	○	○	○	○
14.	心配した	○	○	○	○	○
15.	わくわくした	○	○	○	○	○
16.	罪悪感のある	○	○	○	○	○
17.	熱狂した	○	○	○	○	○
18.	傷敏な	○	○	○	○	○
19.	びりびりした	○	○	○	○	○
20	びくびくした	○	○	○	○	○

質問項目 O

この１週間の、あなたのからだや心の状態についてお聞きいたします。下の２０の文章を読んで下さい。

1	2	3	4
全くないか、まれ（週１日続かない）	ほんの少し（週１～２日）	時々（週３～４日）	ほとんどか、すべて（週５～７日）

1.	普段では何でもないことがわずらわしい。	1	2	3	4
2.	食べたくない。食欲が落ちた。	1	2	3	4
3.	家族や友達からはげましてもらっても、気分が晴れない。	1	2	3	4
4.	他の人と同じ程度には、能力があると思う。	1	2	3	4
5.	物事に集中できない。	1	2	3	4
6.	ゆううつだ。	1	2	3	4
7.	何をするのも面倒だ。	1	2	3	4
8.	これから先のことについて積極的に考えることができる。	1	2	3	4
9.	過去のことについてくよくよ考える。	1	2	3	4
10.	何か恐ろしい気持ちがする。	1	2	3	4
11.	なかなか眠れない。	1	2	3	4

1	2	3	4
全くないか、まれ（週1日続かない）	ほんの少し（週1～2日）	時々（週3～4日）	ほとんどか、すべて（週5～7日）

12.	生活について不満なくすごせる。	1	2	3	4
13.	ふだんより口数が少ない。口が重い。	1	2	3	4
14.	一人ぼっちでさびしい。	1	2	3	4
15.	皆がよそよそしいと思う。	1	2	3	4
16.	毎日が楽しい。	1	2	3	4
17.	急に泣きだすことがある。	1	2	3	4
18.	悲しいと感じる。	1	2	3	4
19.	皆が自分をきらっていると感じる。	1	2	3	4
20.	仕事が手につかない。	1	2	3	4

1	2	3	4
全くないか、まれ（週1日続かない）	ほんの少し（週1～2日）	時々（週3～4日）	ほとんどか、すべて（週5～7日）

12.	生活について不満なくすごせる。	1	2	3	4
13.	ふだんより口数が少ない。口が重い。	1	2	3	4
14.	一人ぼっちでさびしい。	1	2	3	4
15.	皆がよそよそしいと思う。	1	2	3	4
16.	毎日が楽しい。	1	2	3	4
17.	急に泣きだすことがある。	1	2	3	4
18.	悲しいと感じる。	1	2	3	4
19.	皆が自分をきらっていると感じる。	1	2	3	4
20.	仕事が手につかない。	1	2	3	4

Appendix 10: Daytracker Japan Sampling Diary

Project ID _____

唾液採取

あなたが唾液採取した日付 _____月_____日.

あなたには、今晩から明日にかけ、７回唾液採取をして頂きます。
下記の時間に採取してください。
忘れないように、腕時計や目覚まし時計のアラーム機能を活用して頂いても結構です。
検体を採取する度に、この記録日誌にご回答下さい。
それぞれの採取毎に、別々の質問が用意されています（１検体につき１ページ）。

今晩就眠する前に、起床時検体チューブ（チューブ３）とこの検体記録日誌を寝床のそばに置いてください。

あなたの正確な検体採取と日誌への記録が、この調査では特に大切です。たとえ指定された時間とずれていても、実際の採取時刻を記録し、出来るだけ正確に質問にお答えください。

唾液採取手順

1.	採取１５分前は、飲食をしたり、歯を磨いたりしないで下さい。
2.	チューブの蓋を取り、中にある綿球を口に含んでください。この際、手で綿球に触らないように注意して下さい。
3.	綿球に十分唾液が浸るまで、約２分ほど優しく噛み続けて下さい。この間、記録日誌の質問にご回答下さい。
4.	綿球が浸ったら、手を使わず検体チューブに綿球を戻して下さい。チューブの蓋をしっかりつけたら、検体保存ビニール袋に入れて下さい。
5.	検体保存ビニール袋は、冷蔵庫か冷暗所に保管して下さい。

採取時間	チューブ番号	備　考
最初の訪問時	1	当研究室を最初に訪れた際に採取します。
就眠時	2	就眠直前に採取します。
起床時	3	起床直後、寝床を離れる前に、採取します。

場所と活動に関するコード表

私たちは、あなたが唾液採取した時に、どこにいて何をしていたか知る必要があります。
出来るだけ情報をシンプルにするため、このコード表の記号で回答して下さい。
それぞれのページにある質問の回答欄に適当な番号を入れて下さい。

場　所

1	自　宅		8	娯楽施設内
2	職　場		9	屋　外
3	友人 / 親族の家		10	教　室
4	自家用車 / タクシー		11	神社仏閣 / 教会
5	公共交通車内（電車、バスなど）		12	スポーツ施設 / ジム
6	商店 / スーパーマーケット		13	医院 / 病院（歯科含む）
7	飲食店 / レストラン / 酒場		14	他の場所

活　動

A	通勤・通学 / 移動中		K	子供の世話
B	買い物		L	祈り / 参拝 / 瞑想
C	家　事		M	テレビ鑑賞
D	飲　食		N	コンピューター / インターネット / E-メール
E	人と面会		O	電　話
F	うたた寝 / 休憩		P	運　動
G	リラックス		Q	着替え / シャワー / 入浴

☺空白ページ

綿球をチューブ本体に戻す際、中にある小さい内筒チューブをはずさないように注意して下さい。下図に示すように、綿球はこの内筒チューブに入れて下さい。

Project ID _____

チューブ１：研究室訪問時

1.	*今何時ですか？*			午前 / 午後_____時		
2.	*唾液採取した正確な時刻はいつですか？*			午前 / 午後_____時		
	次の２つの質問について、最後のページのコード表から選んで回答して下さい。					
3.	*あなたはどこにいますか？*		4. *あなたは何をしていますか？*			

最近３０分、あなたはどう感じましたか？

		全くない				とても多い
4.	コントロール感	1	2	3	4	5
5.	疲労感	1	2	3	4	5
6.	幸福感	1	2	3	4	5
7.	イライラ、あるいは怒り	1	2	3	4	5
8.	忙しさ	1	2	3	4	5
9.	ストレス感	1	2	3	4	5
10	痛　み	1	2	3	4	5
11.	もしあなたが誰かと話をしていたなら、その会話は快いものでしたか？					
	回答不可　○	1	2	3	4	5

唾液採取前にあなたは下記のことをしましたか？

12.	歯磨き	いいえ	はい
13.	コーヒー、紅茶、緑茶などカフェインを含む飲料物を摂取した	いいえ	はい
14.	薬物を内服した	いいえ	はい
15.	食事した	いいえ	はい

備考/コメント

もしあなたがこの唾液採取期間について私たちに知らせておきたいことがあれば、下の空欄に記録してください。

この記録日誌に記入するお時間を取っていただきありがとうございました。
今回の調査にご協力して頂き誠に感謝します。

次回、研究室訪問時

もし唾液採取が月曜日、火曜日、水曜日、あるいは木曜日に始まった場合

その週の週末に、研究室にお越しください。唾液検体とこの検体記録日誌を回収いたします。

あなたが採取した唾液検体すべてとこの検体記録日誌を忘れずお持ちください。

もし唾液採取が金曜日に始まった場合

唾液サンプルを月曜日まで冷蔵庫に保存し、月曜日に研究室に、唾液検体すべてとこの検体記録日誌をお持ちください。

２回目の予定日について

調査のご協力ありがとうございます。次回２回目は＿＿＿＿＿＿＿＿です。当日に確認の為の、ご連絡をさしあげます。

チューブ２：就眠時

1.	***今何時ですか？***				午前 / 午後＿＿＿＿時	
2.	***唾液採取した正確な時刻はいつですか？***				午前 / 午後＿＿＿＿時	
	次の２つの質問について、最後のページのコード表から選んで回答して下さい。					
3.	***あなたはどこにいますか？***		4. ***あなたは何をしていますか？***			
もし最近３０分、あなたはどう感じましたか？						
		全くない				***とても多い***
4.	コントロール感	1	2	3	4	5
5.	疲労感	1	2	3	4	5
6.	幸福感	1	2	3	4	5
7.	イライラ、あるいは怒り	1	2	3	4	5
8.	忙しさ	1	2	3	4	5
9.	ストレス感	1	2	3	4	5
10	痛　み	1	2	3	4	5
11.	もしあなたが誰かと話をしていたなら、その会話は快いものでしたか？					
	回答不可　○	1	2	3	4	5
唾液採取前にあなたは下記のことをしましたか？						
12.	歯磨き			**いいえ**		**はい**
13.	コーヒー、紅茶、緑茶などカフェインを含む飲料物を摂取した			**いいえ**		**はい**
14.	薬物を内服した			**いいえ**		**はい**
15.	食事した			**いいえ**		**はい**
16.	アルコールを摂取した			**いいえ**		**はい**

Project ID _____

チューブ３：起床時

1.	*今何時ですか？*	午前 / 午後_____時
2.	*唾液採取した正確な時刻はいつですか？*	午前 / 午後_____時
2a.	起床時から唾液採取までに遅れがありましたか？　はい　いいえ	
2b.	もし"はい"なら、どれくらい遅れましたか？ _____分	
3.	*あなたはどこにいますか？*	4. *あなたは何をしていますか？*

最近３０分、あなたはどう感じましたか？

		全くない				とても多い
4.	コントロール感	1	2	3	4	5
5.	疲労感	1	2	3	4	5
6.	幸福感	1	2	3	4	5
7.	イライラ、あるいは怒り	1	2	3	4	5
8.	忙しさ	1	2	3	4	5
9.	ストレス感	1	2	3	4	5
10	痛　み	1	2	3	4	5
11.	もしあなたが誰かと話をしていたなら、その会話は快いものでしたか？					
	回答不可　○	1	2	3	4	5

唾液採取前にあなたは下記のことをしましたか？

12.	歯磨き	いいえ	はい
13.	コーヒー、紅茶、緑茶などカフェインを含む飲料物を摂取した	いいえ	はい
14.	薬物を内服した	いいえ	はい
15.	食事した	いいえ	はい
16.	アルコールを摂取した	いいえ	はい

あなたの検体採取日について

あなたの検体採取日について以下の質問に正確にお答えください。

1.	昨夜、あなたは何時に寝床につきましたか？
2.	昨夜、あなたは何時に就眠しましたか？
3.	今朝、あなたは何時に起きましたか？
4.	今朝、あなたは何時に寝床を離れましたか？
5.	昨夜のあなたの"眠り具合"はいつもとくらべ、どれくらい普段通りでしたか？

○	○	○	○	○
大変良かった	良かった	いつもと同じ	あまり良くなかった	とても悪かった

Project ID

チューブ７：午後３時

1.	*今何時ですか？*					午前 / 午後_____時	
2.	*唾液採取した正確な時刻はいつですか？*					午前 / 午後_____時	
	次の２つの質問について、最後のページのコード表から選んで回答して下さい。						
3.	*あなたはどこにいますか？*		4. *あなたは何をしていますか？*				

最近３０分、あなたはどう感じましたか？

		全くない				とても多い
4.	コントロール感	1	2	3	4	5
5.	疲労感	1	2	3	4	5
6.	幸福感	1	2	3	4	5
7.	イライラ、あるいは怒り	1	2	3	4	5
8.	忙しさ	1	2	3	4	5
9.	ストレス感	1	2	3	4	5
10	痛　み	1	2	3	4	5
11.	もしあなたが誰かと話をしていたなら、その会話は快いものでしたか？					
	回答不可　○	1	2	3	4	5

唾液採取前にあなたは下記のことをしましたか？

12.	歯磨き	いいえ	はい
13.	コーヒー、紅茶、緑茶などカフェインを含む飲料物を摂取した	いいえ	はい
14.	薬物を内服した	いいえ	はい
15.	食事した	いいえ	はい
16.	アルコールを摂取した	いいえ	はい

チューブ４：起床後３０分

1.	*今何時ですか？*					午前 / 午後_____時	
2.	*唾液採取した正確な時刻はいつですか？*					午前 / 午後_____時	
	次の２つの質問について、最後のページのコード表から選んで回答して下さい。						
3.	*あなたはどこにいますか？*		4. *あなたは何をしていますか？*				

最近３０分、あなたはどう感じましたか？

		全くない				とても多い
4.	コントロール感	1	2	3	4	5
5.	疲労感	1	2	3	4	5
6.	幸福感	1	2	3	4	5
7.	イライラ、あるいは怒り	1	2	3	4	5
8.	忙しさ	1	2	3	4	5
9.	ストレス感	1	2	3	4	5
10	痛　み	1	2	3	4	5
11.	もしあなたが誰かと話をしていたなら、その会話は快いものでしたか？					
	回答不可　○	1	2	3	4	5

唾液採取前にあなたは下記のことをしましたか？

12.	歯磨き	いいえ	はい
13.	コーヒー、紅茶、緑茶などカフェインを含む飲料物を摂取した	いいえ	はい
14.	薬物を内服した	いいえ	はい
15.	食事した	いいえ	はい
16.	アルコールを摂取した	いいえ	はい

Project ID _____

チューブ５：午前１０時

1.	*今何時ですか？*	午前 / 午後_____時					
2.	*唾液採取した正確な時刻はいつですか？*	午前 / 午後_____時					
	次の２つの質問について、最後のページのコード表から選んで回答して下さい。						
3.	*あなたはどこにいますか？*		4. *あなたは何をしていますか？*				

最近３０分、あなたはどう感じましたか？

		全くない				とても多い
4.	コントロール感	1	2	3	4	5
5.	疲労感	1	2	3	4	5
6.	幸福感	1	2	3	4	5
7.	イライラ、あるいは怒り	1	2	3	4	5
8.	忙しさ	1	2	3	4	5
9.	ストレス感	1	2	3	4	5
10	痛　み	1	2	3	4	5
11.	もしあなたが誰かと話をしていたなら、その会話は快いものでしたか？					
	回答不可　○	1	2	3	4	5

唾液採取前にあなたは下記のことをしましたか？

12.	歯磨き	いいえ	はい
13.	コーヒー、紅茶、緑茶など力フェインを含む飲料物を摂取した	いいえ	はい
14.	薬物を内服した	いいえ	はい
15.	食事した	いいえ	はい
16.	アルコールを摂取した	いいえ	はい

チューブ６：正　午

1.	*今何時ですか？*	午前 / 午後_____時					
2.	*唾液採取した正確な時刻はいつですか？*	午前 / 午後_____時					
	次の２つの質問について、最後のページのコード表から選んで回答して下さい。						
3.	*あなたはどこにいますか？*		4. *あなたは何をしていますか？*				

最近３０分、あなたはどう感じましたか？

		全くない				とても多い
4.	コントロール感	1	2	3	4	5
5.	疲労感	1	2	3	4	5
6.	幸福感	1	2	3	4	5
7.	イライラ、あるいは怒り	1	2	3	4	5
8.	忙しさ	1	2	3	4	5
9.	ストレス感	1	2	3	4	5
10	痛　み	1	2	3	4	5
11.	もしあなたが誰かと話をしていたなら、その会話は快いものでしたか？					
	回答不可　○	1	2	3	4	5

唾液採取前にあなたは下記のことをしましたか？

12.	歯磨き	いいえ	はい
13.	コーヒー、紅茶、緑茶など力フェインを含む飲料物を摂取した	いいえ	はい
14.	薬物を内服した	いいえ	はい
15.	食事した	いいえ	はい
16.	アルコールを摂取した	いいえ	はい