The Role of Risk in the Health Behaviours of Military Personnel in the United Kingdom Armed Forces

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Declaration of originality

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Abstract

Background. It has been suggested by some that the military may be predisposed to higher levels of sensation seeking than comparable civilian populations; however, there are mixed findings among the previously published literature. Furthermore, the risk-taking personality trait of 'impulsive sensation seeking' (ImpSS) among a military population has not previously been reported, therefore this study investigated ImpSS, perceptions of operational risk, risky health behaviours (alcohol, smoking, driving and sex) and psychological well-being (PWB) across an operational military deployment.

Method. A longitudinal, repeated measures study collected questionnaire data among a brigade of UK army personnel across the phases of an operational deployment to Iraq in 2007. A sample within 1 Mechanised Brigade returned questionnaires at pre-deployment (N = 1374), mid-deployment (N = 889) and post-deployment (N = 537).

Results. Levels of ImpSS were statistically higher in the current UK army sample than in previously reported civilian data. Consistent with previously published literature, the high-ImpSS (H-ImpSS) group tended to smoke (and smoke more), drink more alcohol, drive faster, wear seatbelts less, and engage in risky sexual behaviour more than those in the low-ImpSS (L-ImpSS) group. Additionally, the H-ImpSS group consistently displayed lower risk perceptions of the operational context across all phases of the deployment compared to the L-ImpSS group. Other results relating to PWB, and other aspects of risk behaviour are discussed.

Conclusion. Observed differences between the high and low ImpSS military groups, in terms of risky health behaviours and risk perceptions, mirrored those found in the published sensation seeking literature. However, mean scores on military ImpSS were higher than comparable civilian norms for age and gender, suggesting a higher predisposition for the UK army sample. Additionally, changes in health behaviours and PWB across the deployment cycle show mixed findings and indicates a complex environment that requires further prospective, longitudinal investigation.
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1. Introduction

1.1 Structure of the thesis and overview of chapters

This chapter (chapter one) provides an overview of the individual chapters and sections of the thesis. It is hoped that by providing this overview the reader will understand the structure of the thesis and the rationale for the present study. This structure is intended to provide a golden thread, which stitches together the individual chapters and sections in order to tell a coherent story of a complex and under-researched subject matter.

Chapter two introduces the concept of risk from the social science perspective. A short introduction on the historical emergence of risk is provided before addressing differing perspectives of risk from across the social science spectrum. This spectrum covers the cultural, sociological and psychological perspectives of risk, including the sub-psychological disciplines of social, cognitive and personality psychology. The chapter culminates with providing a rationale for studying risk and health from the personality perspective, and in particular, the construct of sensation seeking.

Chapter three provides an in-depth review of the personality construct of sensation seeking, which is the underpinning construct of this study. Firstly, the origins of sensation seeking are introduced; then the development of the theory and the current theoretical model are described before the construct of ‘impulsive sensation seeking’ is covered, which is the primary measure used in the present study. The criticisms of sensation seeking are then addressed and responded to, which helps to provide the justification for adopting sensation seeking as an underpinning construct in the investigation of military health behaviours.

Chapter four describes the risky health behaviours of alcohol consumption, driving, sex and smoking behaviour. These behaviours are described in terms of their prevalence rates in the United Kingdom, as well as their positive and negative effects. The relationship between health and risk-taking is then explored before presenting some of the previous sensation seeking research that has addressed each of the health behaviours under investigation.

Chapter five addresses the applied context for the study, i.e., the military. The chapter opens by considering the nature of risk within the military, before reviewing
the literature on military risk-taking. Risk is then discussed in terms of military deployments before focusing on how sensation seeking and health behaviours have been investigated within the military, and why a lack of such research has driven the need for the present study.

Chapter six describes the methodology used in the design of the research study. The chapter opens by stating the formal hypotheses and research questions that underpins the study, and then describes the empirical design, the population from which the final sample was derived, the ethical approval needed to conduct the study, the measures used to collect the data, the procedure used to apply these measures, and finally, the analysis plan for the data that was collected.

Chapter seven presents the results of the study, which are divided into individual sections to reflect the differing hypotheses and research questions being asked. The descriptive statistics (section 7.1) help the reader to understand the composition of the study sample, and therefore the context of the results. The results address the ImpSS groups (7.2), and the differences between groups at baseline (7.3) and across the deployment (7.4). Furthermore, irrespective of ImpSS, the results of the study sample are presented in terms of both baseline findings at pre-deployment (7.5) and changes across the deployment (7.6). Finally, sub-sections containing the qualitative data (7.7) and regression analyses (7.8) are included in order to support the principle findings by providing further explanatory power, as well as predicting future behaviour.

Chapter eight is the discussion chapter and interprets the results sections as they pertain to the overarching aims of the study. The implications for the theory of SS and ImpSS are discussed, as is its role within the military, as well as the need for future research in these areas. The health behaviour results are discussed in terms of their relevance to military deployments. Both ImpSS and health behaviours are discussed in terms of the psychology or health. Additionally, the limitations of the study are mentioned and whether these impacted the design of the study and any of the subsequent results and implications.

Finally, chapter nine is the concluding chapter and summarises the totality of the investigation.
2. The Social Science of Risk

2.1 The historical emergence of risk

As a human phenomena and construct, the emergence of risk must have a historical path. The modern concept of risk pertains to knowledge from past events, and how this knowledge influences actions in the present, to produce results (positive or negative) in the future. However, in ancient times, future events were the preserve of the Gods, whereby the action of external deities, as opposed to internal human intervention, was the dominant theme; therefore, there was no attempt to try and tame risk (Bernstein, 1998; Lupton & Tulloch, 2002). The ancient Greeks were among the first societies to create an environment that was less controlled by the power and politics of religion, which enabled intellect and science to grow. However, the Greeks were comfortable with their uncomplicated cultural status quo. They also lacked a numbering system that would help them to calculate probabilities. The ability to conceptualise and measure odds and probabilities can only occur through the calculation of numbers, and it is believed that the numbering system we use today emerged from the Hindus in the Indian subcontinent circa AD 500 and spread across the known world during the crusades (Bernstein, 1998).

The Renaissance period enabled and encouraged the questioning of established traditional religious beliefs. This move from a fate-driven perspective to one of choice is epitomised in the early Italian word for risk – ‘riscare’ – meaning ‘to dare’ (Bernstein, 1998). At this time, two Italians (Girolamo Cardano, 1500-1571 and Galileo Galilei, 1564-1642) developed the mathematics of probability via experiments with gambling and the application of mathematics involving intellectual conundrums of chance. The age of enlightenment during the 18th century saw Daniel Bernoulli (1700-1782) posit that the pure mathematics of risk was flawed because it dealt with objective facts and not subjective people. He recognised that extraneous factors affected the probable outcome of people’s real world decisions, i.e., that the actual value in the real world was different from the expected mathematical value. Therefore, Bernoulli had identified that human beings differ in their evaluation of risk, and this suggests the emergence of what would currently be referred to as risk perception.
During the 20th century, probability, uncertainty and risk were increasingly studied and linked to economics. Within these economic advances was the notion that society as a whole could advance by understanding economic uncertainty and risk, and by embracing a calculated risk-taking approach (Bernstein, 1998; Dake, 1992). This would bring freedom and opportunity, therefore increasing the value of human life. These economic theories viewed human behaviour as rational and mechanistic, but the latter half of the 20th century began to produce research within the social sciences that evidenced the biases and perceptions that undermined these rationalistic models of uncertainty and risk in human behaviour.

2.2 Definitions of risk
The topic of risk is complex, with broad recognition that there is no single accepted definition (Berry, 2004; Joffe, 2003). However, some description, explanation and definitions must be provided in order to conceptualise and frame the subject matter. As commented by Rosa (2003), definitions allow abstract and meta-theoretical frameworks to be simplified, and provide a foundation upon which theoretical structures and intellectual comment can be erected. However, despite the rapidly growing literature on risk, there still exists varying explanations about what is meant by 'risk'.

The British Medical Association (1990) advocated that 'risk is the probability that something unpleasant will happen' (p.14). The Royal Academy of Engineering (RAE) (2002) cited a definition of risk as being 'the probability that an untoward event will happen, multiplied by the impact it could have if it does happen' (p.4). Berry (2004) highlights the problem with trying to find consensus among the disparate definitions of risk. To an extent, the debates are philosophical and represent the underpinning beliefs of the various and numerous scientific and mathematical disciplines interested in the topic of risk. However, most recognised definitions possess core elements, i.e., a probabilistic aspect multiplied by the negative or hazardous consequence. Thus, it is not certain that the event in question will occur (the probabilistic aspect), but if it does, then the outcome will be negative (the hazardous aspect) (Berry, 2004).

Another similarity between the many alternative definitions is that they perceive the outcomes or consequences as almost exclusively negative. In contemporary thinking, risk is less likely to involve a positive outcome (Joffe, 2003).
Theoretically, risk possesses two possible outcomes or probabilities...positive or negative. However, as the theoretical and academic perspectives of risk began to shift during the 20th century, so did the shift in perceived outcome (Berry, 2004). As scientific knowledge advanced, so did the ability to predict and control elements of the natural world, which were previously attributed to unknown/external influences, such as the Gods. Therefore, the accepted level of difference between action and consequence (i.e., risk) decreased as science progressed. The logical progression assumes that outcomes beyond those that could be predicted and controlled must inherently be unwanted, and thus, negative.

Rosa (2003) discusses the ontological and epistemological assumptions that determine the construction of risk. The ontology of risk refers to its metaphysical status in the physical world, and whether it represents an objective, independent construct that is devoid of the influence of perceptions, whether cultural, social or psychological (Krimsky, 1992; Rosa, 2003). The psychometric paradigm espoused by Paul Slovic, and discussed later in this chapter, has been accused of being a ‘realist ontology’, that is to say that his approach to work is too mechanistic and simplistic, and does not adequately account for other factors, such as emotion, poor decision-making, etc. Krimsky (1992) suggests that similar approaches are held by those in advanced societies that are interested in the assessment of technologies and hazards. Thus, how a society develops its ontology (nature of risk) ultimately determined its epistemological choices (knowledge of risk) (Rosa, 2003).

**Differing perspectives on risk**

Within the social science domains there are a number of differing perspectives that shape the topic of risk behaviour. These perspectives have been divided into three key approaches: (a) the cultural, (b) the sociological, and (c) the psychological. These perspectives can be visualised as an ‘onion’ diagram (Figure 1), showing the disparate layers as they funnel down from a high-level cultural view, then drilling down to the sociological view, and ending with the psychological view. The aim of describing these perspectives is to provide an overview of the complexity of the human aspects of risk, and to lead the reader to the key focus of the present study, which is risk-taking behaviour from the perspective of personality psychology.
2.3 Cultural perspective

As always, an agreed definition of a complex and ambiguous subject matter is near impossible to find. However, a broad definition of culture suggests that it is a relatively organised system of shared meanings, values and beliefs, which a particular culture attributes to the people and objects within it (Smith & Bond, 1998). Rarely do cultures possess clear-cut boundaries, and ‘culture’ could be viewed as blurred around the edges where it blends with various social systems. It may be fairer to suggest that where social systems might have abstract yet definable structures, e.g. norms and belief systems, the overall concept of ‘culture’ is more esoteric. Essentially, culture can be simplified in layman’s terms as ‘the way we do things around here’. Smith and Bond (1998, p.67) suggested that:

‘...the traditional concept of culture is too broad and imprecise for scientific use; it must be ‘unpacked’. For psychologists, this unpacking takes the form of identifying constructs that relate to behaviour, such as values, motivations, beliefs, expectancies for reinforcement, personality traits and so forth. These constructs must be quantifiable and measured in ways that are sensitive to the various cultural backgrounds of each respondent’.

According to Rosa (2003) culture acts a filter to a socially constructed philosophy of risk perception. This constructivist paradigm opposes any notion of objective risk due to how these social and cultural filters construct risk as a concept. If, as per the earlier
definitions of risk, it is probabilistic (might happen) and not pre-determined (will happen), then this creates a huge range of options for what risk could be. Therefore, different cultures are free to determine (through their own religious, political and social structures) what they as a society should be concerned with in terms of risk, i.e., social constructivism.

The cultural theory of risk emerged in the 1980s and is the product of collaborative efforts across various individuals and institutions (Rayner, 1992). Krimsky (1992) reminds us that the lineage of cultural theories belongs to anthropology, which discusses the ontological and epistemological assumptions of risk in terms of a cultural theory. This cultural perspective reminds us that despite the dominance of the cognitive psychometric paradigm (Sjoberg, 1996), risk is fundamentally a social product. Such theorists suggest that group and social contexts play a higher function in the selection and response to risk than do individual cognition. Furthermore, it is the social system of a particular culture that determines which aspects of risk are adopted or ignored, to greater or lesser degrees depending on the nature of the risk; which in turn provides that culture with stability regarding cultural identity, rationality and belief systems, i.e., a functionalist approach to cultural survival. Rayner (1992) supports Krimsky by postulating that social organisations define, perceive and manage societal risks. Also, despite the dangers that exist in the world, it is the social system of a culture that emphasises and reinforces the moral, political or religious order that homogenises that society.

However, Rayner (1992) concedes that despite the importance of a cultural theory of risk, there are few systematic empirical studies of risk and culture; however, evidence and studies have emerged since Rayner’s concerns. Although Dake (1992) only reviewed and discussed the politicised and socially constructed nature of risk, Lupton and Tulloch (2002) used the social constructionist approach to study the risk epistemologies of Australians. Additionally, Steg and Sievers (2000) investigated cultural theory in terms of individual perceptions of environmental risks. However, there have also been criticisms of cultural theory; for example, Sjoberg (1996) suggests that despite finding statistically significant results, cultural theory could only explain about five per cent of the variance of perceived risks. Also, in their use of cluster analysis to test the cultural theory of risk perception, Oltedel and Rundmo (2007) found that differing worldviews of the Norwegian public did not perceive
transport risk according to the patterns described by cultural theory; additionally, that
the relationship between risk perception and culture was sporadic and unsystematic.

Hofstede (1994) found that nations and cultures differed in their responses to
uncertainty (even if they scored similarly across other dimensions). Hofstede (1994)
borrowed the term ‘uncertainty avoidance’ from American organisational sociology
and defined it as ‘the extent to which the members of a culture feel threatened by
uncertain or unknown situations’ (p.113). However, uncertainty avoidance should not
be confused with risk avoidance. Risk is often expressed as a probability that a
particular event might happen. Uncertainty has no probability attached to it because
anything can happen and we have no idea what. Therefore, the aim of uncertainty
avoidance is to reduce ambiguity surrounding an event, rather than the risk per se.

Weber, Hsee and Sokolowski (1998) adopted Hofstede’s dimension of individualism-
collectivism to investigate cultural differences on social collectivism across
American, German and Chinese proverbs for risk-taking. They found that more
collectivist cultures tended to advocate more risk-taking advice for both social and
financial risks, and that they were more risk-taking as a result of this. They posit that
collectivist cultures are more risk-taking since their tighter social networks protect
against catastrophic outcomes; also, that individualistic cultures concentrate more on
financial risks than social ones, which stems from their materialistic concerns. Watson
and Kumar (1992) investigated the risk-tasking propensities of culturally diverse
versus culturally homogenous groups and found that culturally homogenous groups
were higher in risk-taking propensity for a series of decision problems. The culturally
diverse groups had more problems with interaction behaviours that interfered with
their problem-solving strategies.

The recognition of both social and cultural influences upon the psychology of
risk has become evident with the increasing inclusion of these factors within
international research. Joffe (1999) commented on the cross-cultural aspects of
cognitive bias due to inter-cultural differences across certain dimensions (e.g. the
dimension of control). Therefore, she posits that nations with a predilection for
higher-levels of control may possess an over-riding sense of invulnerability in an
attempt to control the perceived risk. Additionally, Chang, Asakawa and Sanna (2001)
found that cognitive biases occurred between European Americans and Japanese for
both positive and negative life events.
The two contexts of culture relevant to the present work are that of organisational culture (i.e., the Armed Forces) and national culture (i.e., British). Generally, organisational culture refers to the formal elements of an organisation's existence, e.g. structures and frameworks, products and services, systems and procedures, resource management, etc. (Senior, 2000). However, this represents the overt view of an organisation, and can be imagined as a 'cultural web' which embodies all the elements of what the organisation is in the business of doing. An equally important yet covert aspect of an organisation's culture deals with the human element, e.g. the employees' values, attitudes, and beliefs. These shape the underlying behaviours and norms within the organisation. It is suggested that there are four common characteristics within most definitions of culture, that is: it is learned, it is shared, it is transmitted, and it influences thinking and behaviour.

2.4 Sociological perspective

Emanating from the sociology literature 'the risk society' centres on the two disparate theoretical perspectives of Ulrich Beck and Anthony Giddens. Initially, they possessed similar views that risk is the product of a post-modernistic propensity to perceive risk as a negative attribute brought about by technical modernisation and globalisation. Their divergence occurs at the societal level of risk perception. Beck believed that the reflexive nature of risk was in response to the growing number of risks produced by the complexity of the modern era, i.e., that exposure to risk had increased in modern western society. However, Giddens disagreed. He theorised that western society's sensitivity to risk had increased, and not the actual exposure to risks, therefore, that the nature of risk perception had changed. The mass media's role in the portrayal of risk and danger was highlighted in the opening chapter, and is an important facet in this debate.

As well as looking at risk at a cultural level, papers by Lupton and Tulloch (2002) and Alaszewski and Brown (2007) both adopt a sociological approach and provide a balanced review and criticism of the theories of Beck and Giddens. They comment that the risk society theory starts to fall down due to two key factors: (a) a lack of empirical evidence to test their theories, and (b) that the theory is too rationalistic, general and individualistic, and fails to take into account factors such as age, gender, ethnicity, and social class in constructing differing risk knowledge and experiences.
Lash (1993) has suggested that more consideration should be given to how people respond aesthetically and emotionally to risk, especially as members of cultural sub-groups rather than generalisable individuals. However, Lupton and Tulloch (2002) argue that despite sociology’s appreciation of a broader and more inclusive risk construct, the research has been slow to develop this advancement. A social constructionist approach on risk developed by Lupton and Tulloch suggests that knowledge of risk is mediated through social and cultural frameworks that are dynamic.

In terms of a sociological perspective of health risk then the sociology of deviance provides an interesting insight. Peretti-Watel and Moatti (2006) examined two distinct sociological theories of deviance (neutralisation theory and innovative deviance theory) and how these could be used to better understand complex issues associated with changing risky health behaviours via health-promotion strategies. Neutralisation theory suggests that risk-takers adopt techniques of neutralisation to adapt their beliefs rather than their behaviours because they are aware of the dominant social norms and rules. Innovative deviance suggests that risk-takers adapt their behaviour through illegitimate means because they have less access to legitimate means, for example, the use of performance enhancing drugs in sport to gain a performance advantage.

2.5 Psychological perspective

Social theories
There is a plethora of experimental and empirical evidence to illustrate the effect of the social world on individual and collective behaviour. Some of the more familiar studies include research investigating bystander intervention, social loafing, social facilitation, the risky shift and the subsequent group polarisation studies. Therefore, it appears axiomatic that the social world interacts with, and influences, the underlying cognitive processes that rationalise uncertainty, ambiguity, heuristics, judgements and decision-making that underpin risk behaviours.

Risky shift and group polarisation
The effect of group dynamics upon individual cognition and decision-making was demonstrated via experimental work during the 1960s by James Stoner, a master's
student in the USA (Sabini, 1995). The risky shift phenomenon was discovered after research to investigate the assumption that group consensus on decision-making was generally more conservative than an individual’s. The application of this was within business and management, which possessed implications for the decisions of committees and management boards. In a series of experiments Stoner provided individuals, and then groups made up from those individuals, with twelve sets of hypothetical dilemmas about which they made choice decisions from a range of options. The established assumption at the time was that groups were more conservative than individuals; however, Stoner’s results showed that the groups made riskier decisions compared to when they were individuals on ten of the twelve dilemmas (Sabini, 1995; Stoner, 1961).

Among the numerous explanations are ‘social comparison theory’ (Festinger, 1954) and ‘persuasive argument theory’ (Burnstein, Vinokur & Trope, 1973). Social comparison theory suggests that individuals within the groups compare themselves to the other group members and may have therefore felt the need to appear more risky, thus skewing the group decision toward the more risky options. Persuasive argument theory suggests that people compare the arguments they already know with the arguments they hear in a group situation, which ultimately provides a wider range of alternatives, thus the individual is persuaded to acquiesce toward the riskier decision of the group as more arguments and alternatives are expressed. Although they are competing explanations they provide similar influences, i.e., that consideration of external influences affects individual cognition, beyond the previous individual decision, therefore, parts of both explanations help to understand the processes involved.

However, the risky shift phenomenon was further interrogated by looking at the small number of conservative decisions, i.e., was it an effect or simply chance? Subsequent studies by McCauley, Stitt, Woods and Lipton (1973) found that just as groups could be more risky than their individual members, so could the groups be more conservative; that is to say, the risky shift was not uni-directional. What was discovered was that the shift was an extreme shift based upon the underlying predisposition of the individuals, i.e., if they were individually more conservative then the group shifted to a even more conservative stance, and likewise, if the individuals were risky then the group decision shifted to an extreme risky decision. Thus, the group consensus polarized. Interestingly, both social comparison theory and
persuasive argument theory could still be used to understand the underlying mechanisms for such extreme shifts based on social influences. Impacts on group processes might be of interest to the military as teamwork and group performance is a bedrock of military behaviour and performance; therefore insights into risk-based factors that could enhance or disrupt such behaviour would benefit military thinking and preparations for future performance.

**Social amplification of risk model**

By the middle of the 1980s it was evident that the social aspects of risk were required within a broader and more integrative approach (Kasperson, 1992). This was supported by empirical evidence from experimental psychology and the wider social sciences, which challenged the dominant rational behaviour model espoused by engineers and economists who focused on the mathematical and technical analysis of risk (Kasperson, 1992). Therefore, the fusion of these technical, cognitive, social and cultural concepts within a holistic framework began to emerge.

The social amplification of risk model, developed by Kasperson et al. (1988), is an integrated model that incorporates the interaction of psychological, social, organisational and cultural processes, resulting in either the amplification or attenuation of individual or social risk perceptions (Berry, 2004; Kasperson, 1992). Figure 2 illustrates how the model is operationalised.

![Figure 2. A simplified version of the social amplification of risk model, taken from Berry (2004).](image)

Initially, adverse event characteristics in the physical world are recognised and portrayed via contextual cultural constructs. Next, individuals and groups create interpretations for these hazards. The amplification process begins with the communication of these portrayed hazards by individuals, groups and/or organisations (institutions). Such communication media are referred to as *amplification stations*; although, they also have the potential to attenuate as well as amplify. The spread or
‘ripple’ of the subsequent impacts then produce secondary, indirect effects on a wider scale. For example, Berry (2004) discusses the third generation oral pill scare in the mid-1990s. The direct effects of a poor risk communication message resulted in increases of unwanted pregnancies, which had subsequent indirect effects (i.e., ripples) for families, social services and the healthcare system, and the pharmaceutical industry. Therefore, people involved in risk management and risk communication must consider wider effects and how these are assessed over different time periods. This highlights the complexity of risk as a construct and its role in our (i.e., individual, organisational and societal) daily lives.

Cognitive perspective
As a discipline ‘cognitive psychology is concerned with internal processes, mental limitations, and the way in which these processes are shaped by such limitations’ (Kahneman, Slovic & Tversky, 1982, p.xii). Its dominant paradigm is the information-processing approach. One of the characteristics that shape this approach is the belief that the mind is a limited capacity processor having both structural and resource limitations (Eysenck & Keane, 1995). The cognitive approach views risk as a more objective construct, based on scientific understanding, whose probabilities can be measured, calculated and subsequently interpreted at the individual level. The knowledge, experience and advice of experts is central to this approach, as lay people are deemed as being too subjective, arbitrary and irrational, which leads to inaccurate perceptions and decisions.

The study of human judgement was transformed in the 1970s by the seminal work of Daniel Kahneman and Amos Tversky, who investigated the fallibility of human information processing of judgements, probabilities, and risk. Kahneman and Tversky’s Prospect Theory was concerned with the anomalies and contradictions in human behaviour within the context of monetary gains and losses. Kahneman and Tversky demonstrated that people’s attitudes toward risks concerning financial gains were quite different from their attitudes concerning financial losses. Their work highlighted the reflexive mental operations used to make complex problems manageable and illuminated how the same processes can lead to both accurate and dangerously flawed judgements (Gilovich, Griffin & Kahneman, 2002).

The classical model of rational choice sees the ‘rational actor’ (i.e., the typical person) as an independent and empowered individual who chooses between options
based upon the rational assessment of probability and outcome. The option chosen is
the one that offers the optimal combination of probability and utility (Gilovich &
Griffin, 2002).

The core idea of the heuristics and biases programme is that judgements under
uncertainty are often based on a limited number of simplifying heuristics (i.e.,
decision-making short-cuts based on previous experiences) rather than a more
structured and systematic processing method (i.e., having to develop a novel decision-
making strategy). These heuristics typically yield accurate judgements but can give
rise to systematic error. Examples and case studies from applied domains illustrate
that the process of judgement is not restricted to traditional laboratory-based
psychological research, but rather that heuristics, and the biases associated with them,
have implications for some of the most consequential judgements that life requires
people to make (Gilovich et al., 2002).

However, humans are not purely rational information processing machines.
Despite perceived rationality in cognitive processes, judgements and decision-making,
human behaviour must also be seen within the social world in which human
behaviour occurs. Thus, the interplay of cognitive, social, cultural, and organisational
factors affect the objective, rational (and typically mathematical) assumptions of
decisions. Hence, errors will occur (Krimsky, 1992).

These areas highlight the disconnection between the ‘objectivity’ of true
probabilities based upon mathematical calculation (espoused by experts) and the
subjective assessment of probabilities made by lay people. It was found that deficits in
understanding probabilistic information motivated people to utilise intra-personal
short-cuts or ‘heuristics’ in order to inform decision-making. However, the use of
heuristics can lead to systematic errors or biases.

The psychometric paradigm
Thirty years of research by Paul Slovic and various colleagues has developed a
theoretical framework that has led to a general cognitive science approach resulting in
the psychometric paradigm of risk perception (Slovic, 2000). Slovic’s early studies on
risk revolved around people’s gambling preferences. This proved too narrow a focus
for decision-making under risk and he therefore broadened his attention during the
1970s to look at human responses to natural hazards (e.g. earthquake faults, flood
plains, etc.) and incorporated the emerging psychological knowledge from studies on
probabilistic judgements and risky choices, including the heuristics and biases work of Kahneman and Tversky. Slovic then started looking at technological hazards due to increasing societal concerns regarding nuclear power, pesticides and other technological advancements. Figure 3 illustrates the perceptions of 90 hazards across dimensions such as familiarity (known-unknown risk) and severity (dread risk).

![Figure 3. Perceptions of hazards for familiarity and severity (Slovic, Fischhoff & Lichtenstein, 2000).](image)

The focus for studying technological hazards addressed individuals' expressed preferences for various kinds of risk-benefit trade-offs. Slovic incorporated personality theory to try and characterise 'personalities' of hazards by asking people about risk characteristics (e.g. voluntariness, catastrophic potential, controllability, and dread risk) and how these characteristics influence individual risk perception and acceptance (Slovic, 2000). The development of the psychometric paradigm was an evolutionary process that used various methods to produce quantitative measures of perceived risk, for example, psychometric scaling methods, magnitude estimation
techniques, numerical rating scales, scenario generation techniques and general attitude scales.

One criticism of the psychometric paradigm suggests that it can only explain about 20 per cent of the variance of perceived risk, even less for risk acceptability (Sjoberg, 1996). Slovic (2000) himself recognises the limitations of the paradigm; for example, that individuals can provide meaningful answers to difficult questions, with little or no experience of the associated risk; also, that these perceptions address attitude and opinions, not actual behaviour. However, despite these issues, the deep body of empirical evidence highlights that risk is subjectively defined and means different things to different people, especially across expert and lay opinions, and that such opinions are shaped by psychological, social, organisational and cultural factors.

The proximity heuristic
An interesting cognitive bias that may resonate with the military within the current study is the proximity heuristic. The proximity heuristic suggests that individuals use judgements of closeness, or distance, as a cue for estimating probabilities. Teigen (2005) suggests that the ecological validity of this construct is so high that people tend to see this heuristic as an environmental principle rather than a subjective strategy. It is theorised that individuals judge probabilities by monitoring temporal, spatial and conceptual distance. In a series of experiments Teigen (2005) showed that individuals use the proximity heuristic as a behavioural strategy, and not just a judgement heuristic, by increasing the temporal, physical and psychological margins that influence distance, or proximity, to a risk event. Understanding how this heuristic is operationalised on military operations would be of interest to the military, especially in context such as Afghanistan where the proximal threat from improvised explosive devices is an ever present risk and may play a part in the perception and decision-making schema of soldiers in high threat situations.

The emotional component of risk
The role of affect has been investigated in the context of risk behaviours, risk judgements and benefits. To the military, this may be an interesting aspect of risk because operational deployments such as those typified in Iraq and Afghanistan always produce casualties, which undoubtedly produce emotional impacts amongst brothers-in-arms. Furthermore, it is how emotion-based risk perception and risk-
taking affects decision-making and performance that might be of interest to the
to the military chain of command. The affect heuristic refers to the use of emotions when
assessing judgements and decisions (Slovic, 2000). It is part of the heuristics and
biases that individuals adopt when faced with judgements under uncertainty
(Kahneman et al., 1982) and is a theoretical development of risk perception within the
psychometric paradigm (Slovic, 2000). Traditionally, emotions were seen as
epiphenomenal when viewed within the cognitive perspective of risk, whereby
emotional influences were eliminated from the decision-making process. However, a
shift began to occur in the 1990s, with Shafir, Simonson and Tversky (1993)
conceding that affect may occasionally influence cognitive judgements of risk. This
recognition of emotions as a primary factor in risk decision-making, as opposed to
being epiphenomenal, began to draw attention to its role within the risk paradigm and
was subsequently recognised by others (Berry, 2004; Slovic, 2000). For example,
mood states have been found to affect frequency estimates, with positive moods at the
point of decision-making increasing the frequency estimates for positive events and
vice-versa for negative mood and increases in negative estimates (Berry, 2004).

Emotions can involve a range of factors, such as mood state, anticipated
reactions and emotions (as in anticipated regret), anxiety, and fear. Lowenstein,
Weber, Hsee and Welch (2001) posit that anticipated emotions do not receive as
much attention as current emotional states, and also, that differences exist between
experts and lay people in the use of emotions for decision-making, with lay people
open to more emotional biases than experts, who tend to rely more on scientific
models that try to be more objective and less vulnerable to such biases. Slovic (2000)
suggests that future research should address the mechanisms of affect more closely
and how they interplay with the more traditional cognitive reasoning aspects, for
example, if affect mediates or moderates the cognitive appraisal, or vice-versa.

**Personality and risk**

Personality has been defined as ‘an individual’s characteristic patterns of thought,
emotion, and behaviour’ (Funder, 2001, p.198), or similarly as stable individual
differences in thinking (cognitions), feeling (affect) and behaviour (Vollrath, 2006).
Personality and individual differences have been researched extensively in the social
sciences in previous decades. Additionally, there is an extensive body of research on
how personality factors influence or affect risk behaviours, particularly in regard to
health-related issues, including risky health behaviours (Caspi et al., 1997; Cooper, Wood, Orcutt & Albino, 2003; Vavrik, 1997; Voigt et al., 2009; Vollrath, Knoch & Cassano, 1997).

In terms of generalised risk-taking behaviour, personality and individual differences have been studied in contexts such as: risk perception (Chauvin, Hermand & Mullet, 2007), gambling (Breen & Zuckerman, 1999; Demaree, DeDonno, Burns & Everhart, 2008), monetary decisions (Stone, Yates & Caruthers, 2002), and accident involvement (Clarke & Robertson, 2005; Ulleberg, 2002).

Furthermore, different aspects of personality have been studied within the risk domain, such as comparing different personality constructs (Trimpop, Kerr & Kirkcaldy, 1999), impulsiveness (Breen & Zuckerman, 1999; Rodriguez-Fornells, Lorenzo-Seva & Andres-Pueyo, 2002), trait dominance (Demaree et al., 2009), intensity and novelty seeking (Mallet & Vignoli, 2007), as well as the traditional Big Five personality factors (Clarke & Robertson, 2005; Gullone & Moore, 2000).

However, there is a rationale as to why personality has been forwarded as a primary focus for investigating risk and health behaviours beyond the range of other social science disciplines presented within this chapter. Wiebe and Fortenberry (2006) posit that there is now compelling evidence to support the causal role that personality plays in the course of health outcomes. They evidence the linking pathways between personality and health by discussing numerous models (e.g. stress-moderation models and biological models), and conclude that the study of personality enables health researchers to focus on the mechanisms that explain health behaviour, rather than broader risk factors that describe the associations with health outcomes. The influence of personality on risky health behaviours is also supported by Torgersen and Vollrath (2006), who state that because risky health behaviours tend to cluster together (e.g. alcohol and smoking, smoking and drugs, alcohol and driving, alcohol and sex) the study of personality helps to understand the nuances, interplay and prediction of such behaviours.

One of the most researched aspects of personality relating to risk-taking and risky health behaviour has been that of the Sensation Seeking (SS) personality (Zuckerman, 1979a, 1994, 2007a). Torgersen and Vollrath (2006) also credit Zuckerman for his contribution in applying personality psychology to the health behaviour domain. One of the reasons that SS has been chosen as the current research focus is that SS and risk-taking have been described as ‘two highly overlapping
individual difference constructs’ (Schwebel & Barton, 2006, p.57). Therefore, the personality trait of SS is the focus and underpinning rationale for the current study and is extensively reviewed in the next chapter.

2.6 Chapter summary

In summary, the social science of risk has been described from the perspectives of culture, sociology and psychology. These perspectives help to understand the conceptualisation, structure, organisation and expression of risk and risk-related behaviour, and how risk-related behaviour is subjected to influences involving rationality, perception, bias, emotion, and social and cultural factors. Within the context of the present study, these perspectives and factors can be applied to the military domain and could inform military behaviour and performance, however, a single perspective (or focus) needs to be adopted. Personality psychology has been adopted as the primary focus of the present study because of its potential to help understand the mechanisms of behaviour rather than the broad range of risk-factors that are associated with risky health behaviours.
3. The Sensation Seeking Personality

3.1 Definition

The sensation seeking (SS) personality is defined as:

'The seeking of varied, novel, complex, and intense sensations and experiences, and the willingness to take physical, social, legal, and financial risks for the sake of such experiences' (Zuckerman, 1994, p.27).

Thirty years of research went into reaching this current definition, with three key treatises charting the evolution of SS research (Zuckerman, 1979a, 1994, 2007a). Since the 1960s, and up until the publication of the 1994 update, Zuckerman says that SS has been investigated in over 600 publications (Zuckerman, 1994), and certainly in excess of this since the 1994 publication. In fact, a simple search of PsycINFO between 1969-2009 using the key words of 'sensations seeking' produces 2663 publication hits\(^1\). Sensation seeking research has permeated many areas of psychology (e.g. social, cognitive, organisational, clinical, counselling and sport); however, its consistent and primary focus has been within the health domain.

3.2 Origins and early theory

Zuckerman (1994) asserts that no theoretical concept emerges without some intellectual ancestry. The genesis for SS emerged from research into sensory deprivation that was conducted by Zuckerman and his colleagues between 1958 and 1968 (Zuckerman, 2007a). They noticed a range of individual behaviours exhibited by the participants who had volunteered to spend anywhere between one hour to two weeks in environments that reduced or removed visual or sensory input, including isolation chambers. Reactions observed included anxiety, boredom, hallucinations and processing effects on cognition. This led Zuckerman to ask why people explore the novel and seek new experiences. Why do some people engage in such sensationalist or 'risky' behaviours that other 'normal' people would shy away from? (Zuckerman, 1979a). This started Zuckerman's lifetime quest to find, develop and understand the theoretical basis for SS and its behavioural expressions.

\(^1\) Search conducted 30 July 2009.
Instinct and drive theories

The latter half of the nineteenth Century and first half of the twentieth Century produced many theoretical postulations regarding human and animal behaviour based upon arousal, primary drives and biological needs, such as food, water, sex and survival. These needs are often referred to as ‘instinct’ or ‘drive’ theories. Zuckerman (1979a, 1994) discusses how humans and animals, aside from these primary drives, engage in behaviours that do not meet these biological necessities, but are still performed, and over time, develop a need for stimulation; for example, spices in cooking serve no nutritional benefit but improve palatability and the sensation associated with eating behaviour (Zuckerman, 1979a, 1994).

Sigmund Freud’s psychoanalytic concept of drive sees behaviours categorised into two distinct instincts – a life instinct and a death instinct. Whereas the life instinct is concerned with the functions and behaviours to protect and prolong life, the death instinct is seen as behaviours that are displaced toward the ultimate, unconscious drive towards death. Thus, the reduction of the death instinct, its antecedent behaviours and the tensions it causes should be encouraged. Both Freud and Clarke Hull subscribed to the theory of drive reduction. That is, that satisfaction or fulfilment arises from reducing the tensions caused by innate physiological needs, i.e., the reduction of sensation or stimulation.

However, there are two key limitations with these drive theories as a basis of SS. Firstly, there is a lack of empirical and/or experimental evidence in support of primary drives and arousal or stimulus reduction. Although they allude to both biological and psychological mechanisms, they fail to provide any evidence or any deeper theory into the behavioural basis of such mechanisms, especially the need for reduction. Secondly, as noted by Zuckerman during his sensory deprivation studies, SS behaviour arose from a state of low arousal not over-arousal; thus it is higher arousal, not a reduction in arousal, which is the ultimate goal in SS behaviour (Zuckerman, 1979a, 1994). Therefore, Zuckerman turned his attention to other theories that existed at the time, which could be used to explain the mechanisms for what was found during the sensory deprivation studies, and these relate to arousal and stimulus theories.
Optimal level of stimulation and arousal

Wilhelm Wundt (1832-1920) initially produced a concept of arousal whereby positive feeling was the function of an optimal level of stimulation producing an optimal level of sensation (Zuckerman, 1994). However, over-arousal would create unpleasant or less pleasurable feelings. Freud also had a theory of arousal (the Constancy Principle), but this is where Freud and Wundt diverge as Freud pursued a reductionist perspective, which is to say that Freud saw arousal as negative and man’s natural urge was to reduce it, whereas Wundt saw arousal as a positive feeling. In the intervening years the theories on arousal subsided but were reinvigorated during the 1940s and 1950s.

The optimal level of stimulation (OLS) and optimal level of arousal (OLA) were formally named from the work of Donald Hebb during the 1940s and 1950s. Using the inverted-U hypothesis developed by Yerkes and Dodson (1908), Hebb posited that below a certain intensity threshold sensation/arousal would be sought, and counter to that, arousal beyond the optimum would influence the avoidance and reduction of over-arousal. As a psychophysiologist, Hebb originally explained OLS-OLA as a homeostatic mechanism of arousal. Advancements in neuropsychological science allowed Hebb to explain his theory via the pathways of the reticular activating system (RAS), between the limbic system and cerebral cortex, thus moving the focus of arousal beyond the central brain function, which was the original assumption of Hebb. The limbic system is a sub-cortical region of the brain that is linked to emotion, motivation and mood (Carlson, 1998; Silber, 1999). Later studies showed that arousal is caused by activation of the cortex, which is reliant on activation of the RAS. It was thought that the RAS operated by dampening arousal if the cortex is overloaded and vice-versa (Zuckerman, 1979a, 1994, 2007a).

Duffy (1957) employed a variety of psychophysiological indices, especially electroencephalogram (EEG), to develop and provide evidence for her general theory of arousal. This again shifted arousal away from an emphasis on central brain (cortex) activity to a system-wide approach. Recently, Santesso et al. (2008) used frontal EEG to investigate SS tendencies and found that high SS scores were related to greater relative left frontal activity, which is a region of the prefrontal cortex that is associated with behavioural approach; whereas greater right frontal activity is associated with behavioural withdrawal/inhibition. Duffy also suggested that arousal intensity was disassociated from emotional quality. Up until then the homeostatic
approach suggested that increased arousal brought about positive emotion up to an optimal level, whereby the RAS would suppress the impulses and reduce arousal back to a more pleasant and sustainable level. However, it was generally accepted that some activities can be high in arousal without being unpleasant (e.g. sexual arousal) and under-arousal can also be pleasurable without increasing the need for stimulus (e.g. meditation). This suggested a shift away from arousal per se to theories of arousability (or stimulus change theories).

Zuckerman (1979a, 1994, 2007a) describes how the many theories of arousal have developed through those emphasising homeostasis, intensity, adaptation and potential. These were increasingly supported with psychophysiological (and objective) measures rather than simple theoretical constructs, which were evident in the drive and instinct theories, and the early arousal theories. These advances shifted the knowledge from pure arousal to theories of arousability and set the scene for the theoretical basis of the sensory deprivation experiments looking at SS. These sensory deprivation experiments supported the assumption of the OLA theory that prolonged periods of under-arousal would produce emotional, cognitive and behavioural disturbances, and that such sensory deprivation would result in reduced cortical arousal (Zuckerman, 1979a).

To investigate the consistent individual differences elicited from the sensory deprivation studies, Zuckerman and his colleagues developed a questionnaire measure based on OLS-OLA theory (Zuckerman, 2007a). This produced the first SS Scale (SSS-I) and was a general SS scale. His hypothesis was that high sensation seekers (HSS) would be more stressed by sensory deprivation than low sensation seekers (LSS). This was predicated on the assumption that LSS would already be close( er) to their OLA in some sensory deprivation environments and would therefore be less stressed by the experiments. Furthermore, HSS were assumed to be happiest and would function best at high levels of arousal and would behave in a way that would maintain such a level (Zuckerman, 1979a).

What they found was that HSS tended to volunteer for the studies in higher and disproportionate numbers than LSS. This was at odds with the assumption that the HSS would find the deprivation of stimulation threatening and stressful. Zuckerman posited that the desire for novel stimulation was also a factor in SS beyond simple intensity of stimulation. This finding had implications for the OLS-OLA theory that HSS would avoid under-stimulation by seeking higher intensity stimulation. In his
1994 update Zuckerman reinforces this challenge to OLA by stating that years of research have identified that there are no consistent findings of under-arousal in HSS or over-arousal in LSS.

Furthermore, the discovery of correlated sub-scales of SS indicated that the theory based on OLS-OLA was too narrow and specific and could not account for wider modalities brought about through SS influences and behaviours on intrapersonal cognitions, social interactions and contextual situations. Measures of SS with drug users showed that HSS used both stimulant and depressive drugs in the search for sensation and stimulation and that younger drug users were drawn to risky drugs that their peers used (Zuckerman, 1979a). Also, no difference was found between LSS and HSS for drug preference, i.e., they both engaged in stimulant and depressive drugs, but the stimulant drug was a primary choice for both groups. The results of these studies with drug users did not support the previous assumption regarding the higher functioning and affect of HSS under conditions of high arousal. This evidence again questions the applicability of a general OLA as a theoretical basis for SS and persuaded Zuckerman to look more at biological factors of cortical arousal.

The early physiological tests on the arousal theories of SS adopted measures of skin conductance response (SCR) in the investigation of preferences for different artistic designs. The Orienting Reflex (OR) refers to the behavioural and physiological responses to stimuli and includes both defensive responses (DR) and startle responses (SR). Arousal was initially measured via SCR, but SCR was not sensitive enough, whereas, heart rate (HR) responses were more sensitive to OR, DR and SR and was therefore adopted as a more suitable measure. Findings emerging from several studies in the 1970s showed that novelty, as opposed to pure intensity, played a role in the differences between HSS and LSS in responses to stimuli, i.e., that deceleration of HR occurred when the HSS habituated to repetitive stimuli, but increased when a novel, but lower intensity, stimulus was introduced (Zuckerman, 1979a, 1994, 2007a). This illustrates the implication that HSS and LSS do not differ in underpinning (tonic) reactions to arousal, but they do differ in ‘arousability’ and their reactions to simple, novel stimuli. Additionally, cortical evoked potential (EP) was also used as a measure to identify differences in sensation seekers. Cortical EP occur within the brain, cortical and sub-cortical level, whereas, HR and SCR occur at a more distal end of the physiological reaction response chain.
Zuckerman asserts that robust scientific enquiry is a developmental process as new knowledge is learned (Zuckerman, 2007a). By 1979 Zuckerman had reached the conclusion that OLS-OLA theory was not a cogent basis for the SS trait. This is reflected in the title of his seminal 1979 text (‘beyond the optimal level of arousal’) and is reinforced by a statement in his 1994 update that:

‘New research raised doubts about the usefulness of the OLA of the reticulo-cortical system as the basis of a SS trait. Findings on the biochemical basis of SS required explanation within a psychobiological model’ (Zuckerman, 1994, p.22).

**Personality theory**

During the 1960s, Zuckerman’s early theory saw the behaviours of SS from an OLS-OLA and psychophysiological basis. However, these optimal theorists failed to consider how these physiological characteristics of brain systems could account for expression via personality traits (Zuckerman, 1994). It is not therefore surprising that he looked to the works of Hans Eysenck (1916-1997) and Jeffrey Gray (1934-2004) in providing the links between arousal and physiology in expressing forms of SS through personality and individual differences. Hans Eysenck’s early theoretical work during the 1940s and 1950s was influenced by the learning theory studies of Clark Hull and Ivan Pavlov and the excitatory and inhibitory aspects of the nervous system. This led to Eysenck’s biological bases of personality, which conceived that brain-behaviour systems were typified by demonstrating nomothetic variation in populations; pervasive effects on cognition, emotion and behaviour; and demonstrated stability over time. Eysenck identified the trait dimensions of Extraversion (E) and Neuroticism (N), and a fledgling dimension related to Psychoticism (P) was appearing, but much of his focus concentrated on the E and N dimensions (Zuckerman, 1979a, 1994).

Eysenck later went on to use the OLS-OLA theory to explain the mechanisms and differences in behavioural expressions between introverts and extraverts. Intuitively, Eysenck assumed that SS would be part of the E dimension because extraverts require higher levels of stimulation and arousal than introverts. This was due to the theoretical assumption that introverts possessed higher, natural levels of positive hedonic tone at lower levels of stimulation and arousal. Therefore, extraverts required higher levels of stimulation and arousal beyond their natural predisposition.
and therefore sought this via SS activities. This theoretical assumption is illustrated in Figure 4.

Figure 4. Eysenck’s relation between sensory input for introverts and extraverts (Zuckerman, 1994).

This inclusion of psychophysiological and neuropsychological factors (based on systematic experimental evidence) was reported by Eysenck (1967) and highlighted the theoretical limitations in his previous works, *Dimensions of Personality* (1947) and *The Scientific Study of Personality* (1952), and the simple emphasis on activation and the central nervous system. Additionally, the development of Eysenck’s P dimension (1976) appeared to show that impulsivity was more related to the P rather than E dimension (Zuckerman, 1994).

Jeffrey Gray was a student of Eysenck’s and worked with him at the Institute of Psychiatry in London and was therefore influenced by his work on brain-behaviour systems (Corr, 2007). Gray’s original theory was focused on OLA during the 1960s, but shifted towards a neurophysiological perspective when medical knowledge of the limbic system advanced. Gray’s Limbic Systems Theory during the 1970s used evidence from neurological studies on animals to suggest three basic mechanisms to personality in humans – a reward system, a punishment system and a fight-flight system.

The reward system, referred to as the behavioural approach system (BAS), is concerned with responses to stimuli related to signals for rewards and the cessation of punishment. This mechanism is identified with impulsivity and high level of N, E and
P within Eysenck’s dimensions. Dopamine (DA) is the suggested neurochemical pathway for this disposition (Zuckerman, 1979a, 1994). The punishment mechanism, referred to as the behavioural inhibition system (BIS), aims to detect and inhibit novel stimuli that threatened to punish or frustrate. Therefore, this mechanism is linked to anxiety and psychopathy, along a unidimensional axis. Noradrenalin (NA) and serotonin within the limbic system provide the neurobiological pathway for the BIS. The reward and punishment signals sit on an X-axis of Eysenck’s E, N and P dimensions, where they are intersected, depending upon the nature of the stimuli, to produce anxiety or impulsiveness. The final mechanism, fight-flight, does not appear to hold a place within the SS theory. Although it may intuitively appear to fit the P dimension on an aggression-hostility axis, Zuckerman found that it is not a good match for a broader P dimension or the narrower SS dimensions (Zuckerman, 1994). Zuckerman (1994) asserts that Gray’s BAS mechanism (i.e., approach to stimulation) is more closely related to SS and impulsivity than either BIS or fight-flight. This is important as Zuckerman views SS and impulsivity as highly related traits.

Zuckerman sees the ‘State – Trait’ aspects of personality as part of the same process, rather than independent roots of behavioural expression. The ‘trait’ aspect is the genetic and biological basis that most influences the latent trait of SS, whereas the ‘state’ aspect refers to the environmental factors that foster specific expressions of the trait (i.e., environmental, situational and contextual factors) (Zuckerman, 1994).

In the summary chapter of his seminal text (Zuckerman, 1979a), Zuckerman was already suggesting alternative bases of SS behaviour beyond OLS-OLA, which has been mentioned previously. The last two chapters of the 1979a text are concerned with biological correlates (Chapter 12) and a new theory of SS (Chapter 13).

In relation to social factors, Zuckerman presents limited evidence on the effect of social and environmental influences, e.g. twin and family studies, race, class, education and culture; for example, higher SS scores are found in firstborn and only children. One tentative hypothesis on social-familial environments suggests that social and genetic influences interact whereby parents provide a model as well as the genes for the trait (Zuckerman, 1979a). In his 1979a publication Zuckerman concedes that these influences were speculative due to lack of depth and breadth of data, but suggested these factors as an avenue for future studies.

One of the more promising influences emerged from biological substrates, which suggested a psychobiological (brain-behaviour) model of SS. This draws
together cortical arousal theories (OLS-OLA), based on physiological brain systems (RAS, cerebral cortex and limbic systems) and how these are operationalised via the personality trait of SS.

Significant sex differences in SS scores led to focusing on gonadal hormones (androgens and estrogens); the assumption being that high sensation seeking might be related to high levels of male hormones. The highest correlation was found in HSS, compared to LSS, and in particular within those HSS who scored high on the disinhibition subscale.

Another biological area of focus was neurotransmitters and their effect on behaviour, which had been well established. Zuckerman (1979a) discusses the role of neurotransmitters such as dopamine (DA), serotonin and noradrenalin (NE) within the RAS and limbic system. Serotonin is an indoleamine and DA and NE are catecholamines. Depletion of these has been found to dramatically alter behaviour. These neurotransmitters are part of a group of monoamines and are regulated by the enzyme monoamine oxidase (MAO). Monoamine oxidase is necessary within the brain systems as they regulate the neurotransmitters, e.g. by reducing excessive amounts of these neurotransmitters, which can increase blood pressure levels as a response to their excitatory nature. Dopamine is a catecholamine and produces both excitatory and inhibitory post-synaptic potentials (Carlson, 1998). Noradrenalin is an excitatory catecholamine and a hormone within the sympathetic nervous system. It is secreted from the adrenal glands when the body prepares for physical exertion or exercise (Bird, 1992). Serotonin is an indolamine and has complex behavioural effects. It is known to play a role in regulating mood, eating, sleeping, arousal and pain (Carlson, 1998). Serotonin is linked to dopamine through its ability to inhibit its activity (Silber, 1999).

The hypothesis posits that low levels of MAO in HSS does not suppress the neurotransmitters NE, DA and serotonin. This supports previous findings that failed to find tonic levels of under-arousal in HSS. Conversely, LSS are hypothesised as having high levels of MAO, which suppress the excitatory nature of the neurotransmitters. Zuckerman (1979a) cites early studies in this area that tentatively supported this hypothesis by finding negative correlations between MAO levels and SSS scores. These provided encouraging avenues for the biological basis of the SS trait but needed further expansion and replication.
Figure 5 illustrates this new biological model that Zuckerman proposed at the end of the 1970s and was to drive the theoretical developments during the 1980s.

Expressions: Sex, Drugs, Alcohol, Parties, Travel, Risky Sports, Search for Variety

Figure 5. Zuckerman’s (1979a) revised biological model for sensation seeking

3.3 Theory development

During the 1980s Zuckerman was influenced more by psychopharmacological and biochemical research. He built further on the personality, psychophysiological and biochemical evidence in support of developing an integrated model of SS.

Further research into the biochemical correlates found that arousing stimuli sought by SS produces a release of catecholamines in the brain (Zuckerman, 1994). Where Zuckerman had hypothesised both NE and DA as being involved in the reward mechanism, emerging evidence highlighted that DA alone is essential to brain reward effects. Zuckerman developed his earlier biological model (Figure 6) in order to account for the increasing role of the catecholamine pathways in bringing the HSS closer to their optimal level of catecholamine system arousal (CSA). The rationale behind the CSA is that HSS have lower tonic levels of the neurotransmitters than LSS, therefore the HSS seeks novel and intense stimuli to renew their arousal peaks.
When the stimulation ceases or becomes stagnant, e.g. through inhibitory processes such as habituation or satiation, then the catecholamine system declines. These create behavioural frustration and therefore the need to increase stimulation arises.

Further to this, the role of gonadal hormones was explored. Gonadal hormones increase arousal by lowering MAO levels in the brain. Testosterone levels in the individual, as controlled by the gonadal hormones, reduce with age, as does SS. Additionally, the peak for testosterone is in the late teens or early twenties, which again is the same peak for SS. Therefore, Zuckerman (1994, p.378) suggests that ‘gonadal hormones probably play a role in the development of SS from childhood to adulthood’ at a biochemical level. However, Rosenblitt, Soler, Johnson and Quadango
failed to find a positive relationship between testosterone and SS among a sample of male and female college students; but they did find an inverse relationship between SS and cortisol for men, but not for women, and they suggested that an improved understanding of biological influences on behaviour is required. Additionally, they highlighted that social context (both psychosocial and socio-cultural) may play a more important part than is currently recognised. Fink, Neave, Laughton and Manning (2006) investigated the ratio between second and fourth digit length (2D:4D) and SS, as 2D:4D is recognised as proxy variable for prenatal testosterone. Lower ratios are a consistent marker for higher testosterone levels, with males possessing lower mean ratio scores compared to females. Their findings showed that 2D:4D ratios and SS scores were negatively correlated, and they also found significant correlations in males, but not for females. One of the explanations is that the hormonal environment in utero influences later behavioural development and personality characteristics.

Joseph, Lin, Jiang, Lynam and Kelly (2009) investigated the neural correlates of SS using functional magnetic resonance imaging (fMRI). When comparing LSS and HSS when looking at high- and low-arousal pictures they found that HSS showed stronger fMRI responses to high-arousal stimuli in the regions of the brain associated with arousal, and that LSS showed greater activation in the regions of the brain associated with emotional regulation. Furthermore, LSS showed a greater sensitivity to negative high-arousal pictures compared to positive high-arousal pictures. This suggests over-arousal and possibly distress to viewing such images.

Roberti (2004) conducted a review of the behavioural and biological correlates of SS and concluded that the amount of variance accounted for by biological correlates suggests that it is of practical significance. However, he also comments that conflicting findings between human and animal responses requires further investigation.

As mentioned in his 1979a text, Zuckerman suggested increased focus on genetic, social and environmental influences upon the SS trait and underpinning theory. Twin studies, including studies on identical and fraternal twins in same and different families and environments showed that shared environments contribute nothing to the twins’ similarities on the SS trait and that heritability of the SS subscales is relatively high in twins (Zuckerman, 2007a). This suggests support for a biological basis as twins share half (fraternal) or all (identical) the genes they are
comprised of. Other areas are discussed in his theoretical modification, such as parent-child studies, assortive mating and molecular genetics. Parent-child studies show low to modest correlations on SS scores, as do couples in long-term relationships, whereas husband-wife correlations are higher. Also, where most correlations on other measures of personality traits between spouses have been shown to be low to zero, SS is the exception (Zuckerman, 2007a).

Zuckerman suggests that if developmental biology plays such an essential part in the predisposition to SS then the strength of this disposition can affect the success or failure of parental influence. Parents who themselves are HSS are likely to encourage and support SS exploration and behaviour. However, where there is a discrepancy between parent-child SS tendencies then parents can only model and reinforce LSS tendencies in low-moderate SS children, and may possibly only be able to steer HSS children to safe avenues for expression that are at odds to their own LSS tendencies. Trying to reduce and control HSS tendencies in a child is not recommended, as they will seek the novel and intense stimuli that belies their innate tendency. Finally, Zuckerman (1994) suggests that due to this lack of shared environmental influence, that social peer influence may be more influential than parental influence.

Developments in the personality perspective took a top-down approach from personality traits, through levels of intermediate biological levels to a biological basis (Zuckerman, 2002). Further personality studies by Zuckerman in the 1980s showed that SS, not just impulsivity, was more related to the P dimension, rather than the previously assumed E dimension by Eysenck. This confirmatory work extended beyond the original investigations into developing the P dimension by Eysenck by 1976. In Zuckerman’s 1994 update he discusses the role of other dimensions of personality and their correlations with scales of SS and other related measures. He concludes that such measures load primarily on to the P dimension and that Eysenck’s P scale provides one of the best markers for the dimension of impulsive sensation seeking (ImpSS).

As Gray’s theoretical rationale developed, Zuckerman was drawn towards his integrated approach, whereby behavioural systems were seen as the connecting constructs between the neurological and neurochemical systems that underpinned personality traits (Zuckerman, 2007a). This developed theory of BAS, BIS and fight-flight is what is now referred to as the Reinforcement Sensitivity Theory of
Personality (Corr, 2007). Where Eysenck argued, Gray showed that the science of behaviour is best achieved through an integrated theory, or multiple level of analysis, from areas such as psychobiology, neuroscience, personality and social psychology (Corr, 2007).

### 3.4 Current theoretical model

Zuckerman’s latest model for SS sees a biosocial-biochemical model (Zuckerman, 2007a). This builds upon his early model and CSA representation. Zuckerman (2007a) believes that ‘high sensation seeking is a function of a strong approach and weak inhibition and arousal systems’ (p.27). Behaviour is ultimately decided through the influence of three traits: impulsivity, approach and sociability. This is illustrated in Figure 7.

![Figure 7. The current biosocial-biochemical model for sensation seeking (Zuckerman, 2007a).](image)

The influence of external, socialisation processes is also an important facet of the SS model. Evidence for such influences have been found among surfers in terms of socially acceptable risk-taking (Diehm & Armatas, 2004), and anti-social peer influence was a predictor for reckless behaviour, as was SS (Duangpatra, Bradeley & Glendon, 2009). Furthermore, SS is seen as a trait that shows high heritability and many psychophysiological and biochemical correlates suggesting a biological basis for the trait. Sensation seeking is not a drive but an instinct with a genetic-biological basis and various learned forms of expression. It is maintained by the CSA with behavioural expressions altering the levels of activity in the system. Zuckerman sees DA as the drive mechanism (i.e., approach) and serotonin as the brakes to that system (Zuckerman, 1994, 2007a).
3.5 Measuring sensation seeking

Before the development of the SS scale(s) Zuckerman was searching for a suitable measure for his sensory deprivation studies. His initial inclination was to use existing tests of anxiety and psychopathology but there appeared to be no existing measures that measured individual differences in OLS-OLA (Zuckerman, 1979a).

The items for the original SS scale (SSS-I) were developed by Zuckerman and his colleagues partly by rationality and partly by intuition. They tried to consider a range of behaviours and preferences based on themselves, their families, friends and colleagues. They constructed 54 items that addressed preferences for extreme physical sensations; dangerous sports and excitement; the need for adventure; the need for change; and preferences for excitement, the new and unfamiliar, and irregularity (Zuckerman, 1979a). Factor analyses and other tests were used to remove items and resulted in an inter-correlation that derived the final 50 items for the first general measure of SS. The first study using the SSS-I was published in 1964. The SSS-I adopted a forced choice format to eliminate social desirability and acquiescence response sets (Zuckerman, 1994).

The SSS-II emerged after deeper statistical analysis of the SSS-I, which reduced the scale from 50 items to 34. Re-factoring of the SSS-I and other factor analysis studies highlighted the issue that there might have been more than one stable factor in SS (Farley, 1967). The SSS-II was developed initially for use within the existing sensory deprivation studies, but it became obvious that it possessed wider applicability.

The third form (SSS-III) was developed in 1971 in an attempt to broaden the scale. This included adding items that reflected sex and sexual attitudes, which was a sensitive topic that had been avoided previously. It contained 50 items from the SSS-I general scale and 63 new, broader items giving a total of 113 items. Oblique and orthogonal rotations in the factor analyses produced the emergence of the SSS subscales of thrill and adventure seeking (TAS), experience seeking (ES), boredom susceptibility (BS), and disinhibition (DIS). A general scale (GEN) was still present. Subsequent factor analyses reduced the SSS-IV to 72 items across the five sub-scales - GEN (22 items); TAS (14 items); ES (18 items); BS (18 items); and DIS (14 items). The general scale was still included in order to provide continuity within the research that had been conducted using the SSS-II form (Zuckerman, 1979a).
Further analysis led to the conclusion that the general scale should be removed because of its structural non-independence. The aim for the remaining four sub-scales was to reduce them to 10 items per sub-scale. This was conducted and validated and these are retained within the current Form V (SSS-V), which is a 40-item forced choice questionnaire measuring Total SS as well as the four sub-scales (TAS, ES, BS and DIS). The SSS-V was published in 1978 and remains the most widely used form of the SSS. A description of the sub-scales is below.

**Thrill and adventure seeking (TAS)**
TAS is expressed as a desire to engage in sports or other physically risky activities that provide unusual sensations of speed or defiance of gravity, such as parachuting, scuba diving, or skiing. Most of these activities are moderately risky, which is why LSS tend to avoid engaging in them; and fundamentally, it is the sensation reward that attracts HSS, not the risk per se. Because most of the activities were not common during the test development era (1970s), most of the items are expressed as intentions ("I would like to...") rather than reports of direct experience. It has an internal reliability in version V of between 0.77 and 0.82 (Zuckerman, 1994).

**Experience seeking (ES)**
This factor attempts to explain the seeking of novel sensations and experiences through the mind and senses, as in arousing music, art, and travel, and through social non-conformity with non-conformist groups such as ‘goths’, artists, punks, etc. Some of the language used to describe such activities and groups is a little out of date, e.g. ‘hippies’ in the 1970s, ‘ punks’ in the 1980s, so should be carefully considered when administering to 21st century populations. It has an internal reliability in version V of between 0.61 and 0.67 (Zuckerman, 1994). The ES tendency can be epitomised by Odysseus in Homer’s the Odyssey, on his return home after twenty years away fighting the Trojan Wars:

‘I am a part of all that I have met;
Yet all experience is an arch wherethrough gleams
that untravelled world whose margin fades’
**Disinhibition (DIS)**

This factor describes SS through social activities like parties, social drinking, and sex. It has very little relationship to education, race or social class, but is the sub-scale most highly related to certain psychophysiological correlates of SS, such as HR, OR and cortical EP (Zuckerman, 2007a). It has the strongest relationship with gonadal hormones out of the four subscales and is also strongly influenced by serotonin. It has an internal reliability in version V of between 0.74 and 0.78 (Zuckerman, 1994).

**Boredom susceptibility (BS)**

This factor represents intolerance for repetitive experience of any kind, including routine work and ‘boring’ people. It was the weakest factor to emerge from the factor analyses in the development of the scales, with an internal reliability in version V of between 0.56 and 0.65 (Zuckerman, 1994). It is most highly related to DIS and is high in psychopathic personalities. Zuckerman sees BS as related to the catecholamine system activity (CSA) in explaining why the sensation seeker has high BS and a need for sensations through extreme sports activities (as in TAS), people (as in DIS) and novel experiences (as in ES) (Zuckerman, 2007a).

**Alternative versions of SS scales**

A Form VI was developed in 1984. This is a 128-item questionnaire that is in two parts and addresses actual experience (Part I) and future intentions (Part II). The rationale for the Form VI was that previous versions (Forms I-V) contained items which expressed a desire to engage in some behaviours (even if they had not); activities they had engaged in (which acted as a confounder for those participants who had not); and items reflecting general attitudes. As there is a phenomenological difference between intentions and actual experiences it was thought necessary to attempt to deconflict these behaviours. The response format was changed to a three-point scale based on both experience and intentions. The Form VI is not a substitute for the SSS-V as it does not contain the ES and BS sub-scales or the total score; however it may be useful for those wishing to investigate TAS and DIS only or address queries about specific types of experience (Zuckerman, 1994).

A short version of the SSS was developed by Madsen, Das, Bogen and Grossman (1987). This was a 10-item scale administered to high-school children and undergraduate students. Short-form scales are always useful in research where other
measures are being administered or where brevity is a consideration within the research project. However, it has low internal reliability, therefore Zuckerman (1994) surmised that it may be useful for SS research where time is a limiting factor but is limited as a measure of the general SS tendency.

An even shorter 8-item version of the SSS-V was devised by Hoyle, Stephenson, Palmgreen, Lorch and Donohew (2002). The Brief Sensation Seeking Scale (BSSS) is constructed by using two items from each of the four sub-scales (TAS, BS, ES, DIS) and was designed for use within adolescent populations. However, previous research points to reliability below 0.80 (Stephenson, Hoyle, Palmgreen & Slater, 2003) and also that as it is derived from the SSS-V it does not account for the current theoretical development of the impulsivity construct (McDaniel & Mahan, 2008). By his 1994 update Zuckerman had identified that variations of the SSS (Forms I – VI) had been translated into at least 14 different languages.

3.6 Impulsive sensation seeking

The growing importance of impulsivity or impulsive behaviour within the sensation seeking theory and construct is evident from the amount of coverage it gradually received among the three core texts in 1979a, 1994 and 2007a.

Impulsion, or the need for impulsion, was first discussed within the individual differences and personality theories in the original SS text (Zuckerman, 1979a). Duffy (1957) produced physiological (EEG) measures associated with OLS-OLA studies, which showed that individuals with high arousal (as measured by fast alpha EEG rhythms) were characterised as quick, impulsive and variable in behaviour. Impulsiveness is also discussed as part of Eysenck’s personality theory, particularly related to the extraversion (E) dimension. It was hypothesised that extraverts were more prone to engage in impulsive behaviour. At this stage, both SS and impulsivity were intuitively seen as emanating from more extraverted, sociable individuals, rather than the later studies that showed that SS and impulsivity were more related to the psychoticism (P) dimension, once P was developed as part of Eysenck’s theory. Eysenck felt that E and neuroticism (N), along with the narrower traits of impulsivity and SS, had similar genetic bases (Zuckerman, 1979a) and Zuckerman concludes that the P scale still provides one of the best markers for the impulsive SS (ImpSS) dimension (Zuckerman, 1994).
Gray also recognised the place of emotional temperaments, such as impulsivity, as part of the approach system within his conceptual model to account for consistent patterns of individual differences. Gray posited that impulsives display an inability to anticipate the consequences of their actions and is related to the greater sensitivities between reward stimuli and the expectations of reward, relative to punishment signals and the expectations of punishment, i.e., that they are sensitive to signals for reward but insensitive to signals for punishment. This basically describes the risk appraisal process where we know that HSS typically display a lower risk appraisal process than LSS (Zuckerman, 1994, 2007a), i.e., lower risk perceptions.

From the 1980s Zuckerman regarded impulsivity as closely linked with SS and later studies confirmed this relation at the trait level (Zuckerman, 1994, 2007a). When impulsivity is combined with SS there may be insensitivity to the risk, associated by a lack of planning (Zuckerman, 1994). This increases the probability of a negative consequence, but does not necessarily predict inevitable causation. In the context of criminal behaviour (of a sample of college students) Horvath and Zuckerman (1993) showed that SS and impulsivity were independent predictors of ‘own-behaviour crime’ with correlations of $r = .53$ and $r = .36$ respectively. The correlation between SS and impulsivity was $r = .43$.

Impulsiveness is sometimes termed as ‘narrow impulsivity’, which refers to the tendency to act quickly without reflection (Zuckerman, 1994). It has been linked with arousal and has been demonstrated through EEG experiments (Zuckerman, 1994). However, there is a cognitive issue to discuss. Decisions are often the trade-off between speed and accuracy and HSS should hypothetically prefer speed over accuracy, as a function of stimulus. Zuckerman (1994) cites research studies that have shown that HSS possess faster reaction times on forced choice items in questionnaires, but that there is no consistent evidence that HSS are cognitively impulsive in their reactions, as opposed to decisions. However, it is generally accepted that when impulsivity is combined with HSS then there exists insensitivity to the risk and a lack of planning; this may be characterised by a lack of restraint in situations of potential pleasure (Zuckerman, 1994, 2007a). Zuckerman and Kuhlman (2000) also suggest that those high in impulsiveness possess an inhibition deficiency when faced with dangerous reward-seeking behaviour.

Impulsive sensation seeking (ImpSS) is part of a broader five-factor personality test – the Zuckerman-Kuhlman Personality Questionnaire (ZKPQ)
(Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993) and measures a general need for excitement and impulsivity in SS activities. It was derived from a factor analysis of the SSS-V and other impulsivity scales (Zuckerman, 2007a). Along with ImpSS the ZKPQ also measures Aggression-Hostility, Neuroticism-Anxiety, Activity and Sociability. As the SS and impulsive scales loaded on to a single scale and also on to Eysenck’s P scale it was initially named Impulsive Unsocialized Sensation Seeking. Subsequent factor analysis found all scale elements loaded on to this factor, except socialisation items; therefore, they re-named it Impulsive Sensation Seeking (Zuckerman, 2002).

The ImpSS scale is a 19-item scale containing 8 items on impulsiveness and 11 items measuring general SS. Of the 11 SS items, 8 are taken directly from the SSS-V (4 on ES, 2 on DIS, 1 on BS and 1 on TAS). Figure 8 illustrates the original raw score profile for US college students (males and females) on the ZKPQ ImpSS scale (Zuckerman et al., 1993).

![Figure 8. Original frequency profile for males and females on ZKPQ ImpSS scale.](#)

The ImpSS scale follows a true-false format scale as social desirability was found to be of little importance after initial concerns in the original SS scales (Zuckerman 1994). Another advantage of the ImpSS scale is that its items are of a general nature and does not ask about specific activities (e.g. drinking, drugs, extreme sports), which may confound the responses between those who do and do not engage in such activities (McDaniel & Zuckerman, 2003). Additionally, it has been translated into

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2 Frequency scores and study data emailed by Prof. Marvin Zuckerman (Personal communications, dated April 2006).
Spanish, Catalan, German, Chinese and Japanese (Zuckerman, 2007a). A shortened cross-cultural version of the ZKPQ (ZKPQ-50-CC) was created and psychometrically accepted for the English (United States), French (Switzerland), German and Spanish languages (Aluja, Rossier & Zuckerman, 2006). Furthermore, an equivalence check was conducted on the ZKPQ-50-CC (Aluja, Rossier & Zuckerman, 2007). The equivalence tests showed robust reliability and validity results, suggesting good support for an internet on-line format of the ZKPQ-50-CC as well as the standard paper and pencil format.

ImpSS has been found to have good internal reliability coefficients. Zuckerman (2002) found Cronbach’s α of 0.77 in a male student population and 0.81 in a female student population. McDaniel and Mahan (2008) found Cronbach’s α of 0.87 in a non-student population and 0.84 in a student population. These reliabilities are in excess of the 0.80 suggested by Nunnally (1970). ImpSS correlates highly with the total score on the SSS-V (r = .66) (Zuckerman, 1994). It correlates moderately with the TAS, ES and DIS scales of the SSS-V (r = .43 to .45) and slightly lower for BS (r = .37). Both the ZKPQ and SS scales were reviewed in a systematic review of instruments measuring risk propensity (Harrison, Young, Butow, Salkeld & Solomon, 2005). The ZKPQ was shown to be valid, reliable, appropriate, and applicable to wider populations.

The ImpSS scale is an independent and significant predictor of total risk-taking, with men scoring higher than women. It also correlates significantly for health behaviours such as drinking, smoking, drugs and sex, but not for driving or gambling, for both men and women (Zuckerman, 2007a). The ZKPQ (inclusive of the ImpSS scale) or just the ImpSS sub-scale have been adopted in a range of studies and on a range of high risk groups, for example, prostitutes (O’Sullivan, Zuckerman & Kraft, 1996), high risk sports participants (Jack & Ronan, 1998), and adolescent high school students (van Beurden, Zask, Brooks & Dight, 2005). Its use in studies have included: a quantitative review of personality and sexual risk-taking (Hoyle, Fejfar & Miller, 2000); to investigate the neural correlates of emotional reactivity and sensation seeking (Joseph et al., 2009); looking at US college sports teams (O’Sullivan, Zuckerman & Kraft, 1998); investigating the relationship between ImpSS and gambling (McDaniel & Zuckerman, 2003); predicting personality disorders (Aluja, Cuevas, Garcia & Garcia, 2007); and also when looking at positive (pro-social) and...
negative (anti-social) aspects of risk-taking (Fischer & Smith, 2004). However, it is unknown if it has ever been applied to a military population as no evidence can be found.

In essence, Zuckerman (1994) concludes that 'it appears to measure the general SS tendency...[and] is the most promising short, true-false form for the general SS trait' (pp.46-47). By his 2007a update Zuckerman confirms its utility by stating that it should serve its purpose if only an overall measure of SS is desired (Zuckerman, 2007a). The strength of its psychometric properties and utility for research has been further supported by McDaniel and Mahan (2008). In an examination of the ImpSS scale's validity and reliability, McDaniel and Mahan confirm the ImpSS scale to be a reliable alternative to the SSS-V. This is due to three main reasons: (a) its robust psychometric properties compared to the SSS-V, (b) it is shorter and easier to complete than the SSS-V, and probably more importantly, (c) it reflects the current theoretical stance of Zuckerman on the SS construct by incorporating impulsiveness as a behavioural pathway. Therefore, despite the continued use of the SSS-V for SS research (McDaniel & Mahan, 2008) there is now compelling evidence that the ImpSS scale should be the measure of choice.

3.7 Criticisms of sensation seeking
All theories and their supporting studies succumb to scrutiny and criticism, which is a valuable and necessary part of the scientific process. Zuckerman's SS theory, some of the experimental and/or empirical work, and the measurement of SS have all received such attention.

One of the more common criticisms is with regard to the type of language and wording used in the various SS scales. Forms I-V of the SSS were developed and published during the 1960s and 1970s, therefore the language of the time is reflected in the construction of the items. Although this was recognised by Zuckerman and changes made during the 1980s, some of the language construction will still appear outdated in a modern Western culture in the 21st Century. This has been recognised and commented upon by various authors (Gray & Wilson, 2007; Hoyle et al., 2002; McDaniel & Mahan, 2008) but does not seem to have had any detrimental effect upon the willingness to respond, or its reliability or validity (Zuckerman, 2007b), although some of the wording may invoke sniggers and comments from 21st century adolescent participants.
Further to the language construction issue is the use of behavioural examples that are biased to younger responders. Roth, Hammelstein and Brahlar (2007) suggest that the use of activities like ‘skiing’ and ‘mountaineering’ and behaviours like ‘wild uninhibited parties’ reflect a ‘youthful behavioural style’ (Roth et al., 2007, p.1841), therefore it may not be measuring the SS construct but age-related activities. Zuckerman (2008) responds to this claim by suggesting that ‘youthful behavioural style’ is not a personality trait or type, and forty years of SS research across ages, cultures, genders, etc. simply reflect variations that are found in all age groups in all valid and reliable constructs. Furthermore, development of the ImpSS scale negates such issues (McDaniel & Zuckerman, 2003), as well as the plethora of research on the differences in the biological correlates between age and gender. Roth, Hammelstein and Brahlar (2009) counter this by suggesting that such activities and their age-related differences should not exist a priori; however, Roth et al. (2009) are no doubt aware of the broader SS research arena but make no reference to either the SSS-VI (which asks about actual experience) or the ImpSS on the ZKPQ (which does not ask about specific activities). This factor is recognised by McDaniel and Mahan (2008), whereby despite being around since 1993 the ImpSS scale is often overlooked in favour of the SSS-V.

The confounding influence of named activities related to risk-taking (e.g. drinking, sexual practice, sports, etc.) has been mentioned by many (Gray & Wilson, 2007; Harrison et al., 2005; McDaniel & Mahan, 2008) as well as by Zuckerman (1994, 2007a; 2007b). Paradoxically, Harrison et al. (2005) then go on to question the use of situations and activities that are not relevant to responders. The advantage of the ImpSS scale on the ZKPQ is that activities are not named, and items on the SSS-VI do discuss actual experience on specific activities.

The length of the SSS-V (40 items) and the SSS-VI (128 items) have been criticised in studies where brevity may be required or where a battery of tests are being administered (Arnett, 1994; Hoyle et al., 2002; McDaniel & Mahan, 2008). Again, the advantage of the ZKPQ ImpSS scale is that it possesses 19-items, whilst retaining robust psychometric properties (McDaniel & Mahan, 2008; McDaniel & Zuckerman, 2003).

Social desirability (i.e., the tendency to acquiesce to socially desirable responses on test items) was considered to be of concern for accurate response reporting. Thus, the forced choice format was used to control for social desirability.
By providing two equally possible and desirable alternatives then the desire to acquiesce is reduced. Further analysis went on to show that the impact of social desirability and response bias was minimal (Zuckerman, 1994). However, this has not stopped others from commenting on the forced choice format (Harrison et al., 2005; Hoyle et al., 2002; McDaniel & Mahan, 2008).

Gray and Wilson (2007) attempted to re-examine the SSS-V and comment on its reliability and validity. However, they chose an original SSS that was changed by Zuckerman in subsequently published versions of the SSS-V during the 1980s. Zuckerman (2007b) rebuts their examination by commenting that not only did Gray and Wilson (2007) use an outdated version of the SSS, but the changes they suggested to the SSS-V (from their findings on a sample of UK undergraduate students) did not actually have any effect on improving the internal reliabilities of the four sub-scales. Yet, the low subscale reliability levels of the SSS-V have been questioned (Deditius-Island & Caruso, 2002; Roberti, 2004).

Clayton, Segress and Caudill (2007) comment on the methodological issues of SS, specifically the BSSS, within two specific papers (Stephenson, Velez, Ramirez & Chalela, 2007; Vallone, Allen & Clayton, 2007). Their criticisms were that: (a) much of the previous SS research has focused on youth and adolescent populations, including young adults, (b) that SS research should be longitudinal to see if SS associated to a particularly stimulating event diminishes with exposure, i.e., the impact on the SS tendency with continuing events, (c) the multidimensionality of SS is often overlooked in favour of Total SS scores; however, this criticism ignores the theoretical developments in SS research via ImpSS; although their comment on how studies divide their samples into LSS and HSS group is welcomed and valid, i.e., that such divisions are arbitrary and inconsistent across studies, and finally, (d) in light of the findings by Stephenson et al. (2007) and Vallone et al. (2007) is SS research in danger of ignoring different aspects of SS for differing populations and contexts; however, Clayton et al. (2007) agree that as a personality trait then it is appropriate to label SS as ‘one size fits all’, and also the definition by Zuckerman (1994) and many other theoretical aspects make it clear that context and socialisation are an important part of the variance in expressed behaviour.

The appropriateness of extrapolating results from animal studies to human behaviour, especially those based on invasive biological measures, has been questioned in terms of SS research (Roberti, 2004). The investigation of brain-
behaviour models, as typified by the theoretical developments of SS, are constrained by the inability to conduct certain biological experimentation on humans, for example, potential post-experiment alterations to neurochemical substances and the long-term effects of such alterations. Therefore, extrapolations from animal studies have been explored, with mixed success. Piazza et al. (1993) found increased sensitivity by rats to corticosteroids (stress hormones) in novelty seeking experiments, which mirrored similar reactions by HSS on exposure to stressors. However, Netter, Hennig and Roed (1996) found contradictory evidence between animal and human corticosterone (stress) responses, highlighting the inconsistent nature of responses both within and between animals and humans.

Criticisms of the SS construct have been recognised and addressed, which helps drive forward the theory's development. Despite constructive criticism, there is a general agreement that SS is a valid and reliable personality construct and that it is a potent predictive factor for investigating risk-related behaviour (McDaniel & Mahan, 2008; Roth et al., 2007, 2009, Clayton et al., 2007). Finally, Zuckerman and Kuhlman (2000) remind the reader that 'findings in most of these areas [risky behaviours and activities] have been replicated many times, in different decades, and in different countries' (p.1001), supporting the theory and application of the SS construct for researching risky health behaviours and risk-related activities.

3.8 Sensation seeking and risk-taking

Engagement with risk is experienced at a young age. In fact, unintentional injuries are the leading cause of hospitalisation and premature death for infants and young children (Morrongiello & Lasenby, 2006). To address this issue, Morrongiello and Lasenby (2006) developed a short-form sensation seeking scale for children (SSS-C) for measuring physical risk-taking propensity among 7-12 year olds. Sensation seeking and risk-taking behaviour had predominantly been investigated among adolescents and young adults. This reflects an interaction between the peak of development in the biological correlates underpinning SS (e.g. testosterone) and the socialisation processes in peer-led risk behaviour, which may also be linked to immature development in thinking about consequences, about others, and underlying impulsivity. However, Greene, Kromar, Walters, Rubin and Hale (2000) comment that the adolescent age group tend to be statistically over-represented in most categories and contexts of risk-taking behaviour. Sensation seeking and risk has also
been investigated in older adults, including those aged 65 and older (McDaniel & Zuckerman, 2003).

Sensation seekers do not seek out risk-taking behaviour for its own sake (Zuckerman, 2007a). It is agreed that some aspect of risk-taking must be engaged with in order to enjoy certain SS activities (e.g. extreme sports), but it is not the essential goal of SS (Zuckerman, 1994). For example, HSS can also engage in high tempo rock music, intense and interesting art and violent movies, which fundamentally do not involve high degrees of risk; but why are HSS not perturbed by risk? As stated by Zuckerman (1994):

‘High and low sensation seekers differ in their willingness to take risks for desired sensations, but the low sensation seeker does not value the sensation as much as the high sensation seeker’ (p.153).

This quote highlights one of the key factors within the SS and risk-taking paradigm, that of risk appraisal, or risk perception. How one appraises the risk of a situation ultimately determines the decision to approach or withdraw from an activity involving sensation and an element of risk. Furthermore, risk appraisal is a subjective activity, with many daily activities involving the appraisal of ‘risky-ness’ (Zuckerman, 2007a).

In short, the answer is that HSS perceive lower risk appraisals (i.e., underestimate) than LSS, and are willing to accept these risks for the benefits they confer. In the prediction of risky behaviour Horvath and Zuckerman (1993) found that the best predictor was peer behaviour, followed by SS and then risk appraisal; although the negative correlation between risk appraisal and total SSS-V score was still significant for crime, minor violations and sports, but not for financial risks. Zuckerman (1979b) also found negative correlations between total SSS-V score and total risk appraisal. The evidence therefore supports the relationship between SS, risk appraisal and risk-taking behaviour.

The appraisal process is influenced and affected by a number of factors; for example, perceived benefits are higher and the risk more acceptable when the source of risk is voluntary (Slovic et al., 2000). This supports previous work by Jobe, Holgate and Scrapansky (1983) who found that higher risk-takers, as measured by the Risk-Taking Tendencies Scale (Torrance & Ziller, 1957), tended to volunteer for hazardous experiments more than non-risk takers. This links with Zuckerman’s
sensory deprivation studies in the 1960s where he found that HSS volunteered in disproportionate numbers than LSS to take part in his studies. Theoretically, the sensory deprivation studies should not have been of interest to HSS, however, their lower risk appraisal in terms of underestimating the physiological and psychological effects of sensory deprivation may have been the pathway, as well as novelty, to volunteer for such experiments.

Novelty, perceived severity of consequence and previous experience all influence risk perception and approach. Novelty tends to increase risk appraisal, whereas familiarity (experience) tends to reduce it. Zuckerman (2007a) found a robust correlation \( r = .56 \) between novelty and risk appraisal, particularly at the low novelty (i.e., high experience) end. This indicates a possible intervention strategy for reducing excessive risk-taking of HSS by introducing experience to reduce novelty, thereby reducing repeated exposure which may form into habituation, which inhibits SS and causes the HSS to seek novelty in order to maintain tonic arousal levels. It is difficult to determine, at this stage, whether HSS have lower risk appraisals due to the overwhelming influence of any one variable (e.g. novelty, experience, perceived benefits, etc.). Zuckerman (2007a) has summarised this by suggesting that risk appraisal is an inter-correlated process, as are risky behaviours, and that HSS estimate risk appraisal as lower than LSS even in activities they have not yet been experienced, yet it is stronger (lower in HSS) as a function of experience (Zuckerman, 1994).

Sensation seeking has also been studied in the context of occasional and frequent risk-taking (Desrichard & Denarie, 2005); the hypothesis being that occasional risk-takers would be phenomenologically different to frequent risk-takers. Their results showed that SS was predictive of both frequent and occasional risk-taking, but frequent risk-taking was also predicted by age and negative affect; thereby suggesting a distinction between the two forms of risk-taking behaviour.

Generally, women tend to have higher risk estimates than men and this has been consistently found across a range of health behaviours, e.g. sex, alcohol, drugs, driving and smoking (Zuckerman, 2007a). Flynn, Slovic and Mertz (1994) estimate this difference to be between 10 per cent and 15 per cent higher for women than men. Additionally, an ethnicity bias has also been demonstrated whereby non-white ethnicities over-estimate perceived risks compared to Whites. Zuckerman (2007a) cites his previous studies that have consistently confirmed the finding that SS is higher in men than women and in Whites than African Americans.
Finally, SS has been included within many other studies of risk-taking behaviour and provides robust support for both constructs as being independent, but closely associated; a selected sample of such research includes: reward and loss (Bornovalova et al., 2009); deliberation (Fischer & Smith, 2004); egocentrism (Greene et al., 2000); occupational interests and choice of profession (Mallet & Vognoli, 2007; Zalenski, 1984).

3.9 Chapter summary

In summary, the genesis and theoretical development of the SS construct has been charted. From the early recognition of differences among volunteers for sensory deprivation studies in the 1950s and 1960s, a systematic and concerted effort has been made to find the underpinning factors that form the SS personality. This development has utilised 40 years of experimental and empirical evidence to address factors associated with arousal theories, personality, biology and neuroscience to arrive at the current biosocial-biochemical model that accounts for innate biological (nature) and learned, socialised, contextual factors (nurture) to account for consistent differences in SS and behavioural expressions.

The construction, psychometric properties and continued development of SS measurement have been critiqued, including the numerous criticisms of the construct, which help to improve its development. These developments have led to the most recent theoretical development, and focus of the present study, that of impulsive sensation seeking. It is now necessary to place SS into the context of a behavioural expression, and for the present study, this pertains to risky health behaviour.
4. Health behaviours, risk-taking and sensation seeking

4.1 Health behaviours

Two key historical factors have been attributed to the growing interest in health as a concept: the development of public health institutions and the societal means of achieving and maintaining health.

Firstly, advances in medical science have reduced the impact of infectious diseases upon the world’s population, which has led to a substantial increase in life expectancy in industrialised nations over the last century.

Secondly, technological progress has brought about vastly improved living conditions and standards in these industrialised nations (Conner & Norman, 1995; Stroebe, 2000). Furthermore, it is recognised that motivation can influence an individual’s ability to adopt health promoting behaviours (e.g. regular exercise, health eating, etc.) whilst avoiding health compromising behaviours (e.g. smoking, excessive alcohol, use of illicit drugs, poor diet, reduced physical activity and exercise, unhealthy sexual behaviour and risky driving). It is also recognised that such behaviours are modifiable (Conner & Norman, 1995). The emphasis on modifiable behaviours, as opposed to genetic pre-disposition, is especially pertinent when one considers the rise in premature deaths due to cardiovascular illnesses in Western societies; especially when they have been linked to modifiable behaviours such as smoking, alcohol intake, diet and exercise (Conner & Norman, 1995). It has been suggested that 50 per cent of mortality from the ten leading causes of death is due to behaviour, and 75 per cent of all deaths due to cancer are related to behaviour (Ogden, 2000). There is more than sufficient evidence to show that modifiable lifestyle behaviours have direct influences on the maintenance of health and the prevention of disease (i.e., mortality and morbidity); and various researchers in the field of health psychology have cited numerous large-scale epidemiological studies and a plethora of health-related psychological research that have highlighted the impact of behaviour upon health (e.g. Ogden, 2000; Steptoe & Wardle, 2004; Stroebe, 2000).

Health behaviour is typically defined as the behaviours that an individual undertakes in order to enhance or maintain their health status (Conner & Norman, 1995; Ogden, 2000; Stroebe, 2000), and risky health behaviour has been described as ‘behaviours that increase morbidity and mortality in the short and longer-term. There
are many such behaviours, most of them characterised by providing short-term satisfaction while exposing a person to long-term health hazards' (Torgersen & Vollrath, 2006, p.222). As mentioned previously, such behaviour can be conducted in a health promoting or health compromising way. It would be rational to assume that different health behaviours correlate, i.e., that those who do not smoke or drink alcohol, also engage in regular exercise, have a healthy diet and drive safely. It is often suggested that health behaviours tended to cluster (Torgersen & Vollrath, 2006), as identified in the influential, longitudinal Alameda study that began in California in 1965 (Belloc, 1973). However, subsequent research on the relationship between different health behaviours only shows a weak correlation (Stroebe, 2000), with the exception of smoking behaviour and alcohol intake, whereby heavy alcohol use frequently co-occurs with tobacco smoking (Kahler et al., 2008). One reason provided for such differences is that individuals possess varying and conflicting reasons for engaging with or avoiding different health behaviours, i.e., that different dimensions of health exist within individuals. Therefore, the factors that underlie health behaviours has given rise to the academic approach of trying to understand and model these various dimensions and their underpinning mechanisms, and also the applied public health approach of trying to design and implement interventions and strategies to change the prevalence of such behaviours, i.e., encourage and foster the health promoting and reduce the health compromising (Conner & Norman, 1995). Some of the underlying factors that influence intra-personal dimensions of health and highlight this complex domain of health behaviour include demographic variables (e.g. age, gender, education, etc.), social and cultural factors, emotional factors, personality factors and cognitive processes, as well as beliefs, attitudes and expectations (Conner & Norman, 1995).

It is worth briefly introducing the four health behaviours that are of direct relevance to the current study, before discussing the risk taking aspect of health and how the personality trait of sensation seeking (SS) has been applied to risky health behaviour.

**Smoking behaviour**

*Prevalence rates and statistics*

General trends in smoking behaviour in the UK have shown a slow but steady decline over the last 30 years (Ogden, 2000). Smoking prevalence for adults in England was
25 per cent in 2004 (26 per cent of men and 23 per cent of women) (UK National Health Service, 2006)\(^3\), and although more males tend to smoke compared to females, this rate of decline is greater in men than women (Ogden, 2000). Smoking behaviour tends to be more prevalent among unskilled manual workers and those in lower socio-economic categories, who also tend to have lower educational status and suffer from more chronic medical conditions and psychiatric problems (Steptoe & Wardle, 2004).

**Negative effects**
The negative effects of tobacco smoking have been well documented. It is estimated to account for 30 per cent of all cancer deaths and 90 per cent of all lung cancer mortality (Ogden, 2000; Stroebe, 2000). Furthermore, it is linked to cancers of the mouth, oesophagus and larynx, pancreas, bladder and cervix. It causes pregnancy complications, including low birth weight, detached placenta and premature births (Steptoe & Wardle, 2004). Other problems relate to strokes, coronary heart disease (CHD), cardiovascular illnesses and chronic pulmonary diseases (e.g., bronchitis and emphysema). Life expectancy is also lower in smokers compared to non-smokers. It is a risk factor for injury by affecting bone density, which possesses injury risks for the overweight, the elderly and those undertaking extreme physical activity (e.g. athletes and military personnel).

**Positive effects**
There are no medical health benefits of tobacco smoking, although smoking is used as an appetite suppressant and is associated with body image among young women (Lopez, Drobes, Thompson & Brandon, 2008). However, despite findings that middle-aged smokers weighed less than non-smokers and that smokers who quit gained weight (French & Jeffery, 1995) there is no evidence of weight loss among young smokers who start smoking and some studies have found no difference in weight between smokers and non-smokers (Stroebe, 2000). Graham (1987) has reported the emotional and psychological benefits of smoking through increases in mood levels and as a coping mechanism with difficult events and situations (i.e., stress) and Parrott (2008) cites several other reasons given by smokers for the psychological benefit of smoking, e.g. to help with concentration, feelings of

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\(^3\) UK National Health Service (NHS).
relaxation and contentment. However, Parrott (2008) reports that these benefits fail to materialise when smokers are empirically compared to non-smokers, and that a wealth of research has demonstrated higher levels of daily stress in smokers than in non-smokers and also that ex-smokers who have quit for long-term periods report similar (lower) levels of daily stress than current smokers, who report significantly higher levels of daily stress.

The effects of nicotine on cognitive performance have been reviewed by Newhouse, Potter and Singh (2004). They illustrate conflicting findings which show that nicotine can improve performance on cognitive tasks (e.g. vigilance, sustained choice reaction, alertness, etc.) and other studies that have failed to reproduce these results, and have in fact found that nicotine impairs cognitive performance. Their review findings suggest that the problem lies in the methodological use of different population samples, whereby improvements are generally found in smokers and in certain clinical populations (e.g. attention deficit), but performance is impaired in normal and non-smoking populations. They postulate that the differences between the two populations may be their underlying neurobiology and/or the efficiency of their nicotinic system\(^4\), which is linked to arousal and cognition.

Stopping smoking can have the most positive effect, with the risk of CHD reducing by half one year after quitting and after 15 years it is the same for those who have never smoked (Stroebe, 2000). Also, dependent upon how long one has smoked, how much they smoked per day and how long it has been (in years) since they stopped, many of the health effects are reversible.

**Determinants of smoking**

There are two aspects to prolonged health behaviours; initiation and maintenance. In terms of smoking behaviour it is often initiated in the younger years and has been widely attributed to peer pressure and experimentation. Beyond the demographic factors given earlier, some of the reasons provided for the maintenance of smoking are pleasure-taste, addiction-habit, anxiety, and social rewards (Stroebe, 2000). Zuckerman, Ball and Black (1990) factor analysed a smoking questionnaire in their investigation of personality and impulsive sensation seeking (ImpSS) and found five factors emerged for why people smoked; they were: Attentive-Coping; Negative

\(^4\) The neuronal nicotinic receptors that are found throughout the central nervous system.
Emotion; Alone-Relaxed; Social situations; and Heavy Smoking across all situations. Stroebe (2000) briefly discusses three key determinant topics: the psychological aspect of beliefs, attitudes and intentions; the nicotine regulation addiction model proposed by Schachter (1977); and the genetic influences and variance established by twin studies. Singly, they provide a behavioural, physiological and biological perspective on the determinants of smoking behaviour, and as such they provide a proportion of evidence-based variance to help explain the complex nature of this health behaviour.

Alcohol intake

Prevalence rates and statistics

According to UK Department of Health’s (DoH) 2004 report on alcohol use and misuse in England, men still tend to drink more than women, across low, moderate and higher intake levels, for example, 33 per cent of men and 16 per cent of women drink alcohol to hazardous levels in the UK (NHS, 2009)\(^5\); however, alcohol intake beyond the recommended levels for men and women has been increasing in women since 1992 (from 12 per cent to 17 per cent) whereas it has remained stable in men (27 per cent) for the same period. An alarming figure is that in 2003, a quarter (25 per cent) of school pupils in England aged 11-15 had consumed alcohol in the previous week (Office of National Statistics [ONS], 2004). Since 1991 the age-standardised rate for alcohol-related deaths has at least doubled for men and doubled for women. The rate increase is largest among males in the age groups 35-54 and 55-74 (ONS, 2009)\(^6\). In 2007 there were 863,000 admissions to hospital due to alcohol misuse, and it is estimated that 70 per cent of all peak time visits to accident and emergency are due to alcohol. Finally, in 2007 there were 8724 alcohol-related deaths (ONS, 2009).

The UK Government’s current Alcohol Harm Reduction Strategy\(^7\) (published in 2004) is a cross-cutting strategy aimed at tackling all aspects of alcohol-related harm in England. Its four key aims are to (a) tackle alcohol-related disorder in town and city centres, (b) improve treatment and support for people with alcohol problems, (c) clamp down on irresponsible promotions by the drinks industry, and (d) provide

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\(^5\) Source: NHS website at www.nhs.uk/conditions/alcohol-misuse
\(^6\) www.statistics.gov.uk
\(^7\) http://www.dh.gov.uk/PolicyAndGuidance/HealthAndSocialCareTopics/AlcoholMisuse/fs/en
better information to consumers about the dangers of alcohol misuse. This is a joint initiative between the Department of Health and the Home Office.

Negative effects
Alcohol misuse can create physical, psychological and social problems, for example, physical causes include liver disease (cirrhosis), high blood pressure (hypertension), heart disease, strokes, sexual dysfunction, and some cancers (e.g. mouth, liver, bowel, and breast). Psychological problems include depression and anxiety, memory loss and impaired judgement. The social problems include violence and anti-social behaviour, domestic abuse, increased absenteeism and losing a job, debt and financial problems, and the breakdown of families and relationships.

Positive effects
There is evidence that moderate alcohol intake confers more favourable health outcomes than either heavy drinking or complete abstinence (Steptoe & Wardle, 2004). This moderate consumption helps to reduce overall mortality rates through protection against cardiovascular disease (Camargo, 1999; Klatsky, 1999). Brodsky and Peele (1999) discuss the psychosocial benefits of moderate alcohol consumption and suggest that culture, social environment and expectations help to improve indicators of psychological and social well-being. These indicators include: (1) Psychological (subjective health, pleasure, stress reduction and mental health), (2) Social (sociability, leisure experiences, social cohesion), (3) Performance (long-term cognitive, creativity, income), and (4) Special age groups (youth adjustment, elderly functioning). They summarise by stating that ‘healthful’ drinking (i.e., moderate) is part of a broader cluster of health and well-being factors that, in combination, generate positive sensations and health outcomes.

Driving behaviour
There is no doubt that the motor vehicle (and variants thereof, e.g. buses, coaches, trains, etc.) improved the connectivity of individuals across large land distances, especially in terms of the freedom to choose when and where to go, which fosters an individual sense of control. For example, the proportion of households in the UK with access to a car increased from 52 per cent to 75 per cent between 1971 and 2007. Additionally, the percentage of households in the UK with access to two cars.
increased almost fourfold from 7 per cent in 1971 to 26 per cent in 2007 (ONS, 2009). However, road traffic accidents (RTA) and motor vehicle collisions (MVC) are one of the largest causes of human fatality on an annual basis. It has been estimated that 90 per cent of all accidents are attributable to human error (McKenna, 1983) or at least are the most prevalent in contributing to crashes (US Government Accounting Office, 2003). The UK Department for Transport (DfT, 2009) report that four of the five most frequently reported contributing factors in an accident involved driver or rider error or reaction. Additionally, the UK Automobile Association (AA) commissioned a survey and found that 75 per cent of respondents had been distracted at some stage by a nice view; 55 per cent distracted by a low flying aircraft; 52 per cent distracted by advertising billboards and 30 per cent distracted by roadside art. Furthermore, in terms of irritating behaviours, the main culprits were tailgaters (36 per cent), talking on mobiles (23 per cent), middle lane hoggers (18 per cent) and lane switchers (6 per cent).

Young adults are disproportionately represented in the RTA and MVC statistics. Contributing factors include insufficient skill, lack of experience, underestimation of traffic-related risks, and a tendency to drive faster than older age groups (Hatfield & Fernandes, 2009; Ulleberg, 2002). The UK AA (2009) found that 18-24 year olds were four times more irritated by older drivers (aged 45+) driving too slow, and they were more likely to have speed related accidents compared to older drivers (DfT, 2009).

Further to the human and economic cost, vehicle acquisition and driving behaviour is a concern of the environmental movement and the ‘green agenda’, especially in terms of the make and efficiency of particular vehicles (e.g. ‘gas guzzlers’), annual mileage per individual, and driving styles used which use more fuel and increase carbon dioxide emissions, and also contribute to crashes, e.g. speeding, erratic driving behaviour.

However, driving is still seen as a source of pleasure. As previously stated, it provides freedom of movement and connectivity across distances. In fact, Slovic et al. (2000) have reported that people consider the perceived benefits of motor vehicles to outweigh the perceived risks. Both Hatfield and Fernandes (2009) and Clarke, Ward, Bartle and Truman (2006) have commented on the behaviour of young drivers and

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8 Populus interviewed 21,173 AA members online between 3rd - 10th August 2009.
found that the pleasurable and cathartic aspect of driving is an important factor in their risk-propensity and driving behaviour.

**Prevalence rates and statistics**

In 2002 an average of 102 people per day were killed or severely injured on UK roads (Office for National Statistics, 2009\(^9\)). Over recent years these figures have reduced. The UK DfT (2009) has compared 2008 figures against baseline data taken between 1994-98, and the figures suggest that fatalities fell with almost every type of road user (e.g. car, pedestrian, motorcycle and pedal cycle); also, although traffic rose by 16 per cent, the numbers killed, seriously injured and slightly injured were down on previous years. The DfT has calculated that the average cost of a road casualty (for all severities, i.e., fatal, seriously and slightly injured) is £52,600\(^{10}\), and the average cost of an accident (for all severities) is £75,000\(^{11}\). These figures should be considered when in 2008 there were a total of 230,905 reported casualties of all severities. Therefore, although road safety appears to be improving, the overall numbers are still high and are a significant contributor to annual UK deaths; for example, in 2008 there were 2538 road fatalities (DfT, 2009), whereas in 2007 there were 8724 alcohol-related deaths (ONS, 2009) and approximately 14,000 die from smoking (and smoking-related cancers and illnesses)\(^{12}\).

**Sexual behaviour**

Beliefs and attitudes toward sex have shifted considerably since the ‘sexual revolution’ of the 1960s. Two fundamental factors have affected this shift, the breakdown in social boundaries resulting in a more liberal and open (Western) society, and technological advancements, particularly in global mass media. Today’s sexual zeitgeist is a far cry from two centuries ago where sexual behaviour was seen as a religious or spiritual concern. During the nineteenth century, as scientific knowledge developed, the study, knowledge, and education of sex and sexual behaviour became the preserve of medicine and biological sciences. Sex was now seen as a ‘function’ along with other fundamental human processes (Ogden, 2000).

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\(^{10}\) Average for Fatal (£1,683,800); Serious (£189,200); Slightly (£14,600).  
\(^{11}\) Average for Fatal (£1,906,200); Serious (£218,100); Slightly (£22,600).  
\(^{12}\) Sources: NHS, Patient UK, netdoctor.
This biological, and rather mechanistic view, saw sexual behaviour as an ‘input-process-output’ model, where sexual behaviour culminated in the ‘output’ of reproduction. Therefore, sexual behaviour was to be acknowledged, but only within the limits of reproductive norms for an end purpose (reproduction). It was only during the middle of the 20th century that the social and pleasurable aspects of sexual behaviour began to burgeon. Key researchers, such as Alfred Kinsey (1940s and 1950s), Masters and Johnson (1960s) and Shere Hite (1970s and 1980s) helped to drive development in sex, sexuality and sexual behaviour (Ogden, 2000). The study and investigation of sexual risk-taking pertains to the cost of personal, social and cultural outcomes, in terms of both health and economic indices.

**Prevalence rates and statistics**

The US Centre for Disease Control and Prevention (CDCP, 1997) reported that sexually transmitted infections (STIs) were the most common reported disease in the USA; moreover, by 2008, 80 per cent of new HIV cases in women were attributable to heterosexual transmission (CDCP, 2008). In the UK, the incidence of STIs has been rising since the 1990s (NHS, 2009). There has been a 0.5 per cent increase in diagnosed STIs between 2007 and 2008, with 399,738 new cases reported. The largest increase was for genital herpes, with a 10 per cent increase to a total of 28,957 cases. The 16-24 year old age group contributes the most by accounting for over 50 per cent of new cases (65 per cent in the case of chlamydia), although they account for 12 per cent of the population.

The average age for loss of virginity had lowered from aged 17 in 1990 to aged 16 in 2000 (Wellings et al., 2001); however, in a recent survey of 16-24 year olds, conducted by the BBC, Durex and the MTV music channel, 30 per cent stated that they lost their virginity before the age of consent (i.e., age 16). Furthermore, 4 per cent lost their virginity before aged 14; nine per cent (9 per cent) had sex at age 14; and 17 per cent at age 15. Additionally, 38 per cent did not ‘always’ wear a condom with a new partner; this compares to 49 per cent found in a MORI poll for the National AIDS Trust. These condom statistics may be partly explained by another survey (BMRB International, 2003), which showed that 40 per cent of teenage boys were unaware that free condoms are available from family planning clinics.

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Lader and Hopkins (2008) found that although people’s awareness of STIs has improved, 57 per cent of men and 50 per cent of women reported making no changes to their behaviour despite what they had read, seen or heard about STIs, HIV and AIDS. The UK Health Protection Agency (2003) reported trends in STI occurrence between 1996 and 2002 for 16-19 year olds. The data showed that frequencies of most STIs significantly increased. These increases are attributed (in part) to behavioural factors such as: lower age at first intercourse (Wellings et al., 2001), higher acquisition of new partners within this age group, and increased likelihood of being involved in two or more sexual relationships simultaneously (POST, 2004; Johnson et al., 2001).

The UK currently has the highest rate of teenage pregnancy in Europe. Data from the UK Department of Health and Government Statistical Service (2008) found that abortion rates in England and Wales for 2007 had increased by 2.5 per cent since 2006. Furthermore, since the 1970s the age-standardised abortion rate for 15-44 year olds has at least doubled. Consistently, the rates for all women having abortions aged 20 and under increases each year, and in 2007, 81 per cent of abortions were conducted on single women, which is two-thirds higher than in 1997.

**Negative effects**

Transmitted sexual diseases are predominantly due to unprotected sex (poor condom use) and unclean sexual practices (e.g. vaginal, anal and oral), which can lead predominantly to STIs (e.g. chlamydia, gonorrhoea, syphilis, etc.), but also extends to HIV and AIDS. STIs are associated with other negative health outcomes such as infertility, recurrent infection, ectopic pregnancy, and cervical cancer (UK Parliamentary Office of Science and Technology [POST], 2004) for syphilis the outcomes can be even more extreme, e.g. damage to heart, nervous system, eyes, and brain (NHS, 2009). Other symptoms associated with STIs are: cystitis, bleeding, vaginal discharge (chlamydia); non-itchy rash, tiredness, swollen glands, fever, joint pains, hair loss (syphilis); irritation or discharge from the anus, pain when urinating, pungent discharge from penis or vagina (gonorrhoea), and painful blisters and ulceration, fever, pain when urinating, and vaginal discharge in women (genital herpes).
Unprotected sex can also lead to unplanned/unwanted pregnancies and abortions. The negative social impact is that sex outside of an established relationship can breakdown such relationships, e.g. marriage and civil partnerships.

**Positive effects**

The positive aspects of sexual activity include more than just the mechanistic and functional reproduction of the human species. Although sex is phenomenologically different to love, it can provide reinforcement and commitment in established relationships. In such relationships, the emotional component of sex plays a larger role compared to individuals who are not in relationships. By its nature, sex provides a pleasurable experience, which can be mood enhancing, as well as cathartic.

### 4.2 Health and risk-taking

A significant body of research exists that addresses the role and impact of risk within the domain of health (Berry, 2004; Joffe, 1999; Pidgeon, Kaspersion & Slovic, 2003); in fact, more than could be comprehensively included within this review, for example, the areas of risk assessment, risk perception, risk management, and risk communication are, in their own rights, large areas for comment and fruitful research. Also, as mentioned at the start of this chapter individuals engage in a range of modifiable health behaviours (both health promoting and compromising), therefore, it would be useful to understand what types of people engage in the different types of health behaviours and what are the reasons for their engagement with these positive and/or negative behaviours.

### 4.3 Health and sensation seeking

**Personality and health**

As posited by Vollrath (2006), personality factors play a pivotal role in health, well-being, morbidity and mortality. Personality is not only a major predictor, but the strengths of its effects are similar to those of known biological risk factors (Hampson, Goldberg, Vogt & Dubanowski, 2006). In fact, Vollrath (2006), in her core text that unifies the state-of-the-art research addressing the complex relationship between personality and health, reaffirms the supposition that 'There is no other conceivable
psychological predictor showing an impact that is comparable to that of personality’ (p.2).

To illustrate this point – personality variables relate to the stable individual differences in thinking (cognitions), feeling (affect) and behaviour which are enduring over the lifespan. Similarly, the development of chronic illnesses and involvement in accidents and unintentional injuries are generally due to repeated exposures over extended periods of time, rather than single chance events. Therefore, the behavioural factors that precede these impacts upon health, which emanate from longitudinal, underpinning behaviours, must surely be embedded within these repeated stable personality factors (Vollrath, 2006). Cyders, Flory, Rainer and Smith (2009) report that there has been an increasing improvement in knowledge concerning the role of separate personality dispositions in risky behaviour.

Discovering the personality correlates of risky health behaviours has fascinated personality researchers since the 1960s. Of particular interest are the risk-related mediators and mechanisms of personality and health (Vollrath, 2006). As previously discussed in Chapter 3, and the focus of the current study, the personality trait of SS has been consistently applied to the health domain for over the last 30 years. In particular it has tried to explain the differences in the attraction to, and engagement with, risky behaviours between high sensation seekers (HSS) and low sensation seekers (LSS). Zuckerman (2007a) discusses the three phases involved in the motivation for engagement with addictive substances: (a) curiosity (which may also include aspects such as novelty and impulsiveness), (b) pleasure, and the positive arousing effects, and (c) avoidance of pain or discomfort caused by cessation with the substance(s) involved. In terms of SS, then Zuckerman (2007a) asserts that SS is primarily associated with the first two phases. The following is a brief review of how SS has been applied to the current health behaviours of interest.

**Smoking and sensation seeking**

Despite the fact that global smoking rates in Westernised nations have declined slowly over the last few decades, there is still a significant relationship between smoking behaviour and HSS compared to LSS. As observed by Zuckerman (1994) ‘it is becoming increasingly difficult to find any LSS male smokers’ (p.227). Zuckerman (2007a) asserts that in adolescent and adult populations (across different nations and contexts) there is still a significant relationship between SS and smoking behaviour,
with smokers tending to score higher on SS scores than non-smokers. The best discriminators on SS between smokers and non-smokers have been found on the General and Total SS scores and the Experience Seeking (ES) and Disinhibition (DIS) sub-scales. Furthermore, Carton, Jouvent and Widlocher (1994) found that the DIS, ES and BS sub-scales of a French translation of the SSS-IV were all significantly higher for smokers than non-smokers, and Zuckerman and Kuhlman (2000) found smoking scale scores to be significantly correlated with ImpSS in both males and females.

Consistent with the biosocial theory of SS, Zuckerman (2007a) reviews the biological factors and reported evidence associated with smoking and SS. One pathway is the relationship between nicotine as a stimulant and its effect upon dopamine reactivity (i.e., its positive reinforcement effects). HSS have been found to report stronger arousal and more pleasant responses to a dose of nicotine nasal spray than LSS (Perkins, Gerlach, Broge, Fonte & Wilson, 2001) and it is postulated that after being primed to smoke by the release of dopamine then the SS tendency motivates the HSS to smoke more (Zuckerman, 2007a). The biological pathway of monoamine oxidase (MAO) has also been investigated. Zuckerman (2007a) states that there is strong evidence that smoking lowers MAO and that MAO type-B is approximately 40 per cent lower in smokers than non-smokers. Furthermore, current smokers have lower MAO than non-smokers and MAO levels recover to normal after four weeks of smoking cessation. The effect of MAO on the brain’s arousal and reward system has already been discussed in Chapter 3 and the theory of SS, which suggests that HSS possess lower levels of MAO, which ultimately leads them to seek out novel and intense sensations and stimulation in order to raise these arousal systems. Conversely, LSS possess naturally high levels of MAO, which suppress the need for further arousal and the seeking of excessive stimulation and sensation. MAO is low in both smokers and sensation seekers but it is unclear as to how these factors interact.

There has been a wealth of SS research that has addressed smoking behaviour, across a variety of contexts such as smoking initiation (Lipkus, Barefoot, Williams & Siegler, 1994), level of tobacco use (Kessel, Shiffman, Gny, Paty & Zettler-Segal, 1994), and even smoking cessation (Kahler, Spillane, Metrik, Leventhal & Monti, 2009). It has been posited that sensation seekers may start smoking for the novelty and perceived benefits, but they end up maintaining the behaviour solely as a source
of arousal that is influenced by lower risk appraisals and higher risk tolerance (Clayton et al., 2007; Kahler et al., 2008; Zuckerman, 2007a). Kahler et al. (2008) found that SS was negatively associated with cognitions about quitting, and avoiding smoking situations, possibly due to the stimulation and sensations to be found in social environments (Cyders et al., 2009).

Alcohol and sensation seeking
There have been many studies that have established the association between SS and alcohol use. The key determinants can be understood in terms of genetic, biological, social and cognitive factors.

As previously stated by Greene et al. (2000), SS research tends to concentrate on adolescent and young adult populations, as this is a particularly high-risk group for health compromising behaviours, and many SS and alcohol use studies have also addressed these age-related demographics. A question that has been asked is whether young student populations differ from non-student populations within the same age range. Zuckerman (2007a) asserts that college students drink more heavily than their non-college peers, however, Slutske (2005) found that non-college participants drank more often on a daily basis, whereas college students drank more in terms of both quantity and binge frequencies. Del Boca, Darkes, Greenbaum and Goldman (2004) found that college students tended to engage in sporadic and heavy drinking sessions at specific times, e.g. weekends, holidays, and major social events. Therefore, students probably possess differing drinking patterns to non-college samples, which could be due to economic restrictions on students (i.e., less money, and inconsistent incomes) whereas non-college samples are probably in regular employment and have consistent and higher incomes. Both Yusko, Buckman, White and Pandina (2008) and Cyders et al. (2009) looked at SS and drinking behaviour among college student populations. Yusko et al. (2008) found that college athletes tended to report higher frequencies of Heavy Episodic Drinking (HED), aka ‘binge drinking’, compared to non-athlete student samples.

The results on student versus non-student alcohol consumption paint a complicated picture with mixed findings. The levels of complexity involve the type of drinking behaviour measured (e.g. HED, frequency, amount), the student sample being measured (e.g. sports, engineering, psychology), and whether they are high-school or student populations. These factors are important as they provide comparable
age groups with the anticipated military profile in the present study (i.e., predominantly between 18-25 years old) and help with the interpretation of results regarding military drinking, i.e., is it higher in the military than in the civilian population.

Yusko et al. (2008) also found that higher SS scores were associated with higher levels of reported HED. This issue has also been reported by Donohew, Palmgreen and Lorch (1994) who found that heavy drinkers scored high on SS, but not as high as episodic drinkers. In general, HSS tend to perceive more benefits and fewer risks than LSS (Zuckerman, 2007a).

Social factors associated with SS and alcohol consumption have also been investigated. Beck, Thombs, Mahoney and Finger (1995) found that social facilitation and peer acceptance were key motivational factors, and that scores for such motives were higher in high-intensity drinkers, therefore, high sensation seekers. Yusko et al. (2008) called for more studies associated with social motivations of alcohol use and SS. Their study of student-athlete and student non-athlete samples showed mixed findings in terms of perceptions of peer heavy drinking, normative influences, motives for drinking and SS. However, the student non-athletes did produce higher SS scores and were more likely to use alcohol to cope or enhance the pleasurable effects of alcohol. Zuckerman (2007a) has previously discussed the role of a strong approach tendency in the current model of SS (refer back to Figure 7 on page 43), which sees approach linked to sociability and extroversion. Therefore, HSS tend to gravitate around the same high sensation seeking activities, e.g. extreme sports, and possibly the same types of organisations, e.g. the military, firefighters, etc.

Evidence on the genetic factors (e.g. heritability, twin studies, etc) associated with SS, alcohol use and subsequent dependency shows mixed results (Zuckerman, 2007a). A review of the genetic factors by Zuckerman (2007a) reported that about half of the studies confirm the association with alcoholism, but about half are non-confirmatory. More positive evidence is provided by the biological mechanisms associated with neurotransmitters such as dopamine and serotonin, and their regulatory enzyme monoamine oxidase (MAO). At low doses, alcohol has a stimulant effect that promotes disinhibition, euphoria and activity; however, higher doses of alcohol have a sedating effect that slows cognitive processes, co-ordination, reaction times and induces sleepiness. Furthermore, alcohol has a stimulant effect that increases dopamine activity and stimulates the area(s) of the brain associated with
reward, impulsiveness; which influences behavioural disinhibition. Zuckerman reports that low serotonin activity is associated with higher SS scores; and linked to this is a study by Johansson, Almay, von Knorring, Terrenius and Astrom (1979) who found that pain patients with low levels of endorphins reported higher SS scores. Therefore, there may be many biochemical mechanisms associated with alcohol consumption, and that SS is consistently associated with alcohol consumption and low biochemical predispositions, which supports the biochemical aspect of the SS theory.

Finally, sensation seeking and alcohol use have also been investigated in terms of their relationship to other health behaviours, such as smoking cessation (Kahler et al., 2009), harmful driving (van Beurden et al., 2005) and sexual behaviour (Thompson, Kao & Thomas, 2005). This highlights the co-varying nature of health behaviours, and also that SS is a consistently associated personality variable within the risky health behaviour paradigm.

Driving and sensation seeking
Sensation seeking has been found to associate with nearly every type of risky driving behaviour, such as speeding, seatbelt use, tailgating, aggressive manoeuvring, driving under the influence of drugs and/or alcohol, and any other traffic violations (Zuckerman, 2007a). In a review of studies involving SS and risky driving, Jonah (1997) found that almost every study had a positive relationship between SS and risky driving. Correlations were between the \( r = .30 \) to \( .40 \) range, and that SS accounted for between 10-15 per cent of the variance.

Age and gender differences have also been consistently found, with males more risky than females, and the young more risky than older age groups. Zuckerman and Neeb (1980) found that SS scores increased linearly as a function of driving speed for both genders and the relationship was highly significant for both genders, even when age was statistically controlled. Ulleberg (2002) found that males were statistically more risky than females for risk-enhancing attitudes, risky driving behaviour, perceived less risk, accident rates, and belief in their own sense of control and ability as drivers. Hatfield and Fernandes (2009) found that younger drivers (aged 16-25) demonstrated lower risk aversion, stronger motives for risky driving, higher propensity for taking accident risks, and were also higher in SS when compared to an older driving group (aged 35+).
In conjunction with SS, risky driving behaviour has been studied along with personality sub-types and constructs such as impulsiveness and boredom proneness (Dahlen, Martin, Ragan & Kuhlman, 2005), anger/hostility and conscientiousness (Schwebel, Severson, Ball & Rizzo, 2006), locus of control (Iversen & Rundmo, 2002; Clement & Jonah, 1984), self esteem and chronic self-destructiveness (Smith & Heckert, 1998), monotony and selective attention (Ayvasik, Er & Sumer, 2005), and normalness and anger (Iversen & Rundmo, 2002). Findings tend to support stronger relationships for SS with constructs such as impulsivity, boredom and anger, and that these constructs, along with SS tend to consistently predict risky driving attitudes and behaviours. Alcohol use is also a major predictor in risky driving, and has been found to play a role in SS and harmful driving (van Beurden et al., 2005), and Furnham and Saini (1993) found that TAS and BS were significantly correlated with non-alcohol related driving convictions.

Explanations for the role of SS in risky driving include motivational and cognitive factors. Ayvasik et al. (2005) found that HSS who were also high in monotony and selective attention had a higher number of traffic violations and lower levels of safety skill. Their conclusion was that HSS with high attention appeared to overestimate their driving ability while underestimating driving hazards. Such cognitive factors have been covered by others (Rosenbloom, 2003; Zuckerman, 2007a) and they address the cognitive issues surrounding attention to task demands and sensation seekers’ performance under such conditions. The evidence to date would suggest that HSS tend to perform well under novel, intense (high arousal) and cognitively demanding task requirements; however, once the task is learned, and once arousal, novelty and the cognitive demands subside then boredom and monotony set in and that is when inappropriate decision-making and risk-taking behaviour starts to emerge. Therefore, it can be seen that the interaction between cognitive requirements and motivational impacts can lead to risky driving behaviour. Furthermore, this is compounded by the fact that HSS tend to have lower risk perceptions and more risky attitudes prior to driving behaviour.

**Sexual behaviour and sensation seeking**

Zuckerman’s overview and summation of the SS literature pertaining to sexual risk-taking suggests that HSS of both genders consistently display more permissive attitudes towards sex and engage in more sexual risk-taking than LSS (Zuckerman,
Additionally, other researchers have provided overviews or have reviewed the literature on sexual-risk-taking (Hoyle, et al., 2000; Trobst, Herbst, Masters & Costa, 2002). Sensation seeking has been applied to expressions of sexual risk-taking such as: condom use and unprotected sex, individuals who pay for sex, number of partners, high-risk encounters, and arousal following the use of alcohol and/or drugs (Donohew et al., 2000; Gulette & Lyons, 2006; Hoyle et al., 2000; Norris et al., 2009; O’Sullivan et al., 1996; Thompson et al., 2005; Trobst et al., 2002).

During adolescence there is a peak, specifically in males, of testosterone, which coincides with peaks in SS. This period also sees the emergence of sexual awakenings in both young males and females. The association between testosterone levels and SS have been reported (Aluja & Garcia, 2005; Aluja & Torrubia, 2004). Additionally, dopamine release occurs prior to, and during, sexual activity, although the association with SS scores are mixed (Zuckerman, 2007a); however, the biological correlates (testosterone) and pleasure pathways (dopamine) between SS and sexual activity are theoretically robust and supported by evidence.

The SS sub-scales that correlate most strongly with sexual risk-taking appear to be Disinhibition (DIS) and Experience Seeking (ES), and the weakest association is with Boredom Susceptibility (BS) (Zuckerman, 2007a). A specific Sexual Sensation Seeking Scale was devised (Kalichman et al., 1994; Kalichman & Rompa, 1995) and has been often used to investigate SS within sexual risk-taking; although a range of SS scales have been used within this domain (e.g. SSS, SSS-V, ZKPQ, ImpSS, etc.). The role of DIS and ES in sexual risk-taking pertains to the predisposition of HSS to be drawn to novel, stimulating and arousing situations, as stated by the current definition and theoretical model of SS. Zuckerman (2007a) suggests that sexual risk-taking is fundamentally an evolutionary act, whereby a conflict exists between intense approach-avoidance urges. Potential sexual interaction may include novel and pleasurable sensations, but unchecked, sexual risk-taking can have negative impacts on personal health (e.g. STIs, HIV, AIDS, etc.) as well as social and cultural impacts (e.g. rape, incest, paedophilia, etc.), therefore, as societal values towards sex change (including shifts in taboos), so does the conflict with pleasure, sensation, stimulation, and novelty.

High sensation seekers and impulsives are more likely to use alcohol and/or drugs before sex. The impact of this is an increase in DIS, as well as increasing arousal states (i.e., stimulation). Substance use reduces anxiety states, which in turn
reduces thoughts of potential risks (i.e., lowers risk perception), therefore providing validation for engagement in risky behaviour. Again, this shift in risk perception is a central facet that differentiates HSS from LSS. Risky sex, alcohol use and SS have been previously investigated (Gullette & Lyons, 2006; Norris et al., 2009). Norris et al. (2009) found that both SS and alcohol dose directly increased sexual arousal, and Donohew et al. (2000) found that SS was significantly related to both alcohol and marijuana use before sex. However, Gullette and Lyons (2006) found that although SS was associated with alcohol use for both men and women, there was no association for SS and problems of alcohol consumption in condom usage. Donohew et al. (2000) further found that HSS who were also impulsive decision makers exhibited even greater risk-taking behaviour for alcohol, drugs and sex compared to just HSS or impulsive LSS.

The quantitative review of personality and sexual risk-taking by Hoyle et al. (2000) found that 64 per cent of the 53 studies reviewed pertained exclusively to SS. They found that SS positively correlated with all categories of sexual risk-taking (i.e., number of partners, unprotected sex and high-risk encounters) and that SS predicted all forms of sexual risk-taking. Impulsivity was also found to positively correlate with all categories of sexual risk-taking.

Most studies on risky health behaviours are based on self-reported questionnaires. Sexual activity may be considered a sensitive, possibly embarrassing, topic, which may produce a response bias towards those prepared to respond. Bogeart (1996) found that those participants who volunteered to take part in a sexuality study (both questionnaire responses and watching an explicit film) were higher in SS, had more sexual partners, greater sexual experience and were more open to sexual novelty, when compared to non-volunteer participants.

Although Hoyle et al. (2000) found robust evidence for the use of SS as a valid theory and model for studying sexual risk-taking, they called for a wider use of different models of personality in such behavioural contexts, as well as more research into the biological mechanisms that underpin such behaviour. Broadening the research base would help to improve the knowledge of how wider facets of personality (such as cognitive and psychosocial factors) moderate and mediate sexual risk-taking, which up until now has been mainly focused on the use of psychobiological models of personality.
4.4 Chapter summary

In summary, health behaviours comprise those that are either health promoting (e.g. regular exercise, healthy eating, etc.) or are health compromising (e.g. smoking, unsafe driving, excessive alcohol, poor diet, etc.), with the latter being referred to as risky health behaviours. The present study is concerned with the risky health behaviours of smoking, alcohol, driving and sex; each has been introduced and briefly reviewed in terms of their underlying causes, associated national statistics, and how they each relate to risk-taking behaviour and the SS construct. Sensation seeking has been found to have a strong association with each of the behaviours, as well as predicting future behaviour. High sensation seekers tend to engage in these behaviours in disproportionately higher (more risky) levels, and consistently, when compared to LSS. The reasons for this have been explained in terms of the biological, personality, cognitive, motivational and social factors that underpin the current theoretical model of SS. It now follows that SS and health are placed within the context of the present study, which is the military, and in particular, military deployments.
5. The Military Context

5.1 The military and risk

'Importantly, by its very nature, military activity is about confronting risk and managing it. It is emphatically never about avoiding risk; the military profession is not one for those who are risk averse' (British Defence Doctrine, 2001, pp.3-4).

The quote above illustrates the UK Ministry of Defence’s (MoD) strategic, organisational view of risk. This is supported by a quote from the former head of the British army, who was seen as 'a soldier's soldier', and stated that 'soldiering is not a risk free business; it never can be' (General (retired) Sir Mike Jackson).14

Additionally, despite the increases in litigation and compensation within the MoD, seen as a product of the global 'blame culture', it was reiterated by the Director of Claims in 2004 that 'the department [MoD] is not becoming risk averse' (Stone, 2004). But what do these quotes and statements say about how the military addresses the issue of risk? On the one hand it is an organisation that must manage its risk effectively, both in terms of business and legal imperatives; however, it is also seen as a profession that must involve elements of risk that are seen as beyond normal career and organisational requirements, i.e., the potential exists for the ultimate sacrifice of life, which is part of the military covenant and psychological contract that the individual service person has with their nation's Defence department (Bradley, 2005).

The Health & Safety Executive (HSE) address the issues of individual, organisational and societal risk within their report on 'Reducing risks, protecting people' (HSE, 2001). Within the report issues are discussed, such as the Health and Safety at Work Act 1974 and terms such as 'Tolerability of Risk' (TOR) and 'As Low As Reasonably Practicable' (ALARP) and 'As Low As Reasonably Achievable' (ALARA). However, the MoD possesses crown censure, which means that as a crown body it has immunity and can be excluded from the provisions for statutory

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enforcement, including prosecution and penalties. However, a recent ruling decided that the Human Rights Act can apply to British troops, even on the battlefield.\(^{15}\)

The historical perspective on military risk has generally been viewed in terms of military incompetence (Dixon, 1976). Taking tactical and/or strategic risks has often resulted in overwhelming success or glorious failure/defeat. Some famous examples of such historical risks include the successes at the battles of Agincourt (1415), Gibraltar (1607), Trafalgar (1805) and Waterloo (1815); and examples of risks that resulted in glorious failure include the charge of the Light Brigade (1854), The First Somme (1916), Dunkirk (1940) and Operation Market Garden (1944).

Johnson, Wrangham and Rosen (2002) addressed the historical perception of military risk-taking and viewed it from the angle of military incompetence. They suggested adaptive processes for such behaviour, rather than previous historical explanations that have been rejected.

The military's contemporary attitude and perception of risk revolves around two distinct, but inter-related topics, i.e., the nature of military jobs, and their changing nature relating to the modern military's role on operations and deployments. Firstly, it is assumed that a proportion of the roles, trades and professions in the military are fundamentally different from those in mainstream civilian life, therefore, they inherently involve higher levels of risk, i.e., it is the nature of the job. This has been tacitly endorsed in numerous papers (Glicksohn & Bozna, 2000; Kemsley, Slavin & Bridger, 1999; Maguen et al., 2008; Sicard, Jouve & Blin, 2001) and possesses connotations as laid down by the HSE within their framework for TOR, ALARP and ALARA. Examples of such roles, trades and professions include ground forces such as the infantry, artillery and cavalry; special forces, counter-terrorism and intelligence gathering; air crews in jet fighters, bombers and attack helicopters; and the naval submarine service. In the current operational climate it is also the case that nearly all military personnel who may face harm or threat tend to carry personal weapons on a regular basis, irrespective of whether their trades are common to civilian counterparts, e.g. drivers on convoys, electricians, engineers, telecommunications, administrative and secretarial.

Further to this, it has been suggested that those who join the military may be higher on the risk tolerance curve (Fear et al., 2008; Hooper et al., 2006), especially
those who join to undertake combat roles (e.g. infantry) or who join specialist combat units (e.g. special forces, bomb disposal, underwater diving). However, there is a lack of empirical data to support this. As mentioned above, most of the research on risk in the military has focused on specialist roles that probably involve higher levels of risk, or research into problem behaviours (e.g. alcohol, drugs, violence, etc). There is very little research that has measured risk-taking or risk propensity in normal non-specialist, non-problematic military personnel, across all services (army, navy and air forces). Also, research comparing the military to comparable civilian samples is sparse. The available literature on SS in military populations will be reviewed later in this chapter and highlights this point.

The second and more written about issue across the contemporary military spectrum\(^\text{16}\) is the changing nature of modern military operations. Killgore, Vo, Castro and Hoge (2006) summarise this aspect of modern military risk by introducing inter-related issues such as the rise of concurrent military operations (e.g. Afghanistan and Iraq), the higher tempo of such operations, sustained combat exposure, extended periods of direct intervention (i.e., warfighting), peace enforcement and peace support. Military activity within these contexts often requires rapid decisions and judgments, which can strain available cognitive and emotional resources, which ultimately influences the perception of risk and the willingness to take risks. The MoD argues that due to these factors they could not secure the rights and freedoms that the European Convention on Human Rights seeks to guarantee. This is reinforced by a military staff paper from the U.S. where the wording of the title states that a formula to ‘screw up the army’ is to ‘take no risks and make no mistakes’ (Buche, 1997).

5.2 Empirical research on military risk-taking

In terms of the amount of research into risk over the decades in non-military populations, little attention has been focused on understanding the factors that affect risky behaviours in the military domain (Weber, 2003). Despite this, there is a relatively small history of empirical studies that have addressed the overall notion of risk-taking within the military domain. Most of these research studies have focused on occupational hazards, personality characteristics and personnel selection. This is to be

\(^{16}\) Which refers to military-related strategy, policy, research, science and technology, etc.
expected considering that the development of selection tests emerged from military psychology a long time before they were used by commercial companies.

These military studies have investigated military occupations such as bomb disposal (Glicksohn & Bozna, 2000; Hogan & Hogan, 1989; Cooper, 1982), aviation (Daderman, Meurling & Hallman, 2001; Fry & Reinhardt, 1969; Novello & Youssef, 1974; Sicard, Taillemite, Jouve & Blin, 2003), mine clearance diving and military diving (Biersner, 1971, 1973; Biersner & Cameron, 1970; Biersner & LaRocco, 1983; Biersner & Ryman, 1974; Kemsley et al., 1999), deep submergence vehicles (Biersner, Hall & Linaweaver, 1975) and special forces (Sicard et al., 2001). Risk has also been investigated in terms of military-specific behaviours such as volunteering for hazardous experiments (Jobe et al., 1983) and weapon-related risky behaviours (Glicksohn, Ben-Shalom & Lazar, 2004). Conscripted military recruits have even been used as a control group to compare against elite mountain climbers on risk-taking (Breivik, 1996), and Montag and Birenbaum (1986) used an ex-military and paramilitary sample to address risk-related personality assessments in terms of SS and psychopathology.

Similarly, a search of the journal ‘Risk Analysis: An International Journal’ (1981-2009) found that the topics involving some form of military context included: aviation risk (Efroymson & Suter, 2001; Efroymson, Suter, Rose & Nemeth, 2001; Thompson, Onkal, Avcioğlu & Goodwin, 2004); unexploded ordnance (MacDonald, Small & Morgan, 2008); chemical exposure and environmental waste risk (Brewer, Lillie & Hallman, 2006; Jones et al., 1988; Klauenberg & Vermulen, 1994); warning systems (Pate-Cornell & Neu, 1985); peacekeeping operations (Lehtomaki, Paakkonen & Rantanen, 2005); and more recent world events involving terrorism applications (Cox, 2009; Dillon, Liebe & Bestafka, 2009).

The majority of these studies emanate from the USA, with a scattering among other nations such as Israel, Norway, Sweden, and only two possessing a UK focus (Cooper, 1982; Kemsley et al., 1999). Cooper (1982) investigated the characteristics of successful bomb disposal experts against non-successful bomb disposal operators who possessed extensive experience in Northern Ireland, whereas Kemsley et al. (1999) conducted a review of literature to probe the potential effects of a range of psychological and physiological factors on female performance for the UK military

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clearance diving profession. These scant studies support the observations and recommendations of the UK Defence Scientific Advisory Council (2005, pp.2-18) who concluded that:

'MoD research specifically on psychological and sociological factors in risk perception and communication is very limited...MoD should be acting differently in terms of tracking perceptions of risks to health and well-being...The main focus of MoD research on risk perception should be connected with well-being – particularly applicable in operational areas'.

One measure of risk-taking propensity that has been developed in the military domain and validated among military samples is the Evaluation of Risks (EVAR) scale by Bruno Sicard and his colleagues in France (Sicard, Jouve, Blin & Mathieu, 1999). The EVAR scale is a visual analogue scale of 24-items that measures five risk-related constructs: self-control, danger seeking, impulsiveness, invincibility, and energy. It is designed to be a repeatable measure that addresses both state and trait risk preferences. It was developed and normative data established on French speaking participants, and across a variety of French military samples (Sicard et al., 1999, 2001; Sicard, Jouve, Couderc & Blin, 2001; Sicard et al., 2003) with Cronbach’s α reliabilities ranging between α = 0.51 and 0.73; this is lower than the suggested minimum of 0.80 as suggested by Nunnally (1970).

The validity and reliability of the EVAR scale has also been assessed in an English version for use on US soldiers (Killgore et al., 2006). Reliability analysis showed a Cronbach’s α = 0.78, and a three-factor, not five-factor, solution emerged for this sample, i.e., recklessness/impulsivity, self-confidence and need for control. Although a relatively new measure, with, as-to-date, limited application to a variety of samples and risk-related contexts, Killgore et al. (2006) posit that the EVAR scale, both French and English versions, provides a foundation for the investigation of risk propensity and risk-related behaviours among military respondents. However, as identified previously, the ImpSS scale contains a lower of number items compared to the EVAR scale (19 vs 24 items respectively) and has also demonstrated higher reliability scores above α = 0.80, as well as a stronger theoretical basis embedded in a psychobiological model, therefore, one wonders why the EVAR scale was developed.
to investigate risk-taking propensity when an established theory and measurement already exists. However, Killgore et al. (2008) also applied the EVAR scale to soldiers returning from combat operations in Iraq in an investigation into post-deployment risk-taking propensity and post-combat invincibility. They found that certain combat exposures were predictive of greater risk-taking propensity after homecoming, their postulation being that such combat exposures alter the perceived threshold for invincibility and that this slightly increases the propensity to engage in risky behaviours, i.e., an altered risk perception model may be operating at the cognitive level.

One mainstream hypothesis about risk-taking in the military is the received wisdom (which is often not based on empirical science) that the military are naturally higher in risk-taking propensity than their civilian peers. The argument falls into two camps: (1) those who believe that those who join the military are inherently higher in risk-taking tendencies; that there is something qualitatively and quantitatively different about individuals who choose to join armed military forces, and conversely, (2) those who believe that they are not so different and that they simply reflect the demographic pool of society from whence they came. However, a review of the military research on risk-taking does not answer these postulations. Unfortunately, some of those investigating risk in military contexts may inadvertently reinforce the perception of the military being a unanimously high risk-taking group, who all engage in high-risk activities and who must therefore be high in risk-taking propensity. This feeds into a self-fulfilling perception that does little to illuminate the debate from an impartial, objective, evidence-based perspective. Furthermore, there are many trades and professions within the military, yet research on risk tends to focus on those professions that are considered high risk, as illustrated previously, e.g. bomb disposal, jet pilots, special forces, divers, etc. Again, this skews the perception of the nature and role of risk and risk-takers in the military domain. The author has yet to find empirical research on risk in the military that addresses other important aspects of the military chain, for example, logistics, intelligence, planning, equipment design, etc.

5.3 Risk and operational deployments
Military deployments involve three separate phases – pre-deployment, during-deployment and post-deployment. Previous assumptions held that these phases were discrete with limited inter-relation between them. However, as mentioned previously,
the nature and tempo of modern military operations suggests that the interplay between each phase is becoming increasingly influential, especially as redeployment to the same or another operation within one to two-years is becoming the norm, especially for the army. This is highlighted by Killgore et al. (2006) who assessed their English version of the EVAR scale on a sample of US army soldiers who had been back from Iraq 12-months previously and were preparing to go back in four-months time. Given this important development, each of these phases will be briefly discussed in terms of specific risk-related research.

**Pre-deployment**

Attention to pre-deployment risk centres mainly on the training and preparation of military personnel from a task-focused perspective, for example, pre-combat refresher training for special forces medics (Peoples, Gerlinger, Budinich & Burlingame, 2005) or prior exposure to certain risks acting as a risk factor for future deployments (Bolton, Litz, Adler & Roemer, 2001). This aspect of the risk paradigm is assumed to emanate from the ability of service personnel to conduct their specific jobs and roles. Historically, very little attention has been focused on the ‘softer’ anticipatory nature of risks that may address health concerns, worry and fear, e.g. risk perception. Maguen et al. (2008) investigated the risk and resilience factors among US air force medical personnel. They investigated a range of pre-deployment stressors as well as measures of post-traumatic stress disorder (PTSD), life events, positive military experience, resilience and positive and negative affect.

**During-deployment**

This is a notoriously difficult phase to collect empirical data on, due to the fact that behaviour occurs during a military operation or deployment, and that access to military personnel is a methodological challenge. Therefore, much of the research tends to be retrospective and/or epidemiological (Wallenius, Larsson & Johansson, 2004), or where possible, a quick snapshot via cross-sectional surveys. Naturally, the largest problem with retrospective studies is that salience or accuracy can be affected as time elapses (Norris & Kaniasty, 1992).

There has been little research that has investigated risk-taking or risk perception during operational deployments. Most research addresses risk from an indirect perspective, where the outcome pertains to risk and risk factors, as opposed to
an actual emphasis on the risk paradigm (Boos & Croft, 2004; Wallenius et al., 2004). Lehtomaki et al. (2005) visited Finnish peacekeepers in Kosovo to investigate the most important occupational health and safety risks of the deployed soldiers. Using qualitative and quantitative methods they found the most important risks were traffic accidents, munitions and explosions, occupational hygiene and living conditions.

**Post-deployment**

Historically, the majority of post-deployment risk research has focused on the health effects of being deployed (Kolkow, Spira, Morse & Griejer, 2007). Mancuso, Ostafin and Lovell (2008) investigated the post-deployment assessment in the context of a known exposure to a toxic industrial chemical among US National Guard soldiers who served in Iraq in 2003. This addressed risk perceptions and risk communication associated with operational deployment.

5.4 The military and sensation seeking research

One might be forgiven for jumping to the conclusion that all, or most, military personnel must be higher in SS (therefore, risk-taking propensity) than the civilian population, or more accurately, comparable civilian samples (e.g. extreme and adventure sportsmen). This has already been alluded to (Fear et al., 2008; Hooper et al., 2006). However, there is a very limited amount of previous military research in this area compared with the open source, peer-reviewed literature on a plethora of civilian populations. In Zuckerman’s 1994 text he asserts that over 600 papers on SS have been published in peer-reviewed journals; however, since 1976 (Waters, Ambler & Waters, 1976) there have only been approximately 20 such papers in the published literature involving serving military personnel (both conscripts and/or professional volunteers) and measures of SS, with five of those only available in their original language of Spanish (Bobes et al., 1998; Gonzalez, Saiz, Quiros & Lopez, 2000; Ortet & Sanchez, 1989; Saiz, Gonzalez, Bousono & Bobes, 1998; Saiz, Gonzalez, Parades, Martinez & Delgado, 2001). There are two manuscripts that discuss smaller studies as part of an overall programme of SS research (Breivik, 1999a; 1999b), and one appendix in a text studying US college youth, which happened to use a US navy sample to compare against (Segal, Huba & Singer, 1980). The full list of available papers and reports on military samples using measures of SS presented in Appendix A.
It is worth noting that seven of the studies cited in Appendix A are identified in Zuckerman’s key texts (1979a, 1994, 2007a): they are Biernser and LaRocca (1983), Bradley and Redfering (1978), Breivik (1999a), Klintberg et al. (1991), Segal et al. (1980), von Knorring and Oreland (1985) and Waters et al. (1976). In addition to these there are three papers that measure SS in veteran Israeli Defence Force personnel (IDF) (Neira, Solomon, Ginzburg & Dekel, 2000; Solomon, Ginzburg, Neira & Ohry, 1995) and also an ex-military and paramilitary sample (Glicksohn & Bozna, 2000).

Within UK MoD-funded research only two studies addressing SS could be found. Kemsley et al. (1999) conducted a literature review to address gender issues in risk-taking and safety, team interaction, and the effects of pregnancy and menstruation on performance in connection with females and mine clearance diving. However, they did not conduct any direct measures of SS among UK military personnel; they merely conducted a limited review of previous open source literature. More recently the British army contracted work to be conducted on the prevention of drug misuse in the army (Directorate of Army Personnel Strategy [DAPS], 2007). In a sample of 102 army personnel the SSS-V was used to gather SS data on four groups (non-drug users; pre-army users; those on an early intervention programme after being caught; and those who had used drugs during their career but not been caught [i.e., army drug users]). No statistical differences were found between the groups on the total or subscale scores of the SSS-V. It was also found that the younger soldiers had higher SS scores than older soldiers and those who had served for longer. This supports the many previous studies which have found that SS declines with age (Zukerman, 1994, 2007a). An interesting finding was that the mean scores for total score on the SSS-V increased with use, i.e., non-users were lowest ($\bar{X} = 20.22$), next were former users before joining ($\bar{X} = 22.77$), then those who had been caught ($\bar{X} = 22.79$) and finally the army drug users ($\bar{X} = 27.00$). This may suggest that those highest in SS are those continuing to take the most risks. However, they were limited in their findings by not presenting the subscale means or by conducting further statistical analyses on the highest and lowest mean scores, which was for those who were army drug users ($\bar{X} = 27.00$) and non-drug users ($\bar{X} = 20.22$). Again, this could support previous SS research on drug use in the military (Gonzalez et al., 2000; Saiz et al., 2001; Segal et al., 1980). Finally, an attempt was made to compare the British
army samples with those in Norway by Breivik (1999a, 1999b); however, the British sample sizes were too small in some of the groups to allow for rigorous comparison (e.g. \( N = 7 \) in army drug user group).

Glicksohn et al. (2004) attempted to profile the antisocial risk-taker among Israeli Defence Force recruit conscripts who engaged in risky behaviours with their weapons. They compared the SS means and correlations for their sample of 362 conscript recruits against their previously published norms of an Israeli population (\( N = 682 \)) (Glicksohn & Abulafia, 1998) and found that the military sample were higher on the TAS subscale, slightly higher on DIS, but no different on ES or BS. They did not report if any of the differences between these two samples were significant, although it appears that the TAS scores may be significantly different; however, they did normalise the data to allow comparisons to be made.

A review of the Spanish data from Saiz et al. (2001) and Gonzalez et al. (2000) showed that their samples of conscript recruits did not score higher than either female or male students on any sub-scales or total score on the SSS-V when compared against groups who abstain from illicit drugs, only take cocaine, cannabis, or polydrug use (Gonzalez et al., 2000; Saiz et al., 2001). Also, the conscript recruits did not score higher on any of the subscales or total score when compared to the same student populations who are abstainers, experimenters or recidivists. Furthermore, some papers have used the same sample data and information in different publications (Breivik, 1996, 1999a, 1999b; Klintberg, 1991, 1992; Manning & Fullerton, 1984, 1988).

One of the problems with the reporting of the data in these published papers is the level of detail presented. Some papers do not report the mean scores for their sample, or only report a selection of the means (DAPS, 2007; Daderman et al., 2001), whereas most only report differences with the comparison group (Bradley & Redferring, 1978; Marvel & Hartmann, 1986; Waters et al., 1976); this could be in the form of high versus low SS groups within the same population, or differences with civilian controls. Most do not compare their results to published norms or a control group (Bobes et al., 2002; Marvel & Hartmann, 1986; Saiz et al., 1998). Studies also appear to use different rules for differentiating between high and low SS groups; for example, some use the mean of the sample to split the groups (Bradley & Redferring, 1978), but most simply do not report how they categorised them (Bobes et al., 2002; Marvel & Hartmann, 1986).
Other limitations include inappropriate and uncontrolled data for comparison. For example, the mean age profiles used by Saiz et al. (2001) and Gonzalez et al. (2000) were unbalanced when comparing their conscript recruits ($\bar{X} = 20.28$ years) and students ($\bar{X} = 15.87$). This is a major factor when SS is known to be affected by age, and also where the young students may be prone to a response bias by wishing to appear older and more experienced than their age suggests. This may account for their results, which showed that even 15 year old student females scored higher than adult male conscripts on all SSS-V subscales and in their experience with drugs. Other studies did not publish the age ranges of their sample (Manning & Fullerton, 1984; Waters et al., 1976).

Daderman et al. (2001) adopted both the SSS-IV and SSS-V in the same study. They administered the Form IV to a sample of military air pilot recruits ($N = 18$) and a control group of conscript recruits ($N = 19$), and then administered the Form V to a sample of juvenile delinquents ($N = 47$). Their solution for comparison was to transform their results into T-scores that could be compared to published norms. No explanation is provided as to why they were given different forms of the SSS, but one could assume that the use of different measures at different times could be an attempt to merge disparate studies investigating SS.

The most popular scale used is the SSS-V. This has previously been mentioned (McDaniel & Mahan, 2008) and despite the underpinning theoretical developments in SS and the development of the ImpSS scale and the ZKPQ (Zuckerman et al., 1993) several studies have persisted in using the SSS-V (Bobes et al., 1998; Daderman et al., 2001; Glicksohn et al., 2004; Gonzalez et al., 2000; Saiz et al., 1998, 2001) despite the ImpSS scale being the suggested survey of choice for measuring the general SS tendency (McDaniel and Mahan, 2008). Early studies used the original SSS-I scale (Biersner & LaRocco, 1983; Bradley & Redfering, 1978; Segal et al., 1980; von Knorring & Oreland, 1985) and others have used the SSS-IV (Daderman et al., 2001; Waters et al., 1976).

Among the on-going international Defence research into SS, different nations are using different versions. In the present study the UK are using the ImpSS scale as recommended by McDaniell and Mahan (2008), as are the US in a longitudinal study of deployment and cognitive performance; whereas the Estonian Defence Forces are
using the SSS-V on a repeated measures study of deployment health; both of these studies are yet to complete and report their findings.

There may be a possible confounding effect by using different types of military samples; for example, the difference between professional volunteers and conscripts. It would be fair to hypothesise that individuals who volunteer to join professional militaries could be intrinsically higher in SS and risk-taking propensity than conscripts, who have no choice but to complete their term of compulsory military service. A theoretical hypothesis could be postulated that volunteers might be particularly high in TAS, ES, and BS, thus they volunteer to join the military to seek out such sensations and stimulation. However, such differences in samples could act as a confounding factor when trying to compare military samples to civilian populations, or when trying to compare between military populations. It has been noted that conscript samples, because they are compulsory, accurately reflect the appropriate age and gender profile of their civilian population, therefore they can act as a good control group in military studies who have access to such a population (Breivik, 1996; Daderman et al., 2001). The published studies that have used conscript samples are Bobes et al. (2002), Breivik (1996, 1999a, 1999b), Glicksohn et al. (2004), Gonzalez et al. (2000), Ortet and Sanchez (1989), Saiz et al. (1998, 2001), and von Knorring and Oreland (1985). Even the studies that used ex-military and paramilitary samples are taken from nations where the majority of military service is compulsory, e.g. Israel (Glicksohn & Bozna, 2000; Montag & Birenbaum, 1986; Neira et al., 2000; Solomon et al., 1995). Conversely, the published studies that used volunteer professionals were Biersner and LaRocco (1983), Bradley and Redferring (1978), Manning and Fullerton (1988), Marvel and Hartmann (1986), Segal et al. (1980) and Waters et al. (1976). Some studies used both voluntary professional and conscript samples to compare against (Daderman et al., 2001; Klintberg et al., 1991, 1992).

Further to this, several studies have investigated specialist roles, such as divers (Biersner & LaRocco, 1983), aviation crews and pilots (Daderman et al., 2001; Waters et al., 1976) and special forces, including their support units and airborne infantry (Manning & Fullerton, 1988). The remainder of the military-focused SS studies have used conscript samples and non-specialised military units, or even military samples of drug users (Bradley & Redferring, 1978; DAPS, 2007; Gonzalez et al., 2000; Marvel & Hartmann, 1986; Saiz et al., 2001).
Finally, it is often commented that each of the individual forces has their own subculture (i.e., army, navy, and air force) and even within components, such as between marine and airborne units. Again, if such differences do exist then this could act as a confounding variable for the types of military population being studied in terms of SS and risk propensity.

Within the plethora of autobiographical books on military experiences there is a wealth of anecdotal evidence about the nature of military life, especially related to aspects of risk-taking and the SS personality. Although these personal accounts are based on retrospective experiences, and therefore may be prone to bias and inaccurate recall, they nevertheless provide useful insights into this occupational lifestyle. For example, speaking of his special forces experiences in the 1980s Ely (2002) reminisced how ‘most of the time, squadrons have an incident-free tour. Nothing operational happens unless there is a call out to go across the water, so life could get pretty boring’ (pp.321-322). Additionally, in Northern Ireland during the 1970s Ely (2002) suggested that ‘you could go for days, sometimes weeks, without any incidents, making it a hell of a strain for the soldier to take his job seriously’ (p.73). Mason (1983), speaking of his time in Vietnam in the 1960s recounted how ‘we waited. This was much worse than the assault. Worse than the assault? God, I could see how it was going to be. I would get so bored I would look forward to the battles’ (p.88). This is supported by Caputo (1977) and his experiences in Vietnam: ‘I had no illusions, but I volunteered for a line company anyway. There were a number of reasons, of which the paramount was boredom’ (p.218). It can therefore be seen how military life, and activities on deployments could give rise to risk-taking and sensation seeking behaviour.

5.5 The military and risky health behaviours

There is lots of anecdotal evidence regarding the existence of risky health-compromising behaviours within the military, particularly for alcohol consumption, smoking behaviour and sexual activity. Additionally, historical records, military accounts and autobiographies are replete with such behaviours, which date from ancient times up to modern operations in Afghanistan and Iraq. The four main health behaviours of concern to the present study are alcohol, smoking, sex and driving.
Alcohol consumption

The Russian Front, Winter 1943: ‘A few bottles of alcohol theoretically reserved for wounded men were opened by the captain himself, and that evening we celebrated in the isbas. Everyone who stayed awake was soon quite drunk’ (Sajer, 1999, p.388).

The military are chiefly concerned with excessive alcohol consumption as alcohol impairment not only affects military performance and capability, but contributes to accidents, injuries and the premature death of service personnel. Bell, Amoroso, Wegman and Senier (2001) suggested behavioural pathways whereby risky drinking behaviour contributed to the increased rate of injury deaths of US Persian Gulf War veterans. Further evidence is supported by Garvey-Wilson, Lange, Brundage and Frommelt (2003) who found that consuming more than five drinks per week contributed to the risk factors associated with premature deaths from unintentional injuries among US army personnel between 1990 and 1998. Furthermore, Howland, Bell and Hollander (2007) found that alcohol comorbidity was specifically associated with injuries related to impairment and antisocial behaviour in a large sample of active duty US soldiers who were hospitalised with injuries between 1980 and 2002, which is further supported by Fear et al. (2007) who cite the British army, who in 2002, acknowledged that 80 per cent of violent crime within the army was alcohol related. Finally, Bell, Harford, McCarroll and Senier (2004) found that heavy alcohol consumption was an independent risk factor for the perpetration of spouse abuse among male, enlisted US army soldiers.

There is a general assumption that the military consume more alcohol than comparable civilian populations. Numerous publications have compared military samples against civilian drinking rates (Ballweg & Li, 1989; Bray, Marsden & Peterson, 1991; Bray et al., 2005; Fear et al., 2007; Henderson, Langston and Greenberg, 2009; Hooper et al., 2008; Polich, 1981) and the findings suggest that this general assumption can be supported, especially for binge drinking and heavy alcohol consumption. However, Benjamin, Bell and Hollander (2007) caution against some of these findings due to methodological problems in comparing these populations; limitations include cross-sectional designs comparing non-equivalent surveys (Ballweg & Li, 1989; Polich, 1981), differing definitions of alcohol consumption, e.g. what constitutes binge drinking or heavy drinking (Ballweg & Li, 1989; Bray et al., 2005), and inappropriate statistical procedures (Bray et al., 2005).
Both Fear et al. (2007) and Hooper et al. (2008) found that excessive alcohol consumption is more common in the UK Armed Forces than in the UK general population. Fear et al. (2007) found that the tri-service (army, navy, air force) military sample had higher rates for hazardous drinking, severe drinking, alcohol dependence, alcohol-related harm and binge drinking. Not only that, but military females had higher rates of binge drinking than civilian males. Furthermore, Henderson et al. (2009) looked at alcohol misuse in the British Royal Navy compared to age-matched civilian samples and found that excessive alcohol consumption, especially binge drinking, was significantly more prevalent in the navy sample. Hooper et al. (2008) also found that the UK military sample had higher rates of binge drinking compared to civilian rates, and that this difference persisted over a three-year follow-up period.

Numerous studies have found that demographic risk factors for higher rates of alcohol consumption include being young, single or unmarried, male, having lower educational attainment, being white, a smoker, and from among the non-commissioned (enlisted) ranks (Bray & Hourani, 2007; Fear et al., 2007; Henderson et al., 2009; Iversen et al., 2007). Furthermore, Iversen et al. (2007) found that staying in the military and moving relationship status (i.e., moving from being married to either divorced, separated or widowed) were also significant risk factors for increased heavy drinking. Previously, Iversen et al. (2005) found that alcohol dependence was one of the most common diagnoses in military veterans and that heavy drinking behaviour extends into post-service life for vulnerable individuals who leave the military. This is supported by Wallace, Wallace and Weeks (2008). These demographics not only represent a broad description of today's modern western military forces, but they also represent the modern western civilian population most at risk, suggesting an underlying 'at risk' group, irrelevant of being in the military or civilian populations.

Consideration of the context in which military studies are conducted is essential. The majority of studies are either cross-sectional and/or retrospective, with the majority of these conducted for health surveillance or epidemiological purposes (Bray & Hourani, 2007; Calhoun, Elter, Jones, Kudler & Straits-Troster, 2008; Fear et al., 2007; Federman, Bray & Kroutil, 2000; Garvey-Wilson et al., 2003; Iversen et al., 2007; Jacobson et al., 2008). Various contexts addressing alcohol consumption in military samples include recruits (Steenbergh, Whelan, Meyers, Klesges & DeBon, 2008; Taylor, 2004; Ames, Cunradi & Moore, 2002), serving military personnel (Fear
et al., 2007; Henderson et al., 2009; Hurtado, Trent & Frack, 1997), deployment-related research (Federman et al., 2000; Gutierrez et al., 2006; Jacobson et al., 2008) and veterans (Calhoun et al., 2008; Wallace et al., 2008). These contexts, as well as the individual nuances within each context, provide potential confounding variables that could affect the interpretation of findings regarding alcohol use in the military.

**Alcohol and military deployments**

Modern professional forces possess smaller numbers of personnel than they had historically. Therefore, it is imperative that such forces maximise their available manpower for long-term sustainability and capability, as well as operational performance and effectiveness. It is often reported that risky health behaviours, including risky alcohol consumption, can affect pre-deployment preparation and affect military readiness (Federman et al., 2000; Ferrier-Auerbach et al., 2009; Steenbergh et al., 2008).

In terms of deployment-related alcohol consumption, the prospective research is scant. Pre-deployment alcohol consumption was used as a predictor in a sample of US National Guard soldiers (Ferrier-Auerbach et al., 2009), which found that negative mental health variables, younger age and being unmarried predicted greater total drinking and higher frequency of binge drinking.

Jacobson et al. (2008) looked at alcohol use and alcohol-related problems at pre- and post-deployment. They found that individuals who deployed and reported combat exposure were at increased risk of new-onset heavy weekly drinking, heavy episodic drinking and alcohol-related problems. However, Hooper et al. (2008) found that only certain types of combat exposure were associated with changes in alcohol consumption and deployment experience across a three-year period. In fact, in light of impending combat exposure on future operational deployments, anecdotal evidence suggests that alcohol consumption can be conspicuously tolerated, or even encouraged. Hoge et al. (2004) report that 13 per cent of soldiers felt they needed to cut down their alcohol consumption prior to deployment, and that 17 per cent of soldiers were using alcohol more than they intended.

During most deployments, and all current operations involving UK military personnel, alcohol consumption is prohibited. However, this does not mean that alcohol consumption does not occur. A high profile example of the negative role that alcohol could play on deployment was the abduction of a US soldier in Afghanistan in
July 2009, whereby it is alleged that he was drunk and wandered off his base with some Afghan National Army soldiers. Anecdotal evidence suggests that access to contraband alcohol does occur on deployments and operations, and this possibly highlights the role of factors such as sensation seeking and risk-taking within such situations.

The persistent use of alcohol and its association with previous deployment experience has been the focus of numerous epidemiological studies. In a sample of UK military personnel who were deployed to Iraq in 2003, Rona et al. (2007a) found that the subsequent prevalence of severe alcohol problems (post-deployment) increased with the duration of deployment. Additionally, Rona et al. (2007b) found that alcohol misuse was higher in men who had deployed, as compared to those who had not deployed or compared to female groups. However, they also suggested a general increase in risky alcohol use in the military (deployed or not) compared to national survey data. This is supported by other UK (Fear et al., 2007; Iversen et al., 2007) and US studies (Ballweg & Li, 1989; Bray et al., 1991, 2005; Hooper et al., 2008; Killgore et al., 2008; Polich, 1981).

In summary, risky alcohol consumption has been shown to exist across most aspects of military life and is a part of military culture. Although it is generally comparable to certain civilian populations for age and gender (i.e., predominantly seen in young, single males) the military appear to ‘push the envelope’ further than their civilian peers, especially for binge drinking and heavy alcohol consumption. This supports the case for a generalised higher level of risky alcohol use within the military. Additionally, the risky use of alcohol plays a part in the mental, physical and psychological health outcomes associated with combat exposure and the deployment experience. Despite the lack of longitudinal research across the deployment cycle (pre-, during, post-) there are cross-sectional studies to support the concerns and implications of risky alcohol use for pre-deployment readiness, post-deployment persistence and long-term force sustainability in modern military forces.

Smoking behaviour
The negative health effects of cigarette smoking are well documented, and have been précised in the previous chapter. Yet, despite a steady worldwide decline in smoking among modern western societies, and their militaries (Bray & Hourani, 2007; Kroutil, Bray & Marsden, 1994; Nelson, Pederson & Lewis, 2009), there are still populations
within the military that are at risk, for example, the army, and in particularly the infantry and other frontline combat-related units (Bray & Hourani, 2007; Deuster et al., 2003; Lodge, 1991; Trent, Hilton & Melcer, 2007). Furthermore, recent studies have highlighted the rising rates of smokeless tobacco use by military personnel (Peterson et al., 2007). Risk factors for smoking behaviour in the military share many of the key demographic variables as for risky alcohol consumption, i.e., young, single or unmarried, male, lower educational attainment, being white, and from among the non-commissioned (enlisted) ranks. Also, in general populations, alcohol consumption is more prevalent among current smokers, than smoking is for current drinkers. That is to say, if you are a smoker you are also highly likely to consume alcohol, and at relative levels (i.e., heavy smokers tend to be heavy drinkers).

Cigarette smoking is also an established risk factor for physiological injuries in military personnel, especially among recruits as recruit training is a period of significant, unaccustomed physiological stress (Altarac et al., 2000; Heir & Eide, 1997; Kaufman, Brodine & Shaffer, 2000). Additionally, smoking behaviour in military samples has also been investigated in terms of body weight (Sherrill-Mittleman, Klesges, Massey, Vander Weg & DeBon, 2009), body image (Dobmeyer, Peterson, Runyan, Hunter & Blackman, 2005), physical activity and exercise (Ward et al., 2003), stress (Stein et al., 2008), and combat exposure (Hooper et al., 2008). Although a proportion of young adults who decide to join the military are pre-existing smokers, it has been found that joining the military increases smoking behaviour (Cronan, Conway & Kaszas, 1991; Nelson & Pederson, 2008; Schei & Sogaard, 1994). Larson, Booth-Kewley and Ryan (2007) even suggest that smoking status is a personnel quality indicator and risk factor for psychosocial and health problems prior to military service, as well as an indicator for leaving military service. Finally, as with alcohol consumption, there are numerous studies on smoking behaviour to be found among the epidemiological and health surveillance literature on military populations (Bray & Hourani, 2007; Hurtado et al., 1997; Kroutil et al., 1994; Williams, Bell & Amoroso, 2002). A recent book by Bondurant and Wedge (2009) provides an in-depth review of tobacco use in military and veteran populations, as well as smoking cessation and tobacco-control activities.

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18 Especially for musculoskeletal injuries, lower limb fractures, and their recovery times.
Smoking and military deployments

As found with the other risky health behaviours, prospective studies that investigate operational deployments and the deployment cycle are limited. As mentioned in the previous section on alcohol, it is posited that such risky health behaviours can affect military readiness and performance (Federman et al., 2000; Ferrier-Auerbach et al., 2009; Steenbergh et al., 2008); however, in a study to address the effects of alcohol and tobacco use on troop readiness (Zadoo, Fengler & Catterson, 1993) it was not possible to quantify increased time off and time away from duty as a result of cigarette smoking and alcohol use.

There is a general assumption, mainly anecdotal, but also supported by a limited number of studies that smoking behaviour increases during deployments compared to pre-deployment levels, in terms of (a) an increase in the daily number of cigarettes smoked by current smokers, (b) relapse rates of ex-smoker who begin smoking again, and (c) initiation among non-smokers (Boos & Croft, 2004; DiNicola, Stanton & Destfino, 2006; Forgas, Meyer & Cohen, 1996; Poston et al., 2008; US Army, 2008).

Among the numerous reasons that military personnel cite for initiating, relapsing, maintaining and increasing their smoking behaviour are: the perceived social benefits; the smoking culture in the forces; access to cheaper tobacco products; addiction to nicotine; to stay awake and maintain alertness; the relative health cost versus (perceived) higher operational risks; and most commonly cited, boredom and stress (Boos & Croft, 2004; DiNicola et al., 2006; Forgas et al., 1996; Nelson et al., 2009; Poston et al., 2008; US Army 2008). Interestingly, within the academic literature there is a large body of knowledge suggesting that tobacco is not only an ineffective stress-reduction strategy, but it is also likely to perpetuate a stress response in users. Although the stresses and experiences faced by military personnel may be argued as being unique and beyond that faced by most civilians (especially on deployments), the same finding has been found among US armed forces personnel (Stein et al., 2008). Interestingly, there have been attempts made to introduce smoking cessation programmes in the operational environment (Soltis & van Geertruyden, 2005; US Army, 2008). The success of these interventions has largely been limited by the contextual issues discussed above.

Unfortunately, published, prospective studies of post-deployment smoking behaviour cannot be found. This is surprising considering the reported physical and
psychological effects of military deployments and how smoking is seen as a buffering, coping and stress-reducing strategy, as mentioned above. However, several epidemiological and health surveillance studies have reported the association between subsequent heavy/increased smoking behaviour with previously deployed personnel as compared to non-deployed personnel (Federman et al., 2000). Conversely, in a prospective study of a sample of UK armed forces personnel (navy, army and air force), Hooper et al. (2008) found across a three-year period that although the number of current smokers had reduced, the number of daily cigarettes smoked by current smokers had not changed; also, there was no evidence that being previously deployed and experiencing combat exposure were associated with a change in the number of cigarettes smoked.

Driving behaviour

Northern Ireland, 1980s: ‘He was a likeable bloke. He eventually died alone in Northern Ireland one night, drunk behind the wheel of a car, after crashing into a bridge’ (Falconer, 1998, p.112).

Previous deployment experience is increasingly recognised as a major risk factor for future accidents and premature deaths among military personnel. Until 2007 the biggest killer of service personnel, both on and off-duty (and during both peacetime and during operations), were road traffic accidents (RTA) (Defence Analytical Services Agency, 2007; Hooper et al., 2005; Lay & Harrison, 2009). Recent increases in combat-related fatalities in Iraq and Afghanistan have overtaken RTAs as the main source of fatality for UK, U.S. and Canadian personnel; however, for off-duty fatalities among these nations (and in general across many other military nations) RTAs are still a major source of accidents, injuries and premature death.

Most studies investigating driving risk and military personnel have been epidemiological and cross-sectional, and these numerous studies have consistently found that previous/recent deployment experience is a significant risk factor associated with future driving behaviour and driving risk (Fear et al., 2008; Hooper et al., 2006). Furthermore, as in comparable civilian populations, the key demographic risk factors include young, unmarried, white males, who are from among the lower ranks, and who have lower educational attainment (Hooper et al., 2005, 2006; Lincoln et al., 2006; Williams et al., 2002).
Prospective studies or analyses during deployments are sparse. Ward and Okpala (2005) analysed RTA admissions at a British Military Hospital in Iraq. They found that serious injury was associated with being ejected from a vehicle that had rolled, and that none of those who were ejected had been wearing a seatbelt. A subsequent analysis by Okpala, Ward and Bhullar (2007) analysed data on seatbelt use in military vehicles by British Forces personnel in Iraq and found a large disparity between a clearly defined policy on seatbelt use (i.e., it was mandatory) and individuals’ actual seatbelt use behaviour. Personnel justified their poor seatbelt use by suggesting that seatbelts were restrictive in hostile environments and affected access to their weapons and their ability to exit their vehicle quickly when faced with security dangers. Personnel stated that the biggest threats when driving were the standards of Iraqi driving, poor roads, security dangers and speeding. Such reasons may suggest a cognitive dissonance over personal risk and the individual’s perceived driving ability and perceived control.

It is known that risky health behaviours co-vary in the general population, and driving risk within military populations has been shown to co-vary with other risky health behaviours (Steenbergh et al., 2008) and in particular with heavy alcohol use (Fear et al., 2008; Vassallo et al., 2008; Williams et al., 2002) and heavy smoking (Fear et al., 2008; Ward et al., 2003), but also for substance misuse and condom use (Ward et al., 2003). Interestingly, it has also been associated with the level of combat exposure to traumatic experiences, not just the act of being deployed per se, i.e., higher levels of combat exposure are associated with increased levels of alcohol use (Fear et al., 2008).

**Sexual health and behaviour**

Berlin, 1970s: ‘Imaginable and unimaginable sexual opportunities were on offer. If there was any doubt about a young soldier’s sexuality, Berlin was the place to sort that out’ (Ely, 2002, p.56).

As with smoking and drinking, sexual activity and behaviour are part of military history. Palmer (2003) provides a short historical introduction into the military’s relationship with sexual behaviour and its impact on health and military manpower from Ancient Greece, through the Roman Empire and Napoleonic wars, through to World War Two. The philosophical and academic perspectives for such behaviours are manifold and such perspectives are beyond the scope of the current
thesis, suffice to say that such behaviour has always occurred within the military
domain and continue to occur.

In the modern professional era (i.e., post-World War Two and post-national
service) sexual activity on deployments and operations is not viewed as good
professional conduct, but it is recognised as a natural urge that should be suppressed
until the appropriate time, for example, when deployed it should be saved for the rest
and recuperation (R&R) period, or post-deployment; and during peacetime then it
should be saved for after the working day, at weekends and during leave periods, i.e.,
it should not be part of ‘on duty’ activity. In modern, western military forces sexual
contact amongst military personnel is restricted through the use of Standard Operating
Procedures (SOPs); however, sexual contact in this professional era is still evident.

As a risky health behaviour, sexual behaviour could be viewed as the last
taboo of empirical investigation. This is reflected in the relative paucity of published
studies compared to the other risky health behaviours among military personnel, such
as alcohol, smoking and driving behaviour. The published studies that do exist have
emanated from different nations investigating various aspects of sexual behaviour; for
example, the French investigated risk factors for condom breakage among French
overseas personnel serving in South-East Asia (Deparis, Migliani & Merlin, 1999);
the Canadians used a qualitative methodology (grounded theory) to investigate
cultural ideals that underpin risky sexual practices among Canadian Forces personnel
(Whitehead & Carpenter, 1999); the UK conducted a short sexual health study of
British soldiers undertaking a humanitarian aid relief in Africa in 1994 (Palmer,
2003); Nigeria has addressed some risk factors (e.g. educational status) associated
with HIV risk perception in Nigerian military personnel (Essien et al., 2007). Finally,
the U.S. has conducted the majority of sexual health and behaviour research within
the military by investigating such behaviours among recruits (Abel & Adams, 1996;
Sebro, Shafer, Chang, Pollack & Boyer, 2006), serving personnel (Klein & Adelman,
2008; Trei & Carvelli, 2008; Von Sadovszky, Ryan-Wenger, Germann, Evans &
Fortney, 2008) and among deployments and operational contexts (Albright et al.,
2007).

There are a number of reasons why sexual health and behaviour is of interest
to the military. Firstly, Abel and Adams (1996) highlighted the fact that there is little
published statistical information regarding sexual risk behaviours among military
populations. This is supported by Palmer (2003) who states that his UK study was
'the first study of its kind to be undertaken on British troops since 1945' (p.39). Also, as most STIs are preventable and could lead to negative health outcomes, monitoring such trends is important for maintaining the overall health of military populations (Trei & Carvelli, 2008). Secondly, there is a governmental cost to dealing with personnel with STIs, evacuation from deployment of pregnant female personnel, future abortions, etc. (Abel & Adams, 1996; Albright et al., 2007; Richie, 2001). Thirdly, military medicine is seen as a 'force multiplier' and as such, risky sexual health behaviour can impact upon military personnel available for deployment and overall military capability (Abel & Adams, 1996; Palmer, 2003). Finally, close living quarters and personal contact have increased among military forces as deployments and operations have become increasingly multinational (hypothetically increasing novelty, interest and opportunity), not to mention the blurring of operational trades and roles between frontline combat troops and supporting roles/trades, which also increases contact between the sexes.

Summary of deployment-related health behaviour research
As the previous sections above have shown, there is a general lack of prospective, empirical research on health behaviour(s) across military deployments, especially using longitudinal and repeated measures. This is supported by Federman et al. (2000) who suggest that ‘many aspects of the deployment experience have not been well studied, including its effects on substance use’ (p.205). The challenges with collecting such evidence have led to reliance on epidemiological, cross-sectional studies that utilise retrospective data.

Table 1 illustrates the published research studies that have investigated health behaviours directly relevant to military deployments and the phases of the deployment cycle (pre-, during, post-). The table does not include the numerous epidemiological studies, which tend to be retrospective and cross-sectional. The studies contained in Table 1 only include those that have collected empirical data on health behaviours that have been prospective, retrospective, or both.
Table 1. Published studies of health behaviours around military deployments.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Nationality</th>
<th>Deployment phase</th>
<th>Topic under investigation</th>
<th>Deployment / operation</th>
<th>Military service (sample(s))</th>
<th>Prospective / retrospective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>USA</td>
<td>Military service</td>
<td>Smoking behaviour on deployment</td>
<td>Various</td>
<td>Army and Air Force</td>
<td>Retrospective</td>
</tr>
<tr>
<td>Posner et al (2008)</td>
<td>USA</td>
<td></td>
<td>Tobacco cessation analysis</td>
<td>Iraq</td>
<td>Coalition soldiers</td>
<td>Retrospective</td>
</tr>
<tr>
<td>Jones et al (2004)</td>
<td>UK</td>
<td></td>
<td>Smoking behaviour</td>
<td>Iraq</td>
<td>Army Medical staff</td>
<td>Retrospective</td>
</tr>
<tr>
<td>Forsa &amp; Meyer (2004)</td>
<td>USA</td>
<td></td>
<td>Tobacco use habits</td>
<td>Persian Gulf (Desert Storm)</td>
<td>Army</td>
<td>Prospective</td>
</tr>
<tr>
<td>Alcohol</td>
<td>USA</td>
<td></td>
<td>Predictors of pre-deployment alcohol use in National Guard soldiers</td>
<td>Iraq</td>
<td>National Guard soldiers</td>
<td>Prospective</td>
</tr>
<tr>
<td>Posner et al (2008)</td>
<td>USA</td>
<td></td>
<td>Smoking behaviour</td>
<td>Iraq</td>
<td>Army</td>
<td>Prospective</td>
</tr>
<tr>
<td>Driving</td>
<td>UK</td>
<td></td>
<td>Seatbelt use</td>
<td>Iraq</td>
<td>Army</td>
<td>Prospective</td>
</tr>
<tr>
<td>Okpala &amp; Ward (2007)</td>
<td>UK</td>
<td></td>
<td>Driving</td>
<td>Iraq</td>
<td>Army</td>
<td>Retrospective</td>
</tr>
<tr>
<td>Sex</td>
<td>USA</td>
<td></td>
<td>Pregnancy during deployment</td>
<td>Iraq</td>
<td>Army</td>
<td>Retrospective</td>
</tr>
<tr>
<td>Palmar (2003)</td>
<td>UK</td>
<td></td>
<td>Risk factors (prevalence for condom use)</td>
<td>Various (Aid)</td>
<td>Army</td>
<td>Retrospective</td>
</tr>
<tr>
<td>Desantis et al (1999)</td>
<td>France</td>
<td></td>
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</tbody>
</table>

5.6 Chapter summary

In summary, this chapter has reviewed the nature of risk in the military domain and the empirical research conducted in addressing risk-taking in the military. Despite the frequent assumption that military personnel are naturally higher in risk-taking propensity, the evidence is mixed and far from unequivocal. In terms of the risk-taking literature, most research has been conducted on military personnel in high-risk professions, which skews the overall picture as these personnel represent only a small, specialist sample within the military domain. Unfortunately, there has been limited SS research using military samples to illuminate this topic further. The small number of studies that do exist suggest mixed findings on the SS sub-scales. However, there have been a number of research studies that have addressed military health, and the present findings suggest that risky health behaviours, particularly those related to alcohol and smoking, may be higher in military populations than comparable civilian populations, which suggests an increased risk-taking propensity, which could be due to personality factors and/or socialisation processes within military culture, as well as organisational processes. Finally, experiences from operational deployments suggest an impact on both risk-taking propensity and subsequent expressions of health-related behaviours.

This chapter is the culmination of the literature presented in the last three chapters that have presented a case for the investigation of ImpSS and risky health behaviours within the context of risk and military deployments. It is hoped that the rationale for the present study emerged with each passing chapter Despite the depth of literature on each of these core topics, no previous study has investigated all three
simultaneously, i.e., ImpSS, military deployments and risky health behaviours. Therefore, this informs the hypotheses and research questions at the start of the methodology.
6. **METHOD**

6.1 **Hypotheses and research questions**
There are a number of testable hypotheses, based on previous research on sensation seeking, and also previous military deployment research. In these instances, the research hypotheses state that:

\[ H_1 \] The high ImpSS group will engage in higher rates of risky health behaviour (i.e., drinking, smoking, sex and driving) than the low ImpSS group, and across each phase of the deployment.

\[ H_2 \] The high ImpSS group will possess lower risk perceptions than the low ImpSS group, and across all the deployment phases.

\[ H_3 \] Changes will occur across the deployment for each of the risky health behaviours.

\[ H_4 \] Psychological well-being (PWB) will change across the deployment for the overall sample.

Furthermore, the present study is exploratory in nature, and this has highlighted a number of research questions (RQ) that have not been previously researched or reported in the academic literature. Therefore, the following research questions have been asked and the empirical data collected in order to explore the following:

RQ1. Which variables predict military-related risky health behaviours?
RQ2. Do differences exist between the high and low ImpSS groups on measures of PWB?

6.2 **Power calculation**
A suggested by Wright (2003) and Field (2005) a power calculation was conducted to establish the necessary sample size on an *a priori* basis. G*Power (Cohen, 1992) was the freeware used to establish the criteria. As the present study was a unique and exploratory study, previous standard deviations (SD) or degrees of freedom (df) were not available. Table 2 below illustrates the outputs of G*Power based on the key (anticipated) statistical tests to be conducted on the study data set.
### Table 2. Output of power calculation.

<table>
<thead>
<tr>
<th>Test Type or power test</th>
<th>Tails</th>
<th>Effect size</th>
<th>Probability</th>
<th>Power</th>
<th>Sample size output</th>
</tr>
</thead>
<tbody>
<tr>
<td>t-test. Means: differences between two independent groups (two groups)</td>
<td>A priori: Compute required sample size</td>
<td>1</td>
<td>0.3</td>
<td>0.05</td>
<td>0.95</td>
</tr>
<tr>
<td>t-test. Means: differences between two dependent means (matched pairs)</td>
<td>A priori: Compute required sample size</td>
<td>2</td>
<td>0.3</td>
<td>0.05</td>
<td>0.95</td>
</tr>
<tr>
<td>t-test. Linear multiple regression: fixed model, single regression coefficient</td>
<td>A priori: Compute required sample size</td>
<td>2</td>
<td>0.3</td>
<td>0.05</td>
<td>0.95</td>
</tr>
<tr>
<td>F-test. ANOVA repeated measures, within factors</td>
<td>A priori: Compute required sample size</td>
<td>n/a</td>
<td>0.3</td>
<td>0.05</td>
<td>0.95</td>
</tr>
<tr>
<td>F-test. ANOVA fixed effects, one-way</td>
<td>A priori: Compute required sample size</td>
<td>n/a</td>
<td>0.3</td>
<td>0.05</td>
<td>0.95</td>
</tr>
<tr>
<td>F-test. ANOVA repeated measures, within-between interactions</td>
<td>A priori: Compute required sample size</td>
<td>n/a</td>
<td>0.3</td>
<td>0.05</td>
<td>0.95</td>
</tr>
<tr>
<td>F-test. ANOVA repeated measures, between factors</td>
<td>A priori: Compute required sample size</td>
<td>n/a</td>
<td>0.3</td>
<td>0.05</td>
<td>0.95</td>
</tr>
</tbody>
</table>

### 6.3 Design

This empirical study was designed as a longitudinal, repeated measures study, which used questionnaires to collect the empirical data. The questionnaire data were collected across three distinct phases:

- Pre-deployment (Time 1 – T1);
- Mid-deployment (Time 2 – T2);
- Post-deployment (Time 3 – T3).

The time between T1 and T3 was approximately 12 months, with T2 data collection at the midway point of five to six months. The study utilised a mixed method design by collecting both qualitative and quantitative data; and finally, the data were collected in a ‘real world’ applied environment, i.e., an operational military deployment, which was a non-experimental setting.

### 6.4 Population and sample

The population from which an opportunistic, but representative, sample was taken was a brigade within the British army that deployed to an operational theatre in 2007. Appendix B presents the formal request to approach the brigade and seek their agreement to take part in the study. The brigade comprised of sub-units, which were taken from various regimental battalions that were representative of a mix of trades and roles, for example:

- Combat (frontline) Arms (CA): e.g. Infantry, Royal Armoured Corps, Cavalry;
- Combat Support (CS) Arms: e.g. Engineers, Artillery, Signals;
- Combat Service Support (CSS) Arms: e.g. Logistics, Medical, etc.
Furthermore, each regimental battalion deployed possessed personnel from other regiments attached to them, for example, an infantry battalion had a number of personnel from Royal Signals, Adjutant General’s Corps, Royal Electrical and Mechanical Engineers, etc.

T1 data were collected approximately two months before the brigade deployed. Therefore, each sub-unit was in full preparation for their forthcoming deployment, for example, unit and individual training, the ‘re-rolling’\(^\text{19}\) of some units, and finally, pre-deployment leave. This period of time was very busy and access to such units was limited. Extensive communication and liaison with the chain of command of the Brigade and individual regiments was required in order to make data collection possible at T1, T2, and T3.

The total number of personnel in a Brigade changes depending upon the operational requirement; however, it was expected that the maximum population for the present deployment would be approximately 4000. The study therefore sought to collect data from those sub-units who could spare the time and manpower to complete the T1 questionnaire, this would certainly not be 4000, but 50 per cent of this may have been possible. Based on the reasons stated above, the sample would be opportunistic in nature, but representative of the Army as data would be collected across the various regiments within the brigade.

**Inclusion criteria**

The only real inclusion criteria for being a potential participant in the current study was those personnel who were expected to deploy to the operational theatre and were available on the day of T1 data collection.

**Exclusion criteria**

There were a number of exclusion criteria for the present study:

1. Personnel who were currently part of the unit(s) deploying, but were not actually deployed (for numerous reasons, e.g. rear party remaining in UK, medical downgraded, imminent attendance on courses, etc.);

2. Personnel who were under the legal age to deploy to an operational military environment (a specific point needed to be made separate from point 1 above);

\(^\text{19}\) Re-rolling refers to re-training a sub-unit on particular vehicles and military systems they have not previously used or have not used for some considerable time.
3. Personnel who were currently enrolled onto the existing longitudinal health study being conducted by King’s College, London (KCL)\textsuperscript{20}.

In the case of the KCL Iraq War Study, KCL supplied the author with a list of 207 names who were among the brigade sub-units and were currently enrolled onto the longitudinal KCMHR Iraq War Study. The author sent the names of those individuals to each of the sub-units in advance of data collection so they could be identified and exempt from data collection at T1. This would automatically remove them from the subsequent T2 and T3 data collection periods.

6.5 Materials
The questionnaires were constructed based upon the following measures. Examples of each questionnaire for T1, T2 and T3 can be found in Appendix C.

Demographic variables
A range of demographic variables was collected. These included name, age, gender, relationship status, nationality and ethnicity. Specific military demographics included military arm/unit, rank, length of service and deployment history.

Impulsive sensation seeking (ImpSS)
Taken from the ZKPQ (Zuckerman et al., 1993) the subscale of ImpSS was used within the present study as a short-form measure of general SS. This decision was made for the reasons described in Chapter 3 on the SS personality. The 19-items of the ImpSS scale contain 11 items on SS and 8 items addressing a lack of planning and a tendency to act impulsively without thinking. Of the 11 SS items, 8 are taken directly from the SSS-V, i.e., ES (4), Dis (2), TAS (1) and BS (1). The independent variable of ImpSS was collected at T1 only.

Risk perception of the operational environment
One of the key differences between HSS and LSS is their risk perception (risk appraisal), whereby HSS have been consistently found to have lower risk perceptions of a situation compared to LSS, thereby providing the HSS with a rationale for

\textsuperscript{20} The longitudinal Iraq War Study being conducted by the King’s Centre for Military Health Research (KCMHR) at King’s College London (KCL).
engaging in a particular behaviour. Risk perceptions (risk appraisal) was measured in the following ways.

**Anticipated risk**
At T1 a single item asked participants how risky they thought the forthcoming operational deployment would be. This was measured on a four-point Likert scale from very risky to not at all risky.

**Actual risk**
At T2 a single item asked participants how risky the current operational theatre was. This was measured on a four-point Likert scale from very risky to not at all risky.

**Recall of risk**
At both T2 and T3 items were asked about participants’ previous estimates of the deployment risk; for example, at T2 an item asked: ‘Before you deployed, how risky did you think the current operational theatre would be?’ The same item was also asked at T3. Also at T3 were two other items asking about risk estimates (risk perception) of the in-theatre risk (i.e., how risky was it, and when they were in-theatre how risky was the operational environment). This was measured on a four-point Likert scale from very risky to not at all risky.

**General Health Questionnaire (GHQ)**
The GHQ is the most widely applied self-completion measure of psychiatric disturbance in the UK (Bowling, 1997). It is a pure ‘state’ measure, assessing present state in relation to usual state. Hence, it asks respondents how their health has been in general, over the past few weeks. There are four sub-scales that measure somatic symptoms, anxiety symptoms, depression symptoms, and social dysfunction.

**GHQ-12**
The GHQ-12 provides an overall score, with a maximum score of 36 when using Likert scoring of 0-1-2-3. Scores of 11-12 are typical, with scores of >15 indicating evidence of distress and scores of >20 indicating severe problems and psychological distress. This method of scoring was adopted for the present study because it was used previously by Rona et al. (2006).
The GHQ-12 has been adopted in several studies of UK military health (Browne et al., 2007; Hotopf et al. 2006; Rona et al., 2006, 2007a, 2007b). Additionally, it was used for the same reason as adopting ImpSS as opposed to the SSS-V, i.e., fewer items were used within the overall questionnaires in order to increase voluntary participation in the study. For the present study, the GHQ-12 was used to measure ‘Psychological well-being’ (PWB), as indicated by Bowling (1997).

**Health behaviours**

**Alcohol intake**

The World Health Organisation’s (WHO) Alcohol Use Disorders Identification Test (AUDIT) survey (Babor, Higgins-Biddle, Saunders & Monteiro, 2001) is probably the most recognised and adopted measure for measuring alcohol consumption and identifying alcohol use disorders (AUDs). For the present study the AUDIT-C (Consumption) was adopted. The AUDIT-C utilises the first three items of the 10-item AUDIT, which happen to be the three items that measure hazardous alcohol use, i.e., frequency of drinking, typical quantity and frequency of heavy drinking (i.e., heavy episodic drinking [HED], aka ‘binge drinking’). The AUDIT-C items were chosen because they have previously been used within the overall AUDIT within studies by the KCL Iraq War Study and other associated epidemiological military data (Fear et al., 2007; Hooper et al., 2008).

**Amount of alcohol**

This was scored on 8-point likert scale: 1 or 2 (1); 3 or 4 (2); 5 or 6 (3); 7 to 9 (4); 10 to 14 (5); 15 to 19 (6); 20 to 29 (7); 30 or more (8).

**Frequency of alcohol**

This was scored on 6-point likert scale: Never (0); Monthly or less (1); 2-4 times a month (2); 2 times per week (3); 3 times per week (4); 4 times or more a week (5).

**Frequency of heavy episodic drinking (HED)**

This was scored on 5-point likert scale: Never (0); Less than monthly (1); Monthly (2); Weekly (3); Daily/almost daily (4).
The scale for amount of alcohol was increased (from an AUDIT maximum of ‘10 or more’ drinks to include 10-14, 15-19, 20-29, 30 or more) due to the high level of drinking patterns previously found in the UK military by the KCL research (Fear et al., 2007). Additionally, the wording of two items (i.e., typical quantity and frequency of HED) were altered to capture the number of alcohol units consumed rather than the number of drinks. This was conducted because recent UK Department of Health drinking campaigns have tried to make people aware of the number of units they consume rather than drinks; for example, the weekly safe level for males is 21 units, and 14 units for females. In addition to the AUDIT-C, a single six-point item asked about current drinking behaviour (‘much more’ to ‘much less’) relative to the specific deployment phase, i.e., as they get nearer to deploying (T1), since they have been on deployment (T2), and how much they currently drink since being back from deployment (T3).

**Smoking behaviour**

Items on smoking behaviour were taken from the KCL Iraq War study. Three common items asked at T1, T2 and T3 were: smoking category (current-, ex-, non-), whether they smoked before joining the military, and a subjective estimate of how many cigarettes they smoked a day. Two other items, which were tailored for each phase (T1, T2, T3) asked about whether they started smoking during that phase, and if so, what smoking category were they when the change in behaviour occurred.

**Driving behaviour**

Four items on speeding and seatbelt use were taken from the KCL study and were reported in Fear et al. (2008), who in turn adapted these items from Bell, Amoroso, Yore, Smith and Jones (2000). Two items asked about speeding propensity (in both urban and motorway environments) and two items asked about seatbelt use as a passenger (in both the front and rear of a vehicle).

**Seatbelt use**

This was scored on 5-point likert scale: Always (0); Nearly always (1); Sometimes (2); Seldom (3); Never (4).

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21 Much more, slightly more, about the same, slightly less, much less.
**Speeding behaviour**

This was scored on 3-point likert scale: Below the limit, or within 5mph\(^{22}\) (1); 6-10mph above the limit\(^{23}\) (2); more than 10mph above the limit\(^{24}\) (3).

**Sexual behaviour**

Items on sexual behaviour were taken from the KCL Iraq War study. Common questions asked about: condom use, one night stands, paying for sex, and contracting STIs. Likert scales were used at baseline (T1) to establish prevalence rates, but at T2 and T3 the same questions were asked as continuous measures as the study aimed to look at behaviour at those phases. Therefore, direct comparisons between T1 and the subsequent phases would not be possible, but measures at each phase could be investigated in terms of ImpSS groups, i.e., H-ImpSS versus L-ImpSS. The items asked can be seen in Appendix C.

**Qualitative health behaviour questions**

In addition to a quantitative item asking participants if they felt they were smoking, drinking alcohol and having sex ‘much more’ to ‘much less’ at each phase of the deployment (pre-, during, post-), an open-ended question was included asking the participants why their recent behaviour was as indicted by their response on the likert scores. These qualitative items were asked in an attempt to link the quantitative estimates to the qualitative reasons provided for an increase, reduction or maintenance of that particular behaviour. The rationale, benefits (and limitations) of using such a mixed method approach have been addressed by Mason (2006), and the analysis of open-ended questions is covered by Bowling (1997). The analysis required the grouping of expected themes (i.e., thematic analysis); however, as the responses were open-ended, participants’ responses varied considerably in terms of the expected themes and the length of response, therefore, the use of ‘multicodes’ was required in order to ensure that all responses were robustly accounted for within the emergent themes.

\(^{22}\) Or within 10mph for motorway speeding.  
\(^{23}\) Or 11-20 mph for motorway speeding.  
\(^{24}\) Or 20 mph above for motorway speeding.
6.6 Ethics

The underpinning theoretical rationale and methodological design underwent scientific and ethical scrutiny on four separate occasions. Firstly, it was required to pass scientific scrutiny within the MoD by the Surgeon General’s Research Strategy Group (SGRSG). The SGRSG is the formal high-level MoD committee for supporting and approving health and medical research within the MoD. Secondly, as an army-centric study, it was required to be reviewed by the Directorate of Army Personnel Strategy (DAPS) at Upavon, Wiltshire, UK. Thirdly, the study was evaluated by the University of Surrey’s Research Ethics Committee (REC). Finally, an application was sent to the MoD REC.

Ethical considerations

Although a non-invasive study there were a number of ethical considerations relevant to this study. These included:

- Repeated measures;
- Sensitive nature of questionnaire items and responses;
- Storage of participant data;
- Security of sensitive data offered by participants;
- Anonymity and confidentiality.

Ethical approval

Having been approved for scientific scrutiny, ethical approval was given by the MoD REC in March 200725 (Appendix D). The University of Surrey also approved the protocol in April 200726. Additionally, in accordance with The British Psychological Society, all ethical considerations were adhered to when considering the ethics, guidelines and conduct for research involving human participants (British Psychological Society, 2009).

6.7 Procedure

A simple procedure was utilised at each phase. However, it was anticipated that real world events within each unit would affect and dictate the exact nature of data

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25 MoD REC Ref 0706/91, letter of approval from Prof R. Linton 03/03/2007.
collection on the day. Therefore, a flexible attitude, anticipation of change and lots of pre-collection preparation were required.

**Pre-Deployment (T1)**

Specific dates and times for T1 data collection were pre-arranged with the adjutant of each sub-unit. Different units were based at different military establishments, therefore possessing different facilities, e.g. from large lecture theatres to small classrooms. However, the presentational style for administering the questionnaires was very similar and is described as follows. Each tranche of soldiers \((N = 60-100)\)\(^{27}\) were brought into an appropriate setting, e.g. lecture theatre, at pre-arranged times on pre-arranged dates. Each tranche was allocated a one-hour session. They were provided with a 5-10 minute verbal briefing on the nature of the study, informed of their voluntary status in the study, the requirement for written consent and their legal and ethical rights. Any questions were then taken. The following procedure was then conducted:

- Pens were handed out to those participants who did not arrive with one;
- Individual packs containing one participant information sheet, two consent forms; and one questionnaire booklet were handed to participants;
- Participants were then given an appropriate amount of time to read the participant information sheet and told to keep hold of this as it contained a description of the study and the Principal Investigator’s (PI) contact details;
- Participants were then given an appropriate amount of time to read and sign their two consent forms, as well as witness the person’s next to them. They were told to keep hold of one copy of their own consent form\(^ {28}\) and to put the second one back in the envelope that was provided, along with their questionnaire (when completed);
- Participants were then given an appropriate amount of time to complete the questionnaire;
- On completion of the questionnaire the participant then placed it within the original envelope (along with one signed copy of the consent form), sealed it, and returned it to the PI.

\(^{27}\) Depending on the size of the unit and their available facilities.

\(^{28}\) Their personal copy to be kept with their participant information sheet.
During-Deployment (T2)
A schedule was developed whereby the individual sub-units within the brigade could be visited in order to distribute and collect the questionnaire data. This schedule was organised via the chain of command at the brigade level. A three-week period was utilised as it was expected that several sessions would need to be held with individual units due to the high workload (operational tempo) of the population from which the study sample were drawn. For some units, due to their operational role and location, it would prove to be impossible to conduct organised data gathering sessions with the PI present. Therefore, for four units the questionnaires were delivered to them in order for them to distribute and gather the data at their own pace and within the time, location and operational limitations that they had to work under.

For the remainder of the units, where the PI could attend and conduct data collection, the procedure for data collection was standardised and repeatable, although the locations where the questionnaires were distributed, completed and collected varied, again, due to operational and logistic limitations. Locations varied between:
- Cookhouses;
- Working office spaces;
- Welfare tents;
- Gun emplacement locations.

However, as previously mentioned, the methodology employed in order to distribute, complete and collate the completed questionnaires was similar to T1. The gathered audience were given a brief two-minute reminder of who the PI was and the nature of the research, as well as reminding them of the T1 collection they took part in at pre-deployment in the UK. Questionnaire packs, which were individually named and labelled, were then distributed to the assembled audience. They were asked to complete the questionnaire and then to seal and return it to the PI in an enclosed envelope.

Post-Deployment (T3)
Data collection at T3 was expected to be conducted along the same lines as T1, i.e., with the returning units at their home base in the UK. The only expected main difference would be the numbers of participants involved, which was expected to be smaller for most of the units as approximately 16 per cent of the T1 sample were
expected to have been posted away from their unit on return from the operational deployment. Also, some of the environments in which the T1 data were originally collected were expected to change slightly, for example, at T1 a cookhouse may have been used whilst at T3 a lecture theatre may now be used for the same sub-unit sample. This reflects the changes that the British army are currently undergoing. However, the fundamental approach for collecting the data were as per T1, with liaison between the sub-units’ adjutants and smaller unit commanders (e.g. Regimental Sergeant Major, Company Commander, Company Sergeant Major, etc.).

6.8 Analysis plan

In order to understand the following results sections it is necessary to state clearly the rationale and plan for the presentation of results, and how these will provide the answers to the original research hypotheses and research questions.

Firstly, section 7.1 presents the descriptive statistics so that the reader can understand the profile of the sample, which helps put the presented findings into context.

Section 7.2 presents the descriptive findings of ImpSS as they pertain to the sample, with comparisons made between different demographic groups. The sample was then be divided into high and low ImpSS groups and comparisons made on measures of risk perception (research hypothesis No.2), and also comparisons with previously published ImpSS data on civilian samples (McDaniel & Zuckerman, 2003). This was conducted to see if the present UK army sample were fundamentally different in ImpSS to comparable civilian samples for age and gender.

Section 7.3 presents the baseline findings (i.e., pre-deployment) between the ImpSS groups and their differences in health behaviours. Section 7.4 also addresses the differences in ImpSS groups’ health behaviours, but across the phases of the deployment. These two sections provide the data to answer research hypothesis No.1 and research question No.2 (RQ2).

Sections 7.5 and 7.6 address the baseline findings (i.e., pre-deployment) and changes across the phases of the deployment among the overall sample (irrespective of ImpSS) respectively. This addresses research hypothesis No.3 and No.4. The rationale for asking these hypotheses are that prospective health behaviour data across an operational UK deployment has not previously been collected, and this also helps
to understand the context in which risk-taking and sensation seeking behaviour is exhibited.

Section 7.7 presents the qualitative data that was collected. This was conducted in order to provide supporting explanatory evidence for changes in health behaviours across time (section 7.3 and 7.4). This data also contributes to the interpretation and understanding that is presented in the discussion chapter (chapter 8).

Finally, section 7.8 presents the regression analyses and addresses research question 1 (RQ1). The analysis initially addresses the role of ImpSS as a predictor of current and future health behaviour, and then the subsequent analyses include the risky health behaviours to address the co-varying and clustering of health behaviours and their predictive relationship.
7. RESULTS

7.1 RESULTS I: Descriptive Statistics

Descriptive statistics provide a numerical summary of the data set (Coolican, 1999), which enables the reader to understand the context of the study sample, and which ultimately assists with interpretation of the data. The following descriptive statistics provide information on the current study’s sample of military personnel from the British army.

Sample response sets
The maximum responses received at each time phase were:

- Pre-deployment \((N = 1374)\);
- Mid-deployment \((N = 889)\); response rate of 64.7%
- Post-deployment \((N = 537)\); response rate of 60.4% of T2; and 39.1% of T1.

Age
The mean age of the sample was 25.1 years \((SD = 6.1)\). The military is an organisation known to be skewed toward the young and this is reflected in the age distribution below in Figure 9 and is representative of a typical army brigade.

Figure 9. Age distribution of UK military (army) sample.
Furthermore, age-related groups were established for later analyses, i.e., 17-24, 25-34, and 35-44.

**Gender**

As with the skewed age distribution, the military is predominantly a male institution. Females represent approximately 9-10% of the army. Therefore, the present study’s sample is slightly under represented by females at 4.6% \( N = 63 \), with males making up 95.4% of the study sample.

**Relationship status**

Figure 10 illustrates the distribution of the present sample by their relationship status. The majority of the sample were single and not in a relationship (35.6%) or married (29.3%) or in a long-term relationship (25%). The most interesting group to investigate in terms of risky health behaviours will be the single group; however, the other two main groups may also provide interesting insights into their health behaviours when considering their relationship status and potential impacts on spouses, partners and children.

![Figure 10. Distribution of sample by relationship status.](image)

**Nationality and ethnicity**

The distribution of nationality within the sample was British (89.7%), other Commonwealth (5.3%), Fijian (2.9%), Nepalese (Ghurkha) (0.3%) and other (1%).

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Ethnicity was distributed as White (87.9%), Black (6%), mixed white (1.5%) and other ethnicities (2.9%).

**Time served in the military**
The mean time served in the army was 6.2 years (SD = 5.5). The median was 4 years with 52.4% serving between one and four years. The maximum time served was 32 years by an individual.

**Rank**
Figure 11 illustrates the distribution of the sample by rank. As expected non-commissioned ‘other ranks’ (i.e., junior ranks, junior non-commissioned officers [NCO] and senior NCOs) are more numerous than the commissioned officer ranks. However, as with gender, the sample is under represented in terms of officers.

![Distribution of UK army sample by rank.](image)

**Military arm**
Figure 12 illustrates the distribution of the present sample by their individual arm. As expected, the infantry make up the largest sub-sample (32.1%). Frontline combat troops (i.e., the CA comprised 48% of the sample, whereas the CS made up 20% and CSS made up 31%).
Previous military experience

A number of the sample possessed previous military experience, within organisations such as the army cadet force (19.6%), combined cadet force (4.9%) and the territorial army (7.5%).

Operational experience

For 44.2% of the sample it was their first operational tour. The number of tours for those who were not on their first tour ranged from 1 to 13, with a median value of one. The majority of subsequent tours experienced were: one tour (23.3%), two (12.5%), three (6%) and four (6%). These data are represented in Figures 13 and 14.

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20 Household Cavalry/Royal Armoured Corps (H Cav/RAC); Royal Artillery (RA); Royal Engineers (RE); Royal Signals (R Sigs); Royal Army Medical Corps (RAMC); Royal Logistics Corps (RLC); Royal Electrical and Mechanical Engineers (REME); Adjutant General Corps (AGC); Army Physical Training Corps (APTC).
Figure 13. Previous operational experience.

Figure 14. Multiple deployments groups.
7.2 RESULTS II: Impulsive Sensation Seeking

Descriptive statistics of the sample

Table 3 illustrates the statistical output of the scores on the ImpSS scale. The mean score for the present sample was $\bar{X} = 11.27$ (SD = 3.5). The distribution of scores is slightly negatively skewed, as illustrated in Figure 15, and represents higher SS scores found in adolescent, teenage and young adult samples (Zuckerman, 1994). This is mirrored in the present sample due to age and gender bias, but is fairly representative of a modern army unit. Moreover, the shape and spread of this distribution suggests it is safe to proceed with further statistical analysis without the need to transform the data.

Table 3. Descriptive output of ImpSS scores.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
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<tr>
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<td>.066</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-.320</td>
</tr>
<tr>
<td>Std. Error of Kurtosis</td>
<td>.133</td>
</tr>
<tr>
<td>Range</td>
<td>18.000</td>
</tr>
<tr>
<td>Minimum</td>
<td>1.000</td>
</tr>
<tr>
<td>Maximum</td>
<td>19.000</td>
</tr>
</tbody>
</table>

Figure 15. Normal distribution of ImpSS scores.
Table 4 illustrates the mean (and standard deviation) scores for ImpSS by demographic variables, with significant differences within each variable shown in Table 5.

Table 4. Mean ImpSS scores for the sample’s general demographics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>11.3</td>
<td>3.5</td>
</tr>
<tr>
<td>Female</td>
<td>10.2</td>
<td>3.7</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17-24</td>
<td>12.3</td>
<td>3</td>
</tr>
<tr>
<td>25-34</td>
<td>10.2</td>
<td>3.6</td>
</tr>
<tr>
<td>35-44</td>
<td>9.3</td>
<td>3.7</td>
</tr>
<tr>
<td>Rank</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junior NCO</td>
<td>11.8</td>
<td>3.7</td>
</tr>
<tr>
<td>Officer</td>
<td>10.2</td>
<td>3.4</td>
</tr>
<tr>
<td>Senior Officer</td>
<td>9.2</td>
<td>2.9</td>
</tr>
<tr>
<td>Senior NCO</td>
<td>8.9</td>
<td>3.6</td>
</tr>
<tr>
<td>Relationship status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>12.3</td>
<td>3.1</td>
</tr>
<tr>
<td>In long-term relationship</td>
<td>11.7</td>
<td>3.2</td>
</tr>
<tr>
<td>Living with partner</td>
<td>11.4</td>
<td>3.5</td>
</tr>
<tr>
<td>Separated</td>
<td>10.4</td>
<td>3.8</td>
</tr>
<tr>
<td>Married</td>
<td>9.8</td>
<td>3.6</td>
</tr>
<tr>
<td>Divorced</td>
<td>9.8</td>
<td>4.1</td>
</tr>
<tr>
<td>Nationality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>British</td>
<td>11.5</td>
<td>3.4</td>
</tr>
<tr>
<td>Fijian</td>
<td>10.4</td>
<td>4.2</td>
</tr>
<tr>
<td>Any other</td>
<td>9.9</td>
<td>3</td>
</tr>
<tr>
<td>Other Commonwealth</td>
<td>9.4</td>
<td>3.8</td>
</tr>
<tr>
<td>Gurkha</td>
<td>9</td>
<td>2.7</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixed white</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>White</td>
<td>11.4</td>
<td>3.4</td>
</tr>
<tr>
<td>Any other</td>
<td>11</td>
<td>3.4</td>
</tr>
<tr>
<td>Black</td>
<td>9.6</td>
<td>4</td>
</tr>
<tr>
<td>Other Asian</td>
<td>9.9</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 5. Significant differences within demographic variables on ImpSS.

<table>
<thead>
<tr>
<th>Demographic variables</th>
<th>t/F</th>
<th>df</th>
<th>Slg. (p)</th>
<th>Effect size (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male* - Female</td>
<td>2.22</td>
<td>1372</td>
<td>&lt;.05</td>
<td>0.06</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17-24* - 25-34</td>
<td>84.59</td>
<td>2,1350</td>
<td>&lt;.001</td>
<td>0.33</td>
</tr>
<tr>
<td>17-24* - 35-44</td>
<td>84.59</td>
<td>2,1350</td>
<td>&lt;.001</td>
<td>0.33</td>
</tr>
<tr>
<td>25-34* - 35-44</td>
<td>84.59</td>
<td>2,1350</td>
<td>&lt;.05</td>
<td>0.33</td>
</tr>
<tr>
<td>Rank</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pte* - Senior NCO</td>
<td>29.69</td>
<td>3,1372</td>
<td>&lt;.001</td>
<td>0.25</td>
</tr>
<tr>
<td>Pte* - Officer</td>
<td>29.69</td>
<td>3,1372</td>
<td>&lt;.05</td>
<td>0.25</td>
</tr>
<tr>
<td>Pte* - Senior Officer</td>
<td>29.69</td>
<td>3,1372</td>
<td>&lt;.05</td>
<td>0.25</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White* - Black</td>
<td>6.45</td>
<td>6,1360</td>
<td>&lt;.001</td>
<td>0.16</td>
</tr>
<tr>
<td>White* - Other Asian</td>
<td>6.45</td>
<td>6,1360</td>
<td>&lt;.01</td>
<td>0.16</td>
</tr>
<tr>
<td>Mixed White* - Other Asian</td>
<td>6.45</td>
<td>6,1360</td>
<td>&lt;.01</td>
<td>0.16</td>
</tr>
<tr>
<td>Nationality</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>British* - Other Commonwealth</td>
<td>7.96</td>
<td>4,1362</td>
<td>&lt;.001</td>
<td>0.15</td>
</tr>
</tbody>
</table>

* denotes higher mean ImpSS score
Figure 16 illustrates the gradual reduction in mean ImpSS by age. The erratic trend towards the right hand side of the figure reflects the smaller number of participants for older ages (≥39).

The mean scores for ImpSS by army unit are shown in Figure 17. This indicates that the frontline combat units (e.g. infantry and cavalry) scored higher than support units such as logistics and engineers.

A one-way ANOVA of the individual units categorised into CA, CS and CSS units shows that the CA ($\bar{x} = 11.9$, SD = 3.3) units are statistically higher than both the CS ($\bar{x} = 10.6$, SD = 3.5) and CSS ($\bar{x} = 10.6$, SD = 3.6) units ($F(2, 1361) = 23.07$, $p<.001$, $r = .18$), but there was no significant difference between the CS and CSS units.

Further to this, an ANCOVA was conducted that controlled for age and gender (the biggest source of variance for SS) and it was found that both age ($F(1, 1340) =$

---

30 All ANOVA tests use the post hoc corrections of Bonferroni, Tukey, Games-Howell and REGWQ. The Bonferroni correction is the default post hoc reported unless stated.
159.94, \( p<.001, r=.33 \) and gender (\( F(1, 1340) = 4.57, p<.05, r=.06 \)) were significantly related to ImpSS. The pairwise comparisons showed that there were significant differences between the CA and CS arms (\( F(2, 1340) = 11.31, p<.001 \)) and between the CA and CSS (\( p =.002 \)), but no difference between the CS and CSS arms. Therefore, there appeared to be a valid difference between the CA and the other arms in terms of the ImpSS tendency.

**Establishing high and low ImpSS groups**

To conduct between-group analysis it was necessary to create high and low ImpSS groups (i.e., H-ImpSS and L-ImpSS). Separating the sample into tertiles (i.e., thirds) allowed the lower tertile to represent the L-ImpSS group and the higher tertile to represent the H-ImpSS group. It is a previously used method (van Beurden et al., 2005) and allowed for robust comparison between the two groups, whilst overcoming the limitations of using a quartile divide or a median split. The tertile split meant that any observed differences are real, but also allowed for increased sample sizes across time, which was key for the trend analysis across the deployment phases. A cut-off score of \( \leq 10 \) was established for the L-ImpSS and a score of \( \geq 13 \) for the H-ImpSS group. The sample sizes for these groups across time are shown in Table 6.

**Table 6. ImpSS group samples across time.**

<table>
<thead>
<tr>
<th>ImpSS Group</th>
<th>Sample sizes (N=)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
</tr>
<tr>
<td>Low ImpSS</td>
<td>538</td>
</tr>
<tr>
<td>High ImpSS</td>
<td>556</td>
</tr>
</tbody>
</table>
ImpSS and risk perception

Consistent with previous findings, the H-ImpSS group were found to have lower risk perceptions compared to the L-ImpSS group. This was consistently found across all phases of the deployment and is presented at Table 7 and illustrated in Figure 18. The implications of this finding is that by perceiving lower risk perceptions, the H-ImpSS group validate their desire to engage in risky behaviour in order to find the sensation and stimulation that they seek.

Table 7. Comparison of ImpSS groups and risk perceptions across the deployment.

<table>
<thead>
<tr>
<th>Risk perceptions</th>
<th>L-ImpSS Mean (SD)</th>
<th>H-ImpSS Mean (SD)</th>
<th>t</th>
<th>df</th>
<th>Sig. (p)</th>
<th>Effect size (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-deployment (T1)</td>
<td>2.55 (.56)</td>
<td>2.39 (.67)</td>
<td>4.29</td>
<td>1073</td>
<td>&lt;.001</td>
<td>0.13</td>
</tr>
<tr>
<td>During deployment (T2)</td>
<td>2.69 (.53)</td>
<td>2.60 (.59)</td>
<td>2.14</td>
<td>697</td>
<td>=.05</td>
<td>0.08</td>
</tr>
<tr>
<td>Post-deployment (T3)</td>
<td>2.69 (.51)</td>
<td>2.57 (.61)</td>
<td>2.39</td>
<td>384</td>
<td>=.01</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Figure 18. Visual comparison of ImpSS groups on operational risk perception.

Recall of risk perceptions

Further to the risk perception, it was decided to see if the recall of risk changed over time, therefore displaying a temporal bias. Figures 19 (L-ImpSS) and 20 (H-ImpSS) illustrate the same risk perceptions as shown in Figure 18, but with the addition of the recall of risk compared to previous estimates at the previous phase of deployment.
Table 8 presents the statistical comparisons between the data illustrated in Figures 19 and 20. The table shows that the H-ImpSS consistently and systematically perceive the risk of the operational deployment as lower than the L-ImpSS group, as well as the differences both within and between the ImpSS groups. Additionally, a repeated measures ANOVA (between participants) across the deployment (irrespective of ImpSS) shows consistent differences.
Table 8. Summary for deployment risk perceptions.

<table>
<thead>
<tr>
<th>Risk perception</th>
<th>Mean H-ImpSS</th>
<th>Mean L-ImpSS</th>
<th>t / F</th>
<th>df</th>
<th>Sig. (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Between ImpSS groups</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 - T2 recall</td>
<td>2.43 - 2.26</td>
<td>2.56 - 2.28</td>
<td>3.82</td>
<td>1,713</td>
<td>NS</td>
</tr>
<tr>
<td>T1 - T3 recall</td>
<td>2.38 - 2.29</td>
<td>2.54 - 2.28</td>
<td>2.07</td>
<td>1,423</td>
<td>NS</td>
</tr>
<tr>
<td>T2 - T3 recall</td>
<td>2.62 - 2.23</td>
<td>2.72 - 2.32</td>
<td>4.05</td>
<td>1,405</td>
<td>&lt;.05</td>
</tr>
<tr>
<td><strong>Within ImpSS group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 - T2 recall</td>
<td></td>
<td>2.43 - 2.27</td>
<td>2.56 - 2.28</td>
<td>6.84</td>
<td>364</td>
</tr>
<tr>
<td>T1 - T3 recall</td>
<td>2.39 - 2.29</td>
<td>2.54 - 2.27</td>
<td>5.21</td>
<td>226</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>T2 - T3 recall</td>
<td>2.62 - 2.23</td>
<td>2.72 - 2.32</td>
<td>6.39</td>
<td>210</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

NS - Not significant; n/a - not applicable
* paired t-tests; ** repeated measures ANOVA

Comparing military and civilian samples on ImpSS

In order to better understand the results of the ImpSS data presented thus far, and to establish if the military are naturally higher in ImpSS compared to the civilian population, a comparison of the present data was conducted with a suitable civilian paper. The data published in McDaniel and Zuckerman (2003) was chosen as a comparison for two reasons; firstly, mean and standard deviation scores were published, which enabled comparison tests to be conducted; and secondly, the McDaniel and Zuckerman (2003) data was divided into age groups and gender, which enabled comparison with the present study sample.

Figure 21 provides a visual comparison between the present data and the data published by McDaniel and Zuckerman (2003) according to gender and age groups. However, this does not provide a statistical comparison. Table 10 presents a statistical comparison between the current data and McDaniel and Zuckerman (2003) for both males and female groups on ImpSS.

Figure 21. Comparison of mean ImpSS by age groups (*denotes no female data for 35-44 age group).
Table 10. Comparing ImpSS among military and civilian samples.

<table>
<thead>
<tr>
<th></th>
<th>Present study</th>
<th>McDaniel &amp; Zuckerman (2003)</th>
<th>Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (sd) n=</td>
<td>Mean (sd) n=</td>
<td></td>
</tr>
<tr>
<td>overall male</td>
<td>11.32 (3.47) 1311</td>
<td>10.99 (3.87) 1144</td>
<td>$t(2453) = 4.26, p&lt;.01, r =0.09$</td>
</tr>
<tr>
<td>overall female</td>
<td>10.31 (3.76) 63</td>
<td>9.68 (4.16) 1825</td>
<td>$t(1886) = 2.41, p&lt;.01, r =0.06$</td>
</tr>
</tbody>
</table>

However, because the McDaniel and Zuckerman (2003) sample were much older than the present sample it was necessary to separate the data for each gender by age groups so a more robust comparison could be made. These are presented in Tables 11 and 12.

Table 11. Comparing ImpSS among male military and civilian samples.

<table>
<thead>
<tr>
<th></th>
<th>Present study</th>
<th>McDaniel &amp; Zuckerman (2003)</th>
<th>Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males Mean (sd) n=</td>
<td>Mean (sd) n=</td>
<td></td>
</tr>
<tr>
<td>18-24</td>
<td>12.33 (2.99) 730</td>
<td>10.68 (4.87) 47</td>
<td>$t(775) = 6.23, p&lt;.01, r =0.22$</td>
</tr>
<tr>
<td>25-34</td>
<td>10.31 (3.59) 430</td>
<td>9.87 (4.10) 77</td>
<td>$t(505) = 1.86, p&lt;.05, r =0.08$</td>
</tr>
<tr>
<td>35-44</td>
<td>9.28 (3.67) 129</td>
<td>8.38 (4.24) 81</td>
<td>$t(208) = 3.15, p&lt;.01, r =0.21$</td>
</tr>
</tbody>
</table>

Table 12. Comparing ImpSS among female military and civilian samples.

<table>
<thead>
<tr>
<th></th>
<th>Present study</th>
<th>McDaniel &amp; Zuckerman (2003)</th>
<th>Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Females Mean (sd) n=</td>
<td>Mean (sd) n=</td>
<td></td>
</tr>
<tr>
<td>18-24</td>
<td>11.61 (3.48) 33</td>
<td>10.18 (4.23) 64</td>
<td>$t(95) = 3.35, p&lt;.01, r =0.33$</td>
</tr>
<tr>
<td>25-34</td>
<td>8.76 (3.59) 29</td>
<td>7.50 (4.16) 85</td>
<td>$t(112) = 2.92, p&lt;.01, r =0.27$</td>
</tr>
<tr>
<td>35-44</td>
<td>no data no data</td>
<td>7.03 (3.85) 103</td>
<td></td>
</tr>
</tbody>
</table>

Furthermore, because differences have been found within the present military sample between the three different combat groups, and also differences across age groups, then age-related differences across the combat groups was also conducted in comparison with McDaniel and Zuckerman (2003). This was only conducted for the male samples because of the small and inappropriate sample sizes among the military females within these sub-groups. The findings of thee comparisons are presented in Tables 13, 14 and 15. The interpretation of these results, along with the entirety of the ImpSS data in this chapter, is conducted in the discussion chapter.
Table 13. Comparing ImpSS among 18-24 year old male military (combat groups) and civilian samples.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>Mean (sd)</td>
<td>n= 420</td>
</tr>
<tr>
<td>CA</td>
<td>12.59 (2.95)</td>
<td></td>
</tr>
<tr>
<td>CS</td>
<td>11.63 (2.99)</td>
<td>146</td>
</tr>
<tr>
<td>CSS</td>
<td>12.23 (3.05)</td>
<td>159</td>
</tr>
</tbody>
</table>

Table 14. Comparing ImpSS among 25-34 year old male military (combat groups) and civilian samples.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>Mean (sd)</td>
<td>n= 180</td>
</tr>
<tr>
<td>CA</td>
<td>11.07 (3.29)</td>
<td></td>
</tr>
<tr>
<td>CS</td>
<td>9.59 (3.97)</td>
<td>80</td>
</tr>
<tr>
<td>CSS</td>
<td>9.82 (3.59)</td>
<td>167</td>
</tr>
</tbody>
</table>

Table 15. Comparing ImpSS among 35-44 year old male military (combat groups) and civilian samples.

<table>
<thead>
<tr>
<th>35-44yr old Males by combat group</th>
<th>Present study</th>
<th>McDaniel &amp; Zuckerman (2003)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>Mean (sd)</td>
<td>n= 43</td>
</tr>
<tr>
<td>CA</td>
<td>9.79 (4.08)</td>
<td></td>
</tr>
<tr>
<td>CS</td>
<td>9.05 (3.53)</td>
<td>34</td>
</tr>
<tr>
<td>CSS</td>
<td>8.89 (3.31)</td>
<td>51</td>
</tr>
</tbody>
</table>
7.3 RESULTS III: Baseline Behaviour (ImpSS)

Table 16 illustrates the results of comparing the H-ImpSS versus L-ImpSS groups on measures of health behaviours at pre-deployment. The table shows that in all but one behaviour the H-ImpSS group were statistically more risky than the L-ImpSS group.

Table 16. Comparison of ImpSS groups on health behaviours at pre-deployment (T1).

<table>
<thead>
<tr>
<th>Health Behaviours (T1)</th>
<th>Mean (SD) H-ImpSS</th>
<th>Mean (SD) L-ImpSS</th>
<th>t</th>
<th>df</th>
<th>Sig. (p)</th>
<th>Effect size (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alcohol</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency of alcohol</td>
<td>3.16 (1.3)</td>
<td>2.73 (1.3)</td>
<td>-5.49</td>
<td>1050</td>
<td>&lt;.001</td>
<td>0.17</td>
</tr>
<tr>
<td>Amount of alcohol</td>
<td>3.97 (2.1)</td>
<td>3.02 (1.9)</td>
<td>-7.69</td>
<td>1035</td>
<td>&lt;.001</td>
<td>0.23</td>
</tr>
<tr>
<td>Frequency of HED (binge)</td>
<td>2.49 (.85)</td>
<td>2.08 (.96)</td>
<td>-7.17</td>
<td>1013</td>
<td>&lt;.001</td>
<td>0.22</td>
</tr>
<tr>
<td>Current perception of intake</td>
<td>.16 (1.0)</td>
<td>.01 (.86)</td>
<td>-2.59</td>
<td>1030</td>
<td>&lt;.01</td>
<td>0.08</td>
</tr>
<tr>
<td><strong>Smoking</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily smoking rate</td>
<td>13.16 (8.7)</td>
<td>11.27 (8.9)</td>
<td>-2.69</td>
<td>649</td>
<td>&lt;.01</td>
<td>0.11</td>
</tr>
<tr>
<td>Current perception of behaviour</td>
<td>.24 (.75)</td>
<td>.19 (.78)</td>
<td>-0.73</td>
<td>527</td>
<td>NS</td>
<td>0.03</td>
</tr>
<tr>
<td><strong>Driving</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed in built-up area</td>
<td>1.71 (.65)</td>
<td>1.47 (.58)</td>
<td>-5.87</td>
<td>931</td>
<td>&lt;.001</td>
<td>0.19</td>
</tr>
<tr>
<td>Speed on motorway</td>
<td>2.06 (.65)</td>
<td>1.79 (.65)</td>
<td>-6.96</td>
<td>925</td>
<td>&lt;.001</td>
<td>0.22</td>
</tr>
<tr>
<td>Seatbelt use in front as a passenger</td>
<td>0.83 (1.0)</td>
<td>0.33 (.75)</td>
<td>-5.47</td>
<td>1015</td>
<td>&lt;.001</td>
<td>0.17</td>
</tr>
<tr>
<td>Seatbelt use in the rear</td>
<td>1.43 (1.4)</td>
<td>1.07 (1.3)</td>
<td>-4.33</td>
<td>1069</td>
<td>&lt;.001</td>
<td>0.13</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age first intercourse</td>
<td>14.9 (1.7)</td>
<td>15.8 (2.3)</td>
<td>6.1</td>
<td>902</td>
<td>&lt;.001</td>
<td>0.20</td>
</tr>
<tr>
<td>Condom use (for single group only)</td>
<td>1.96 (1.2)</td>
<td>1.61 (1.2)</td>
<td>-2.64</td>
<td>377</td>
<td>&lt;.01</td>
<td>0.13</td>
</tr>
<tr>
<td>One night stands</td>
<td>1.53 (1.2)</td>
<td>.90 (1.0)</td>
<td>-10.41</td>
<td>1062</td>
<td>&lt;.001</td>
<td>0.31</td>
</tr>
<tr>
<td>Pay for sex</td>
<td>.30 (.74)</td>
<td>.22 (.63)</td>
<td>-3.76</td>
<td>1051</td>
<td>&lt;.001</td>
<td>0.12</td>
</tr>
<tr>
<td>Contracted an STI</td>
<td>.39 (.71)</td>
<td>.24 (.58)</td>
<td>-3.67</td>
<td>1043</td>
<td>&lt;.001</td>
<td>0.12</td>
</tr>
<tr>
<td>Current perception of behaviour</td>
<td>.57 (1.1)</td>
<td>.32 (1.0)</td>
<td>-3.95</td>
<td>1051</td>
<td>&lt;.001</td>
<td>0.12</td>
</tr>
<tr>
<td>Amount of sex in last 2 months</td>
<td>22.3 (24.8)</td>
<td>16.9 (20.4)</td>
<td>-2.26</td>
<td>877</td>
<td>.05</td>
<td>0.08</td>
</tr>
</tbody>
</table>

Table 16 clearly shows that the H-ImpSS group engage in more risk-taking regarding these health behaviour items. That is to say, they tend to drive faster, wear seatbelts less, drink alcohol in larger quantities, more often and tend to binge more often. They also engage more in risky sexual behaviour, and finally, tend to smoke and smoke more on a daily basis. Additionally, they also perceived that as they neared being deployed they thought they drank more alcohol, smoked more and have more sex than the L-ImpSS group. These findings are consistent with differences between low and high sensation seeking groups on health behaviours found in the published literature.

31 Perception of smoking behaviour at T1.
ImpSS and smoking
Further to the finding in Table 16 that H-ImpSS tend to smoke more on a daily basis compared to L-ImpSS, a one-way ANOVA (between participants) showed that ImpSS differed across smoking categories \(F(2, 1363) = 16.29, p<.001, r = .15\), with the current smoker group \((M = 11.8, SD = 3.4)\) being statistically higher in ImpSS than both the ex-smoker \((\bar{X} = 10.4, SD = 3.6)\) and non-smoker \((\bar{X} = 10.9, SD = 3.5)\) categories. However, there was no difference between non-smokers and ex-smokers.

An independent samples t-test between heavy smokers (>20 cigarettes per day) and non-heavy smokers showed that there were no significant differences at T1, although the one-tailed hypothesis that heavy smokers would be higher in ImpSS was bordering on statistical significance \(t(813) = -1.62, p = .052, r = .06\). Similar tests for T2 and T3 showed no statistical differences on ImpSS taken at T1.

Furthermore, in response to Zuckerman’s assertion that ‘it is becoming increasingly difficult to find any LSS male smokers’ (1994, p.227), it was found that there were \(n = 288\) male H-ImpSS smokers (which constituted 53.8% of the H-ImpSS group) compared to \(n = 208\) male L-ImpSS smokers (which constituted 40.4% of the L-ImpSS group). This suggests that in an army military sample it is still possible to find LSS male smokers for research purposes; although this might still be an issue in navy and air force populations, where smoking rates are much lower and mirror civilian smoking rates.

ImpSS and alcohol
Table 16 illustrates that the H-ImpSS group engaged in more risky alcohol consumption than L-ImpSS on all three items of the AUDIT-C, as well as the perception that they had increased their alcohol consumption more than the L-ImpSS as they neared being deployed.

In terms of changes in alcohol intake for the ImpSS groups across the deployment, Table 15 illustrates such changes for pre- (T1) and post-deployment (T3). After a series of paired t-tests it can be seen there was a tendency to drink the same or less at T3, with the only (non-significant) increase seen by L-ImpSS at T3 for frequency of alcohol.
Table 17. Paired t-tests for pre- and post-deployment alcohol consumption by ImpSS group.

<table>
<thead>
<tr>
<th>Alcohol consumption (T1-T3)</th>
<th>Direction of behaviour</th>
<th>T1 Mean (SD)</th>
<th>T3 Mean (SD)</th>
<th>t</th>
<th>df</th>
<th>Sig. (p)</th>
<th>Effect size (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of alcohol</td>
<td>no diff</td>
<td>3.65 (1.22)</td>
<td>3.00 (1.29)</td>
<td>0.88</td>
<td>501</td>
<td>NS</td>
<td>0.04</td>
</tr>
<tr>
<td>L-ImpSS</td>
<td>More at T3</td>
<td>2.91 (1.23)</td>
<td>2.99 (1.29)</td>
<td>-1.01</td>
<td>202</td>
<td>NS</td>
<td>0.07</td>
</tr>
<tr>
<td>H-ImpSS</td>
<td>Less at T3</td>
<td>3.31 (1.21)</td>
<td>3.05 (1.29)</td>
<td>2.59</td>
<td>191</td>
<td>&lt;.01</td>
<td>0.18</td>
</tr>
<tr>
<td>Amount of alcohol</td>
<td>Overall sample</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Less at T3</td>
<td>3.69 (1.09)</td>
<td>3.22 (2.03)</td>
<td>4.107</td>
<td>498</td>
<td>&lt;.001</td>
<td>0.18</td>
</tr>
<tr>
<td>L-ImpSS</td>
<td>Use improved at T3</td>
<td>3.08 (1.04)</td>
<td>2.64 (1.80)</td>
<td>3.2</td>
<td>201</td>
<td>&lt;.01</td>
<td>0.22</td>
</tr>
<tr>
<td>H-ImpSS</td>
<td>Use improved at T3</td>
<td>4.19 (2.02)</td>
<td>3.09 (2.09)</td>
<td>3.14</td>
<td>190</td>
<td>&lt;.01</td>
<td>0.22</td>
</tr>
<tr>
<td>Frequency of heavy drinking (binge)</td>
<td>Overall sample</td>
<td>no diff</td>
<td>2.33 (.89)</td>
<td>2.31 (.92)</td>
<td>0.34</td>
<td>498</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>L-ImpSS Use improved at T3</td>
<td>.28 (.81)</td>
<td>.26 (.79)</td>
<td>0.73</td>
<td>217</td>
<td>NS</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>H-ImpSS Use improved at T3</td>
<td>.67 (1.07)</td>
<td>.57 (1.07)</td>
<td>1.26</td>
<td>192</td>
<td>NS</td>
<td>0.09</td>
</tr>
<tr>
<td></td>
<td>H-ImpSS Less at T3</td>
<td>2.56 (.820)</td>
<td>2.45 (.66)</td>
<td>1.99</td>
<td>190</td>
<td>&lt;.05</td>
<td>0.14</td>
</tr>
</tbody>
</table>

ImpSS and driving

Table 17 illustrates that the H-ImpSS group engaged in more risky driving behaviour than the L-ImpSS by driving faster in both motorway and built-up (urban) environments, and they also tended to wear seatbelts less when riding as a passenger in both the front and rear of a vehicle.

In terms of changes in driving behaviour for the ImpSS groups across the deployment, Table 18 illustrates such changes for pre- (T1) and post-deployment (T3). After a series of paired t-tests it can be seen that despite a set of mixed trends in both directions only post-deployment seatbelt use in the rear improved for both ImpSS groups, and driving speed on motorways reduced only for H-ImpSS.

Table 18. Paired t-tests for pre- and post-deployment driving behaviour by ImpSS group.

<table>
<thead>
<tr>
<th>Driving behaviour (T1-T3)</th>
<th>Direction of behaviour</th>
<th>T1 Mean (SD)</th>
<th>T3 Mean (SD)</th>
<th>t</th>
<th>df</th>
<th>Sig. (p)</th>
<th>Effect size (r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seatbelt use front (passenger)</td>
<td>no difference</td>
<td>.45 (.92)</td>
<td>.41 (.95)</td>
<td>0.64</td>
<td>517</td>
<td>NS</td>
<td>0.04</td>
</tr>
<tr>
<td>L-ImpSS Use improved at T3</td>
<td>.20 (.81)</td>
<td>.26 (.76)</td>
<td>0.73</td>
<td>217</td>
<td>NS</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>H-ImpSS Use improved at T3</td>
<td>.67 (1.07)</td>
<td>.57 (1.07)</td>
<td>1.26</td>
<td>192</td>
<td>NS</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>Seatbelt use rear (passenger)</td>
<td>Use improved at T3</td>
<td>1.31 (1.46)</td>
<td>1.07 (1.4)</td>
<td>4.17</td>
<td>518</td>
<td>&lt;.001</td>
<td>0.18</td>
</tr>
<tr>
<td>L-ImpSS Use improved at T3</td>
<td>1.08 (1.38)</td>
<td>.87 (1.37)</td>
<td>2.57</td>
<td>217</td>
<td>&lt;.01</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td>H-ImpSS Use improved at T3</td>
<td>1.63 (1.61)</td>
<td>1.19 (1.46)</td>
<td>3.05</td>
<td>191</td>
<td>&lt;.01</td>
<td>0.22</td>
<td></td>
</tr>
<tr>
<td>Speed on motorway</td>
<td>Overall sample</td>
<td>1.92 (.88)</td>
<td>1.84 (.97)</td>
<td>2.35</td>
<td>436</td>
<td>&lt;.05</td>
<td>0.11</td>
</tr>
<tr>
<td>L-ImpSS Speed reduced at T3</td>
<td>1.75 (.64)</td>
<td>1.60 (.62)</td>
<td>1.07</td>
<td>188</td>
<td>NS</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>H-ImpSS Speed reduced at T3</td>
<td>2.14 (.64)</td>
<td>2.03 (.69)</td>
<td>2.01</td>
<td>158</td>
<td>&lt;.05</td>
<td>0.16</td>
<td></td>
</tr>
<tr>
<td>Speed in built-up area (urban)</td>
<td>Overall sample</td>
<td>1.55 (.88)</td>
<td>1.55 (.83)</td>
<td>-0.07</td>
<td>443</td>
<td>NS</td>
<td>0.02</td>
</tr>
<tr>
<td>L-ImpSS Speed increased at T3</td>
<td>1.38 (.56)</td>
<td>1.40 (.87)</td>
<td>-0.02</td>
<td>192</td>
<td>NS</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>H-ImpSS Speed reduced at T3</td>
<td>1.74 (7.1)</td>
<td>1.73 (.96)</td>
<td>0.21</td>
<td>161</td>
<td>NS</td>
<td>0.02</td>
<td></td>
</tr>
</tbody>
</table>
ImpSS and sexual activity

Table 16 illustrates that the H-ImpSS group engaged in more risky sexual behaviour than the L-ImpSS in terms of age of first sex, condom use\(^{32}\), one night stands, paying for sex, contracting STIs, current perception of sexual activity and amount of sex in the last two months.

Relationship between ImpSS and risky health behaviours

Table 19 illustrates the correlations between ImpSS and the items on each risky health behaviour taken at pre-deployment. Footnote #32 points out that the group who were single and not in a relationship were deemed the group of most interest as they tend to display higher levels of sexual risk-taking behaviour, therefore this group is represented in the sexual health behaviours below, whereas for the other health behaviours (alcohol, smoking, driving) the entire sample is used.

Table 19. Correlations between ImpSS and T1 health behaviour items.

<table>
<thead>
<tr>
<th></th>
<th>ImpSS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alcohol</strong></td>
<td></td>
</tr>
<tr>
<td>Frequency of alcohol</td>
<td>.19***</td>
</tr>
<tr>
<td>Amount of alcohol</td>
<td>.21***</td>
</tr>
<tr>
<td>Frequency of HED</td>
<td>.21***</td>
</tr>
<tr>
<td><strong>Smoking</strong></td>
<td></td>
</tr>
<tr>
<td>Daily smoking rate</td>
<td>.09*</td>
</tr>
<tr>
<td><strong>Driving</strong></td>
<td></td>
</tr>
<tr>
<td>Seatbelt use (front)</td>
<td>.17***</td>
</tr>
<tr>
<td>Seatbelt use (rear)</td>
<td>.13***</td>
</tr>
<tr>
<td>Speeding (urban)</td>
<td>.17***</td>
</tr>
<tr>
<td>Speeding (motorway)</td>
<td>.19***</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
</tr>
<tr>
<td>Age first sex</td>
<td>-.22***</td>
</tr>
<tr>
<td>Condom use</td>
<td>.15***</td>
</tr>
<tr>
<td>One night stand</td>
<td>.24***</td>
</tr>
<tr>
<td>Pay for sex</td>
<td>.03</td>
</tr>
<tr>
<td>STI</td>
<td>.12*</td>
</tr>
</tbody>
</table>

*\(p<.05; \text{***}p<.001\).

\(^{32}\) Condom use for the “Single (not in a relationship)” group as they are the most high-risk group and condom use is not confounded by other relationship groups where condom use is required less or no longer used (e.g. married, living with partner, in a long-term relationship).
7.4 RESULTS IV: Changes in Behaviour over Time (ImpSS)

This section covers the changes in health behaviours across the phases of deployment between the H-ImpSS and L-ImpSS groups. A range of mixed ANOVAs (2x2 and 2x3) were conducted and are reported.

**Alcohol consumption**

**Amount of alcohol**
A mixed ANOVA (2x2) was conducted. The tests of within-subject effects showed that there was a significant effect for amount of alcohol across time ($F(1, 391) = 20.09, p<.001$), although there was no significant interaction between the amount of alcohol and ImpSS. Therefore, the amount of alcohol reduced at post-deployment compared to pre-deployment, and that rate of reduction was similar for both ImpSS groups. The tests of between-subject effects found that there was a significant effect of ImpSS ($F(1, 391) = 42.43, p<.001$), indicating that the H-ImpSS group consumed more alcohol at both pre- and post-deployment than the L-ImpSS group.

**Frequency of alcohol**
A mixed ANOVA (2x2) was conducted. The tests of within-subject effects showed that there was no significant effect for the frequency of alcohol. This suggests that there was no change in the frequency of alcohol consumption across time. However, there was a significant interaction between the frequency of alcohol and ImpSS ($F(1, 393) = 2.13, p<.01$), showing that the H-ImpSS group reduced their frequency at post-deployment, whereas the L-ImpSS group increased their frequency of drinking at post-deployment; however, for both ImpSS groups these changes in frequency were at non-significant levels.

The tests of between-subject effects found that there was a significant effect of ImpSS ($F(1, 393) = 4.70, p<.05$), indicating that the frequency of alcohol between the H-ImpSS and L-ImpSS groups were different, with the H-ImpSS group consuming alcohol more frequently at both pre- and post-deployment. Although the amount consumed by the H-ImpSS group reduced at post-deployment ($\bar{X} = 3.05, SD = 1.27$) this level was still higher than the increase by L-ImpSS at post-deployment ($\bar{X} = 2.99, SD = 1.28$).
**Frequency of HED**
A mixed ANOVA (2x2) was conducted. The tests of within-subject effects showed that there was no significant effect for the frequency of HED and no significant interaction between HED and ImpSS; this suggests that there was no change in HED behaviour across time for both ImpSS groups. The tests of between-subject effects found that there was a significant effect of ImpSS ($F(1, 390) = 21.78, p<.001$), indicating that the frequency of HED between the H-ImpSS and L-ImpSS groups were different, with the H-ImpSS group consuming higher amounts of alcohol during a single drinking session at both pre- and post-deployment.

**Smoking behaviour**
A mixed ANOVA (2x3) was conducted. The tests of within-subject effects showed that there was a significant effect for daily smoking rate ($F(1.70, 352.59) = 28.07, p<.001$), although there was no significant interaction between daily smoking rate and ImpSS. This suggests that there was a change in daily smoking rate across time for both ImpSS groups. Subsequently, the tests of within-subject contrasts found differences across daily smoking rate between T1-T2 ($F(1, 207) = 29.20, p<.001$), T2-T3 ($F(1, 207) = 38.58, p<.001$) and T1-T3 ($F(1, 226) = 5.07, p<.05$), but there was no significant interaction between the PWB and ImpSS contrasts. These findings suggest that daily smoking rate increased at mid-deployment (compared to pre-deployment), and then reduced at post-deployment, to levels that were below both mid- and pre-deployment. The direction of these changes was similar for both ImpSS groups.

The tests of between-subject effects found that there was not a significant effect of ImpSS, indicating that rating of daily smoking rate between the H-ImpSS and L-ImpSS groups were similar.

**Driving behaviour**

**Seatbelt use (front)**
A mixed ANOVA (2x2) was conducted. The tests of within-subject effects showed that there was no significant effect for front seatbelt use and no significant interaction

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33 Reporting the Greenhouse-Geisser statistic as the Mauchly’s test of Sphericity was significant ($p<.001$) and the Greenhouse-Geisser Epsilon was .85.
between seatbelt use in the front and ImpSS. This suggests that there was no change
in front seatbelt use for both ImpSS groups across time.

The tests of between-subject effects found that there was a significant effect of
ImpSS \((F(1, 409) = 20.60, p<.001)\), indicating that the front seatbelt use between the
H-ImpSS and L-ImpSS groups were different, with the H-ImpSS group wearing front
seatbelts less at both pre- and post-deployment.

**Seatbelt use (rear)**

A mixed ANOVA (2x2) was conducted. The tests of within-subject effects showed
that there was a significant effect for rear seatbelt use across time \((F(1, 408) = 16.30, p<.001)\), although there was no significant interaction between rear seatbelt use and
ImpSS. This suggests that for both ImpSS groups, there was an improvement in rear
seatbelt use at post-deployment (i.e., an increased compliance to wear rear seatbelts
more).

The tests of between-subject effects found that there was a significant effect of
ImpSS \((F(1, 408) = 9.66, p<.01)\), indicating that rating of rear seatbelt use between
the H-ImpSS and L-ImpSS groups were different, with the H-ImpSS group wearing
rear seatbelts less at both pre- and post-deployment compared to the L-ImpSS group.

**Speeding (urban)**

A mixed ANOVA (2x2) was conducted. The tests of within-subject effects showed
that there was no significant effect for speeding in urban environments and no
significant interaction between this tendency to speed and ImpSS. This suggests that
there was no change in urban speeding behaviour for both ImpSS groups across time.
However, a comparison of the mean scores across time for both ImpSS groups
indicated that the L-ImpSS group tended to increase their speeding behaviour,
whereas the H-ImpSS group reduced their speeding behaviour, but these differences
were not significant \((F(1, 353) = .29, p=.59, ns)\).

The tests of between-subject effects found that there was a significant effect of
ImpSS \((F(1, 353) = 37.29, p<.001)\), indicating that the tendency to speed in urban
areas between the H-ImpSS and L-ImpSS groups were different, with the H-ImpSS
group tending to drive faster at both pre- and post-deployment compared to the L-
ImpSS group.
**Speeding (motorway)**

A mixed ANOVA (2x2) was conducted. The tests of within-subject effects showed that there was a significant effect for motorway speeding ($F(1, 346) = 5.13, p<.05$), although there was no significant interaction between motorway speed and ImpSS. This suggests that for both ImpSS groups there was an improvement (i.e., slowing down) in motorway speed at post-deployment.

The tests of between subject effects found that there was a significant effect of ImpSS ($F(1, 346) = 38.87, p<.001$), indicating that the H-ImpSS group drove faster on motorways compared to the L-ImpSS group at both pre- and post-deployment.

**Risk perceptions**

A mixed ANOVA (2x3) was conducted. The tests of within-subject effects showed that there was a significant effect for risk perception across time ($F(1.95, 801.55) = 22.59, p<.001$), although there was no significant interaction between risk perception and ImpSS.

Subsequent tests of within-subject contrasts found mixed results, with differences in risk perceptions were found between T1-T2 ($F(1, 412) = 36.67, p<.001$) and between T1-T3 ($F(1, 423) = 25.58, p<.001$), but no differences emerged between T2-T3 ($F(1, 412) = 14.48, p<.001$). Also, there was no significant interaction between the risk perception and ImpSS contrasts. These results suggest that for both ImpSS groups their perception of risk increased at mid-deployment (compared to pre-deployment) and was higher at post-deployment compared to pre-deployment, but there was no difference between mid-deployment and post-deployment. This may suggest that actual experiences on the deployment changed the perception of risk, and that this perception was maintained after the deployment.

The tests of between-subject effects found that there was a significant effect of ImpSS ($F(1, 412) = 9.09, p=.003$), indicating that the H-ImpSS group perceived operational risk as lower when compared to the L-ImpSS group at pre-, mid- and post-deployment.

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34 Reporting the Greenhouse-Geisser statistic as the Mauchly's test of Sphericity was significant ($p<.01$) and the Greenhouse-Geisser Epsilon was .97.
7.5 RESULTS V: Baseline Behaviour (overall sample)

The following section provides the baseline prevalence rates for the risky health behaviours (alcohol, smoking, driving, sex), psychological well-being (PWB) and self-perception of health (SPH) captured at pre-deployment (T1). These data refer to the overall sample of deploying army personnel, and are not specific to the ImpSS groups, whose data was reported in Section 7.3.

**Alcohol behaviour**

Ninety-five per cent (95%) of respondents at T1 said that they drink alcohol. 4.6% 'never' drink in terms of frequency or binge drinking, which reflects the 5% who stated that they did not drink alcohol. Table 20 illustrates the mean, mode and median values for baseline alcohol consumption.

Table 20. Baseline alcohol consumption.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Mode</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency</strong></td>
<td>2-4 times per month</td>
<td>2-4 times per month</td>
<td>2 times per week</td>
</tr>
<tr>
<td><strong>Amount</strong></td>
<td>7-9 units</td>
<td>10-14 units</td>
<td>10-14 units</td>
</tr>
<tr>
<td><strong>Freq. of Binge</strong></td>
<td>Monthly</td>
<td>Weekly</td>
<td>Monthly</td>
</tr>
</tbody>
</table>

The recommended upper level for weekly unit consumption is 21 units for males and 14 units for females. Further analysis shows that 19.7% of the overall sample drank >20 units on a typical day when they were drinking. 14% of males drank >20 units, and 17% of females consumed >15 units on a typical day when drinking. The mean, mode and median values have been reported in order to provide the range of alcohol consumption.

**Smoking behaviour**

At T1, 47% categorised themselves as current smokers, 41.9% as non-smokers, and 11.1% as ex-smokers. In terms of gender, 47.5% of males (N = 620) stated they were current smokers, whereas 35.5% of females (N = 22) considered themselves current smokers. Among the overall sample, 69.6% stated that they smoked before joining the army. Among the current smokers only, 79.2% stated that they smoked before joining
the army. The mean (standard deviation) figures for daily smoking rate were 12.4 (8.8) for the overall sample, and 15.6 (7.0) for current smokers.

Figure 22 illustrates the distribution of smoking category for the individual army units. Further analysis suggests that the frequency for current smokers is highest among the CA (51.8%), then 44.4% for CS units and 40.7% for CSS units. In addition, Table 21 illustrates the frequency of smoking status by age groups.

![Smoking rates by unit](image)

**Figure 22. Smoking categories by army unit.**

**Table 21. Frequency (%) of smoking status by age groups.**

<table>
<thead>
<tr>
<th>Age group</th>
<th>N</th>
<th>Current smoker</th>
<th>Non-smoker</th>
<th>Ex-Smoker</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-24</td>
<td>759</td>
<td>51.3</td>
<td>41.8</td>
<td>7.0</td>
</tr>
<tr>
<td>25-34</td>
<td>455</td>
<td>41.1</td>
<td>44.7</td>
<td>13.8</td>
</tr>
<tr>
<td>35-44</td>
<td>129</td>
<td>43.4</td>
<td>34.9</td>
<td>21.7</td>
</tr>
</tbody>
</table>

**Driving behaviour**

At T1, 85.3% stated that they had a driving licence and current driving experience.

**Seatbelt use**

Table 22 presents the T1 baseline data on seat belt use in both the front and rear of a vehicle when riding as a passenger.
Table 22. Baseline frequencies (%) for seatbelt use.

<table>
<thead>
<tr>
<th>Pre-deployment (T1)</th>
<th>Seatbelt use as a passenger</th>
<th>Front of vehicle</th>
<th>Rear of vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always</td>
<td>79.7</td>
<td>55.6</td>
<td></td>
</tr>
<tr>
<td>Nearly always</td>
<td>8.0</td>
<td>13.4</td>
<td></td>
</tr>
<tr>
<td>Sometimes</td>
<td>7.0</td>
<td>12.8</td>
<td></td>
</tr>
<tr>
<td>Seldom</td>
<td>2.1</td>
<td>5.2</td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>3.2</td>
<td>13.0</td>
<td></td>
</tr>
</tbody>
</table>

**Speeding**

Table 23 presents the T1 baseline data on speeding behaviour in both built-up (urban) and motorway environments.

Table 23. Baseline percentages for speeding behaviour.

<table>
<thead>
<tr>
<th>Pre-deployment (T1)</th>
<th>Motorway (M)</th>
<th>Urban (U)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below the limit, or within 5mph (U) or 10mph (M)</td>
<td>26</td>
<td>48.7</td>
</tr>
<tr>
<td>6-10mph (U) or 11-20mph (M) above the limit</td>
<td>54.3</td>
<td>43.5</td>
</tr>
<tr>
<td>More than 20mph (U) or 20mph (M) above the limit</td>
<td>19.7</td>
<td>7.8</td>
</tr>
</tbody>
</table>

Table 24 presents comparative data for speeding behaviour and seatbelt use between the present study and the findings by Fear et al. (2008), who collected epidemiological data during the longitudinal Iraq War study on UK armed forces personnel.

Table 24. Comparison between present study and previous UK research.

<table>
<thead>
<tr>
<th></th>
<th>Present study (N =1374)</th>
<th>Fear et al. (2008) (N =1504)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speeding above 20mph on Motorway</td>
<td>19.6%</td>
<td>14%</td>
</tr>
<tr>
<td>Speeding above 10mph in built-up area</td>
<td>7.9%</td>
<td>5%</td>
</tr>
<tr>
<td>Seatbelt use (sometimes, seldom, never)</td>
<td>13%</td>
<td>6%</td>
</tr>
</tbody>
</table>

**Sex**

The mean (SD) for age of first sex among the sample (N = 1288) was 15.4yrs (2.0). In terms of gender-related differences, the mean age for males was 15.3yrs (1.9) and for females was 16.5yrs (2.0). Table 25 below shows the frequency (%) of sexual activity behaviours for the entire sample, irrespective of relationship group.
Table 25. Baseline percentages for risky sexual health behaviours.

<table>
<thead>
<tr>
<th>Risky sexual activity</th>
<th>Percentage (N=) of risky sexual activity</th>
<th>Most of the time</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condom use</td>
<td></td>
<td>10.6 (142)</td>
<td>15.9 (212)</td>
<td>19.0 (254)</td>
<td>22.0 (294)</td>
</tr>
<tr>
<td>One night stands</td>
<td></td>
<td>3.1 (41)</td>
<td>14.0 (188)</td>
<td>21.0 (281)</td>
<td>21.5 (288)</td>
</tr>
<tr>
<td>Paying for sex</td>
<td></td>
<td>0.6 (8)</td>
<td>1.6 (21)</td>
<td>5.4 (72)</td>
<td>11.9 (169)</td>
</tr>
<tr>
<td>Contracting a STI</td>
<td></td>
<td>0.4 (6)</td>
<td>0.5 (7)</td>
<td>6.4 (88)</td>
<td>15.0 (201)</td>
</tr>
</tbody>
</table>

The sample was split into two groups: (1) the ‘single (not in a relationship)’ group, and all other relationship groups (not-single group). This was conducted for two reasons; firstly, it was assumed that the ‘single’ group were considered to the primary ‘at risk’ group for risky sexual activity, and secondly, the differences between these two groups would highlight differences of interest. Table 26 illustrates the frequencies (%) for the risky sexual behaviours of the single group at pre-deployment.

Table 26. Baseline percentages for risky sexual behaviour for the ‘single’ group.

<table>
<thead>
<tr>
<th>Risky sexual activity</th>
<th>Percentage (N=) of risky sexual activity</th>
<th>Most of the time</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condom use</td>
<td></td>
<td>16.9 (80)</td>
<td>26.0 (123)</td>
<td>26.6 (126)</td>
<td>20.7 (98)</td>
</tr>
<tr>
<td>One night stands</td>
<td></td>
<td>6.5 (31)</td>
<td>26.9 (138)</td>
<td>32.3 (154)</td>
<td>22.6 (108)</td>
</tr>
<tr>
<td>Paying for sex</td>
<td></td>
<td>0.8 (4)</td>
<td>2.3 (11)</td>
<td>9.9 (47)</td>
<td>18.1 (88)</td>
</tr>
<tr>
<td>Contracting a STI</td>
<td></td>
<td>0.8 (4)</td>
<td>0.6 (3)</td>
<td>6.1 (29)</td>
<td>16.1 (77)</td>
</tr>
</tbody>
</table>

Comparisons between the two groups highlight some interesting differences. An independent t-test shows a significant difference, with the not-single group being older ($\bar{x} = 26.7$yrs (6.5)) than the single group ($\bar{x} = 22.3$yrs (4.1)) ($t(1326) = 15.32, p<.001, r = .39$). An ANCOVA (controlling for age) comparing age at first intercourse showed a younger mean age for the not-single group ($\bar{x} = 15.35$yrs (2.0)) compared to the single group ($\bar{x} = 15.38$yrs (2.0)) ($F(2, 1265) = 14.51, p<.05, r = .15$).
Table 27 illustrates the findings from a series of ANCOVAs (controlling for age) or independent t-tests (if age was not a significant covariate) between the two relationship groups.

Table 27. Comparisons between relations group on measures of risky sexual behaviour.

<table>
<thead>
<tr>
<th></th>
<th>Mean (SD)</th>
<th>t/F</th>
<th>df</th>
<th>p</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Condom use</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Group</td>
<td>1.8 (1.2)</td>
<td>14.91</td>
<td>1315</td>
<td>&lt;.001</td>
<td>0.38</td>
</tr>
<tr>
<td>Not-single group</td>
<td>2.9 (1.3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>One night stands</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Group</td>
<td>1.9 (1.1)</td>
<td>254.63</td>
<td>2, 1316</td>
<td>&lt;.001</td>
<td>0.38</td>
</tr>
<tr>
<td>Not-single group</td>
<td>1.2 (1.2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Paying for sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Group</td>
<td>0.48 (0.8)</td>
<td>-6.57</td>
<td>747</td>
<td>&lt;.001</td>
<td>0.23</td>
</tr>
<tr>
<td>Not-single group</td>
<td>0.19 (0.6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>STI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Group</td>
<td>0.34 (0.7)</td>
<td>-.91</td>
<td>1318</td>
<td>NS</td>
<td>0.03</td>
</tr>
<tr>
<td>Not-single group</td>
<td>0.30 (0.6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* t-test used if age was not significant if controlled for by ANCOVA

NS = not significant

The results from Table 27 show that condom use was lower in the not-single group. The interpretation of this was that this group probably do not see the need to use condoms as much because they are in more stable relationships (e.g. married, living with partner, in long-term relationship); additionally, the use of female contraception (in conjunction or in place of condoms) is also probable within these relationships.

The single group were significantly more risky in their behaviours of paying for sex and one night stands, but not for contraction of STIs. A bivariate correlation among the single group for condom use and STI show a weak but significant correlation ($r = .16, p<.001$). The findings in Table 27, in conjunction with frequencies found in Table 26, suggest that the single group are still the primary at risk group, however, it also highlights the need to consider other relationship groups, and not to assume that their relationship status precludes engagement in risky sexual activity.

When asked if they had been having sex lately, 91.3% ($N =1212$) of the sample said 'yes', whilst 8.7% ($N =115$) said ‘no’. Table 28, illustrates the self-reported amount of sexual activity among those reporting yes.
Table 28. Self-reported amount of sex among those with recent sexual activity ($N=1211$).

<table>
<thead>
<tr>
<th></th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Much less</td>
<td>4.0</td>
</tr>
<tr>
<td>Slightly less</td>
<td>6.1</td>
</tr>
<tr>
<td>About the same</td>
<td>48.2</td>
</tr>
<tr>
<td>Slightly more</td>
<td>22.0</td>
</tr>
<tr>
<td>Much more</td>
<td>21.8</td>
</tr>
</tbody>
</table>

Relationship between risky health behaviours

Table 29 presents a correlation matrix between all the items asked of the four risky health behaviours.

Table 29. Correlation matrix between the four risky health behaviours.

<table>
<thead>
<tr>
<th></th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>SM1</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>SE1</th>
<th>SE2</th>
<th>SE3</th>
<th>SE4</th>
<th>SE5</th>
<th>SE6</th>
<th>SE7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A1) Frequency of alcohol</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A2) Amount of alcohol</td>
<td>.26***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A3) Frequency of HED</td>
<td>.65***</td>
<td>.48***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SM1) Daily smoking rate</td>
<td>.15***</td>
<td>.17***</td>
<td>.14***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driving</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(D1) Seatbelt use front</td>
<td>.15***</td>
<td>.14***</td>
<td>.11***</td>
<td>.12***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(D2) Seatbelt use rear</td>
<td>.13***</td>
<td>.14***</td>
<td>.15***</td>
<td>.07***</td>
<td>.12***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(D3) Speeding urban</td>
<td>.18***</td>
<td>.17***</td>
<td>.13***</td>
<td>.05***</td>
<td>.22***</td>
<td>.39**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(D4) Speeding out of way</td>
<td>.16***</td>
<td>.19***</td>
<td>.14***</td>
<td>.13***</td>
<td>.23***</td>
<td>.49**</td>
<td>.47**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SE1) Age first sex</td>
<td>.09***</td>
<td>.18***</td>
<td>.16***</td>
<td>.18***</td>
<td>.12***</td>
<td>.11***</td>
<td>.07***</td>
<td>.07***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SE2) Condom use</td>
<td>.05***</td>
<td>.03***</td>
<td>.02***</td>
<td>.06***</td>
<td>.10***</td>
<td>.14***</td>
<td>.09***</td>
<td>.02***</td>
<td>.04***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SE3) One night stand</td>
<td>.21***</td>
<td>.20***</td>
<td>.20***</td>
<td>.08***</td>
<td>.07***</td>
<td>.05***</td>
<td>.10***</td>
<td>.19***</td>
<td>.39***</td>
<td>.29***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SE4) Pay for sex</td>
<td>.18***</td>
<td>.20***</td>
<td>.20***</td>
<td>.07***</td>
<td>.08***</td>
<td>.11***</td>
<td>.14***</td>
<td>.19***</td>
<td>.39***</td>
<td>.26***</td>
<td>.23***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SE5) STI</td>
<td>.07***</td>
<td>.03***</td>
<td>.09***</td>
<td>.09***</td>
<td>.07***</td>
<td>.08***</td>
<td>.14***</td>
<td>.17***</td>
<td>.18***</td>
<td>.09***</td>
<td>.20***</td>
<td>.28***</td>
<td>-</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<.05; **p<.01; ***p<.001.

Psychological well-being (PWB)

The mean (standard deviation) score for PWB as scored by the GHQ-12 was 10.4 (4.9). In terms of PWB categories: 82.6% were within the ‘normal’ range, 13.4% were ‘distressed’ and 4.1% were ‘severe’. This suggests that prior to a deployment not all military personnel are optimised in terms of their PWB. The various reasons for this will be discussed further in the discussion chapter.
7.6 RESULTS VI: Changes in Behaviour over Time (overall sample)

The following section presents the changes in health behaviours (alcohol, smoking and driving), PWB and risk perceptions across the deployment phases, i.e., trend analysis. These data refer to the overall sample of army personnel who deployed, and are not specific to the ImpSS groups, whose data was reported in section 7.4.

Alcohol

Table 30 illustrates the changes in drinking status across the phases of the deployment. The change between T1 and T2 indicates a reduction of 23.5% among those who considered themselves current drinkers. This is attributed to participants' temporal perception of their drinking levels in-theatre at T2, whereby the majority of the sample were not allowed access to alcohol whilst deployed (i.e., an organisational sanction), and may have therefore considered themselves as non-drinkers at T2. Furthermore, at the mid-deployment stage, 91.3% of participants stated that they were drinking less compared to pre-deployment. This temporal shift is supported by the T3 data, which shows that drinking status rose again at post-deployment, back to similar pre-deployment levels.

Table 30. Changes in drinking status across the phases of deployment.

<table>
<thead>
<tr>
<th>Frequency (%) of drinking status</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>95.5</td>
<td>72</td>
<td>94</td>
</tr>
<tr>
<td>No</td>
<td>4.4</td>
<td>28</td>
<td>6</td>
</tr>
</tbody>
</table>

Paired t-test analysis conducted on the alcohol consumption items found that there were no significant differences between T1 and T3 on two out of the three items taken from the AUDIT-C (i.e., HED and frequency of drinking in terms of weeks/month). Only one item was significantly different \((t(498) = 3.98, p<.001, r =.18)\) and this related to the amount of alcohol consumed on a typical day when the participants did drink, and which found that the amount of alcohol reduced at post-deployment. These findings, i.e., no change and a reduction, are contrary to expected changes whereby previous cross-sectional and epidemiological studies have reported the association between being deployed and alcohol consumption (e.g. Fear et al., 2007).
Furthermore, at post-deployment, 21% of participants perceived that they were drinking less, 24% drinking more and 55% about the same, compared to how much they normally drink.

**Smoking**

Table 31 illustrates the changes in smoking status across the phases of the deployment.

Table 31. Changes in smoking status across the phases of deployment.

<table>
<thead>
<tr>
<th>Deployment phase</th>
<th>Sample size (N =)</th>
<th>Smoking status across the deployment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Current smoker (%)</td>
</tr>
<tr>
<td>T1</td>
<td>1366</td>
<td>47</td>
</tr>
<tr>
<td>T2</td>
<td>862</td>
<td>48</td>
</tr>
<tr>
<td>T3</td>
<td>530</td>
<td>46.4</td>
</tr>
</tbody>
</table>

Table 32 illustrates the changes in daily smoking rate for current smokers across the phases of the deployment.

Table 32. Changes in mean daily smoking rate for current smokers (who were ‘current’ at T1).

<table>
<thead>
<tr>
<th>Deployment phase</th>
<th>Sample size (N =)</th>
<th>Mean daily smoking rate (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-deployment</td>
<td>632</td>
<td>15.6 (7.0)</td>
</tr>
<tr>
<td>During-deployment</td>
<td>396</td>
<td>19.5 (10.5)</td>
</tr>
<tr>
<td>Post-deployment</td>
<td>238</td>
<td>14.4 (8.1)</td>
</tr>
</tbody>
</table>

In terms of the statistical differences in the daily smoking rates between T1 ($\bar{x} = 13.8$, SD = 8.1), T2 ($\bar{x} = 17.6$, SD = 12.1) and T3 ($\bar{x} = 12.9$, SD = 8.7), a repeated measures ANOVA showed no difference between T1-T3, but significant differences were found between T1-T2 ($F(1.76, 449.79) = 38.18, p<.001$) and also between T2-T3 ($p<.001$).

However, a paired t-test on current smokers between T1 ($N = 234$, $\bar{x} = 15.8$, SD = 6.5) and T3 ($N = 234$, $\bar{x} = 14.4$, SD = 8.1) showed a significant difference ($t(233) = -2.69, p<.01, r = .17$); although the reduction in daily cigarette use was 1.4 cigarettes per day, which is unlikely to confer a health benefit if the mean was 14-15 cigarettes per day among these current smokers.

---

35 Greenhouse-Geisser correction.
Table 33 shows the reported number of recidivists among the ex-smokers, and the number of first time smokers across the deployment cycle. As can be seen, the pre-deployment and during deployment phases are the most likely times that smoking behaviour emerges among these two groups. Further to this, the incidence rate is higher among ex-smokers compared to first timers.

Table 33. Who starts to smoke across the deployment.

<table>
<thead>
<tr>
<th>Who started smoking, and when</th>
<th>First timers (N=)</th>
<th>Ex-smokers (N=)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-deployment</td>
<td>13</td>
<td>70</td>
</tr>
<tr>
<td>During-deployment</td>
<td>12</td>
<td>51</td>
</tr>
<tr>
<td>Post-deployment</td>
<td>3</td>
<td>20</td>
</tr>
</tbody>
</table>

**Driving**

Table 18 (p.130) presents the findings from paired t-tests analysis between T1 and T3 for driving behaviour, which shows mixed results. Firstly, seatbelt use in the front of a vehicle showed no statistical difference; also, no statistical difference was found for driving speed in built-up areas. However, seatbelt use in the rear improved post-deployment ($t(516) = 4.17, p<.001, r = .18$), and the propensity to speed on motorways reduced ($t(438) = 2.35, p<.05, r = .11$). Despite the improvements in rear seatbelt use and reduction in motorway speed, their change in behaviour could still be considered risky. That is to say, although the post-deployment levels of behaviour reduced or remained the same, they were still high or 'risky'; for example, Table 34 illustrates the relative changes in these two behaviours, even though they significantly improved.

Table 34. Relative improvements in driving behaviour between pre- and post-deployment.

<table>
<thead>
<tr>
<th></th>
<th>Pre-deployment (%)</th>
<th>Post-deployment (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motorway speeding</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below the limit, or within 10mph</td>
<td>26.2</td>
<td>32.7</td>
</tr>
<tr>
<td>11-20mph above the limit</td>
<td>54.2</td>
<td>52.1</td>
</tr>
<tr>
<td>More than 20mph above the limit</td>
<td>19.6</td>
<td>15.2</td>
</tr>
<tr>
<td><strong>Seatbelt use</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>'Always' in the rear of a vehicle as a passenger</td>
<td>42.4</td>
<td>55.6</td>
</tr>
</tbody>
</table>
Table 35 presents comparative data for speeding behaviour and seatbelt use between the present study (pre- and post-deployment) and the findings by Fear et al. (2008), who collected epidemiological data during the longitudinal Iraq War study on UK armed forces personnel.

<table>
<thead>
<tr>
<th>Speeding above 20mph on Motorway</th>
<th>Speeding above 10mph in built-up area</th>
<th>Seatbelt use (sometimes, seldom, never)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present study</td>
<td>Fear et al. (2008)</td>
<td>N =1374</td>
</tr>
<tr>
<td>Pre-deployment (N =522)</td>
<td>Post-deployment (N =1504)</td>
<td>(N =1504)</td>
</tr>
<tr>
<td>19.6%</td>
<td>7.9%</td>
<td>13%</td>
</tr>
<tr>
<td>15.2%</td>
<td>7.4%</td>
<td>12.3%</td>
</tr>
<tr>
<td>14%</td>
<td>5%</td>
<td>6%</td>
</tr>
</tbody>
</table>

Sex
The items asked on sexual risk-taking were not identical across the deployment phases. This was due to the nature of interest into sexual risk-taking within the specific MoD military stakeholder, whereby they were only interested in cross-sectional data on sexual risk-taking as opposed to repeated measures. Therefore, the collected data did not allow for trend analysis across the deployment cycle as with the items on alcohol, smoking and driving behaviour.

Psychological well-being
In terms of the statistical differences in PWB between T1 ($\bar{x} = 9.7$, SD = 4.8), T2 ($\bar{x} = 12.0$, SD = 5.3) and T3 ($\bar{x} = 10.9$, SD = 4.9), a repeated measures ANOVA showed consistent differences between each phase ($F(2, 1036) = 40.34, p<.001$), with PWB becoming worse during the deployment compared to pre-deployment, and then improving at post-deployment compared to during the deployment, but it did not improve as per pre-deployment levels. The degradation during the deployment was to be expected, and to some extent so was the post-deployment change, which suggests an enduring effect for post-deployment well-being, and may highlight important issues regarding post-deployment readjustment. The data above is supported by Table 36, which illustrates the frequencies for PWB categories as measured by the GHQ-12.
Table 36. Frequency of GHQ categories across the deployment cycle.

<table>
<thead>
<tr>
<th>Frequency (%) of GHQ-12 categories across the deployment</th>
<th>Normal</th>
<th>Distressed</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-deployment</td>
<td>82.6</td>
<td>13.4</td>
<td>4.1</td>
</tr>
<tr>
<td>During-deployment</td>
<td>71.5</td>
<td>19.6</td>
<td>8.9</td>
</tr>
<tr>
<td>Post-deployment</td>
<td>80.9</td>
<td>14.2</td>
<td>4.9</td>
</tr>
</tbody>
</table>

Risk perceptions

A repeated measures ANOVA\textsuperscript{37} for risk perceptions across the phases of deployment showed a significant difference between all phases ($F(1.97, 1021.05) = 19.15, p<.001$). The mean (SD) scores for each phase were: pre-deployment ($\bar{x} = 2.48, SD = .61$), mid-deployment ($\bar{x} = 2.64, SD = .57$), and post-deployment ($\bar{x} = 2.63, SD = .57$). A deeper interpretation of these findings is covered in the discussion chapter where the overall issue of operational risk perception is discussed.

\textsuperscript{36} The military stakeholder for the sexual health data was the Medical Operations branch within the UK Permanent Joint Headquarters.

\textsuperscript{37} Greenhouse-Geisser correction.
7.7 RESULTS VII: Qualitative Results

This section presents the qualitative data gathered. They were collected in order to provide supporting explanations in the interpretation of the main quantitative data, in particular, to help explain possible reasons for change in health behaviours across the deployment cycle.

Within the questionnaires, a single item asked the participants about their current perception of behaviour for alcohol consumption, smoking and sexual activity; for example, at pre-deployment (T1) participants were asked 'as you get closer to going on deployment, do you think you currently smoke more, less or about the same?' Responses were scored on a 5-point likert scale (much more, slightly more, about the same, slightly less, much less). The participants were then prompted to provide a short qualitative reason by being asked: 'What do you think the main reasons for this are?' This open-ended question was asked for current alcohol intake, smoking behaviour and sexual activity at each deployment phase. The number of responses from the participants can be seen in Table 37.

<table>
<thead>
<tr>
<th></th>
<th>Smoking</th>
<th>Alcohol</th>
<th>Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>346</td>
<td>881</td>
<td>779</td>
</tr>
<tr>
<td>T2</td>
<td>332</td>
<td>507</td>
<td>654</td>
</tr>
<tr>
<td>T3</td>
<td>139</td>
<td>308</td>
<td>292</td>
</tr>
<tr>
<td>Total Number</td>
<td>817</td>
<td>1696</td>
<td>1725</td>
</tr>
</tbody>
</table>

The total number of responses received was 4238; however, it was expected that the final number that emerged from the analysis would change. This was mainly due to two reasons. Firstly, not everyone who responded provided a 'sensible' reason, i.e., some participants were deemed to have used inappropriate language or humour that were not related to the responses under investigation (e.g. 'isn't it f***ing obvious?'); therefore, such responses were removed from the final analysis, which would result in a reduction in the total number. Secondly, and conversely, some individuals provided multiple reasons for their behaviour change, therefore this would increase the total...
number of individual responses (e.g. ‘Stress and being away from home and having a
good time with friends and your girlfriend’).\textsuperscript{38}

Table 38 (below) presents the final number of valid reasons reported (i.e.,
4326) compared to the numbers initially responded in Table 37 above (i.e., 4238). The
difference between these numbers (i.e., the final number of responses within the
individual themes was higher) suggest that the number of inappropriate responses was
minimal, and that the participants engaged with the open-ended questions and were
candid in their reasons. This is an encouraging finding and provides the support for
asking open-ended, qualitative questions in support of the main quantitative data in an
exploratory and complex subject matter.

Table 38. Final number of responses within the post-analysis themes ($n = 4326$).

<table>
<thead>
<tr>
<th></th>
<th>Smoking</th>
<th>Alcohol</th>
<th>Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>317</td>
<td>970</td>
<td>708</td>
</tr>
<tr>
<td>T2</td>
<td>462</td>
<td>534</td>
<td>684</td>
</tr>
<tr>
<td>T3</td>
<td>128</td>
<td>271</td>
<td>252</td>
</tr>
<tr>
<td><strong>Total Number</strong></td>
<td><strong>907</strong></td>
<td><strong>1775</strong></td>
<td><strong>1644</strong></td>
</tr>
</tbody>
</table>

Qualitative analysis approach

The approach used for the analysis of the qualitative data was based on content
analysis. This involves coding the open-ended responses into closed categories in
order to summarise and systematise the data (Wilkinson, 2004). Initially, the
individual responses were coded into broad themes at the highest level. This ‘top-
down’ approach was used because of the author’s familiarity with the military subject
matter, which has been identified by Wilkinson (2004) as a valid approach. Therefore,
some key themes were expected to emerge (e.g. stress, boredom, family issues) based
on previous literature (e.g. Maguen et al., 2008; Boos & Croft, 2004).

However, in order to be cognisant of the categorising process a ‘bottom-up’
approach was also adopted, which is similar to the ‘constant comparative method’ as
employed by grounded theorists (Charmaz, 2004). This dual process enabled the
identification of expected themes, whilst allowing for unexpected themes to emerge.

There are a number of benefits to the use of the content analysis approach, for
example, (1) it allows a large number of responses to be categorised into conceptual

\textsuperscript{38} Three themes are present in this single quote: (1) stress, (2) being away, (3) having a good time with friends and girlfriend.
themes, (2) these many themes can visualised, (3) the data can be summarised in an easy form, (4) comparisons can be made with the other concurrent emerging themes within the same data set, and (5) comparisons can also be made with previously published research in the same research domain (e.g. reasons for changes in health behaviour).

Figures 23-31 illustrate the coded and counted themes emerging from the present study. For each theme a number of responses that pertain to that theme is provided in brackets. Tables 42-44 illustrate the top ten reasons for each behaviour across each phase of the military deployment.

Because of methodological issues surrounding the validity of the coding process (Wilkinson, 2004) it was decided not to collapse the high-level themes into a smaller number of overarching themes. If this was conducted then there would be more opportunity for errors in interpretation as the process of amalgamating themes could be prone to an increased risk of individual bias. Furthermore, if the main focus of the present study was qualitative, then a more robust analytical approach would have been adopted, but because the use of qualitative data was used as a supporting approach in order to understand the context of behaviour, and to aid the interpretation of the quantitative results, the current qualitative approach and the level of qualitative analysis was deemed sufficient and valid.
Alcohol

A breakdown of the initial 1696 responses regarding the perception of current alcohol consumption is presented in Table 39.

Table 39. Content analysis of qualitative responses to perceived alcohol consumption.

<table>
<thead>
<tr>
<th>Perception of alcohol intake</th>
<th>Number of responses received</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
</tr>
<tr>
<td>Much more</td>
<td>109</td>
</tr>
<tr>
<td>Slightly more</td>
<td>239</td>
</tr>
<tr>
<td>About the same</td>
<td>327</td>
</tr>
<tr>
<td>Slightly less</td>
<td>127</td>
</tr>
<tr>
<td>Much less</td>
<td>79</td>
</tr>
</tbody>
</table>

Pre-deployment alcohol themes

Figure 23. Emergent themes for perceived pre-deployment alcohol consumption.
Mid-deployment alcohol themes

Figure 24. Emergent themes for perceived mid-deployment alcohol consumption.

Post-deployment alcohol themes

Figure 25. Emergent themes for perceived post-deployment alcohol consumption.
Smoking

The breakdown of initial responses for the perception of current smoking behaviour is presented in Table 40.

Table 40. Content analysis of qualitative responses to perceived smoking behaviour.

<table>
<thead>
<tr>
<th>Perception of smoking behaviour</th>
<th>Number of responses received</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
</tr>
<tr>
<td>Much more</td>
<td>28</td>
</tr>
<tr>
<td>Slightly more</td>
<td>129</td>
</tr>
<tr>
<td>About the same</td>
<td>147</td>
</tr>
<tr>
<td>Slightly less</td>
<td>28</td>
</tr>
<tr>
<td>Much less</td>
<td>16</td>
</tr>
</tbody>
</table>

Pre-deployment smoking themes

Figure 26. Emergent themes for perceived pre-deployment smoking behaviour.
Mid-deployment smoking themes

![Diagram of Mid-deployment smoking themes]

Figure 27. Emergent themes for perceived mid-deployment smoking behaviour.

Post-deployment smoking themes

![Diagram of Post-deployment smoking themes]

Figure 28. Emergent themes for perceived post-deployment smoking behaviour.
Sexual activity
The breakdown of initial responses for the perception of current sexual activity is presented in Table 41.

Table 41. Content analysis of qualitative responses to perceived sexual activity.

<table>
<thead>
<tr>
<th>Perception of sexual activity</th>
<th>Number of responses received</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
</tr>
<tr>
<td>Much more</td>
<td>228</td>
</tr>
<tr>
<td>Slightly more</td>
<td>225</td>
</tr>
<tr>
<td>About the same</td>
<td>202</td>
</tr>
<tr>
<td>Slightly less</td>
<td>64</td>
</tr>
<tr>
<td>Much less</td>
<td>60</td>
</tr>
</tbody>
</table>

Pre-deployment sexual activity themes

Figure 29. Emergent themes for perceived pre-deployment sexual activity.
Mid-deployment sexual activity themes

Figure 30. Emergent themes for perceived mid-deployment sexual activity.

Post-deployment sexual activity themes

Figure 31. Emergent themes for perceived post-deployment sexual activity

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Summary of health behaviour themes
Tables 42-44 provide a summary of the participants' top ten reasons for their perceived change across the deployment for alcohol consumption, smoking behaviour and sexual activity.

Table 42. The top ten reasons for perceived behaviour change for alcohol consumption.

<table>
<thead>
<tr>
<th>Top 10 qualitative reasons provided for perceived change in alcohol use</th>
<th>Increase</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-deployment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Socialising with friends/family</td>
<td>Improve/ maintain fitness/health</td>
</tr>
<tr>
<td>2</td>
<td>No alcohol on Ops</td>
<td>Not enough (less) time/ too busy</td>
</tr>
<tr>
<td>3</td>
<td>Last chance for fun before tour</td>
<td>Quiet time with family</td>
</tr>
<tr>
<td>4</td>
<td>Might die/might be last chance</td>
<td>To warm off (cut down) alcohol intake</td>
</tr>
<tr>
<td>5</td>
<td>Worry about the tour</td>
<td>Don't drink much anyway</td>
</tr>
<tr>
<td>6</td>
<td>Stress</td>
<td>To keep mind clear and focused</td>
</tr>
<tr>
<td>7</td>
<td>Enjoy life while you can</td>
<td>Job-related need to cut down</td>
</tr>
<tr>
<td>8</td>
<td>Worried about saving family</td>
<td>To prepare for deployment</td>
</tr>
<tr>
<td>9</td>
<td>Cohesion with colleagues</td>
<td>Close off drinking/lost interest in alcohol</td>
</tr>
<tr>
<td>10</td>
<td>To relax/ calm nerves</td>
<td>Saving money</td>
</tr>
<tr>
<td>During deployment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Not had it in a while, miss it</td>
<td>Not allowed/policy</td>
</tr>
<tr>
<td>2</td>
<td>Stress</td>
<td>Alcohol prohibition/ Job performance</td>
</tr>
<tr>
<td>3</td>
<td>Depressed</td>
<td>Deprivation and hot environment</td>
</tr>
<tr>
<td>4</td>
<td>Drink on RUR</td>
<td>Can live without</td>
</tr>
<tr>
<td>5</td>
<td>Work pressure</td>
<td>Am missing it</td>
</tr>
<tr>
<td>6</td>
<td>Didn't drink much at home</td>
<td>Long work hours, lack of time</td>
</tr>
<tr>
<td>7</td>
<td>Bereavement</td>
<td>Can't get hold of it (access)</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>I don't drink on tour</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Positive health reasons</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-deployment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Stress (general)</td>
<td>Don't need it, don't want it</td>
</tr>
<tr>
<td>2</td>
<td>Socialising more</td>
<td>For stress and health</td>
</tr>
<tr>
<td>3</td>
<td>Missed it/ worried it</td>
<td>Family reasons (married, new baby etc.)</td>
</tr>
<tr>
<td>4</td>
<td>Bereavement</td>
<td>Lost the taste on tour</td>
</tr>
<tr>
<td>5</td>
<td>To aid sleep</td>
<td>Cost (saving money, too expensive)</td>
</tr>
<tr>
<td>6</td>
<td>Fragile life, lives to the max</td>
<td>In a new unit, current workload</td>
</tr>
<tr>
<td>7</td>
<td>To relax</td>
<td>Drank too much before tour</td>
</tr>
<tr>
<td>8</td>
<td>I feel happier, less worries</td>
<td>Back to normal after initial binge</td>
</tr>
<tr>
<td>9</td>
<td>To avoid thinking and feelings</td>
<td>Personal issues (control stress)</td>
</tr>
<tr>
<td>10</td>
<td>Stress (work)</td>
<td>Not a big drinker</td>
</tr>
</tbody>
</table>

Table 43. The top ten reasons for perceived behaviour change for smoking behaviour.

<table>
<thead>
<tr>
<th>Top 10 qualitative reasons provided for perceived change in smoking behaviour</th>
<th>Increase</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-deployment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Stress (general)</td>
<td>Trying to cut down or quit</td>
</tr>
<tr>
<td>2</td>
<td>Stress (current tempo, prep)</td>
<td>To improve fitness</td>
</tr>
<tr>
<td>3</td>
<td>General fear, nerves, worry</td>
<td>Family reasons (new baby, children)</td>
</tr>
<tr>
<td>4</td>
<td>Boredom, spare time</td>
<td>Not a regular smoker anyway</td>
</tr>
<tr>
<td>5</td>
<td>Stress (future operation)</td>
<td>To improve my health</td>
</tr>
<tr>
<td>6</td>
<td>Socialising with peers (alcohol)</td>
<td>Future operational area (i.e. too hot)</td>
</tr>
<tr>
<td>7</td>
<td>Relaxation, calming, comforting</td>
<td>To improve health (for the tour)</td>
</tr>
<tr>
<td>8</td>
<td>Stress (concerns for family)</td>
<td>Money issues (can't afford it)</td>
</tr>
<tr>
<td>9</td>
<td>Amount of time on exercises</td>
<td>Stress</td>
</tr>
<tr>
<td>10</td>
<td>Might be last chance, could die</td>
<td>Stress</td>
</tr>
<tr>
<td>During deployment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Stress (general)</td>
<td>Am quitting, have quit</td>
</tr>
<tr>
<td>2</td>
<td>Boredom, spare time</td>
<td>Operational environment is too hot</td>
</tr>
<tr>
<td>3</td>
<td>Stress (current tempo, prep)</td>
<td>Alternative smoking pattern</td>
</tr>
<tr>
<td>4</td>
<td>High Op Tempo and workload</td>
<td>Other things too think about</td>
</tr>
<tr>
<td>5</td>
<td>Cheaper cost</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Faster tempo, spare time</td>
<td>Relax (de-stress)</td>
</tr>
<tr>
<td>7</td>
<td>Frustrations, anger</td>
<td>Habit</td>
</tr>
<tr>
<td>8</td>
<td>To get a break</td>
<td>Stress</td>
</tr>
<tr>
<td>9</td>
<td>To keep sober (sanctity)</td>
<td>Stress</td>
</tr>
<tr>
<td>10</td>
<td>Stress (general)</td>
<td>Am quitting, have quit</td>
</tr>
<tr>
<td>Post-deployment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Boredom</td>
<td>Trying to give up / have quit</td>
</tr>
<tr>
<td>2</td>
<td>Relaxation, calming, comforting</td>
<td>Less stress since tour</td>
</tr>
<tr>
<td>3</td>
<td>Social (drinking more, friends)</td>
<td>Smoked too much on tour</td>
</tr>
<tr>
<td>4</td>
<td>Hand to cut down after tour</td>
<td>More expensive now</td>
</tr>
<tr>
<td>5</td>
<td>Boredom</td>
<td>Positive health reasons</td>
</tr>
<tr>
<td>6</td>
<td>High workload</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Habit, addiction</td>
<td>Family reasons (new baby, children)</td>
</tr>
<tr>
<td>8</td>
<td>To break up routine</td>
<td>Workplace restrictions</td>
</tr>
<tr>
<td>9</td>
<td>More time after being on tour</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 44. The top ten reasons for perceived behaviour change for sexual activity.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Increase</th>
<th>Decrease</th>
<th>No change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Last chance (deployed for months)</td>
<td>Less time, workload, deployment prep</td>
<td>Normal sex/life/routines with partner</td>
</tr>
<tr>
<td>2</td>
<td>Might not come back (might die)</td>
<td>Live away from partner</td>
<td>No change/no reason</td>
</tr>
<tr>
<td>3</td>
<td>Will miss my partner (vice-versa)</td>
<td>Partner pregnant</td>
<td>Geographical distance from partner</td>
</tr>
<tr>
<td>4</td>
<td>To enjoy it and have fun</td>
<td>Relationship ended</td>
<td>Imminent deployment</td>
</tr>
<tr>
<td>5</td>
<td>Won't get any on deployment</td>
<td>Single, no partner</td>
<td>Enjoy it</td>
</tr>
<tr>
<td>6</td>
<td>Role, role change</td>
<td>Worry about deployment</td>
<td>Not worried about deployment</td>
</tr>
<tr>
<td>7</td>
<td>Trying for baby before deploying</td>
<td>Lack of opportunity</td>
<td>Single, no partner</td>
</tr>
<tr>
<td>8</td>
<td>Live life to the max</td>
<td>Too tired</td>
<td>Workload and preparation before deploying</td>
</tr>
<tr>
<td>9</td>
<td>Partner wants to make me happy</td>
<td>Lack of interest</td>
<td>Young family</td>
</tr>
<tr>
<td>10</td>
<td>Missed it</td>
<td>Relationship problems before deploying</td>
<td>Not interested</td>
</tr>
</tbody>
</table>

Pre-deployment

<table>
<thead>
<tr>
<th>Missed it</th>
<th>Away from partner</th>
<th>Lack of access to opposite sex</th>
<th>Am on operational tour</th>
</tr>
</thead>
<tbody>
<tr>
<td>I get busy</td>
<td>I was on R&amp;R</td>
<td>Opposite sex not attractive on tour</td>
<td>Relationship not possible</td>
</tr>
<tr>
<td>Others are missing their partner</td>
<td>Workload, no time</td>
<td>Being faithful to partner</td>
<td>Not on R&amp;R yet</td>
</tr>
<tr>
<td>Not enough social places, events, etc.</td>
<td>Not interested</td>
<td>Not interested</td>
<td>Not interested</td>
</tr>
</tbody>
</table>

During deployment

<table>
<thead>
<tr>
<th>Sex life improved in general</th>
<th>Relationship has ended</th>
<th>Partner pregnant or raw baby</th>
<th>Would like more but can't get more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enjoy it or missed it</td>
<td>Having relationship problems</td>
<td>Love of libido</td>
<td>I like it</td>
</tr>
<tr>
<td>Missed partner (vice versa)</td>
<td>Too tired</td>
<td>Stress (general)</td>
<td>Back to normal</td>
</tr>
<tr>
<td>New partner or relationship</td>
<td>Geographical distance from partner</td>
<td>Geographical distance from partner</td>
<td>Distance from partner</td>
</tr>
<tr>
<td>Relationship improved since return</td>
<td>Lack of confidence</td>
<td>Have young family (no time)</td>
<td>Nothing changed</td>
</tr>
<tr>
<td>Trying for baby</td>
<td>Need more</td>
<td>Happy with current level</td>
<td>Can't be bothered</td>
</tr>
<tr>
<td>Fruity or low life/life to the max</td>
<td>Reduce stress</td>
<td>Have young family (no time)</td>
<td>Happy with current level</td>
</tr>
<tr>
<td>Reduce stress</td>
<td>Lack of confidence</td>
<td>Have young family (no time)</td>
<td>Happy with current level</td>
</tr>
<tr>
<td>Get married</td>
<td>Not in a relationship</td>
<td>Have young family (no time)</td>
<td>Happy with current level</td>
</tr>
<tr>
<td>Hotter (calms are down)</td>
<td></td>
<td>Have young family (no time)</td>
<td>Happy with current level</td>
</tr>
</tbody>
</table>

Post-deployment

<table>
<thead>
<tr>
<th>Sex life improved in general</th>
<th>Relationship has ended</th>
<th>Partner pregnant or raw baby</th>
<th>Would like more but can't get more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enjoy it or missed it</td>
<td>Having relationship problems</td>
<td>Love of libido</td>
<td>I like it</td>
</tr>
<tr>
<td>Missed partner (vice versa)</td>
<td>Too tired</td>
<td>Stress (general)</td>
<td>Back to normal</td>
</tr>
<tr>
<td>New partner or relationship</td>
<td>Geographical distance from partner</td>
<td>Geographical distance from partner</td>
<td>Distance from partner</td>
</tr>
<tr>
<td>Relationship improved since return</td>
<td>Lack of confidence</td>
<td>Have young family (no time)</td>
<td>Nothing changed</td>
</tr>
<tr>
<td>Trying for baby</td>
<td>Need more</td>
<td>Happy with current level</td>
<td>Can't be bothered</td>
</tr>
<tr>
<td>Fruity or low life/life to the max</td>
<td>Reduce stress</td>
<td>Have young family (no time)</td>
<td>Happy with current level</td>
</tr>
<tr>
<td>Reduce stress</td>
<td>Lack of confidence</td>
<td>Have young family (no time)</td>
<td>Happy with current level</td>
</tr>
<tr>
<td>Get married</td>
<td>Not in a relationship</td>
<td>Have young family (no time)</td>
<td>Happy with current level</td>
</tr>
<tr>
<td>Hotter (calms are down)</td>
<td></td>
<td>Have young family (no time)</td>
<td>Happy with current level</td>
</tr>
</tbody>
</table>
7.8 RESULTS VIII: Predicting Behaviour

In order to better understand the role of risk within the present study it was necessary to model the constructs of ImpSS, risk perception and the risky health behaviours, using both linear (simple) and multiple regression analyses. Initially, linear regressions were conducted between ImpSS and the T1 health behaviours. This was conducted in order to establish if ImpSS was predictive of health behaviour. The theoretical link for establishing the sensation seeking construct as a predictor for future behaviour has been reported; for example, van Beurden et al (2005, p.38) reported that ‘sensation seeking has proven to be a strong predictor of engagement in harmful driving and social behaviours, including HED’. The sexual health items were omitted from the regressions because of the need to focus on the highest priority health behaviours that potentially possess a greater impact on the health, well-being and capability of military personnel (i.e., driving behaviour, alcohol consumption and smoking behaviour), which has been highlighted in chapter 5, section 5.5. The results of the simple regressions for ImpSS only are presented at Table 45.

<table>
<thead>
<tr>
<th>Variable</th>
<th>R</th>
<th>β</th>
<th>R Squared</th>
<th>B</th>
<th>F change</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily smoking rate</td>
<td>.09</td>
<td>.09</td>
<td>.008</td>
<td>9.81</td>
<td>6.18</td>
<td>=.013</td>
</tr>
<tr>
<td>Seatbelt use (front)</td>
<td>.17</td>
<td>.17</td>
<td>.029</td>
<td>-.030</td>
<td>40.16</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Seatbelt use (rear)</td>
<td>.13</td>
<td>.13</td>
<td>.016</td>
<td>.70</td>
<td>21.91</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Speeding in urban</td>
<td>.17</td>
<td>.17</td>
<td>.029</td>
<td>1.25</td>
<td>34.75</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Speeding on motorway</td>
<td>.19</td>
<td>.19</td>
<td>.039</td>
<td>1.51</td>
<td>47.17</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Amount of alcohol</td>
<td>.21</td>
<td>.21</td>
<td>.045</td>
<td>2.11</td>
<td>60.96</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Frequency of alcohol</td>
<td>.19</td>
<td>.19</td>
<td>.037</td>
<td>2.14</td>
<td>50.51</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Frequency of HED</td>
<td>.21</td>
<td>.21</td>
<td>.042</td>
<td>1.66</td>
<td>58.10</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

As can be seen, although ImpSS significantly predicts engagement with the individual risky health behaviours (refer to the Sig. F Change column), the amount of variance accounted for by ImpSS is very small (refer to the $R^2$ column), with a minimum variance of 0.08% (for daily smoking rate) and a maximum variance of 4.5% (for the amount of alcohol consumed).

Further to this, simple regressions were conducted for both risk perceptions and PWB and their predictive power among the health behaviours. However, PWB consistently showed an inability to significantly predict health behaviour, whereas
risk perceptions demonstrated mixed findings, with either no predictive power for some health behaviours, or extremely low variance for other health behaviours (i.e. <1%). Therefore, both risk perceptions and PWB were omitted from the multiple regression analyses. Table 46 presents a correlation matrix for the regression analyses between ImpSS and the health behaviours, as well as between the individual health behaviours.

Table 46. Pre-regression zero order correlations between ImpSS and T1 health behaviours.

<table>
<thead>
<tr>
<th></th>
<th>ImpSS</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>SM1</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A1) Frequency of alcohol</td>
<td>.19***</td>
<td>~</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A2) Amount of alcohol</td>
<td>.21***</td>
<td>.28***</td>
<td>~</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(A3) Frequency of HED</td>
<td>.21***</td>
<td>.55***</td>
<td>.48***</td>
<td>~</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SM1) Daily smoking rate</td>
<td>.09**</td>
<td>.15***</td>
<td>.17***</td>
<td>.14***</td>
<td>~</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driving</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(D1) Seatbelt use front</td>
<td>.17***</td>
<td>.15***</td>
<td>.14***</td>
<td>.11***</td>
<td>.18***</td>
<td>~</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(D2) Seatbelt use rear</td>
<td>.19***</td>
<td>.12***</td>
<td>.14***</td>
<td>.14***</td>
<td>.07*</td>
<td>.57***</td>
<td>~</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(D3) Speeding urban</td>
<td>.17***</td>
<td>.15***</td>
<td>.17***</td>
<td>.17***</td>
<td>.05</td>
<td>.28***</td>
<td>.20***</td>
<td>.45***</td>
<td>~</td>
</tr>
<tr>
<td>(D4) Speeding motorway</td>
<td>.19***</td>
<td>.18***</td>
<td>.21***</td>
<td>.19***</td>
<td>.13**</td>
<td>.23***</td>
<td>.20***</td>
<td>.45***</td>
<td>~</td>
</tr>
</tbody>
</table>

* p < .05; ** p < .01; *** p < .001.

Guidance from Field (2005) suggests that 10-15 participants should be required for each independent variable (IV) in a multiple regression. This figure was considered more than adequate when considering the sample size for the present study, i.e., pre-deployment (N = 1374), mid-deployment (N = 889) and post-deployment (N = 537).

Dummy variables were created for the demographic variables because they were originally classed as categorical variables (nominal), therefore these were recoded as either present (score = 1) or absent (score = 0). Such dichotomous coding is required for simple and multiple regression analyses (Field, 2005). Previous research has identified key demographic variables in military research as risk factors for risk-related behaviour (Bray & Hourani, 2007; Fear et al., 2007; Ferrier-Auerbach et al., 2009; Henderson et al., 2009); therefore, it can be argued that these demographic factors would predict the propensity to engage in risky health behaviour.

In conducting the multiple regressions, the predictor variables were entered in separate blocks relevant to their categories, e.g. ImpSS, past [same] behaviour, co-varying behaviours, and demographics (see Table 47). If there were multiple variables within an individual block (e.g. demographics), they were entered in a stepwise method. This approach was deemed to be the most appropriate method for exploratory work (Field, 2005).
The justification for using ImpSS and demographic factors as predictor variables has been made above. The co-varying nature of health behaviours suggests that there may be a predictive relationship among certain health behaviours, and in certain directions; for example, the disinhibiting effects of alcohol has been shown to influence the desire to engage in risky health behaviours (e.g. drink-driving, risky sex, smoking behaviour), and alcohol may even negate the desire to abstain from certain behaviours, such as its disinhibiting effect (Kahler et al., 2009). Hampson, Severson, Burns, Slovic and Fisher (2001) suggest that alcohol is one of the first substances that younger adolescents experience, and its use is predictive of future use with other substances. However, for other health behaviours it would be less plausible, from a theoretical perspective, to suggest that risky sexual behaviour would lead to (i.e., predict) risky driving behaviour because the behavioural pathways and underpinning mechanisms that lead risky sexual activity to impact on subsequent driving behaviour have not been established. This clustering of health behaviours has been described earlier in the thesis (chapter 2, section 2.5) and is supported by Torgersen and Vollrath (2006).

Multiple regression analyses: Baseline prediction at pre-deployment

Tables 47-62 illustrate the IVs used to predict each health behaviour at T1.

T1 Smoking behaviour

Table 47 illustrates the IVs entered into the regression analysis in order to predict the DV of T1 risky smoking behaviour, as measured by daily smoking rate.

<table>
<thead>
<tr>
<th>Personality</th>
<th>Health behaviours</th>
<th>Demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1 ImpSS</td>
<td>T1 Smoker</td>
<td>Block 3 Lower rank</td>
</tr>
<tr>
<td>Block 2 T1 Frequency of alcohol</td>
<td>Block 3 Male</td>
<td></td>
</tr>
<tr>
<td>Block 3 T1 Amount of alcohol</td>
<td>Block 4 White</td>
<td></td>
</tr>
<tr>
<td>Block 4 T1 Frequency of HED</td>
<td>White</td>
<td></td>
</tr>
</tbody>
</table>

Table 48 presents the key statistics for the regression model for T1 risky smoking behaviour. The total variance explained by this model was 46%. ImpSS was not a significant predictor in the multiple regression, despite being a significant predictor in the simple regression (Table 45). As expected, being a smoker accounted for the
largest amount of variance (38%), with co-varying alcohol consumption accounting for 3% and demographic variables accounting for 5-6% of the variance.

Table 48. Summary of multiple (stepwise) regression for T1 risky smoking (daily smoking rate) (N = 706).

<table>
<thead>
<tr>
<th>Variables</th>
<th>R</th>
<th>( \beta )</th>
<th>R Squared</th>
<th>R Square change</th>
<th>B</th>
<th>F change</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoker</td>
<td>.68</td>
<td>.63</td>
<td>.46</td>
<td>.38</td>
<td>.72</td>
<td>486.33</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Block 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency of alcohol</td>
<td>.15</td>
<td>.15</td>
<td>.02</td>
<td>.02</td>
<td>1.02</td>
<td>14.63</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Amount of alcohol</td>
<td>.18</td>
<td>.10</td>
<td>.03</td>
<td>.01</td>
<td>.43</td>
<td>6.88</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Block 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower rank</td>
<td>.24</td>
<td>.18</td>
<td>.06</td>
<td>.03</td>
<td>9.58</td>
<td>.23</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Single</td>
<td>.26</td>
<td>-.10</td>
<td>.07</td>
<td>.01</td>
<td>-1.81</td>
<td>7.79</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>White</td>
<td>.27</td>
<td>.08</td>
<td>.08</td>
<td>.01</td>
<td>2.98</td>
<td>4.75</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Male</td>
<td>.29</td>
<td>.08</td>
<td>.08</td>
<td>.01</td>
<td>3.43</td>
<td>4.76</td>
<td>&lt;.05</td>
</tr>
</tbody>
</table>

T1 Alcohol consumption

T1 Amount of alcohol

Table 48 illustrates the IVs entered into the regression analysis in order to predict the DV of T1 amount of alcohol.

Table 49. Predictor variables entered into stepwise regression for T1 amount of alcohol.

<table>
<thead>
<tr>
<th>Personality</th>
<th>Health behaviours</th>
<th>Demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td>Block 2</td>
<td>Block 3</td>
</tr>
<tr>
<td>ImpSS</td>
<td>T1 Frequency of HED</td>
<td>T1 Daily smoking rate</td>
</tr>
<tr>
<td></td>
<td>T1 Frequency of alcohol</td>
<td>T1 Smoker</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 50 presents the key statistics for the regression model for T1 amount of alcohol. The total variance explained by this model was 22%. ImpSS was a significant predictor and accounted for 5% of the variance, with the related behaviour of frequency of HED accounting for 17% of the model's variance.

Table 50. Summary of multiple (stepwise) regression for T1 amount of alcohol (N = 707).

<table>
<thead>
<tr>
<th>Variables</th>
<th>R</th>
<th>( \beta )</th>
<th>R Squared</th>
<th>R Square change</th>
<th>B</th>
<th>F change</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ImpSS</td>
<td>.22</td>
<td>.22</td>
<td>.05</td>
<td>.05</td>
<td>.13</td>
<td>36.70</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Block 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency of HED</td>
<td>.46</td>
<td>.42</td>
<td>.21</td>
<td>.17</td>
<td>.95</td>
<td>147.39</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Block 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily smoking rate</td>
<td>.47</td>
<td>.07</td>
<td>.22</td>
<td>.01</td>
<td>.02</td>
<td>4.01</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Block 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower rank</td>
<td>.47</td>
<td>.07</td>
<td>.22</td>
<td>.004</td>
<td>.93</td>
<td>4.39</td>
<td>&lt;.05</td>
</tr>
</tbody>
</table>

169
**T1 Frequency of alcohol**

Table 51 illustrates the IVs entered into the regression analysis in order to predict the DV of T1 frequency of alcohol.

<table>
<thead>
<tr>
<th>Personality</th>
<th>Health behaviours</th>
<th>Demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Block 1</strong></td>
<td><strong>Block 2</strong></td>
<td><strong>Block 3</strong></td>
</tr>
<tr>
<td>ImpSS</td>
<td>Amount of alcohol</td>
<td>Daily smoking rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Smoker</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Block 4</strong></td>
<td></td>
<td>Single</td>
</tr>
<tr>
<td></td>
<td></td>
<td>White</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lower rank</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
</tr>
</tbody>
</table>

Table 52 presents the key statistics for the regression model for T1 frequency of alcohol. The total variance explained by this model was 41%, which is higher than the model for the amount of alcohol consumed (Table 50). ImpSS accounted for 4% of the variance, which is similar to the previous model in Table 50. Frequency of HED was again the highest source of variance and accounted for 33%, which should be expected as the two items measuring alcohol frequency were highly correlated ($r = .65$, $p<.001$), as shown in Table 46. The co-varying behaviour of smoking also emerged as a significant predictor, but at a very low level (1%), and the demographic variables of being single and white accounted for 3%.

<table>
<thead>
<tr>
<th>Variables</th>
<th>R</th>
<th>$\beta$</th>
<th>$R^2$</th>
<th>Change $R^2$</th>
<th>Change $\beta$</th>
<th>$F$ change</th>
<th>Sig. F change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ImpSS</td>
<td>.19</td>
<td>.19</td>
<td>.04</td>
<td>.04</td>
<td>.07</td>
<td>27.11</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Block 2</td>
<td>Frequency of HED</td>
<td>.63</td>
<td>.60</td>
<td>.40</td>
<td>.33</td>
<td>.86</td>
<td>389.44</td>
</tr>
<tr>
<td>Block 3</td>
<td>Daily smoking rate</td>
<td>.64</td>
<td>.08</td>
<td>.41</td>
<td>.01</td>
<td>.01</td>
<td>7.74</td>
</tr>
<tr>
<td>Block 4</td>
<td>Single</td>
<td>.24</td>
<td>.15</td>
<td>.08</td>
<td>.02</td>
<td>.39</td>
<td>16.90</td>
</tr>
<tr>
<td>White</td>
<td>.28</td>
<td>.09</td>
<td>.07</td>
<td>.01</td>
<td>.63</td>
<td>.38</td>
<td>&lt;.01</td>
</tr>
</tbody>
</table>

**T1 Frequency of HED**

Table 53 illustrates the IVs entered into the regression analysis in order to predict the DV of T1 frequency of HED.
Table 53. Predictor variables entered into stepwise regression for T1 frequency of HED.

<table>
<thead>
<tr>
<th>Personality</th>
<th>Health behaviours</th>
<th>Demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td>Block 2</td>
<td>Block 3</td>
</tr>
<tr>
<td>ImpSS</td>
<td>Frequency of alcohol</td>
<td>Daily smoking rate</td>
</tr>
<tr>
<td></td>
<td>Amount of alcohol</td>
<td>Smoker</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lower rank</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Single</td>
</tr>
<tr>
<td></td>
<td></td>
<td>White</td>
</tr>
</tbody>
</table>

Table 54 presents the key statistics for the regression model for T1 frequency of HED. The total variance explained by this model was 49%. Similar behaviour (i.e., frequency and amount of alcohol) accounted for 44% of the model’s variance. ImpSS was consistent among the T1 models of alcohol consumption by accounting for 5% of the variance in Table 54 (frequency of HED), 4% in Table 52 (frequency of alcohol), and 5% in Table 50 (amount of alcohol).

Table 54. Summary of multiple (stepwise) regression for T1 frequency of HED (N = 707).

<table>
<thead>
<tr>
<th>Variables</th>
<th>R</th>
<th>β</th>
<th>R Squared change</th>
<th>B</th>
<th>F change</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ImpSS</td>
<td>.22</td>
<td>.29</td>
<td>.05</td>
<td>.05</td>
<td>.13</td>
<td>36.30 &lt;.001</td>
</tr>
<tr>
<td>Block 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency of alcohol</td>
<td>.64</td>
<td>.22</td>
<td>.41</td>
<td>.38</td>
<td>.06</td>
<td>420.70 &lt;.001</td>
</tr>
<tr>
<td>Amount of alcohol</td>
<td>.69</td>
<td>.61</td>
<td>.49</td>
<td>.08</td>
<td>.43</td>
<td>111.05 &lt;.001</td>
</tr>
</tbody>
</table>

**T1 Driving behaviour**

**T1 Seatbelt use (front)**

Table 55 illustrates the IVs entered into the regression analysis in order to predict the DV of T1 front seatbelt use.

Table 55. Predictor variables entered into stepwise regression for T1 front seatbelt use.

<table>
<thead>
<tr>
<th>Personality</th>
<th>Health behaviours</th>
<th>Demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td>Block 2</td>
<td>Block 3</td>
</tr>
<tr>
<td>ImpSS</td>
<td>Seatbelt use (rear)</td>
<td>Frequency of alcohol</td>
</tr>
<tr>
<td></td>
<td>Speeding (urban)</td>
<td>Amount of alcohol</td>
</tr>
<tr>
<td></td>
<td>Speeding (motorway)</td>
<td>Frequency of HED</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lower rank</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Single</td>
</tr>
<tr>
<td></td>
<td></td>
<td>White</td>
</tr>
</tbody>
</table>

Table 56 presents the key statistics for the regression model for T1 front seatbelt use. The total variance explained by this model was 34%. ImpSS was a significant predictor that accounted for 2% of the variance. The remaining three driving
behaviour items accounted for 32% of the variance, and the demographic variable of being white only accounted for <1%.

Table 56. Summary of multiple (stepwise) regression for T1 seatbelt use (front) (N = 1080).

<table>
<thead>
<tr>
<th>Variables</th>
<th>R</th>
<th>β</th>
<th>R Squared</th>
<th>R Squared change</th>
<th>B</th>
<th>F change</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ImpSS</td>
<td>.15</td>
<td>.15</td>
<td>.02</td>
<td>.02</td>
<td>.04</td>
<td>23.12</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Block 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seatbelt use (rear)</td>
<td>.57</td>
<td>.55</td>
<td>.32</td>
<td>.30</td>
<td>.35</td>
<td>472.51</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Speeding (urban)</td>
<td>.56</td>
<td>.13</td>
<td>.33</td>
<td>.02</td>
<td>.18</td>
<td>23.77</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Speeding (motorway)</td>
<td>.56</td>
<td>.07</td>
<td>.34</td>
<td>.004</td>
<td>.09</td>
<td>5.69</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Block 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency of HED</td>
<td>.56</td>
<td>.06</td>
<td>.34</td>
<td>.004</td>
<td>.20</td>
<td>5.96</td>
<td>&lt;.05</td>
</tr>
</tbody>
</table>

**T1 Seatbelt use (rear)**

Table 57 illustrates the IVs entered into the regression analysis in order to predict the DV of T1 rear seatbelt use.

Table 57. Predictor variables entered into stepwise regression for T1 rear seatbelt use.

<table>
<thead>
<tr>
<th>Personality</th>
<th>Health behaviours</th>
<th>Demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td>Block 2</td>
<td>Block 3</td>
</tr>
<tr>
<td>ImpSS</td>
<td>Seatbelt use (front)</td>
<td>Frequency of alcohol</td>
</tr>
<tr>
<td></td>
<td>Speeding (urban)</td>
<td>Amount of alcohol</td>
</tr>
<tr>
<td></td>
<td>Speeding (motorway)</td>
<td>Frequency of HED</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 58 presents the key statistics for the regression model for T1 rear seatbelt use. The total variance explained by this model was 33%, which was similar to front seatbelt use. Similar driving behaviour accounted for 31% of the variance, with front seatbelt use accounting for the majority of this variance (31%), which reflects their significant correlation ($r = .57, p < .001$). ImpSS only accounted for 1%.

Table 58. Summary of multiple (stepwise) regression for T1 seatbelt use (rear) (N = 1080).

<table>
<thead>
<tr>
<th>Variables</th>
<th>R</th>
<th>β</th>
<th>R Squared</th>
<th>R Squared change</th>
<th>B</th>
<th>F change</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ImpSS</td>
<td>.11</td>
<td>.11</td>
<td>.01</td>
<td>.01</td>
<td>.04</td>
<td>13.39</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Block 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seatbelt use (front)</td>
<td>.56</td>
<td>.56</td>
<td>.31</td>
<td>.30</td>
<td>.67</td>
<td>472.51</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Speeding (motorway)</td>
<td>.57</td>
<td>.09</td>
<td>.32</td>
<td>.01</td>
<td>.19</td>
<td>11.57</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Block 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency of HED</td>
<td>.57</td>
<td>.07</td>
<td>.33</td>
<td>.01</td>
<td>.11</td>
<td>7.32</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Block 4</td>
<td>Block 3</td>
<td>Frequency of HED</td>
<td>Lower rank</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>.57</td>
<td>-.06</td>
<td>.33</td>
<td>.003</td>
<td>-.31</td>
<td>5.41</td>
<td>&lt;.05</td>
</tr>
</tbody>
</table>
**T1 Speeding (urban)**

Table 59 illustrates the IVs entered into the regression analysis in order to predict the DV of T1 speeding in urban areas.

Table 59. Predictor variables entered into stepwise regression for T1 speeding (urban).

<table>
<thead>
<tr>
<th>Personality</th>
<th>Health behaviours</th>
<th>Demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td>Block 2</td>
<td>Block 3</td>
</tr>
<tr>
<td>ImpSS</td>
<td>Seatbelt use (rear)</td>
<td>Frequency of alcohol</td>
</tr>
<tr>
<td></td>
<td>Seatbelt use (front)</td>
<td>Amount of alcohol</td>
</tr>
<tr>
<td></td>
<td>Speeding (motorway)</td>
<td>Frequency of HED</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 60 presents the key statistics for the regression model for T1 speeding in urban areas. The total variance explained by this model was 23%. ImpSS was a significant predictor accounting for 3% of the model variance. Again, other driving behaviours accounted for the largest part of the variance at 20%. As a co-varying behaviour, alcohol consumption emerged as a significant predictor but at a very low rate (<1%).

Table 60. Summary of multiple (stepwise) regression for T1 speeding (urban) (N = 1080).

<table>
<thead>
<tr>
<th>Variables</th>
<th>R</th>
<th>β</th>
<th>R Squared change</th>
<th>B</th>
<th>F change</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ImpSS</td>
<td>.17</td>
<td>.17</td>
<td>.03</td>
<td>.03</td>
<td>30.26</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Block 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speeding (motorway)</td>
<td>.45</td>
<td>.43</td>
<td>.20</td>
<td>.18</td>
<td>239.29</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Seatbelt use (front)</td>
<td>.47</td>
<td>.14</td>
<td>.22</td>
<td>.02</td>
<td>25.77</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Block 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount of alcohol</td>
<td>.48</td>
<td>.06</td>
<td>.23</td>
<td>.02</td>
<td>4.81</td>
<td>&lt;.05</td>
</tr>
</tbody>
</table>

**T1 Speeding (motorway)**

Table 61 illustrates the IVs entered into the regression analysis in order to predict the DV of T1 speeding on motorways.

Table 61. Predictor variables entered into stepwise regression for T1 speeding (motorway).

<table>
<thead>
<tr>
<th>Personality</th>
<th>Health behaviours</th>
<th>Demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td>Block 2</td>
<td>Block 3</td>
</tr>
<tr>
<td>ImpSS</td>
<td>Seatbelt use (rear)</td>
<td>Frequency of alcohol</td>
</tr>
<tr>
<td></td>
<td>Seatbelt use (front)</td>
<td>Amount of alcohol</td>
</tr>
<tr>
<td></td>
<td>Speeding (urban)</td>
<td>Frequency of HED</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 62 presents the key statistics for the regression model for T1 motorway speeding. The total variance explained by this model was 25%. The results are similar to those presented in Table 60.

<table>
<thead>
<tr>
<th>Variables</th>
<th>R</th>
<th>β</th>
<th>R Squared</th>
<th>B</th>
<th>F change</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ImpSS</td>
<td>.19</td>
<td>.19</td>
<td>.04</td>
<td>.04</td>
<td>44.51</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Block 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speeding (urban)</td>
<td>.48</td>
<td>.42</td>
<td>.21</td>
<td>.18</td>
<td>.45</td>
<td>239.29</td>
</tr>
<tr>
<td>Seatbelt use (rear)</td>
<td>.48</td>
<td>.12</td>
<td>.23</td>
<td>.01</td>
<td>.06</td>
<td>20.09</td>
</tr>
<tr>
<td>Seatbelt use (front)</td>
<td>.48</td>
<td>.08</td>
<td>.23</td>
<td>.004</td>
<td>.06</td>
<td>5.69</td>
</tr>
<tr>
<td>Block 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amount of alcohol</td>
<td>.49</td>
<td>.11</td>
<td>.24</td>
<td>.01</td>
<td>.04</td>
<td>16.68</td>
</tr>
<tr>
<td>Frequency of alcohol</td>
<td>.48</td>
<td>.07</td>
<td>.25</td>
<td>.004</td>
<td>.04</td>
<td>5.67</td>
</tr>
</tbody>
</table>

The results of the baseline pre-deployment multiple regressions highlight a similar pattern. ImpSS has shown to be a significant predictor for alcohol consumption and driving behaviour, but only for between 1-5% of the variance; although ImpSS did not emerge for smoking behaviour. Similar behaviour emerged as the highest predictor, and this is supported by the high and significant correlations between such behaviours (e.g. frequency of HED and frequency of general alcohol consumption). Despite the fact that co-varying health behaviours and demographic variables have emerged as significant predictors, these are at very low levels, approximately 1%.

**Predicting behaviour across time**

Predicting behaviour across time is of interest to health psychologists because if one can predict the factors that influence future health compromising behaviour then strategies and interventions can be planned in advance in order to counter these future behavioural challenges.

**T2 Smoking behaviour**

Table 63 illustrates the IVs entered into the regression analysis in order to predict the DV of T2 daily smoking rate.
Table 63. Predictor variables entered into stepwise regression for T2 risky smoking.

<table>
<thead>
<tr>
<th>Personality</th>
<th>Health behaviours</th>
<th>Demographics</th>
<th>Deployment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td>Block 2</td>
<td>Block 3</td>
<td>Block 4</td>
</tr>
<tr>
<td>ImpSS</td>
<td>T1 Smoker</td>
<td>T1 Frequency of HED</td>
<td>White</td>
</tr>
<tr>
<td>T1 Daily smoking rate</td>
<td>T1 Amount of alcohol</td>
<td>T1 Frequency of alcohol</td>
<td>Male</td>
</tr>
<tr>
<td>T2 Smoker</td>
<td>T2 Frequency of alcohol</td>
<td>T2 Frequency of alcohol</td>
<td>Lower rank</td>
</tr>
</tbody>
</table>

Table 64 presents the key statistics for the regression model for T2 daily smoking rate. The total variance explained by this model was 49%. As with T1 smoking behaviour, ImpSS failed to emerge as a significant predictor. The largest amount of variance was accounted for by previous smoking status and previous daily smoking rate, which accounted for 36%. Frequency of HED predicted 2% and demographic variables predicted 3% of the model. Perceiving their job as boring was a significant predictor and accounted for 1% of the variance. This is interesting as previous research found that boredom is one of the reasons that military personnel provide for validating their increase in smoking behaviour (Boos & Croft, 2004).

Table 64. Summary of multiple (stepwise) regression for T2 risky smoking (daily smoking rate) (N = 406).

<table>
<thead>
<tr>
<th>Variables</th>
<th>R</th>
<th>β</th>
<th>R Squared</th>
<th>R Square change</th>
<th>B</th>
<th>F change</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 Daily smoking rate</td>
<td>.63</td>
<td>.59</td>
<td>.39</td>
<td>.35</td>
<td>.88</td>
<td>227.87</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>T1 Smoker</td>
<td>.69</td>
<td>-5.87</td>
<td>.48</td>
<td>.01</td>
<td>-14</td>
<td>4.00</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>T2 Smoker</td>
<td>.67</td>
<td>.32</td>
<td>.47</td>
<td>.08</td>
<td>11.54</td>
<td>57.58</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Block 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 Frequency of HED</td>
<td>.15</td>
<td>.15</td>
<td>.02</td>
<td>.02</td>
<td>1.89</td>
<td>8.10</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Block 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>.19</td>
<td>.14</td>
<td>.04</td>
<td>.02</td>
<td>7.53</td>
<td>7.85</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Male</td>
<td>.22</td>
<td>.09</td>
<td>.05</td>
<td>.01</td>
<td>5.23</td>
<td>3.92</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>Block 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T2 boring job</td>
<td>.69</td>
<td>.10</td>
<td>.49</td>
<td>.01</td>
<td>1.18</td>
<td>7.99</td>
<td>&lt;.01</td>
</tr>
</tbody>
</table>

T3 Smoking behaviour

Table 65 illustrates the IVs entered into the regression analysis in order to predict the DV of T3 risky smoking behaviour, as measured by daily smoking rate.

Table 65. Predictor variables entered into stepwise regression for T3 risky smoking.

<table>
<thead>
<tr>
<th>Personality</th>
<th>Health behaviours</th>
<th>Demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td>Block 2</td>
<td>Block 3</td>
</tr>
<tr>
<td>ImpSS</td>
<td>T1 Smoker</td>
<td>T3 Frequency of alcohol</td>
</tr>
<tr>
<td>T1 Daily smoking rate</td>
<td>T3 Amount of alcohol</td>
<td>T3 Frequency of HED</td>
</tr>
<tr>
<td>T2 Smoker</td>
<td>T2 Frequency of alcohol</td>
<td>T3 Frequency of HED</td>
</tr>
<tr>
<td>T3 Smoker</td>
<td>T3 Frequency of alcohol</td>
<td>T3 Frequency of HED</td>
</tr>
</tbody>
</table>

175
Table 66 presents the key statistics for the regression model for T3 daily smoking rate. The total variance explained by this model was 67%. As with pre-deployment (Table 47) and mid-deployment smoking (Table 64) ImpSS failed to emerge as a significant predictor of daily smoking rate. Previous smoking status and behaviour predicted 21%, and co-varying frequency of alcohol predicted 1%. As expected, current smoking status accounted for the largest amount of variance (45%), however, demographic variables failed to emerge as significant predictors.

<table>
<thead>
<tr>
<th>Variables</th>
<th>R</th>
<th>β</th>
<th>R Squared change</th>
<th>B</th>
<th>F change</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>T3 Smoker</td>
<td>.67</td>
<td>.67</td>
<td>.45</td>
<td>16.08</td>
<td>162.59</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>T1 Daily smoking rate</td>
<td>.78</td>
<td>.43</td>
<td>.60</td>
<td>.15</td>
<td>84.15</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>T1 Smoker</td>
<td>.81</td>
<td>-.35</td>
<td>.65</td>
<td>.05</td>
<td>-10.37</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>T2 Daily smoking rate</td>
<td>.81</td>
<td>.15</td>
<td>.66</td>
<td>.01</td>
<td>6.39</td>
<td>&lt;.01</td>
</tr>
</tbody>
</table>

T3 Alcohol consumption

T3 Amount of alcohol

Table 67 illustrates the IVs entered into the regression analysis in order to predict the DV of T3 amount of alcohol.

<table>
<thead>
<tr>
<th>Personality</th>
<th>Health behaviours</th>
<th>Demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td>Block 2</td>
<td>Block 3</td>
</tr>
<tr>
<td>ImpSS</td>
<td>T1 Frequency of HED</td>
<td>T1 Daily smoking rate</td>
</tr>
<tr>
<td>T1 Frequency of alcohol</td>
<td>T1 Smoker</td>
<td>T2 Smoker</td>
</tr>
<tr>
<td>T1 Amount of alcohol</td>
<td>T2 Frequency of HED</td>
<td>T3 Smoker</td>
</tr>
<tr>
<td>T3 Frequency of alcohol</td>
<td>T3 Daily smoking rate</td>
<td>T3 Daily smoking rate</td>
</tr>
</tbody>
</table>

Table 68 presents the key statistics for the regression model for T3 amount of alcohol. The total variance explained by this model was 34%. Although a higher level of prediction than the T1 model, the majority of results are similar; for example, ImpSS significantly predicted 4% (5% at T1), and daily smoking rate predicted 2% (1% at T1). Past alcohol behaviour predicted 6%, whereas current frequency of HED accounted for 22% (17% at T1). Demographic variables failed to emerge; although they only predicted <1% at T1.
Table 68. Summary of multiple (stepwise) regression for T3 amount of alcohol (N = 225).

<table>
<thead>
<tr>
<th>Variables</th>
<th>R</th>
<th>β</th>
<th>R Squared</th>
<th>R Square change</th>
<th>B</th>
<th>F change</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Block 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Block 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T3 Frequency of HED</td>
<td>.51</td>
<td>.48</td>
<td>.28</td>
<td>.22</td>
<td>1.06</td>
<td>85.76</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>T1 Amount of alcohol</td>
<td>.57</td>
<td>.27</td>
<td>.33</td>
<td>.06</td>
<td>.27</td>
<td>21.13</td>
<td>&lt;.001</td>
</tr>
<tr>
<td><strong>Block 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T2 Daily smoking rate</td>
<td>.58</td>
<td>.12</td>
<td>.34</td>
<td>.02</td>
<td>.02</td>
<td>4.85</td>
<td>&lt;.05</td>
</tr>
</tbody>
</table>

T3 Frequency of alcohol

Table 69 illustrates the IVs entered into the regression analysis in order to predict the DV of T3 frequency of alcohol.

Table 69. Predictor variables entered into stepwise regression for T3 frequency of alcohol.

<table>
<thead>
<tr>
<th>Personality</th>
<th>Health behaviours</th>
<th>Demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Block 1</strong></td>
<td><strong>Block 2</strong></td>
<td><strong>Block 3</strong></td>
</tr>
<tr>
<td>ImpSS</td>
<td>T1 Frequency of alcohol</td>
<td>T1 Daily smoking rate</td>
</tr>
<tr>
<td>T1 Amount of alcohol</td>
<td>T1 Smoker</td>
<td>Male</td>
</tr>
<tr>
<td>T1 Frequency of HED</td>
<td>T2 Smoker</td>
<td>Single</td>
</tr>
<tr>
<td>T3 Amount of alcohol</td>
<td>T2 Daily smoking rate</td>
<td>White</td>
</tr>
<tr>
<td>T3 Frequency of HED</td>
<td>T3 Smoker</td>
<td></td>
</tr>
<tr>
<td>T3 Daily smoking rate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 70 presents the key statistics for the regression model for T3 frequency of alcohol. The total variance explained by this model was 53%. ImpSS, co-varying health behaviours and demographic variables did not emerge as significant predictors. The largest source of variance was T3 frequency of HED, which accounted for 44% of the model. Past alcohol behaviour at T1 predicted 9% of future behaviour.

Table 70. Summary of multiple (stepwise) regression for T3 frequency of alcohol (N = 225).

<table>
<thead>
<tr>
<th>Variables</th>
<th>R</th>
<th>β</th>
<th>R Squared</th>
<th>R Square change</th>
<th>B</th>
<th>F change</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Block 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T3 Frequency of HED</td>
<td>.66</td>
<td>.67</td>
<td>.44</td>
<td>.44</td>
<td>.88</td>
<td>170.78</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>T1 Frequency of alcohol</td>
<td>.72</td>
<td>.31</td>
<td>.52</td>
<td>.06</td>
<td>.31</td>
<td>35.91</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>T1 Amount of alcohol</td>
<td>.72</td>
<td>-.11</td>
<td>.53</td>
<td>-.07</td>
<td>-.07</td>
<td>4.53</td>
<td>&lt;.05</td>
</tr>
</tbody>
</table>

T3 Frequency of HED

Table 71 illustrates the IVs entered into the regression analysis in order to predict the DV of T3 frequency of HED.
Table 71. Predictor variables entered into stepwise regression for T3 frequency of HED.

<table>
<thead>
<tr>
<th>Personality</th>
<th>Health behaviours</th>
<th>Demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td>Block 2</td>
<td>Block 3</td>
</tr>
<tr>
<td>ImpSS</td>
<td>T1 Frequency of alcohol</td>
<td>T1 Daily smoking rate</td>
</tr>
<tr>
<td></td>
<td>T1 Amount of alcohol</td>
<td>T1 Smoker</td>
</tr>
<tr>
<td></td>
<td>T1 Frequency of HED</td>
<td>T2 Smoker</td>
</tr>
<tr>
<td></td>
<td>T3 Amount of alcohol</td>
<td>T2 Daily smoking rate</td>
</tr>
<tr>
<td></td>
<td>T3 Frequency of alcohol</td>
<td>T3 Smoker</td>
</tr>
<tr>
<td></td>
<td>T3 Daily smoking rate</td>
<td></td>
</tr>
</tbody>
</table>

Table 72 presents the key statistics for the regression model for T3 frequency of HED. The total variance explained by this model was 59%. As has been found consistently, ImpSS predicted 4% of the model's variance, with the remaining 55% accounted for by the other alcohol items. Within this 55%, previous alcohol consumption predicted 5%.

<table>
<thead>
<tr>
<th>Variables</th>
<th>R Squared</th>
<th>R Squared change</th>
<th>B</th>
<th>F change</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ImpSS</td>
<td>.19</td>
<td>.04</td>
<td>.04</td>
<td>8.11</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Block 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T3 Frequency of alcohol</td>
<td>.67</td>
<td>.48</td>
<td>.42</td>
<td>170.78</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>T3 Amount of alcohol</td>
<td>.73</td>
<td>.54</td>
<td>.08</td>
<td>38.91</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>T1 Frequency of HED</td>
<td>.76</td>
<td>.58</td>
<td>.04</td>
<td>21.92</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>T1 Frequency of alcohol</td>
<td>.77</td>
<td>.59</td>
<td>-.10</td>
<td>6.86</td>
<td>&gt;.015</td>
</tr>
</tbody>
</table>

T3 Driving behaviour

T3 Seatbelt use (front)

Table 73 illustrates the IVs entered into the regression analysis in order to predict the DV of T3 front seatbelt use.

Table 73. Predictor variables entered into stepwise regression for T3 front seatbelt use.

<table>
<thead>
<tr>
<th>Personality</th>
<th>Health behaviours</th>
<th>Demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td>Block 2</td>
<td>Block 3</td>
</tr>
<tr>
<td>ImpSS</td>
<td>T1 Seatbelt use (rear)</td>
<td>T1 Frequency of alcohol</td>
</tr>
<tr>
<td></td>
<td>T1 Seatbelt use (front)</td>
<td>T1 Amount of alcohol</td>
</tr>
<tr>
<td></td>
<td>T1 Speeding (urban)</td>
<td>T1 Frequency of HED</td>
</tr>
<tr>
<td></td>
<td>T1 Speeding (motorway)</td>
<td>T3 Frequency of alcohol</td>
</tr>
<tr>
<td></td>
<td>T3 Seatbelt use (rear)</td>
<td>T3 Amount of alcohol</td>
</tr>
<tr>
<td></td>
<td>T3 Speeding (urban)</td>
<td>T3 Frequency of HED</td>
</tr>
<tr>
<td></td>
<td>T3 Speeding (motorway)</td>
<td></td>
</tr>
</tbody>
</table>
Table 74 presents the key statistics for the regression model for T3 front seatbelt use. The total variance explained by this model was 44%. ImpSS predicted 3% of the model's variance, with the remaining 41% accounted for by the other driving behaviour items. Within this 41%, previous driving behaviour predicted 9%.

<table>
<thead>
<tr>
<th>Variables</th>
<th>R</th>
<th>β</th>
<th>R Squared</th>
<th>R Squared change</th>
<th>B</th>
<th>F change</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ImpSS</td>
<td>.17</td>
<td>.17</td>
<td>.03</td>
<td>.03</td>
<td>.04</td>
<td>12.27</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Block 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T3 Seatbelt use (rear)</td>
<td>.57</td>
<td>.56</td>
<td>.33</td>
<td>.30</td>
<td>.36</td>
<td>183.26</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>T1 Seatbelt use (front)</td>
<td>.64</td>
<td>.31</td>
<td>.41</td>
<td>.08</td>
<td>.34</td>
<td>51.77</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>T3 Speeding (urban)</td>
<td>.66</td>
<td>.18</td>
<td>.44</td>
<td>.03</td>
<td>.26</td>
<td>20.39</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>T1 Seatbelt use (rear)</td>
<td>.67</td>
<td>-.11</td>
<td>.44</td>
<td>.01</td>
<td>-.07</td>
<td>4.88</td>
<td>&lt;.01</td>
</tr>
</tbody>
</table>

**T3 Seatbelt use (rear)**

Table 75 illustrates the IVs entered into the regression analysis in order to predict the DV of T3 rear seatbelt use.

<table>
<thead>
<tr>
<th>Personality</th>
<th>Health behaviours</th>
<th>Demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td>Block 2</td>
<td>Block 3</td>
</tr>
<tr>
<td>ImpSS</td>
<td>T1 Seatbelt use (rear)</td>
<td>T1 Frequency of alcohol</td>
</tr>
<tr>
<td>T1 Seatbelt use (front)</td>
<td>T1 Amount of alcohol</td>
<td>Male</td>
</tr>
<tr>
<td>T1 Speeding (urban)</td>
<td>T1 Frequency of HED</td>
<td>Single</td>
</tr>
<tr>
<td>T1 Speeding (motorway)</td>
<td>T3 Frequency of alcohol</td>
<td>White</td>
</tr>
<tr>
<td>T3 Seatbelt use (front)</td>
<td>T3 Amount of alcohol</td>
<td></td>
</tr>
<tr>
<td>T3 Speeding (urban)</td>
<td>T3 Frequency of HED</td>
<td></td>
</tr>
<tr>
<td>T3 Speeding (motorway)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 76 presents the key statistics for the regression model for T3 rear seatbelt use. The total variance explained by this model was 47%. ImpSS, co-varying health behaviours and demographic variables failed to emerge as a significant predictor. Previous rear seatbelt use predicted 32%, whereas current front seatbelt use accounted for a further 15%. This highlights the predictive power of past behaviour on future behaviour.
Table 76. Summary of multiple (stepwise) regression for T3 seatbelt use (rear) \((N = 407)\).

<table>
<thead>
<tr>
<th>Variables</th>
<th>R</th>
<th>β</th>
<th>R Squared</th>
<th>R Square change</th>
<th>B</th>
<th>F change</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Block 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 Seatbelt use (rear)</td>
<td>.56</td>
<td>.56</td>
<td>.32</td>
<td>.32</td>
<td>.56</td>
<td>188.70</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>T3 Seatbelt use (front)</td>
<td>.69</td>
<td>.42</td>
<td>.47</td>
<td>.15</td>
<td>.64</td>
<td>117.42</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

**T3 Speeding (urban)**

Table 77 illustrates the IVs entered into the regression analysis in order to predict the DV of T3 speeding in urban areas.

Table 77. Predictor variables entered into stepwise regression for T3 speeding (urban).

<table>
<thead>
<tr>
<th>Personality</th>
<th>Health behaviours</th>
<th>Demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block 1</td>
<td>Block 2</td>
<td>Block 3</td>
</tr>
<tr>
<td>ImpSS</td>
<td>T1 Seatbelt use (rear)</td>
<td>T1 Frequency of alcohol</td>
</tr>
<tr>
<td></td>
<td>T1 Seatbelt use (front)</td>
<td>T1 Amount of alcohol</td>
</tr>
<tr>
<td></td>
<td>T1 Speeding (urban)</td>
<td>T1 Frequency of HED</td>
</tr>
<tr>
<td></td>
<td>T1 Speeding (motorway)</td>
<td>T3 Frequency of alcohol</td>
</tr>
<tr>
<td></td>
<td>T3 Seatbelt use (rear)</td>
<td>T3 Amount of alcohol</td>
</tr>
<tr>
<td></td>
<td>T3 Seatbelt use (front)</td>
<td>T3 Frequency of HED</td>
</tr>
<tr>
<td></td>
<td>T3 Speeding (motorway)</td>
<td></td>
</tr>
</tbody>
</table>

Table 78 presents the key statistics for the regression model for T3 speeding in urban areas. The total variance explained by this model was 39%. ImpSS accounted for 7% of the variance, which is slightly higher than the commonly found amount of variance across the majority of the regression analyses for both alcohol consumption and driving behaviour (i.e., ~4-5%). Past behaviour (T1) for urban speeding accounted for the largest amount of variance (18%), and current driving behaviour accounted for 14%, which meant that driving behaviour as a whole accounted for 32%. Both other co-varying health behaviours and demographic variables failed to emerge as significant predictors.

Table 78. Summary of multiple (stepwise) regression for T3 speeding (urban) \((N = 407)\).

<table>
<thead>
<tr>
<th>Variables</th>
<th>R</th>
<th>β</th>
<th>R Squared</th>
<th>R Square change</th>
<th>B</th>
<th>F change</th>
<th>Sig. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Block 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ImpSS</td>
<td>.26</td>
<td>.26</td>
<td>.07</td>
<td>.07</td>
<td>.05</td>
<td>28.03</td>
<td>&lt;.001</td>
</tr>
<tr>
<td><strong>Block 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 Speeding (urban)</td>
<td>.49</td>
<td>.44</td>
<td>.28</td>
<td>.18</td>
<td>.43</td>
<td>98.86</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>T3 Speeding (motorway)</td>
<td>.59</td>
<td>.35</td>
<td>.36</td>
<td>.11</td>
<td>.33</td>
<td>67.22</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>T3 Seatbelt use (front)</td>
<td>.62</td>
<td>.19</td>
<td>.39</td>
<td>.03</td>
<td>.13</td>
<td>21.71</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>
Table 79 illustrates the IVs entered into the regression analysis in order to predict the DV of T3 speeding on motorways.

### Table 79. Predictor variables entered into stepwise regression for T3 speeding (motorway).

<table>
<thead>
<tr>
<th>Personality</th>
<th>Health behaviours</th>
<th>Demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Block 1</td>
<td>Block 2</td>
</tr>
<tr>
<td>ImpSS</td>
<td>T1 Seatbelt use (rear)</td>
<td>T1 Frequency of alcohol</td>
</tr>
<tr>
<td>T1 Seatbelt use (front)</td>
<td>T1 Amount of alcohol</td>
<td>Male</td>
</tr>
<tr>
<td>T1 Speeding (urban)</td>
<td>T1 Frequency of HED</td>
<td>Single</td>
</tr>
<tr>
<td>T1 Speeding (motorway)</td>
<td>T3 Frequency of alcohol</td>
<td>White</td>
</tr>
<tr>
<td>T3 Seatbelt use (rear)</td>
<td>T3 Amount of alcohol</td>
<td></td>
</tr>
<tr>
<td>T3 Seatbelt use (front)</td>
<td>T3 Frequency of HED</td>
<td></td>
</tr>
<tr>
<td>T3 Speeding (urban)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 80 presents the key statistics for the regression model for T3 speeding on motorways. The total variance explained by this model was 36%. ImpSS accounted for 4% of the variance, which has been a consistent finding among the regression analyses. Past behaviour (T1) for motorway speeding accounted for the largest amount of variance (21%), and current driving behaviour accounted for 10%, which meant that driving behaviour as a whole accounted for 31%, similar to urban speeding in Table 48. Other co-varying health behaviours failed to emerge as significant predictors, but the demographic variable of being white did emerge, but only accounting for <1%.

### Table 80. Summary of multiple (stepwise) regression for T3 speeding (motorway) (N = 407).

<table>
<thead>
<tr>
<th>Variables</th>
<th>R</th>
<th>β</th>
<th>R Squared</th>
<th>R Square change</th>
<th>B</th>
<th>F change</th>
<th>Stg. F Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Block 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ImpSS</td>
<td>.22</td>
<td>.22</td>
<td>.05</td>
<td>.05</td>
<td>.04</td>
<td>21.42</td>
<td>&lt;.001</td>
</tr>
<tr>
<td><strong>Block 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1 Speeding (motorway)</td>
<td>.51</td>
<td>.47</td>
<td>.26</td>
<td>.26</td>
<td>.47</td>
<td>112.59</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>T3 Speeding (urban)</td>
<td>.59</td>
<td>.32</td>
<td>.34</td>
<td>.09</td>
<td>.33</td>
<td>52.32</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>T3 Seatbelt use (front)</td>
<td>.59</td>
<td>.09</td>
<td>.34</td>
<td>.01</td>
<td>.06</td>
<td>3.88</td>
<td>&lt;.05</td>
</tr>
<tr>
<td><strong>Block 4</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>.59</td>
<td>-.09</td>
<td>.36</td>
<td>.01</td>
<td>-.26</td>
<td>5.65</td>
<td>=.018</td>
</tr>
</tbody>
</table>

Although the primary findings of each of the regression models have been presented, further interpretation of these results is discussed in the following discussion chapter.
8. DISCUSSION

8.1 Informing sensation seeking theory

The findings from this study help to inform the theory of SS, in particular ImpSS. Firstly, by adopting the measure of ImpSS it adds to the small but burgeoning area in this latest theoretical development of the sensation seeking construct. McDaniel and Mahan (2008) comment that Zuckerman (1994) called for greater inclusion of the ImpSS scale within research; however, there was a lack of enthusiasm due to concerns over psychometric issues by some researchers (e.g. Hoyle et al., 2002). McDaniel and Mahan (2008) investigated issues surrounding the reliability, construct validity and concurrent validity of the ImpSS scale, and stated that the ImpSS scale was psychometrically sound, valid, reliable, and should be included in more SS research studies in preference to the SSS-V. Secondly, by using a UK military sample to investigate this specific risk-taking personality construct, it is thought to be the first reported study of its kind and contributes to the debate about risk-taking in the military, which is an increasing area of interest (Killgore et al., 2006, 2008; Killgore, Castro & Hoge, 2010; Momen et al., 2010; Steenbergh et al., 2008).

The findings herein mirror those broadly found and reviewed in the previous literature (Zuckerman, 1994, 2007a); for example, that ImpSS is higher in males than females, and that it declines with age, which is the profile of the general SS tendency. In the present study a (near) normal distribution was demonstrated (Figure 15, p.124), and the mean scores compared with previously published data on ImpSS by McDaniel and Zuckerman (2003). This comparison was conducted in order to investigate whether the military is higher in risk-taking propensity than comparable civilian populations. On face value the overall mean scores did not differ much (Table 10, p.131) but as the two populations were broken down into more comparable groups for age and gender, statistically significant and meaningful differences became stronger; with the final position being that the present UK army sample was statistically and meaningfully higher in ImpSS than a U.S. civilian population. Potential confounders to this finding are discussed later in terms of the military population, i.e., the present population was an army sample and may be higher (or lower) in ImpSS than navy and air force populations. Additionally, cultural differences between the U.S. and UK could be raised, however, this was not expected to have an impact due to the cultural
similarity between the UK and U.S. (Hofstede, 1994). Having established the demographic basis of the military sample, the individual research hypotheses could be addressed.

**Hypothesis 1: The high ImpSS group will engage in higher rates of risky health behaviour (i.e., drinking, smoking, sex and driving) than the low ImpSS group, and across each phase of the deployment.**

This hypothesis can be supported. The present findings are in-line with previous research, which has consistently found that H-ImpSS (or HSS) groups display higher levels of risky health behaviours than L-ImpSS (LSS) groups. This was found across all items for each of the four health behaviours investigated (alcohol consumption, smoking, risky driving and risky sexual activity). Furthermore, the H-ImpSS group displayed higher levels of risky behaviour across each of the deployment phases, as found in chapter 7.4 and the mixed ANOVA analyses. However, frequency of alcohol at post-deployment showed an interesting interaction whereby the L-ImpSS group increased their frequency of alcohol whereas the H-ImpSS reduced their frequency. Furthermore, despite this interaction, the observed changes for both ImpSS groups between pre- and post-deployment were not significant.

Furthermore, the differences between ImpSS groups were consistently significant, but the effect sizes suggest that these differences were only weakly or moderately meaningful. For example, chapter 7.3 found that the range of effect sizes between ImpSS groups on baseline health behaviours was between $r = .08$ and $r = .31$, which suggests weak to moderate effects, i.e., weak to moderate meaningfulness.

Zuckerman (2007a) suggested that as well as a suitable measure for investigating the general SS tendency, the ImpSS scale was particularly effective for investigating the risky health behaviours of drinking, drugs and sex. Within the present study the correlations between ImpSS and the individual health behaviour items (Table 19, p.137) showed significant, but weak to moderate, correlations; with the strongest correlations among the sexual behaviours, in particular, age at first sex ($r = -.22$, $p<.001$) and one night stands ($r = -.22$, $p<.001$). Typically, significant correlations ranged between $r = .13$ to .22, with paying for sex as the lowest, non-significant correlation ($r = .03$, NS). These correlations appear broadly similar when compared to the correlations between the EVAR-B scale and risky alcohol
consumption reported by Killgore et al. (2010). Also, previous SS research has found correlations within similar ranges found in the present study (Dahlen et al., 2005; Hatfield & Fernandes, 2009; Iversen & Rundmo, 2002; Kahler et al., 2009; Norris et al., 2009; Schwebel et al., 2006; Ulleberg, 2002). However, higher correlations have been found between SS and risky health behaviours (e.g. Cyders et al., 2008; Hampson et al., 2001); and there have even been mixed findings, with Yusko et al. (2008) finding high correlations between SS and alcohol consumption for athlete students, but much lower correlations for SS and alcohol consumption among non-athlete students.

Ultimately, what has been shown in the present study, and mirrors previous findings, is that as the SS tendency increases then so does the level of engagement in risky health behaviour. The differences between ImpSS groups were consistently significant, but the effect sizes suggest that these differences are only weakly or moderately meaningful. Unfortunately, effect sizes are not reported as often as suggested (Field, 2005; Wright, 2003), and the key statistics, which enable the calculation of the effect size, are sometimes absent in journal articles. Finally, the correlations between ImpSS and health behaviours are significant but weak to moderate. Torgersen and Vollrath (2006) suggest that one possible reason for significant but weak-moderate findings in personality research could be the narrow emphasis on personality traits rather than a broader appreciation and consideration of personality types. The argument for type-based research is that combinations of traits allow aspects of personality to emerge, whereas the single trait approach do not allow for characteristics of personality to fully emerge. Therefore, as a construct, SS (and ImpSS) may need to be considered within a broader risk-taking personality type.

Risk perception
Central to the theory of SS is the disparity in risk perceptions (or risk appraisal). This suggests that those high in the SS tendency perceive a specific risk event as lower than those who are lower in the trait. This legitimises the sensation seeking or risk-taking activities of H-ImpSS (or HSS). The present findings can therefore be used to answer the second of the original hypotheses.

_Hypothesis 2: The high ImpSS group will possess lower risk perceptions than the low ImpSS group, and across all the deployment phases._
This hypothesis can be supported. The present findings are in-line with previous findings, whereby those high in the SS tendency display lower risk perceptions than those lower in the SS trait. These differences were also consistent across time for each of the deployment phases. The correlation between ImpSS and risk perception was weak but significant \( r = -.14, p < .001 \).

Further to this, the recall of risk was systematic and consistent across time between these two groups, with both groups underestimating previous estimates. This possibly suggests a systematic cognitive phenomenon in recall judgements, whereby underestimation of recall could be seen as a protective factor for future psychological well-being. However, one potential confounding variable was a possible ‘ceiling effect’ in the items used to measure operational risk perception; for example, the participants scored risk perception across a 4-point likert scale, with the mean scores tending to be positively skewed towards the higher end (i.e., ‘very risky’ and ‘slightly risky’). This suggests that the recall of previous estimates may not be able to be scored any higher than previous; thus the only way to subsequently score is the same as previous or lower. If the recall scores were not statistically different then the ceiling effect would be assumed to have occurred (because future scores could not be rated as any higher), but the present study found consistent underestimations at future reporting times, and in both ImpSS groups, which suggests that a possible cognitive bias may have been occurring. However, further studies need to be conducted, using a wider likert scale (e.g. 6-point or 8-point) to establish if the present findings were indeed a cognitive phenomenon or a methodological limitation.

Freres and Gillham (2006) reported that increased risk perceptions lead to more protective health practices, because lower, incongruent risk perceptions lead to increased risk-taking. In terms of the ImpSS and risk perception findings within the present study then this can be supported, as the L-ImpSS group, who possessed higher risk perceptions, engaged in the risky health behaviours at lower levels compared to the H-ImpSS group.

**Psychological well-being**

One further area of ImpSS that was investigated was that of PWB. This was investigated because it has not been previously investigated (or reported) in the academic literature and possesses interesting implications for SS theory. In order to address this issue, the following research question was asked.
Research question 2: Do differences exist between the high and low ImpSS groups on measures of PWB?

This was an exploratory research question as no previous evidence of such findings could be found among the literature. Zuckerman (1994, 2007a) posits that the potential for over-arousal in those low in the SS tendency brings about increases in anxiety, which is why LSS (or L-ImpSS) tend to increase their risk perceptions of an event, which possibly influences their decision to disengage from (or completely avoid) risky behaviour. Therefore, the theoretical assumption that differences may exist between ImpSS groups on measures of PWB can be hypothesised. However, no such differences emerged, either as a cross-sectional measure (e.g. Time 1) or as a function of change across time. This finding could question the assumption that LSS disengage from risky activities because of the negative arousal states that LSS experience. Therefore, could motivation play a more prominent role? For example, HSS engage in risky behaviour because their biochemical arousal and reward system is under-aroused, thus they are motivated to engage with risk in order to stimulate their arousal and reward system; which also helps to explain why they perceive risk as lower than LSS. Conversely, LSS are not motivated to engage in risk-taking activities as their fundamental arousal and reward levels are at optimal levels. Furthermore, both LSS and HSS may experience similar arousal states for the same activity (e.g. a scary ride at a theme park), but the HSS are more motivated to feed their arousal and reward system, whereas the LSS are less motivated, therefore they do not seek the sensation and stimulation. Finally, not finding the anticipated difference could have been a methodological limitation, which is to say that PWB may not be the variable that captures negative affect between ImpSS groups, or alternatively, the GHQ-12 was an inappropriate measure of PWB, although Bowling (1997) refers to the GHQ as a measure of PWB.

8.2 ImpSS and risk-taking in the military

This study has increased the scientific knowledge-base regarding the issue of SS and risk-taking behaviour within the military domain.

The military and ImpSS

It is believed that this is the first known study using the SS measure of ImpSS on a military population. This drives forward the understanding of risk-taking propensity
within a population that are assumed to be risk-takers in a high-risk employment group, but where the evidence is not unequivocal. This study has demonstrated that not everyone in the present army sample is high in ImpSS. The normal distribution curve shown in Figure 15 (p.124) shows that the ImpSS tendency is spread across the 19-item range, which suggests there are low, medium and high ImpSS within a representative army sample. Additionally, the age and gender differences replicate established findings reported in the literature (Zuckerman, 1994, 2007a).

A systematic review conducted as part of the current Doctor of Philosophy programme produced mixed findings in terms of the previous studies measuring SS among military samples. For example, the military samples tended to score higher than normal civilian populations on the SS sub-scales of experience seeking (ES) and thrill and adventure seeking (TAS), but lower on boredom susceptibility (BS) and disinhibition (DIS). Furthermore, the population who tended to score highest were people who engaged in extreme and/or high-adrenalin sports (e.g. mountaineering, sky diving, parachuting, etc.). As previously shown, the current military sample were statistically higher for ImpSS compared to those data reported in McDaniel and Zuckerman (2003), although it had almost the same mean score ($\bar{X} = 11.8$) as van Beurden et al. (2005), who also used the same tertile split for high and low ImpSS groups as the present study. Therefore, there still remains uncertainty regarding the assumption that the military are higher in the general SS tendency than comparable civilian populations. One way of addressing this issue is to collect more SS data on large, representative samples among the other two services (i.e., navy and air force). This would help to establish if ImpSS is high across the UK Armed Forces or whether it is army-specific. However, differences with the other services cannot be pursued further as this data does not currently exist.

Analysis of covariance (ANCOVA) (controlling for age and gender) showed statistical differences between the CA and both the CS and CSS arms. This supports a common assumption within the army that there are fundamental differences within the service, i.e., that individuals who join the infantry and the more frontline units of the army are intrinsically different to rear echelon and non-combat units in terms of their SS, ImpSS and risk-taking propensity. Figure 17 (p.126) shows that the mean for the infantry was $\bar{X} = 11.8$ and for the cavalry it was $\bar{X} = 11.9$. Furthermore, these findings suggest that although individuals high in ImpSS may be attracted to the military, this
is certainly not unequivocal across the entire army. Thus, it is assumed that people join the army for a variety of reasons beyond risk-taking and SS, e.g. economic, family ties and history, career, etc; for example, it is understood within the recruitment strategy and policy domain of the MoD that external factors, such as economic recessions, increases the numbers of volunteers seeking to join the armed forces. This is currently the case within the British army whereby they are currently over-subscribed for the first time in years. As such, contingency planning has taken place and ‘Operation Solomon’ has been set up by the MoD to deal with the influx of new recruits with extra training courses having to be organised. Therefore, this provides an alternative view in the debate about risk-taking and the motivations of people who decide to join the military.

The age-related decline witnessed in the present sample suggests that the nature of army work may not delay a decline in SS. The military provides access to unique experiences that everyday civilians do not have access to (e.g. military deployments, fighting wars, firing weapons, etc.) and the military also provides access to heavily subsidised extreme and/or high-adrenalin sports and adventurous training, which the average individuals in the civilian population would probably not have access to because of the prohibitive costs. Therefore, it could be posited that these factors might produce a long-term socialisation process that keeps SS and risk-taking tendencies high, but this was not seen in the present study when the military age groups and combat arms were compared against McDaniel and Zuckerman’s (2003) civilian sample. In fact, the results of Tables 13-15 show that the differences between the UK military and U.S. civilian samples became non-significant among the older age groups, and among the CS and CSS units.

**The military and risk-taking**

A fundamental question that emerges from the present study is: ‘are the military more prone to higher rates of sensation seeking and risk-taking than civilians?’ According to the present study, they are, but this can only be said for the UK army. Sicard et al. (2003) reported that military pilots were higher than commercial pilots on all dimensions of the EVAR scale, except impulsiveness. Limitations to this current understanding include the use of different measures of ‘risk-taking’ across both military and civilian samples; a lack of studies utilising large samples across military arms (e.g. army, navy, air force); and not enough studies across different military
trades, roles and sub-populations. Killgore et al. (2010) report that the U.S. version of the EVAR scale has only been applied to deployed military personnel, and not to non-deployed military personnel or to civilian samples. Therefore, targeted research that addresses these limitations will help to improve our understanding of military risk-taking.

Killgore et al. (2010) have developed a modified version of their previous U.S. version of the EVAR scale (Killgore et al., 2006, 2008). The latest version, the EVAR-B(ubble) is a modified version, which incorporates a response line of 25 horizontal bubbles as opposed to a visual analogue scale. The aim of this is to speed up the scoring of large sample data through the use of optical scanning equipment. This suggests that they intend to continue to validate and use the EVAR scale in future studies. Additionally, Momen et al. (2010) have developed and initially validated the Military Operational Risk Taking Scale (MORTS), which is a 31-item scale used to 'identify military personnel with a tendency to engage in or avoid operationally non-essential risks that are maladaptive to the mission' (p.128).

An issue of concern with these numerous scales that are emerging is that it precludes comparative research. Despite being validated against previously established scales, they are essentially trying to measure the same broad constructs and behaviours (i.e., risk-taking). Momen et al. (2010) even compared their MORTS against the EVAR scale and discussed the concept of SS and impulsivity in the military; however, they did not measure SS or ImpSS. The ImpSS scale consists of 19-items and has demonstrated a Cronbach’s α of .84/.87 (McDaniel & Mahan, 2008); the EVAR scale contains 24-items and an established Cronbach’s α of .78 (Killgore et al., 2006) and the MORTS comprises 31-items and reports that it shows excellent reliability (Momen et al., 2010). To the author this seems as though we are going off down rabbit holes when there already exists valid and reliable measures with a longer history of psychometric validation and real world application, i.e., sensation seeking and impulsive sensation seeking. The dilemma that appears to be emerging is whether military scientists should apply global measures of risk-taking and sensation seeking to a military context, or does the military require the development of bespoke risk-taking measures? From the evidence provided in the present study (and the lack of evidence that has also been mentioned) it is posited that
the former option should be the preferred option until contrary evidence is reported which necessitates the need for the latter option.

8.3 Risky health behaviours

Stroebe (2000) discusses the behavioural responses to stress; this includes engagement with risky health behaviours, especially for smoking behaviour and alcohol consumption. Independent of the differences between the ImpSSS groups, which have been discussed, there was an assumption that changes in health behaviours might occur across the phases of the deployment. This led to the following hypothesis:

**Hypothesis 3**: Changes will occur across the deployment for each of the risky health behaviours.

**Alcohol**

Mid-deployment alcohol consumption reduced significantly because alcohol was not available for the majority of the sample; this was due to organisational sanctions and not volitional behaviour (i.e., there was a limited amount of alcohol in-theatre, but the majority of the brigade were not allowed access to it). The findings between pre- and post-deployment alcohol consumption showed mixed results; therefore the hypothesis can only be partly refuted. The only significant change was a post-deployment reduction in the amount of alcohol consumed on a typical day when drinking occurred, whereas HED and frequency of drinking did not change. This is a thought-provoking finding as it has generally been suggested that ‘alcohol misuse has been shown to increase following military deployments’ (Rona et al., 2010, p.37), as well as being linked to psychological (mental) health issues brought about by negative experiences during the deployment (Bell et al., 2004; Browne et al., 2008; Federman et al., 2000; Hooper et al., 2008; Jacobson et al., 2008). Research in this area needs to understand the tipping point between post-deployment celebrations and enduring dependence.

After six-months without alcohol, and with 95 per cent of the sample categorized as drinkers, it was expected that alcohol consumption would significantly increase for a short time after returning home. There are two confounding factors to this assumption; firstly, post-deployment data collection was conducted 2-3 months after participants returned home. Therefore, their drinking behaviour may have
increased for a short time after returning but returned to baseline levels (for the majority of participants) by the time T3 data were collected. Also, the brigade returned to the UK in early December 2007, which meant they would not only celebrate their return to the UK, but also the festive Christmas period. The second confounding factor is that pre-deployment (baseline) levels of alcohol consumption were high, therefore, if the high T1 levels of alcohol consumption were due to a pre-deployment effect (as opposed to a true baseline) then any perceived increase in drinking behaviour by the participants on returning home may have not have emerged.

Smoking

Smoking increased at mid-deployment, both in terms of the daily smoking rates of smokers, and also in terms of the changes in smoking status, particularly ex-smokers (recidivists) who started smoking again, and first time smokers who had never smoked before. Interestingly, daily smoking rate for current smokers significantly reduced at post-deployment; although the levels of current smokers remained broadly similar (i.e., 47 per cent at pre- and 46.4 per cent at post-deployment). A deeper look at smoking status found that 85.3 per cent (n = 220) of T3 participants who were current smokers at T1 were still smokers at T3, with 10.5 per cent (n = 27) now categorizing themselves as ex-smokers. Conversely, among the ex-smoking group at T1, 25.9 per cent (n = 15) now classified themselves as current smokers at T3. It could be that estimates of daily smoking rate were subjected to a self-reporting bias (i.e., under- and over-estimation); however, as paired t-tests were conducted then this bias would also be relevant to pre-deployment measurement. Further analysis outside of this study could investigate the complexity of smoking behaviour change between current, ex- and non-smokers across all phases. The present data suggests that a proportion of individuals move across smoking categories between each of the deployment phases, and for a variety of reasons and motivations. These moves are also not one directional or static and individuals can move back to previous smoking categories or onto another category. Therefore, deeper analysis of the qualitative data on perceived reasons for changes in smoking behaviour and smoking status should help to improve our understanding into this complexity of issues that influence deployment-related smoking behaviour. What is clear from these data is that despite the qualitative evidence suggesting that participants who smoked wanted to cut-down
or quit (across all phases of the deployment), the quantitative data suggests otherwise. This highlights the issue of (and gap between) intention and behaviour in health psychology and the disparities between people’s intentions and motivations, and their actual behaviour (i.e., the intention-behaviour gap).

**Driving**

Driving behaviour during a deployment is a complex issue, the reasons of which have been previously covered in the methodology, and which is why it was not collected during the deployment but only collected at pre- and post-deployment, and was only relevant to normal day-to-day driving of military personnel in their private vehicles and not military-specific driving. As with alcohol consumption, the findings on risky driving behaviour showed mixed results; therefore the hypothesis that behaviour change will occur can only be partly refuted. It was found at post-deployment that the rate of wearing seatbelts in the rear of a vehicle increased and the tendency to speed on motorways reduced, which are improvements in behaviour. However, there was no change for seatbelt use in the front as a passenger or for driving in urban (built-up) areas. Again, as with alcohol consumption, it has been reported that post-deployment driving risk significantly increases for military personnel (Bell et al., 2000; Fear et al., 2008). However, Fear et al. (2008) rightly suggest that risk is not evenly distributed and that there are a range of demographic, personality and mental health variables that are known to affect risk-taking and these could be used to help target such populations and any subsequent interventions. Along with alcohol consumption, the fundamental levels of driving behaviour could be seen as excessive and higher (more risky) than found in the general UK population, once adjusted for age and gender. As with all the health behaviours in the present study, deeper analysis of the individual data sets could be explored further and reported in the peer reviewed literature, which is the current plan.

**Sex**

It has already been mentioned that items asked on sexual risk-taking were not identical across the deployment phases, therefore the data did not allow for trend analysis across the deployment cycle. The implications for this are discussed later in terms of changes to future studies in this area.
Hypothesis 4: Psychological well-being (PWB) will change across the deployment for the overall sample.

This hypothesis was posited because of the known impacts of military deployments upon health behaviours and mental health issues. Also, PWB as measured by the GHQ-12 has been widely used within previous UK studies. Therefore, a strong case could be made to track changes in PWB across the deployment. As expected, PWB became worse during the deployment. At post-deployment PWB improved, but not back to the levels found at pre-deployment. This issue will also be discussed later in terms of post-deployment review, but one reason for the level of PWB found at post-deployment could be the time period when it was collected, i.e., 2-3 months post-deployment. Therefore, if the data had been collected earlier or later during the post-deployment phase would the levels of PWB have been worse earlier or improved later? or vice-versa? Additionally, for the majority of participants, PWB will recover back to ‘normal’ as measured by the GHQ-12 criteria; however, it is recognised that for a small, higher-risk proportion of personnel, PWB will remain poor or become worse, due to factors such as the length of deployment, high levels of combat exposure experienced, difficulties with readjustment, and those with underlying mental health issues (Browne et al., 2006; Rona et al., 2007a, 2007b; Stuart & Bliese, 1998).

Qualitative data

The range and amount of qualitative data collected during the present study improves the current awareness of the reasons that military personnel ascribe to their health behaviours, as well as the changes in their behaviour across time. As described in the literature review, there is a lack of qualitative research investigating military health. Those that have collected some form of qualitative data (e.g. Boos & Croft, 2004; Maguen et al., 2008) show consistent (but generic and limited) reasons for some behaviours, e.g. boredom and stress. However, the present study enhances this knowledge by identifying many more factors that contribute to behaviour and behaviour change; for example, job-related issues, family-related issues, health-related issues, environmental factors, economic factors, etc. The present qualitative data was collected on a much larger sample than previously reported by Boos and Croft (2004) and Maguen et al. (2008), and also on a wider range of health behaviours. The current level of content analysis provides an initial level of
understanding beyond that previously reported, however, it could be further analysed to answer more specific questions that are outside the requirement of the present study; for example, do H-ImpSS and L-ImpSS groups provide similar or different qualitative reasons for their behaviour changes? Or, what reasons do smokers and/or drinkers give for changes in their behaviour across the deployment cycle?

**Research Question 1: Which variables predict military-related risky health behaviours?**

In results section 7.8 a series of regression analyses were conducted. These results are interpreted based on three criteria: (1) the findings of previously published results, (2) the aim of the current study, and (3) the findings which emerged from the current analyses.

**Impulsive sensation seeking**

Previously, van Beurden et al. (2005) found that ImpSS accounted for 18 per cent of the variance for HED, and Yukso et al. (2009) found that SS accounted for 2 per cent of the variance related to HED. Results from the present study indicated that ImpSS predicted between 1 and 4.5 per cent of behaviour in the simple, linear regressions (Table 45). In the multiple regressions (of T1 health behaviour), ImpSS was predictive of between 1 and 5 per cent, which is similar to the linear regressions. Further comparison between the T1 linear and T1 multiple regressions found that ImpSS increased its predictive variance for the drinking behaviour, reduced its predictive variance for seatbelt use, and remained the same for speeding behaviour; however, the changes were very small and did not exceed a change further than 1 per cent. Regression models predicting behaviour across time found that ImpSS was predictive between 3 and 7 per cent, which is higher than both the linear and T1 multiple regression models. Finally, ImpSS was predictive in all the multiple regression analyses, except T1, T2, and T3 smoking behaviour, T3 frequency of alcohol and T3 rear seatbelt use.

So why was ImpSS a weak predictor in the present study compared to previous findings? One possible reason could be the low correlations between ImpSS and the health behaviours (Table 46). Table 46 found that the correlation between ImpSS and daily smoking rate was significant, but it was also the lowest correlation among the health behaviours ($r = .09, p < .01$). Regression analysis is based upon
predicting a relationship that is essentially a correlation; therefore, if low correlations are identified between variables, then this may affect any subsequent predictive power. This may provide a partial explanation why ImpSS was not a significant predictor of smoking behaviour (daily smoking rate) at T1, T2 and T3. Zuckerman and Kuhlman (2000) found that ImpSS accounted for 5 per cent of the variance among various risky health behaviours, which is broadly approximate to the average amount of variance accounted for by ImpSS in the current multiple regression analyses.

Also, as discussed earlier, Torgersen and Vollrath (2006) suggest that the study of individual personality traits often throw up mixed findings and that individual traits, such as SS, could be too narrow to allow strong characteristics of personality to fully emerge in certain analyses. Therefore, personality traits, such as SS and ImpSS, may need to be considered within the broader focus of personality types.

**Past behaviour**

The importance and impact of past behaviour has been robustly supported by Conner and Norman (1995, p.45) who stated that past behaviour has been found in numerous studies to be ‘the most powerful predictor of subsequent behaviours’. Conner and Norman (1995) also suggest that past behaviour needs to be considered within social cognitive variables, as it is through these mediating decision-making variables that future behaviour is subsequently operationalised. In the present study, past behaviour emerged as a strong significant predictor of future behaviour, for example, rear seatbelt use at T1 predicted 32 per cent of rear seatbelt use at T3. The range of variance accounted for was between 1 and 32 per cent, with an average of 11.4 per cent, which is higher than the variance accounted for by ImpSS.

One potential problem is that the role of past behaviour may be over-estimated because of the way in which past behaviour is measured compared to other variables. That is to say, the assessment of past and current behaviour are normally based on similar item construction (e.g. T1 and T3 amount of alcohol are scored 0-5), whereas, the item construction for other (similar) contributing variables are often constructed in a different way (e.g. T1 amount of alcohol [0-5] predicting T3 frequency of HED [0-4]); therefore it would be expected that past and current behaviour are more highly correlated and share smaller amounts of variance. One final explanation is that past
behaviour reflects habitual behaviour and is therefore a separate construct addressing ‘habit’ rather than an independent variable per se. Therefore, if the behaviour is relatively novel then intentions may be best measured, whereas for long-term repeatable behaviour then habits may be best explored.

**Similar behaviour**

Similar behaviour refers to associated behaviours within the same construct, for example, speeding behaviour and seatbelt use within the construct of driving behaviour, or amount of alcohol and frequency of alcohol within the construct of alcohol consumption. In the present study, similar behaviour was predictive at both the same time period (i.e., at T1) and across time (i.e., T1 predicting T3). Analysis of the multiple regression models suggests that similar behaviour at T1 accounted for between 1 and 36 per cent of the variance, with an average of 14 per cent. Additionally, similar variables that were most similar (e.g. front and rear seatbelt use) were more predictive (average of 27.5 per cent variance) than least similar variables (e.g. front seatbelt use and speeding on motorways), where the average variance was 4.1 per cent.

In terms of the prediction of similar variables across time, then the average amount of variance accounted for by previous similar behaviour (both most similar and least similar) was 11.6 per cent (the range was between 1 and 32 per cent). These results are less favourable than similar behaviour at T3, which was an average of 17 per cent of the variance (the range was between 1 and 44 per cent), and is higher than similar behaviour at T1 (X=14 per cent).

These findings suggest that similar behaviour and past behaviour are more complex than might be considered. A level of complexity emerges when deeper analysis starts to consider the similarity of variables at both the same time period (cross-sectional) and across time (longitudinal). In this sense, the most similar behaviours at the same time period are more powerfully predictive than similar past behaviour, and past behaviour in general. This is likely to reflect the higher correlations among most similar variables, which was mentioned previously. Therefore, research into the impact of past behaviour upon future behaviour needs to consider this complexity because it may introduce methodological limitations that could affect subsequent results.
The clustering of health behaviours

Vickers, Conway and Hervig (1990) highlight the multidimensional and co-varying nature of health behaviours, which is supported by Fear et al. (2007). Torgersen and Vollarath (2006) also stated that health behaviours tend to cluster together. This is to be expected for some behaviours (e.g. smoking and alcohol) but may not intuitively sound rational for others (e.g. sex and driving). The amount of variance from among the other behaviours (DV) as predictors of a particular behaviour (IV) was low, on average 1.2 per cent, with a range of <1 - 2 per cent. It was found that alcohol consumption predicted both smoking behaviour and driving behaviour, and that smoking behaviour predicted alcohol consumption. Co-varying behaviours were present in six T1 regression models, but only in two T3 models.

Demographic factors

Demographic variables were included due to their consistently reported association with health issues in military research; for example, Ferrier-Auerbach et al. (2009) found that mental health variables, younger age and being unmarried predicted pre-deployment alcohol use in terms of greater total drinking and frequency of HED. In the current analyses demographic variables emerged as predictive variables, but not in all models and mainly within the T1 models, however they did emerge across smoking drinking and driving variables, and predicted between 0.4 - 6 per cent of the variance in any one model. Their strongest role was within T1 smoking behaviour, where the demographic factors of lower rank, being single, white and male accounted for 6 per cent of the variance. The most commonly occurring variable was being white, which emerged in six models, whilst lower rank, being single, and being male each emerged in two models. These findings suggest although demographic variables predicted health behaviour, they accounted for very little of the variance (up to 6 per cent) and were scarce in their prediction of future behaviour as compared to current behaviour.

In summary, the regression analyses found that all the predictive variables (i.e., past behaviour, current behaviour, similar behaviour, ImpSS, co-varying behaviours and demographic variables) predicted current and future behaviour. The amount of variance within the models ranged between 22 - 67 per cent. The ranked

39 Demographic variables emerged in 7 of 17 regression models.
40 Demographic variables emerged in 5 of 8 T1 models; in 1 of 1 T2 models; and in 1 of 8 T3 models.
average amount of variance accounted for by each of these categories was as follows: similar behaviour (15.5 per cent), past behaviour (11.4 per cent), ImpSS (3.4 per cent), demographic variables (1.3 per cent) and co-varying behaviours (1.2 per cent).

8.4 Summary of deployment phases

Pre-deployment
One of the key issues to emerge and which requires consideration is whether the levels of behaviour at T1 represent a true baseline, or whether they represent a pre-deployment effect. There are two important implications of this. Firstly, if they are a true baseline, the lack of worsening behavioural change at post-deployment (which was anticipated for driving and alcohol behaviour) suggests that repeated measures studies are highlighting an issue not detected by the previous research studies that utilised cross-sectional designs and compared deployed versus non-deployed samples. This is because the present repeated measures study did not find as much post-deployment behaviour change as suggested by previous cross-sectional and retrospective studies.

The second issue pertains to whether there is a pre-deployment effect, whereby the physical and psychological demands that take place during pre-deployment training and preparation (which could be as long as 6-months) produce behavioural changes that increase alcohol consumption, levels of sexual activity, smoking behaviour and risky driving behaviour which are more risky and less healthy than those that would be a normal and true baseline.

Evidence to support the latter assumption (i.e., a pre-deployment effect) is provided by the qualitative data, which suggests that there are numerous competing demands during pre-deployment preparation. These can be broadly broken down into personal demands and job-related demands; for example, stresses about the hectic pace of preparation (which impacts upon personal life), as well as the stresses, concerns and worries about leaving family. The items asking if personnel thought their health behaviours (alcohol, smoking and sex) had increased, reduced or not changed as they prepared to deploy showed that higher percentages increased their alcohol intake, smoking behaviour and sexual activity prior to deploying. This may have been because of anticipated restrictions that would have taken place during the deployment (particularly for alcohol and sex); therefore, a proportion of the sample
increased their alcohol intake (28.2 per cent) and sexual activity (41.6 per cent) because they would not have access to it during the deployment.

Furthermore, in terms of PWB, it was found that 17.5 per cent of the sample was within the *distressed* and *severe* categories; therefore, not everyone is within the ‘normal’ range of PWB at pre-deployment, suggesting that some military personnel are not optimised for operational deployment. Again, the evidence in the qualitative data presented in section 7.7 suggests that the pre-deployment phase produces a distinct set of demands, which produce adaptive behavioural responses, which can be both health promoting and/or health compromising. This is supported by previous studies, which suggest that ‘pre-deployment stressors may create a high baseline of tension, resulting in a ripple effect of stress...stress before deployment is the norm rather than a liability’ (Maguen et al., 2008, p.6-7). Additionally, MacDonald et al. (1998) found that pre-deployment anxiety and distress were higher than early, mid- and post-deployment follow-ups. Also, MacDonald, Chamberlain, Long and Mirfin (1999) found that the level of daily hassles at the pre-deployment phase predicted all the mental health outcomes they investigated (i.e., anxiety, depression and well-being).

Finally, the regression analyses found that past behaviour was a significant predictor of future behaviour; therefore, the level of risky health behaviour engaged in at pre-deployment possesses important implications for future behaviour at post-deployment.

In summary, pre-deployment is an important phase to address because it sets the tone for the forthcoming deployment, and may also impact post-deployment readjustment. The present findings suggest that personnel are not operating at 100 per cent before they deploy, and this could be the cumulative result of a range of job-related factors and personal issues; therefore, these behaviours and factors require more consideration and further empirical investigation.

### During-deployment

Driving behaviour was not investigated during the deployment because of the complexity of driving issues during military operations; however, Reavley and Black (2006) found that road traffic accidents (RTA) were a significant cause of morbidity and mortality during a 6-month period in a UK field hospital in Iraq. This is supported by Ward and Okpala (2005) and Okpala et al. (2007) who investigated seatbelt use
and RTA admissions to a UK field hospital. This suggests that driving behaviour does have an impact on military deployment, and that a bespoke investigation of risk-taking (including SS and/or risk perceptions) related to driving behaviour may be warranted in the future; however, this was beyond the scope of the present study.

Alcohol intake significantly reduced during the deployment and ~92 per cent reported that their alcohol intake had reduced since being on deployment. This was mainly due to the official sanctions that were in place. However, a small minority gained access to alcohol. Although there was a 'two can rule' in place during the deployment, some participants stated in their qualitative responses that they had alcohol posted out to them, which was a breach of military rules. This, along with anecdotal evidence, suggests that for a small minority, alcohol is still used on operations, and it would be interesting to investigate in the future if these individuals were high in SS or whether this was linked to enduring alcohol dependence problems.

As with alcohol, sexual activity significantly reduced during the deployment, and again, ~92 per cent reported that their sexual activity had reduced since being on deployment. This was attributed to a lack of access to partners who were back in the UK, or access to any sexual contact on deployment for the single group. However, as with illicit alcohol consumption, a small minority did have access to sexual contact, with 2.5 per cent (N = 20) suggesting that they had more sex since being on deployment; and anecdotal evidence supports this behaviour. Sexual contact on military operations and deployment is against 'standard operating instructions' when deployed; however, it is recognised that a small minority do engage in such behaviour. Again, it would be interesting to investigate whether such people are high in the SS tendency. In terms of these behaviours, an a priori hypothesis would suggest that the small numbers of military personnel who engage in illicit behaviour on military deployment are higher in the SS tendency.

The key health behaviour finding at mid-deployment in the present study was smoking behaviour. As expected, the daily smoking rate increased, as previously identified in previous studies (Boos & Croft, 2004; DiNicola et al., 2006). Among the current smokers at mid-deployment, 71.7 per cent self-reported that their smoking behaviour had increased, whereas 20 per cent reported that it had stayed the same and only 7.4 per cent reported that they had reduced their smoking. The number of

\[41\] For a small number of the brigade, they were allowed two cans of alcohol on a Saturday night only. This factor was unknown at the design stage of the study.
participants who categorized themselves as a ‘current smoker’ increased by 1 per cent compared to pre-deployment. The qualitative data suggests that the key (but not only) reasons for increasing smoking behaviour during the deployment included: boredom, stresses, anxiety and anger, and high workload. The top ten reasons are captured in Table 43. Ironically, participants suggested that the way to de-stress, calm down and relax was also to smoke more. This issue has been discussed in the review of literature whereby smoking (and increasing smoking rate) does not appear to reduce long-term levels of daily stress, hassles and anxieties, despite this perception among smokers. This cyclical mechanism would suggest that smokers tend to have higher levels of daily stresses, and that smoking provides an immediate dose of nicotine and the perception of a short-term calming effect. However, this reinforces the association with (and dependence upon) nicotine; therefore, this increases the perceived stresses, which leads to further reliance on nicotine in order to reduce these levels.

PWB became worse during the deployment compared to pre-deployment. The impact upon well-being from being on deployment has been reported by MacDonald et al. (1998, 1999) who found that depression increased significantly compared to the pre- and post-deployment phases. It has also been suggested that factors such as separation from family and friends contribute to these increases during the deployment (MacDonald et al., 1999; O’Brien, 1994; Richie, Anderson & Rusk, 1994), and such factors are thought to play a role within the current study, along with the competing demands of the military tasks and workload during the deployment.

It is thought that this study provides the first reported (and prospective) measures of military risk perceptions during a deployment. Risk perceptions changed over time (for the entire sample, as well as both ImpSS groups) and it is thought that the rise in risk perceptions during the deployment (i.e., perceived as more risky) is based on the nature of the deployment at that point in time. That is to say, the level of combat activity experienced by the brigade on Operation Telic 10 in Iraq in 2007 was not benign (whereas other phases of Operation Telic in Iraq were relatively benign and much lower in combat activity). If the present deployment had been more benign then one would expect to find that risk perceptions would have been lower (i.e., perceived as less risky), possibly even lower than pre-deployment expectations. This raises an interesting point as to whether risk perceptions during the deployment are systematically higher than pre-deployment expectations (i.e., across all military
deployments) or whether they are subjected to situational factors at both pre-deployment (i.e., expectations) and during the deployment (i.e., current experience).

**Post-deployment**

One of the key deployment concerns regarding both physical and psychological health is the post-deployment readjustment phase. This is for two main reasons: (1) post-deployment is perceived as the easier of the deployment phases from which to collect empirical data, and (2) defence policy and strategy is mainly focused on the effects of being deployed; for example, impacts upon the duty of care of service personnel and the high profile of PTSD.

In reference to the first point, the present study found that the post-deployment phase was the most difficult phase to collect data from, especially for repeated measures studies which rely on tracking specific participants. The response rate for T3 \((N=537)\) compared to T2 \((N=889)\) was 60.4 per cent, whereas the response rate for T2 compared to T1 \((N=1374)\) was 64.7 per cent. The overall response rate between T1 and T3 was 39.1 per cent. The issue of response bias, non-responders and sample degradation has been addressed and commented upon in previous military research (Hotopf et al., 2003) but is not thought to have affected the robustness of the current findings. To support this, a comparison was conducted between T1 units who deployed and participants that completed T1 questionnaires but did not subsequently deploy. Independent t-tests did not show any differences between these groups. Therefore, the reduction in response rates is mainly attributed to reduced access to previous participants, rather than their voluntary withdrawal from the study. For example, at T3 it was estimated that ~16 per cent of the sample would be posted from their current unit on return to the UK. In fact, in excess of 20 per cent of the sample were posted upon return, for a variety of reasons (e.g. posted to new units, posted onto career courses, territorial (reserve) soldiers returned to their civilian lives, soldiers who had left the army, etc.); therefore, tracking these individuals proved very difficult and significant time elapsed attempting to collect their T3 data, therefore ruling out their T3 data for possible inclusion in the study.

The findings on risky health behaviours highlight the complexity involved with studying these factors; for example, some behaviours changed across pre- and post-deployment (e.g. amount of alcohol, seatbelt use in the rear, speeding on motorways, daily smoking rate, PWB) but others did not change (e.g. frequency of
drinking, HED, seatbelt use in the front, speeding in built-up areas, smoking status). Additionally, change may occur in a positive direction (i.e., behaviour improves) or a negative direction. This confounds some of the previous findings in the epidemiological literature on increased risk at post-deployment, whereby being deployed is associated with worse health behaviours and mental health when compared to non-deployed samples. The implications of this have been discussed within the pre-deployment section and whether a pre-deployment effect suppresses true post-deployment differences, which could be seen as a Type II error.

Although PWB improved post-deployment, it did not return to pre-deployment levels. This might suggest an on-going effect upon PWB months after returning home. The T3 data were collected 2-3 months after returning to the UK from Iraq, therefore, it may be that PWB takes a period of months for full readjustment to occur. Although MacDonald et al. (1999) collected post-deployment measures of deployment stressors upon immediate return from deployment and then a follow-up period 6-7 months after, they admit that any observed changes are still state-related and may not provide a full appreciation of post-deployment issues. It is suggested that any studies that aim to collect post-deployment data should collect repeated measures at periodic times (e.g. upon immediate return, and then after 1, 3, 6, 12-months, and possibly longer), so as to allow longitudinal trend analysis. This approach would help understand whether health behaviours and indices of psychological health are acute and short-term, or enduring and of more concern for long-term health and well-being.

It was found that risk perceptions reduced at post-deployment, but were not as low as pre-deployment anticipations. However, if the nature of the deployment would have been different then it is assumed that both the mid- and post-deployment risk perceptions would have changed accordingly. Therefore, understanding, and accounting for, the context and experiences of the actual deployment is an important factor in the formation of risk perceptions, which ultimately shapes post-deployment readjustment. However, it is believed that there are no other published studies that have investigated and measured deployment risk perceptions in order to inform this topic further.

Bell et al. (2001) proposed five possible pathways in order to explain why people who return from war are at an increased risk of injury, and to explain changes in physical, psychological and mental health outcomes: (1) an increased rate of clinical depression, PTSD and other psychiatric conditions, (2) the option of negative
coping strategies and behaviours, (3) individual responses to ill-defined symptoms and diseases (e.g. Gulf War Syndrome), (4) a reporting bias by focusing on injury mortality, and (5) a methodological limitation of sampling from among high-risk, specialist military jobs and roles that involve engagement with higher levels of risk (e.g. speed, explosives, aviation, chemicals, etc.).

Finally, interventions to help with post-deployment catharsis and future readjustment have been reported. Hacker-Hughes et al. (2008) discuss the use of ‘decompression’ as a buffer between leaving a war zone and returning to the home nation. Decompression was first used in by U.S. troops during the Vietnam War, and it is described as a short period of time that enables troops to readjust to leaving a war zone, which allows for cathartic activities (e.g. BBQs, sports, rest, etc.) and structured readjustment before heading home. In 1982, the UK armed forces experienced an enforced decompression after the Falkland conflict because the naval taskforce had to sail back to the UK after the conflict; therefore this allowed enough time for some catharsis and readjustment to take place at sea.

Further to this, the UK armed forces used decompression during their time in Iraq (2003-2009) and it is currently used after deployment to Afghanistan. However, Hacker-Hughes et al. (2008) point out that there is a dearth of evidence as to whether decompression works. Many military personnel suggest that it is a worthwhile activity, but this is a ‘satisfaction survey’ rather than an objective evaluation of its effectiveness. There is a complete lack of any longitudinal evidence to support whether decompression reduces post-deployment physical, mental and psychological health issues. Additionally, anecdotal evidence suggests that not everyone wants to undergo decompression because their personal support network is in the UK (or within their home nation for foreign and commonwealth soldiers serving in the UK armed forces). Therefore, research to investigate decompression needs to be commissioned in order to answer two key questions; firstly, does decompression reduce the impact of physical, mental and psychological health issues compared to those who do not attend decompression? And secondly, what are the benefits of decompression? And what are the differences between those who experience decompressions versus those military personnel who utilise other support networks? These questions currently remain unanswered.
8.5 Implications for the psychology of health

General research on health campaigns, strategies and interventions

The implications for the psychology of health centre on the ability to encourage health-promoting behaviours, as well as reduce health-compromising behaviours. This is often conducted through health campaigns, strategies and interventions, and is often referred to as ‘health promotion’. From hereon, the terms intervention, campaign and strategy are used interchangeably, in order to describe health promotion activities.

The target of interventions can be split into two main camps: (1) volitional behaviours that encourage individual responsibility, control and decision-making, and (2) enforced behaviours brought about by government intervention and legislation (Ogden, 2000). In the former, volitional behaviour is informed and supported through interventions such as: media information campaigns, medical advice from GPs and hospitals, worksite interventions, and community-based programmes. In the latter, the government can impose interventions through the legal process, e.g. restricting or banning advertising, restricting the sale of the source of the behaviour (e.g. alcohol, tobacco), raising the costs of the source of behaviour (taxation through budgetary increases), or restricting or banning the particular behaviour in public places.

Previous changes in legislation have been seen to work (e.g. seatbelt use in front and rear, banning smoking in shops, cinemas and the workplace), whilst others have been recently enforced (e.g. banning advertising in some sports [e.g. smoking advertising in Formula One motor racing], banning smoking in public places such as pubs, bars, restaurants, etc.), and other interventions are due to come into force soon, e.g. the Health Act 2009 will prohibit large retailers from displaying cigarettes and tobacco at the point of sale in 2011.

However, there are limitations with government interventions; for example, some interventions would be impractical to implement, e.g. a complete ban on tobacco and/or alcohol use (e.g. prohibition in the U.S. in the 1930s). Government interventions can also be financially costly, and the current economic state of the UK suggests that public funding for non-essential, non-frontline health services is likely to be affected, i.e., reduced, within and beyond 2010. Finally, interventions requiring a change in the law could be opposed and may not survive the parliamentary process; for example, a proposed rise of 10 per cent in the taxation on cider was originally
proposed in the March 2010 Budget, but was later suspended in the run up to the 2010 General Election.

Stroebe (2000) suggests that both approaches (volitional and enforced) should be used in a complementary style to help influence behaviour change and maximise the potential benefits. However, Stroebe also suggests that despite the increased knowledge and understanding of risky health behaviours, attitude formation and change, the impact of health education and promotion activities has been disappointing. Stroebe suggests that one of the problems is concerned with the relative risk of individual behaviour change compared against the absolute risk of populations. Therefore, should interventions be aimed at the individual differences of target populations and high-risk groups, or should they be population-based? Ulleberg (2002) suggests that young drivers should not be treated as a homogenous group and that interventions should be targeted for certain high-risk groups. However, they also concede that low-risk groups also benefit from targeted health campaigns, and in general, low-risk groups respond better to health campaigns but are not necessarily the primary group of interest. Therefore, this highlights the complexity involved in whether to target specific, heterogeneous, high-risk groups, or wider, homogenous, low-risk populations. Ogden (2000) also provides both supporting and refuting evidence for certain types of intervention for certain types of risky health behaviour.

Berry (2004) authored a book on risk, communication and health psychology, and irrespective of the SS trait, there are a range of issues involving the communication of health risks, and the design of health campaigns, strategies and interventions. For example, the utility and impact of health information (by whatever form of media, e.g. leaflet, television, radio, internet) can be affected by the content and presentation of information. Factors include: the level of detail, the clarity of language and terminology, and the use of statistics and figures, which create ‘framing effects’ and can influence the over- and under-estimation of probabilities. Overall, Berry (2004) concludes that such factors give cause for concern and impacted the utility of such health promotion methods.

The discussion within this sub-section introduces the complex nature of the underpinning mechanisms for engaging in, and disengaging from, risky health behaviours (i.e., initiation, maintenance, reduction, adherence/compliance, relapse, etc.), as well as the range of behaviours involved in health behaviour change, e.g.
alcohol consumption, smoking behaviour, sexual activity, recreational drug use, use of medication, driving behaviour, eating behaviour, and exercise and physical activity.

**Sensation seeking-specific**

In terms of the application of health promotion activities to SS, Zuckerman (2007a) suggests that it is not easy (or necessarily possible) to change a biochemically-based personality trait such as SS; however, he also states that ‘biology is not destiny’ (p.201) and that eventually the SS tendency will decline with age. Zuckerman (2007a) devotes an entire chapter to the prevention and treatment of unhealthy risk-taking behaviour, and such interventions have also been investigated by health researchers; for example, HED, celebrating behaviours and harmful driving among adolescents (van Beurden et al., 2005), smoking cessation among heavy social drinkers (Kahler et al., 2009), traffic safety campaigns (Ulleberg, 2002), and risky sex (Donohew et al., 2000).

Within the SS literature there is a common belief that in order to target sensation seekers for health promotion activities then the design of interventions needs to consider and include aspects that are novel, arousing and stimulating (Donohew et al., 2000). The theoretical rationale suggests that these attributes will appeal to HSS and should help to attract, hold the attention of and persuade HSS to engage with the aims of a specific health promotion campaign or behaviour change strategy (Donohew et al., 2000).

In other areas of health psychology (e.g. social cognition models) there are problems such as the ‘intention-behaviour gap’ (Berry, 2004), but within the SS domain the primary concern is not the initial motivation to engage with health promotion strategies for behaviour change, but the motivation to maintain, adhere and comply with such interventions, so as to foster persistent and long-term behaviour change. For example, HSS do not tend to maintain attention and they tend to get bored if the level of stimulation or sensation drops below certain arousal levels (Zuckerman, 1994, 2007a), therefore as the novelty of a behaviour change strategy wears off the HSS may disengage and relapse (Kahler et al., 2009). Another contributing factor toward non-compliance or relapse is the physiological withdrawal from the behaviour (or more accurately the substance) which provides the stimulation and sensation that is attractive and enticing to HSS, for example, the habitual and addictive nature of nicotine in smoking, the social aspects of alcohol use (including
the disinhibition effect that leads to impulsiveness), the speed associated with risky driving, and finally, the psychological arousal that leads to the physical sensations in sexual activity. It has been suggested that the reason for continuing a particular behaviour is not the positive reinforcement from the source of stimulation but rather the avoidance of withdrawal and the negative affect associated with such withdrawal (Clayton et al., 2007; Kahler et al., 2009).

Alternatively, HSS could be likened to ‘inclined abstainers’42 within the intention-behaviour gap debate (Sheeran, 2002). There is no specific research evidence available in this area, but it could be theoretically argued that if the initial intentions of HSS were high but they subsequently did not comply (or relapsed) then this may help to explain the variance for the intention-behaviour gap among sensation seekers for their behaviour.

Some of the debate regarding the targeting of the SS tendency concerns four possible approaches: (1) whether to try and reduce the SS tendency, (2) whether to get HSS to disengage from risky health behaviour, (3) rather than disengagement, whether it is best to encourage safer forms of the particular risky behaviour, or (4) whether to find alternative expressions for SS behaviour.

As previously stated, trying to reduce the SS tendency is extremely difficult (especially in younger males) as the trait is biologically-based, and hormonal and chemical intervention would be both illegal and immoral. Attempting to get HSS to totally disengage from particular health behaviours is also highly unlikely due to the reinforcing and habitual properties as to why HSS engage in such behaviours in the first place (i.e., stimulation, sensation, enjoyment, etc.). The more intelligent debate and focus for intervention concerns the final two suggestions. Some suggest that the focus should be on finding alternative (less risky) methods for the expression of the SS tendency. But is there any evidence that alternative expressions work? Kahler et al. (2009) found that younger HSS smoking cessation groups responded better than older HSS groups. They suggest that younger groups may have a variety of alternative methods for expressing SS behaviour than older age groups. However, they did not discuss whether social outlets should be behaviour-specific or generic expressions of the SS tendency. For example, to reduce risky driving behaviour should alternative

42 ‘Inclined abstainers’ are individuals who possess positive intentions to change their health behaviour, but fail to act and comply with the intended behaviour change. Sheeran (2002) suggests that these individuals account for the majority of inconsistency within the intention-behaviour gap.
methods be driving related (e.g. driving or riding-related sports, [e.g. rally driving, bike dirt tracks, etc.] driving simulators or computer games, etc.) or if linked to speed and adrenalin could alternative methods be used (e.g. fairground rides and water parks, alternative sports involving speed [e.g. skiing and snowboarding, water skiing, etc.]); although sports still come with a risk of unintentional accidents and injuries (Sherrard, Lenne, Cassell, Stokes & Ozanne-Smith, 2004; Strowbridge & Burgess, 2002).

Donohew et al. (2000) suggest that one potential method for targeting interventions among ImpSS is to involve behaviour rehearsal. The rationale is that ImpSS cannot adequately contemplate, plan, and maintain behaviour change strategies due to their innate impulsive and SS tendencies; therefore, behaviour rehearsal that is designed to maintain the necessary levels of arousal, stimulation and sensation will attract and maintain the interest and motivation of HSS until over-learning has been achieved and a conditioned response occurs. It is hoped that this could be enough to overcome the impulsive tendency associated with non-planning. This approach is also supported by Kahler et al. (2009).

Ulleberg (2002) suggests that targeting the level of lifestyle rather than a specific behaviour may be a useful strategy. This is because health behaviours tend to co-vary or ‘cluster’ and this is especially the case among HSS whereby they will congregate in similar groups in order to seek reinforcement and acceptance for their risk-taking or SS behaviour. Therefore, future health promotion strategies may become more intelligent and complex by viewing health behaviours as a ‘system’ and adopting a system-wide approach. This is supported by van Beurden et al. (2005) who suggest that health practitioners should adopt a holistic approach that ‘focuses on the network of interacting factors’ (p.40); however, the application and evaluation of this approach is yet to be established and reported.

It was reported previously that some researchers have suggested the need to target specific, heterogeneous, high-risk groups (Ulleberg, 2002), however, others disagree. Van Beurden et al. (2005) have suggested that irrespective of the SS tendency, homogenous, population-based interventions should be used in order to target a wider range of risky health behaviours, especially among adolescent groups, who are generally the most relevant high-risk group.
Military-related implications

The military has the ability to provide a range of alternative expressions for SS tendencies, e.g. recreational sports, adventure training, and the constant requirement for military training and practice. The provision of subsidised sports means that the military can provide the training and access to sports that would normally be relatively expensive to undertake compared to civilian costs, e.g. white water kayaking, mountain climbing, skiing, parachuting, sub-aqua diving, etc. These types of sports have previously been shown to attract HSS (Breivik, 1996, 1999a, 1999b).

Furthermore, military training and practice can involve exciting and stimulating activities that provide sensation and arouse adrenalin, e.g. pilots and personnel involved in aviation need to train and practice by flying in planes and helicopters. Personnel taking part in military exercises need to travel in aviation assets, maritime fast boats, and a range of military vehicles. In certain trades there is the requirement to fire weapons systems, e.g. personal rifles, machine guns, man-portable missile systems, grenades, rockets, mortars, artillery guns, etc. These sort of activities are initially conducted in recruit training, then they are periodically conducted as part of career training and formal assessments (e.g. annual personal weapons test), and finally, are necessary as part of pre-deployment training to operational deployments, e.g. Iraq and Afghanistan.

Therefore, it can be seen how formal job-specific training and subsidised sports provide periodic opportunities for the outlet of SS tendencies within the military. How these outlets (and the implications for risky health behaviour interventions) are utilised by the military are yet to be explored as the research to explore SS within the UK military and the evidence-base for applied health interventions has yet to be established. However, this brief discussion has shown that the knowledge-base exists within the civilian health domain in order to inform the military. The findings from the present study provide evidence that a significant proportion of the UK army are likely to be within the medium and high ImpSS range, and that the level of risky health behaviours that they have engaged in suggest them as a valid group for targeted health promotion strategies.

8.6 Study limitations

Every study has its limitations, despite the best of intentions and the best of preparations. This is especially the case for applied studies that seek to collect
empirical data in non-laboratory settings where the degree of control is not optimal. The following sections describe the limitations of the present study and how a repeat study could be improved.

**Reduction in sample size**

There were a number of reasons why the sample size for T2 reduced significantly from T1. The main reasons were as follows:

*End of Tour*

A number of the sample had ‘End of Toured’ (EOT) during the deployment. This meant they had returned to the UK at some stage during their deployment and did not return to Iraq. Individuals had EOT for numerous reasons, for example:

1. They might have been posted to another military unit;
2. They might have been injured whilst on deployment and medically evacuated to the UK;
3. They may have been nominated to be ‘rear party’ for their returning unit and were therefore the vanguard back in the UK;
4. They might have been due to attend certain military courses.

*Conducting duties at time of collection*

Military operations can be a busy and hectic time; therefore, it is only natural to have expected that a proportion of the sample at the time of collection were busy conducting military duties. Thus, it was necessary to plan two, sometimes three, data collection sessions with the same unit in order to capture individuals who could not be present at the earlier pre-arranged sessions.

*Voluntary withdrawal from study*

It was expected to have natural wastage due to individuals no longer wishing to take part in the study. This was not voiced in any formal withdrawal, but after accounting for the other factors mentioned above, if participants had still not completed and returned their questionnaire then it was assumed that they were no longer interested in participating in the study.
Changes to a repeat study

If this study was repeated there are a number of lessons that emerged which would inform and improve any subsequent study. Suggested changes would include:

1. The repeat collection from participants at T3, even if they did not complete the questionnaire at T2. In the present study, if a participant did not complete a questionnaire at a particular phase (i.e., T2) they were not followed-up for the next phase (i.e., T3). If this had been conducted then a larger sample size would have emerged at T3, which would have enabled more robust paired t-tests across pre- and post-deployment.

2. The collection of repeated measures for ImpSS at T3. The aim of this would be to see if the deployment experience had an effect upon this relatively stable personality construct, i.e., it would identify if such traits were susceptible to state effects brought about by the deployment experience.

3. Identifying the most suitable health behaviour measures for comparison to other military health and/or deployment research. The present study fulfilled this aspiration in parts by adopting some of the same measures as the King’s College London Iraq War Study, but this highlights one of the problems with trying to compare research findings in military health, i.e., many studies utilise disparate measures, which ultimately affect the ability to compare findings and interpretations. The result of this is ambiguity among the numerous studies on military health, and deployment-related phenomena.

4. The use of an entire scale for certain measures, for example, the use of the full 10-item AUDIT, rather than the 3-item AUDIT-C. Although the use of the AUDIT-C is legitimate when brevity is required (as in the present study), there is an inconsistent use of which items are used; this was previously discussed in the methodology. Also, if a measurement of alcohol consumption is the key dependent variable then the 10-item AUDIT should be adopted.

5. Using the same measures for sexual activity at different deployment phases so that the data could be robustly compared. In the present study, the investigation of sexual activity was focused on a baseline, cross-sectional requirement by the military customer, rather than pre- and post-behaviours. Future deployment research interested in sexual activity as a key dependent variable would need to use the same measures across time.
6. Using a wider Likert scale for measuring risk perception, for example, a 6-point or 8-point scale rather than the 4-point scale used in the present study. This may control for the potential ceiling effect that confounds the findings in the present study regarding the systematic under-estimation in recall of risk perception.

7. Using a larger sample of representative participants during the piloting of the questionnaire. This was a constraining factor during the present study because of the necessity to capture the brigade before they deployed, otherwise the study would have been delayed by six months, and there were no guarantees that the next brigade would agree to be part of the study.

8. The inclusion of larger numbers of females, officers, and ethnicities and nationalities. These demographics were slightly under-represented in this study. This was brought about by the limited access to units within the brigade who were available on certain days due to their pre-deployment preparation, i.e., predominately an opportunity sample.

8.7 Future research

In terms of military health research there has been a call for more longitudinal studies that are repeated measures on the same participants, across an operational deployment (pre-, during and post-). This has been reinforced in two recent papers published after the completion of the present study (i.e., Allison-Aipa, Ritter, Sikes & Ball, 2010 and Killgore et al., 2010).

An area for future SS research is the transient nature of risk-taking propensity after exposure to risk events, i.e., risk propensity state versus risk propensity trait. Sicard, Jouvre and Blin (2007) have investigated this among BASE jumpers (Building, Antenna, Span and Earth) using the EVAR scale, and they suggest that extreme risk events can produce effects on the state nature of individuals, i.e., BASE jumpers reduced their risk-taking propensity post-risk event. This resonates with previous findings by Zuckerman (2007a) who suggests that novelty tends to increase risk appraisal, whereas familiarity tends to reduce it. In the context of military deployments it would be useful to understand if risk events produced changes in risk propensity in terms of SS and/or ImpSS. An immediate theoretical and methodological issue is whether any changes would be short-term (post-risk event) or long-term (post-deployment after risk exposures).
It is thought that this study was the first known study to investigate ImpSS in a military sample and also in a UK military sample; however, it focused on army soldiers. In order to improve our knowledge of the nature of SS (and ImpSS) within modern militaries it would be beneficial to investigate these personality constructs within the following populations. Firstly, research on military recruits would be able to inform on the underlying risk-taking propensity before individuals join the military. This would help to inform the broad assumption that risk-takers join the military. The present study has shown that ImpSS is normally distributed across an army sample only. Furthermore, a longitudinal study that measured risk-taking personality across time would help to understand if risk-taking propensity changes over time as part of military culture and socialisation processes, for example, does SS decline at the same rates as found in civilian populations, or does being in the military suppress the decline because of the nature of the job? i.e., more exposure to high risk events.

Secondly, by measuring these constructs across the army, navy and air force, the findings would provide an inter-service understanding about the nature of risk-taking propensity. That is to say, do different types of people (in terms of SS and risk-taking) join different services? Finally, research should also look at normal military populations, not just the high-risk military occupations (e.g. bomb disposal experts, pilots, diving, special forces, etc.). It is believed that there is a requirement for both types of studies, for example, larger studies on the wider military population informs on the nature for the military in general; however, bespoke studies on specialist populations improves our understanding for specific requirements (e.g. recruitment, training, and job-related performance).

The data from the recall of risk perceptions identified a systematic underestimation in recall by both H-ImpSS and L-ImpSS groups. However, these findings were confounded by a potential ceiling effect. Therefore, in order to develop these findings and discover whether they are due to a methodological limitation or represent an actual risk phenomenon, a future study should use a wider likert scale to allow for a wider distribution of responses. This should reduce the potential for a ceiling effect.

The present author also collected data on ImpSS and mid-deployment PWB relating to eating behaviour and food choice of UK military personnel (army) on Operation Herrick in Afghanistan in 2008. Therefore, a comparison can be made between these two samples on these measures. This not only provides further evidence of ImpSS and PWB on UK military personnel on deployed operations, but
the comparisons would enable further discussion about the nature of such measures in military personnel.
9. Conclusion

It is believed that the present study was the first of its kind. It collected data from a large sample of UK army personnel and tracked them on a tour of Iraq (before, during and after deployment) in an attempt to identify the impacts, relationships and associations between ImpSS, risk perceptions, PWB and risky health behaviours. The findings have shown that ImpSS was higher in the military sample compared to previously published civilian data. Additionally, the findings mirror current knowledge on sensation seeking, which is that individuals higher in the sensation seeking tendency report lower risk perceptions and engage in risky health behaviours at higher levels than those lower in sensation seeking. Furthermore, ImpSS was found to have significant correlations with risky health behaviours and be a significant predictor of future behaviour.

However, in tempering these positive findings, it must be remembered that differences between ImpSS groups only weakly to moderately meaningful, as were the correlations with the health behaviours, and its predictive ability, although significant, was low, i.e., ImpSS predictive variance was between 2 and 8 per cent. Additionally, the current sample was based solely on army soldiers, and differences in ImpSS may exist between the army, navy and air force; and at lower levels in the other two forces, therefore, the current evidence is inconclusive in definitively establishing that the military are higher in the sensation seeking tendency.

In terms of deployment-related factors, the observed changes in health behaviours (or lack of change) highlight the complex nature of behaviour change regarding military deployments, which is currently far from understood. The collection of both quantitative and qualitative data helps to unpick this complexity; and mixed method approaches should be increasingly adopted in complex, applied studies. More prospective, longitudinal data is also required regarding military health and deployments, and this has been increasingly called for in the published literature.

Finally, military capability is reliant on military performance. Military performance is reliant upon the military personnel who can undertake the necessary tasks. Without the prospective, longitudinal evidence on risk-taking, risk perceptions and health behaviours then the military is unsighted as to the impacts of physical, mental and psychological factors upon its personnel and their behaviour.
References


Burnstein, E., Vinokur, A. & Trope, Y. (1973). Interpersonal comparison versus persuasive argumentation: A more direct test of alternative explanations for group...


APPENDICES
APPENDIX A
APPENDIX A: Sensation Seeking Studies That Have Used Military Samples


APPENDIX B
From: Surgeon Commodore L Jarvis MB FRCR MRCS LRCP MIEE, Royal Navy

Director Medical Policy
Defence Medical Services Department
Room 7.E.20
MINISTRY OF DEFENCE
Main Building, Whitehall, London, SW1A 2HB

Brigadier R H D Toomey CBE
Commander 1 Mechanised Brigade
Delhi Barracks
Tidworth
SALISBURY
SP9 7DX

Date: 9 November 2006

Dear Richard

THE ROLE OF RISK IN THE HEALTH BEHAVIOURS OF UK MILITARY PERSONNEL: DSTL REQUEST FOR ACCESS TO 1 MECHANISED BRIGADE DURING OP TELIC 10

1. DSTL have been tasked and funded by the Research Acquisition Organisation to undertake a research project entitled “The role of risk in the health behaviours of UK military personnel”. This project was submitted to the Surgeon General and his Research Strategy Group where it was strongly endorsed.¹ The project addresses an important issue as there is growing anecdotal evidence that deployments may have an adverse effect on the health behaviours of our personnel. Furthermore, these changes in behaviour may extend across all the phases of the deployment (pre-, during, and post-). With the current operational tempo this may lead to a long-term deterioration in health and fitness. The aim of this research is to provide a scientifically robust evidence base by investigating what impact deployments have upon the health behaviours of personnel.

2. DSTL has approached you with a view to studying your personnel during their deployment of OP TELIC.² 1 Mechanised Brigade would be well placed to support this project due to their wide range trades, operational roles and the timing of their forthcoming deployment. I very much hope that you will be able to support Neil Verrall at DSTL in this endeavour.

¹ Following endorsement by the Surgeon General, the project was also scrutinised and supported by DFD.
² HFI/DIF-AR-001 dated Nov 06.
From Brigadier R H D Toomey CBE

COMD/DO

Surgeon Commodore L Jarvis MB FRCR MRCS
LRCP MIEE, Royal Navy
Director Medical Policy
Defence Medical Services
Room 7.E.20
MINISTRY OF DEFENCE
Main Building
Whitehall
London
SW1A 2HB

To

Surgeon Commodore L Jarvis MB FRCR MRCS
LRCP MIEE, Royal Navy
Director Medical Policy
Defence Medical Services
Room 7.E.20
MINISTRY OF DEFENCE
Main Building
Whitehall
London
SW1A 2HB

Subject: THE ROLE OF RISK IN THE HEALTH BEHAVIOURS OF UK MILITARY PERSONNEL: ACCESS TO 1 MECHANIZED BRIGADE DURING OP TELIC 10

Thank you for your letter dated 30 November 2006. I am very happy to support your research project entitled "The Role of Risk in the Health behaviours of UK Military Personnel". I will ensure that the Brigade liaises with Neil Verrall at DSTL to ascertain his requirement. The scope of the project looks very interesting. I would be interested to know its findings.

Yours sincerely,

Richard Toomey
APPENDIX C
HEALTH & RISK PERCEPTION
SURVEY OF MILITARY PERSONNEL

➢ This Study is important and will make a difference.

➢ The questionnaire will not take as long to fill in as you think. It should take about 15-25 minutes to complete.

➢ By participating in the study, you help yourself and your colleagues in the future.

➢ You don’t have to fill in this questionnaire – participation in the survey is voluntary.

➢ The information you provide is 100% confidential.

➢ Please turn over for more information
Please remember, this survey is confidential. Only the lead researcher will see your data. No military line managers will have access to it. However, I need to track your data across the deployment for analysis reasons, and I also need some background data. Please write your answers where there are lines (___) or tick the boxes (☐) below.

Full Name: __________________________________________

Service number: ______________________________________

Your Unit (Regt/Bn/Pl): __________________________________

How old are you? _______ years old

Are you: Male ☐  Female ☐

Are you:
- Married ☐  Separated ☐
- Living with partner ☐  Divorced ☐
- In long-term relationship ☐  Widowed ☐
- Single & not in long-term relationship ☐

Are you:
- British ☐  Other Commonwealth ☐
- Gurkha ☐  Any other (please write in) ☐
- Fijian ☐

Which of the following best describes you?
- White ☐  Other Asian ☐
- Black (African, Caribbean or other) ☐  Chinese ☐
- Mixed White ☐  Any other (please write in) ☐
- Any other mixed background ☐
- Indian, Pakistani, Bangladeshi ☐

R*STRICTED – when completed
How long have you served in the Army? _______ years (to the nearest year)

What is your current paid rank?
- JUNIOR NCO (equiv to. Pte, LCpl, Cpl)
- SENIOR NCO (Sgt, SSgt/CSgt, WO2/WO1)
- COMMISSIONED OFFICER (2Lt, Lt, Capt)
- SENIOR OFFICER (Maj, Lt Col, Col, Brig)

What is your Arm or Service?
- H Cav/RAC
- RA
- RE
- R Signals
- Infantry
- AAC
- RAMC
- RLC
- REME
- AGC
- APTC
- QARANC
- RADC
- Int Corps
- Other

(please write in below)

Were you ever in the: (please tick if yes)
- Army Cadet Force
- Combined Cadet Force
- Territorial Army

Is this your first operational deployment?  Yes □  No □

Please go to the next section
Please answer the question below

How many previous operational deployments have you been on in total? _______
(not including this coming OP TELIC 10 deployment)
1. **What type of person are you?**

Below is a series of statements that people might use to describe themselves in their general day to day lives (not your specific military job). Read each statement and decide whether or not it describes you. If you agree that it describes you then tick TRUE. If you disagree with the statement and feel that it does not describe you then tick FALSE. **Answer every statement**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>True</th>
<th>False</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I tend to begin a new job without much planning on how I will do it.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I like to have new and exciting experiences and sensations even if they are a little frightening.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>I often do things on impulse.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>I enjoy getting into new situations where you can't predict how things will turn out.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Before I begin a complicated job, I make careful plans.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>I like to explore a strange city or section of town by myself, even if it means getting lost.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>I often get so carried away by new and exciting things and ideas that I never think of possible complications.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>I am an impulsive person.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>I prefer friends who are excitingly unpredictable.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>I would like to take off on a trip with no pre-planned or definite routes or timetables.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>I very seldom spend much time on the details of planning ahead.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>I like doing things just for the thrill of it.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>I sometimes like to do things that are a little frightening.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>I'll try anything once.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>I would like the kind of life where one is on the move and travelling a lot, with lots of change and excitement.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>I sometimes do &quot;crazy&quot; things just for fun.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>I tend to change interests frequently.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>I usually think about what I am going to do before doing it.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>I like &quot;wild&quot; uninhibited parties.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. What type of person are you?

Below is a series of choices that people might use to describe their preferences. Please indicate which of the choices most describes your likes, dislikes or the way you feel. It is important that you respond to every question, with only ONE response per question. Please circle either A or B for your preference on each and every question. There are no right or wrong answers, we are just interested in your preference.

<table>
<thead>
<tr>
<th></th>
<th>Do you prefer A or B?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>There are some movies I enjoy seeing a second or even third time.</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>I can't stand watching a movie that I’ve seen before.</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>I get bored seeing the same old faces.</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>I like the comfortable familiarity of everyday friends.</td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>I dislike people who do or say things just to shock or upset others.</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>When you can predict almost everything a person will do and say he or she must be a bore.</td>
</tr>
<tr>
<td>4</td>
<td>A</td>
<td>I usually don’t enjoy a movie or play where I can predict what will happen in advance.</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>I don’t mind watching a movie or play where I can predict what will happen in advance.</td>
</tr>
<tr>
<td>5</td>
<td>A</td>
<td>I enjoy looking at home movies, videos, or travel slides.</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>Looking at someone’s home movies, videos, or travel slides bores me tremendously.</td>
</tr>
<tr>
<td>6</td>
<td>A</td>
<td>I prefer friends who are excitingly unpredictable.</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>I prefer friends who are reliable and predictable.</td>
</tr>
<tr>
<td>7</td>
<td>A</td>
<td>I enjoy spending time in the familiar surroundings of home.</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>I get very restless if I have to stay around home for any length of time.</td>
</tr>
<tr>
<td>8</td>
<td>A</td>
<td>The worst social sin is to be rude.</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>The worst social sin is to be a bore.</td>
</tr>
<tr>
<td>9</td>
<td>A</td>
<td>I like people who are sharp and witty even if they do sometimes insult others.</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>I dislike people who have their fun at the expense of hurting the feelings of others.</td>
</tr>
<tr>
<td>10</td>
<td>A</td>
<td>I have no patience with dull or boring persons.</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>I find something interesting in almost every person I talk to.</td>
</tr>
</tbody>
</table>
The following section contains questions about your perceptions that are important for the study. There are no right or wrong answers. You should answer the questions as honestly as possible, giving your first impressions and feelings.

I am a person who likes taking risks

<table>
<thead>
<tr>
<th>agree completely</th>
<th>agree somewhat</th>
<th>disagree somewhat</th>
<th>disagree completely</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

How risky do you think the forthcoming operational theatre/deployment will be?

<table>
<thead>
<tr>
<th>Very risky</th>
<th>slightly risky</th>
<th>not very risky</th>
<th>not at all risky</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
I would like to know how your general health has been over the past few weeks. Please answer all the questions below by circling the answer which you think applies to you. Remember that I want to know about present and recent complaints.

**Have you recently:**

<table>
<thead>
<tr>
<th>Question</th>
<th>Better than usual</th>
<th>Same as usual</th>
<th>Less than usual</th>
<th>Much less than usual</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Been able to concentrate on whatever you're doing?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Lost much sleep over worry?</td>
<td>not at all</td>
<td>no more than usual</td>
<td>rather more than usual</td>
<td>much more than usual</td>
</tr>
<tr>
<td>c) Felt that you are playing a useful part in things?</td>
<td>more so than usual</td>
<td>same as usual</td>
<td>less useful than usual</td>
<td>much less useful</td>
</tr>
<tr>
<td>d) Felt capable of making decisions about things?</td>
<td>more so than usual</td>
<td>same as usual</td>
<td>less than usual</td>
<td>much less capable</td>
</tr>
<tr>
<td>e) Felt constantly under strain?</td>
<td>not at all</td>
<td>no more than usual</td>
<td>rather more than usual</td>
<td>much more than usual</td>
</tr>
<tr>
<td>f) Felt that you couldn't overcome your difficulties?</td>
<td>not at all</td>
<td>no more than usual</td>
<td>rather more than usual</td>
<td>much more than usual</td>
</tr>
<tr>
<td>g) Been able to enjoy your normal day-to-day activities?</td>
<td>more so than usual</td>
<td>same as usual</td>
<td>less than usual</td>
<td>much less than usual</td>
</tr>
<tr>
<td>h) Been able to face up to your problems?</td>
<td>more so than usual</td>
<td>same as usual</td>
<td>less able than usual</td>
<td>much less able</td>
</tr>
<tr>
<td>i) Been feeling unhappy or depressed?</td>
<td>not at all</td>
<td>no more than usual</td>
<td>rather more than usual</td>
<td>much more than usual</td>
</tr>
<tr>
<td>j) Been losing confidence in yourself?</td>
<td>not at all</td>
<td>no more than usual</td>
<td>rather more than usual</td>
<td>much more than usual</td>
</tr>
<tr>
<td>k) Been thinking of yourself as a worthless person?</td>
<td>not at all</td>
<td>no more than usual</td>
<td>rather more than usual</td>
<td>much more than usual</td>
</tr>
<tr>
<td>l) Been feeling reasonably happy, all things considered?</td>
<td>more so than usual</td>
<td>about same as usual</td>
<td>less so than usual</td>
<td>much less than usual</td>
</tr>
</tbody>
</table>
In general, how would you currently rate your health? *(please tick)*

Excellent ☐  Very good ☐  Good ☐  Fair ☐  Poor ☐

**Alcohol Intake**

Compared to your unit colleagues, what are your chances of dying of an alcohol related illness in the future?

- Much below average ☐
- Below average ☐
- About the same ☐
- Above average ☐
- Much above average ☐

Compared to yourself, what are your unit colleague's chances of dying of alcohol related illness in the future?

- Much below average ☐
- Below average ☐
- About the same ☐
- Above average ☐
- Much above average ☐

Do you drink alcohol?

- No ☐  *ignore the questions below on alcohol and continue to the next section on driving*
- Yes ☐  *please answer the following questions on alcohol*

In your current environment, how often do you have a drink containing alcohol?

- Never ☐
- Monthly or less ☐
- 2-4 times a month ☐
- 2 times per week ☐
- 3 times per week ☐
- 4 times or more a week ☐
In your current environment, how many UNITS of alcohol do you have on a typical day when you are drinking? (please use the table below to help estimate how many units)

<table>
<thead>
<tr>
<th>Units</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 or 2</td>
<td>A pint of standard beer/lager = 2 units.</td>
</tr>
<tr>
<td>3 or 4</td>
<td>A pint/ can of strong beer/lager = 3 units.</td>
</tr>
<tr>
<td>5 or 6</td>
<td>A single measure of spirit/ small glass of wine = 1 unit.</td>
</tr>
<tr>
<td>7 to 9</td>
<td>A bottle of alcopop (e.g. Smirnoff Ice) = 1.5 units.</td>
</tr>
<tr>
<td>10 to 14</td>
<td>15 to 19</td>
</tr>
<tr>
<td>20 to 29</td>
<td>30 or more</td>
</tr>
</tbody>
</table>

How often do you have six or more UNITS on one occasion?

Never    
Less than monthly    
Monthly    
Weekly    
Daily/almost daily

As you get closer to going on deployment, do you think you currently drink alcohol - more, less or about the same?

much more    slightly more    about the same    slightly less    much less

What do you think the main reasons for this are?
Driving Behaviour

When driving in the UK, how often do you use your seatbelt when you drive, or ride as a front passenger, in a car/vehicle?

- Always
- Nearly always
- Sometimes
- Seldom
- Never

When driving in the UK, how often do you use your seatbelt when you ride as a rear passenger in the back of a car/vehicle?

- Always
- Nearly always
- Sometimes
- Seldom
- Never

Compared to your unit colleagues, what are your chances of being involved in a road traffic accident in the future?

- Much below average
- Below average
- About the same
- Above average
- Much above average

Compared to yourself, what are your unit colleague's chances of being involved in a road traffic accident in the future?

- Much below average
- Below average
- About the same
- Above average
- Much above average

Do you have a driving licence and recent driving experience?

- No (Ignore the following questions on driving and continue to the next section on smoking)
- Yes (please answer the driving questions below)

In the UK, when you drive in a built up area, how close to the speed limit do you usually drive?

- Below the limit, or within 5 miles per hour
- 6 - 10 miles per hour above the limit
- More than 10 mile per hour above the limit
In the UK, when you are driving on a motorway, how close to the speed limit (e.g. 70mph) do you usually drive?

- Below, the limit, or within 10 miles per hour
- 11 – 20 miles per hour above the limit
- More than 20 miles per hour above the limit

**Smoking Behaviour**

(regardless if you're a smoker or non-smoker)...I could smoke for a few years and then quit if I wanted to.

- disagree strongly
- disagree slightly
- neither agree or disagree
- agree slightly
- agree strongly

(regardless if you're a smoker or non-smoker)...I doubt that I would ever die from smoking even if I smoked for 30 or 40 years.

- disagree strongly
- disagree slightly
- neither agree or disagree
- agree slightly
- agree strongly

Compared to your unit colleagues, what are your chances of dying of a smoking related illness in the future?

- Much below average
- below average
- about the same
- above average
- much above average

Compared to yourself, what are your unit colleague’s chances of dying of a smoking related illness in the future?

- Much below average
- below average
- about the same
- above average
- much above average
How would you currently categorize yourself?

Ex-smoker

Current smoker

Non-smoker  
  ignore the questions below on smoking and continue to next section on sex

Did you smoke before you joined the UK Armed Forces?  No  Yes

If a current smoker, how many cigarettes, cigars or rollups do you currently smoke a day?____ per day

If a current smoker, have you started smoking leading up to the deployment?  Yes  No

If you answered ‘yes’ above, are you...

...a first time smoker, I’ve never smoked before this deployment

...an ex-smoker who has started again

As you get closer to going on deployment? do you think you currently smoke more, less or about the same?

  much more  slightly more  about the same  slightly less  much less

What do you think the main reasons for this are?  

   ........................................................................................................
   ........................................................................................................
   ........................................................................................................
This section is about a subject that can be very embarrassing or distressing to some individuals; you do not have to complete this section if you choose, however, your truth and honesty will greatly assist this research study. We would like to remind you that your data and any information you provide will ONLY be accessed by the lead researcher (Mr Neil Verrall) and your individual data will be confidential. Your data will NOT be singled out or identified in the analysis. Thank you very much for your co-operation.

Compared to your unit colleagues, what are your chances of contracting a sexually transmitted infection (STI) in the future?

- Much below average
- Below average
- About the same
- Above average
- Much above average

Compared to yourself, what are your unit colleague's chances of contracting a sexually transmitted infection (STI) in the future?

- Much below average
- Below average
- About the same
- Above average
- Much above average

How old were you when you had sexual intercourse for the first time? _______ years old

When you have sexual intercourse, how often do you use a condom?

- Always
- Most of the time
- Sometimes
- Rarely
- Never

How often do you have a one night stand?

- Always
- Most of the time
- Sometimes
- Rarely
- Never

Have often do you pay to have sex with someone?

- Always
- Most of the time
- Sometimes
- Rarely
- Never

Have you ever contracted a sexually transmitted infection?

- Always
- Most of the time
- Sometimes
- Rarely
- Never
As you get closer to going on deployment, do you think you currently have sex more, less or about the same?

- much more
- slightly more
- about the same
- slightly less
- much less

In the past 2 months, have you had sex with anyone?

- No  ☐  ignore the questions below
- Yes  ☐  Was this person your main partner?  Yes  ☐  No  ☐

In the past 2 months, how many times have you had sexual intercourse? ________ (approx.)

This is the end of the survey. Thank you very much for taking the time to complete it.

If you have been affected by any of the issues in this questionnaire, then please contact the Principle Investigator (Mr. Neil Verrall), your Line Management, your Chain of Command or a Medical Officer.

Alternatively, contact the Samaritans at:

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From Germany: 0800 181 0721 / or 0800 181 0722
From Holland: 0602 222 88
From Cyprus: 0809 1122 / or Military 2345
From Gibraltar: 55666 / or Military 5666
HEALTH & RISK PERCEPTION
SURVEY OF MILITARY PERSONNEL

➢ This Study is important and will make a difference.

➢ The questionnaire will not take as long to fill in as you think. It should take about 10-20 minutes to complete.

➢ By participating in the study, you help yourself and your colleagues in the future.

➢ You don’t have to fill in this questionnaire – participation in the survey is voluntary.

➢ The information you provide in this questionnaire is 100% confidential and anonymous.

➢ Please turn over for more information
Participant No..................

**In Theatre Activity**

Compared to your unit colleagues, how often do you go outside camp as part of your day-to-day military role? (e.g. on patrol, driving, etc.)

- a lot of my time
- often
- sometimes
- not very often
- not at all

How repetitive or boring is your daily job/role on this deployment

- always
- most of the time
- sometimes
- rarely
- never

Have you been on R&R yet?

- Yes
- No

**Risk Perceptions**

The following section contains questions about your perceptions that are important for the study. There are no right or wrong answers. You should answer the questions as honestly as possible, giving your first impressions and feelings.

How risky do you think the current operational theatre/deployment is?

- Very risky
- slightly risky
- not very risky
- not at all risky

Before you deployed, how risky did you think the current operational theatre would be?

- Very risky
- slightly risky
- not very risky
- not at all risky
I would like to know how your general health has been over the past few weeks. Please answer all the questions below by circling the answer which you think applies to you. Remember that I want to know about present and recent complaints.

### Have you recently:

<table>
<thead>
<tr>
<th>Question</th>
<th>More So</th>
<th>Same As</th>
<th>Less Than</th>
<th>Much Less</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you recently:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Been able to concentrate on whatever you're doing?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Lost much sleep over worry?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Felt that you are playing a useful part in things?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d) Felt capable of making decisions about things?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e) Felt constantly under strain?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f) Felt that you couldn't overcome your difficulties?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>g) Been able to enjoy your normal day-to-day activities?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>h) Been able to face up to your problems?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>i) Been feeling unhappy or depressed?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>j) Been losing confidence in yourself?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>k) Been thinking of yourself as a worthless person?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>l) Been feeling reasonably happy, all things considered?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In general, how would you currently rate your health?

Excellent □  Very good □  Good □  Fair □  Poor □

Compared to before you were deployed, how would you rate your health now?

Much better now □  Somewhat better now □  About the same now □  Somewhat worse now □  Much worse now □

Alcohol Intake

Do you drink alcohol?

No □   *ignore the questions below on alcohol and continue to the next section on smoking*

Yes □  *please answer the questions below on alcohol*

In your current environment, how often do you have a drink containing alcohol?

Never □  Monthly or less □  2-4 times a month □  2 times per week □  3 times per week □  4 times or more a week □
In your current environment, how many UNITS of alcohol do you have on a typical day when you are drinking? (Please use the table below to help estimate how many units)

1 or 2  □  10 to 14  □
3 or 4  □  15 to 19  □
5 or 6  □  20 to 29  □
7 to 9  □  30 or more □

How often do you have six or more UNITS on one occasion?

Never  □
Less than monthly  □
Monthly  □
Weekly  □
Daily/almost daily □

Compared with how much you normally drink, do you think you currently drink more, less or about the same?

much more  □  slightly more  □  about the same □  slightly less □  much less □

What do you think the main reasons for this are? ...........................................................................................................................................................................................................................................................................................................
Participant No...........................

Smoking Behaviour

How would you currently categorize yourself?

Ex-smoker  □  (someone who has not smoked at all in the last 6 months)
Current smoker  □
Non-smoker  □  ignore the questions below on smoking and continue to next section on sex

Did you smoke before you joined the UK Armed Forces?  No □  Yes □

If a current smoker, how many cigarettes, cigars or rollups do you currently smoke a day? ______ per day

If a current smoker, have you started smoking since being on deployment? Yes □  No □

If you answered ‘yes’ above, are you...

...a first time smoker, I’ve never smoked before this deployment □
...an ex-smoker who has started again □

Compared with how much you normally smoke, do you think you currently smoke more, less or about the same as you get nearer to going on deployment?

much more □  slightly more □  about the same □  slightly less □  much less □

What do you think the main reasons for this are?......................................................................................................................................................
.............................................................................................................................................................................................................
.............................................................................................................................................................................................................

R*RICTED – when completed  5
Participant No.................

Sexual Health

This section is about a subject that can be very embarrassing or distressing to some individuals; you do not have to complete this section if you choose, however, your truth and honesty will greatly assist this research study. We would like to remind you that your data and any information you provide will ONLY be accessed by the lead researcher (Mr Neil Verrall) and your individual data will be confidential. Your data will NOT be singled out or identified in the analysis. Thank you very much for your co-operation.

Since you have been deployed on OP TELIC 10 how often have you... (based on your best estimate)

...had a one night stand? ________ times

...had unprotected sex? ________ times

...paid to have sex with someone? ________ times

...contracted a sexually transmitted infection? ________ times

Since arriving in theatre have you had sex with anyone?

No ☐

Yes ☐ Was this person your main partner? Yes ☐

No ☐

Since arriving in theatre how many times have you had sexual intercourse? ________ (approx.)

Compared with how much you normally have sex, do you think you currently have sex more, less or about the same as you get nearer to going on deployment?

much more ☐ slightly more ☐ about the same ☐ slightly less ☐ much less ☐

This is the end of the survey. Thank you very much for taking the time to complete it.
HEALTH & RISK PERCEPTION
SURVEY OF MILITARY PERSONNEL

➢ This Study is important and will make a difference.

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➢ You don’t have to fill in this questionnaire – participation in the survey is voluntary.

➢ The information you provide in this questionnaire is 100% confidential and anonymous.

➢ Please turn over for more information
Risk Perceptions

The following section contains questions about your perceptions that are important for the study. There are no right or wrong answers. You should answer the questions as honestly as possible, giving your first impressions and feelings.

Now that you are back in the UK, how risky did you think your last operational theatre was?

- very risky
- slightly risky
- not very risky
- not at all risky

Before you deployed, how risky did you think the last operational theatre was going to be?

- very risky
- slightly risky
- not very risky
- not at all risky

When you were in theatre, how risky did you think the last operational theatre was?

- very risky
- slightly risky
- not very risky
- not at all risky
General Health

I would like to know how your general health has been over the past few weeks. Please answer all the questions below by circling the answer which you think applies to you. Remember that I want to know about present and recent complaints.

Have you recently:

a) Been able to concentrate on whatever you're doing?
   better than usual   same as usual   less than usual  much less than usual

b) Lost much sleep over worry?
   not at all   no more than usual   rather more than usual  much more than usual

c) Felt that you are playing a useful part in things?
   more so than usual   same as usual   less useful than usual  much less useful

d) Felt capable of making decisions about things?
   more so than usual   same as usual   less than usual   much less capable

e) Felt constantly under strain?
   not at all   no more than usual   rather more than usual  much more than usual

f) Felt that you couldn't overcome your difficulties?
   not at all   no more than usual   rather more than usual  much more than usual

g) Been able to enjoy your normal day-to-day activities?
   more so than usual   same as usual   less than usual  much less than usual

h) Been able to face up to your problems?
   more so than usual   same as usual   less able than usual  much less able

i) Been feeling unhappy or depressed?
   not at all   no more than usual   rather more than usual  much more than usual

j) Been losing confidence in yourself?
   not at all   no more than usual   rather more than usual  much more than usual

k) Been thinking of yourself as a worthless person?
   not at all   no more than usual   rather more than usual  much more than usual

l) Been feeling reasonably happy, all things considered?
   more so than usual   about same as usual   less so than usual  much less than usual
Participant No: 

In general, how would you currently rate your health?

Excellent □ Very good □ Good □ Fair □ Poor □

Compared to before you were deployed, how would you rate your health now?

Much better now □ Somewhat better now □ About the same now □ Somewhat worse now □ Much worse now □

Compared to when you were on deployment, how would you rate your health now?

Much better now □ Somewhat better now □ About the same now □ Somewhat worse now □ Much worse now □
Alcohol Intake

Do you drink alcohol?

No  ☐  *ignore the questions below on alcohol and continue to the next section on driving*

Yes  ☐  *please answer the questions below on alcohol*

In your current environment, how often do you have a drink containing alcohol?

Never  ☐

Monthly or less  ☐

2-4 times a month  ☐

2 times per week  ☐

3 times per week  ☐

4 times or more a week  ☐

In your current environment, how many UNITS of alcohol do you have on a typical day when you are drinking? (please use the table below to help estimate how many units)

<table>
<thead>
<tr>
<th>Units of Alcohol</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2 units</td>
<td>1</td>
</tr>
<tr>
<td>3-4 units</td>
<td>2</td>
</tr>
<tr>
<td>5-6 units</td>
<td>3</td>
</tr>
<tr>
<td>7-9 units</td>
<td>4</td>
</tr>
<tr>
<td>10-14 units</td>
<td>5</td>
</tr>
<tr>
<td>15-19 units</td>
<td>6</td>
</tr>
<tr>
<td>20-29 units</td>
<td>7</td>
</tr>
<tr>
<td>30+ units</td>
<td>8</td>
</tr>
</tbody>
</table>

1 or 2  ☐  10 to 14  ☐

3 or 4  ☐  15 to 19  ☐

5 or 6  ☐  20 to 29  ☐

7 to 9  ☐  30 or more  ☐

How often do you have six or more UNITS on one occasion?

Never  ☐

Less than monthly  ☐

Monthly  ☐

Weekly  ☐

Daily/almost daily  ☐
Participant No..........................

Compared with how much you normally drink, do you think you currently drink more, less or about the same?

much more  □  slightly more  □  about the same  □  slightly less  □  much less  □

What do you think the main reasons for this are? .............................................................................................. .....
.................................................................................................................................................................
.................................................................................................................................................................

Driving Behaviour

When driving in the UK, how often do you use your seatbelt when you drive or ride as a front passenger in a car/vehicle?

Always □  Nearly always □  Sometimes □  Seldom □  Never □

When driving in the UK, how often do you use your seatbelt when you ride as a rear passenger in the back of a car/vehicle?

Always □  Nearly always □  Sometimes □  Seldom □  Never □

Do you have a driving licence?

No  □  ignore the questions below on driving and continue to next section on smoking

Yes □  please answer the driving questions below

In the UK, when you drive in a built up area, how close to the speed limit do you usually drive?

Below the limit, or within 5 miles per hour □

6 – 10 miles per hour above the limit □

More than 10 mile per hour above the limit □

R*STRICTED – when completed 5
In the UK, when you are driving on a motorway, how close to the speed limit (e.g. 70mph) do you usually drive?
- Below the limit, or within 10 miles per hour
- 11 – 20 miles per hour above the limit
- More than 20 miles per hour above the limit

Smoking Behaviour

How would you currently categorize yourself?
- Ex-smoker
- Current smoker
- Non-smoker

Did you smoke before you joined the UK Armed Forces? No □  Yes □

If a current smoker, how many cigarettes, cigars or rollups do you currently smoke a day? per day

If a current smoker, have you started smoking since being on deployment? Yes □  No □

If you answered ‘yes’ above, are you...
- ...a first time smoker, I’ve never smoked before this deployment □
- ...an ex-smoker who has started again □

Compared with how much you normally smoke, do you think you currently smoke more, less or about the same?
- much more □
- slightly more □
- about the same □
- slightly less □
- much less □

R*STRICTED – when completed  6
What do you think the main reasons for this are?

Sexual Health

This section is about a subject that can be very embarrassing or distressing to some individuals; you do not have to complete this section if you choose, however, your truth and honesty will greatly assist this research study. We would like to remind you that your data and any information you provide will ONLY be accessed by the lead researcher (Mr Neil Verrall) and your individual data will be confidential. Your data will NOT be singled out or identified in the analysis. Thank you very much for your co-operation.

Since you have been deployed on OP TELIC 10 how often have you... (based on your best estimate)

...had a one night stand? _______ times

...had unprotected sex? _______ times

...paid to have sex with someone? _______ times

...contracted a sexually transmitted infection? _______ times

Since arriving in theatre have you had sex with anyone?

No □

Yes □  Was this person your main partner? Yes □

No □

Since arriving in theatre how many times have you had sexual intercourse? _______ (approx.)

Please continue over......
Participant No..........................

Compared with how much you normally have sex, do you think you currently have sex more, less or about the same?

- [ ] much more
- [ ] slightly more
- [X] about the same
- [ ] slightly less
- [ ] much less

This is the end of the survey. Thank you very much for taking the time to complete it.

If you have been affected by any of the issues in this questionnaire, then please contact the Principle Investigator (Mr. Neil Verrall), your Line Management, your Chain of Command or a Medical Officer.

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- From Holland: 0602 222 88
- From Cyprus: 0809 1122 / or Military 2345
- From Gibraltar: 55666 / or Military 5666

R*STRICTED – when completed
APPENDIX D
Mr Neil G. Verrall,
Senior Psychologist,
A2/G020,
Dstl Farnborough,
Ively Road,
Hampshire GU14 0LX.

Dear Mr Verrall,

Re: The role of risk in the health behaviours of UK military personnel

Thank you for submitting this protocol for ethical review by the Ministry of Defence Research Ethics Committee and for making alterations in line with my comments.

I am happy to give ethical approval on behalf of the Ministry of Defence Research Ethics Committee and should be grateful if you would send me a copy of your final report in due course.

Yours sincerely,

Dr Robert Linton
Chairman MoDREC