Chapter 6 – DISCUSSION

6.1 OVERVIEW

This discussion section will serve to:

- Summarize the key findings of RTG-164's work;
- Explore hypotheses for the effect that deployment may have on health risk behaviours;
- Identify priorities for future research; and
- Identify priorities for mitigation of deployment-related health risk behaviours.

6.2 SUMMARY OF KEY FINDINGS

RTG-164 began by developing a large list of potential health risk behaviours that could be affected by deployment. This list included the following health risk behaviours:

- Tobacco use;
- Risky alcohol use;
- Risky driving behaviours;
- Sleep/rest behaviours;
- Risky behaviours other than those related to motor vehicles (e.g., falls);
- Stimulant use;
- Hygiene (e.g., hand-washing);
- Exercise;
- Malaria prevention/arthropod protection behaviours;
- Immunization uptake;
- Risky sexual behaviour;
- Risky eating habits; and
- Use of illicit drugs.

The Task Group did not include suicide or other forms of intentional self-harm as a health risk behaviour, given the ample attention this issue from another NATO RTG.

To make its work manageable, the Task Group proposed a set of ten criteria to be used in order to identify the behaviours that should be of greatest interest for military organizations. These included:

- The impact of the behaviour on operational effectiveness;
- The strength of the evidence of a relationship to deployment;
- The relevance of the psychology of risk to the behaviour;
- The public health impact of the behaviour;
- The impact of the behaviour on individual well-being;
- The impact of the behaviour on non-operational effectiveness in military organizations;
- The ability to influence the behaviour through individual-level interventions;

- The ability to influence the behaviour at the environmental level;
- The out-of-pocket cost of the behaviour for the individual; and
- The effect of the behaviour on health care costs.

The first three of these criteria were judged by the RTG to be most important for its work. Of the behaviours listed above, the RTG judged that risky driving, tobacco use, and risky drinking were the behaviours of greatest interest to the RTG. Sleep and rest behaviours were judged to have a strong effect on operational effectiveness, strong evidence of an association with deployment, and a small relevance to the psychology of risk. However, there has been extensive work on the important topic of sleep and fatigue management in NATO and elsewhere, so this was not judged to be a high priority for RTG-164.

RTG members reviewed the scientific literature and did some original research to explore the relationship between deployment and three key behaviours (tobacco use, risky driving, and risky drinking). RTG-164 found strong and consistent evidence of an association between at least some deployments and these behaviours. A number of well-done cross-sectional studies and a few longitudinal studies suggest that the association between deployment and both tobacco use and risky drinking is causal in nature. Numerous cross-sectional and cohort studies supported a relationship between deployment and risky driving behaviour. In addition, the RTG found compelling the association between at least some deployments (specifically the Vietnam War and the 1990 – 1991 Gulf War) and later death from external causes of death including motor vehicle accidents. The limited longitudinal data showing that deployment was associated with a *decline* in self-reported risky driving behaviour from pre- to post-deployment is hard to reconcile against this finding. One possible explanation for this apparent disparity is residual confounding in the cross-sectional studies (i.e., that deployed cohorts had different risk taking propensity than non-deployed cohorts).

6.3 MECHANISMS: HOW DOES DEPLOYMENT INFLUENCE HEALTH RISK BEHAVIOURS?

We found evidence that deployment influences at least three health risk behaviours: tobacco use, risky driving, and risky drinking. This section explores possible common mechanisms for this effect.

While medical professionals treat health risk behaviours as a group (with the common element being that they are behaviours with a negative impact on health), these are diverse behaviours that are driven by (and then sustained by) very diverse factors: What makes a person start smoking as an adolescent is very different from what makes it difficult for a life-long smoker to quit. Different patterns of risk behaviours (e.g., heavy daily drinking vs. occasional binge drinking) have different drivers and different consequences. Some health risk behaviours actually consist of a series of complex behaviours, each of which has its own substrate and consequences. This is most apparent in driving behaviours: Getting behind the wheel when intoxicated is different from failure to use seatbelts, which in turn are different from thrill-seeking through road racing and driving while sleep-deprived.

The experience of deployment is equally complex and variable: Many deployed personnel do not experience combat, and even those who do experience it in different ways. Deployment can consist of both highly positive experiences (the sense of reward from having served one’s country) and highly negative experiences (losing valued friends and colleagues in combat).

Despite the variability and complexity of the deployment experience and of health risk behaviours, the ability of the former to have a consistent effect on the latter demands an explanation. The following sub-section lays out some hypotheses entertained by the RTG that could explain the link between deployment and at least these three health risk behaviours.

6.3.1 Artifact

While many of the studies on the association between deployment and health risk behaviours are of high quality, all are observational in that they compare the health behaviours in cohorts who deployed or happened not to deploy. Randomizing large groups of personnel to deploy or not deploy for research purposes would eliminate many possible sources of bias, but this is not a realistic option. All observational studies have controlled for the confounding effects of measured covariates (e.g., age, sex), but residual confounding is always a possibility. In particular, it is difficult to exclude the plausible possibility that those who deploy are intrinsically more risk-prone than those who don't. Longitudinal studies of risk behaviours of deployed and non-deployed cohorts can help, but there is still some potential for bias.

6.3.2 Distress and Mental Disorders

Psychological distress and mental disorders are both common consequences of demanding deployments, particularly those associated with traumatic stressors such as combat. The association of combat exposure and deployment-related health risk behaviours would be expected if distress and mental disorders (known to be combat-related) were key mediators.

Mediation by mental disorders is most convincing for alcohol use disorders in combat veterans; some studies have shown that all or nearly all of the increased risk of alcohol used disorders is mediated by other co-morbid mental disorders, notably PTSD [1]. Alcohol use disorders represent only a sub-set of risky drinking behaviours, and RTG-164 could not locate any studies looking at the possible mediation of risky drinking in general. However, there is strong evidence that those with PTSD [2], other anxiety disorders [3], and mood disorders [4] do "self-medicate" with alcohol to control their symptoms. The consensus in the research community seems to be that mental disorders leading to alcohol use is a stronger pathway than alcohol use leading to other mental disorders. Thus, the RTG judged it very likely that a significant part of effect of deployment on risky drinking is mediated by distress and mental disorders.

Tobacco use has a complicated relationship with mental disorders. Longitudinal studies show that it is both a contributor to and a consequence of mood and anxiety disorders. That is, smokers have an increased risk of later developing these disorders [5], and those with mental disorders have an increased risk of later tobacco use [6];[7]. Different studies have yielded different results when it comes to which causal pathway is stronger (i.e., smoking leading to mental disorders or mental disorders leading to smoking). This may relate to differences in the study populations, the time period of observation, or other methodological differences. Nevertheless, RTG-164 concluded that it was plausible that distress and mental disorders contribute at least in part to the increased risk of smoking seen in those who have deployed; the magnitude of this effect is likely smaller than the corresponding association with risky drinking.

The link between mental disorders and risky driving behaviour is less well understood, in largest measure because it has not been as well researched. In addition, as described in an earlier chapter, risky driving is a complex set of behaviours. The mechanisms by which mental disorders could contribute to risky driving behaviour are explored in depth in that same chapter:

- Mental disorders and distress can lead to alcohol or drug use, which in turn could impair driving;
- Failure to adapt combat driving behaviour to the home environment, which is at least in part driven by post-deployment anxieties;
- Anxiety and depression may have direct effects on driving performance and indirect effects through the used of potentially impairing medications used in their treatment;
- Sleep disturbance, which is a cardinal symptom of mood and anxiety disorders; and
- Anger and aggressivity, which again is an important symptom of mood and anxiety disorders.

As noted earlier in the chapter on risking driving behaviours, it is plausible that distress and mental disorders may exert part of their effect on health risk behaviours through changes in risk psychology variables.

RTG-164 therefore thought that it is likely that distress and mental disorders mediate (directly or indirectly) at least some of the deployment-related increase in health risk behaviours. For nearly all studies (both cross-sectional and longitudinal), it is impossible to exclude the possibility that the associations between mental distress and health risk behaviours are seen because they share a common substrate (genetic or environmental) as opposed to one causing the other. Studies of twins [8];[9] who are discordant for combat experience have confirmed that much (but not all) of the association between post-combat mental disorders and tobacco and alcohol use is due to shared genetic and environmental factors as opposed to a primary causal effect of mental disorders.

Thus, for all three health risk behaviours considered in this report, the Task Group thought that distress and mental disorders were significant mediators, although the evidence is weakest for tobacco use. However, much of the apparent link between disorders and health risk behaviours is due to their sharing some of the same genetic and environmental substrates.

6.3.3 Risk-Related Issues

Some of the pertinent issues related to risk, health behaviours and deployment will be briefly discussed. This is not only pertinent regarding the risky health behaviours of military personnel, but also includes the broader aspects of the psychology of risk and the variation and nature of military deployments, both operational and otherwise (e.g., humanitarian relief, peacekeeping, counterinsurgency).

6.3.3.1 Measuring Military Risk-Taking

One of the challenges facing the military's increasing interest in 'risk' is whether military personnel adequately reflect civilian populations or whether the military is a bespoke population that requires special attention. This is an important issue as it helps to decide whether measures of military risk can be utilised from the non-military academic literature, as in the case of the sensations seeking personality [10] or whether there is a genuine research gap that requires the military and Defence Scientists to develop bespoke tools for measuring military risk, as in the case of the Evaluation of Risk (EVAR) scale [11];[12] or the Measure of Operational Risk-taking scale [13].

A recent systematic review [14] of sensation seeking studies that have used military samples as part of their research suggests that the military are not as high or dominant in sensation seeking as might be assumed; for example, the military appeared to score higher than civilian samples on the sensation seeking sub-scales of thrill and adventure seeking, and on experience seeking, but the civilian samples appeared to score higher on the sub-scales of dis-inhibition and boredom susceptibility. However, in a recent UK study [15];[16] the military (Army) sample was statistically higher in "impulsive sensation seeking" [17] when compared to a comparable U.S. civilian sample [18], matched for age and gender . The systematic reviews [14];[16] also highlighted a range of methodological issues and the low number of such military studies, so that at this stage it would not be accurate to conclude that the military are higher in risk-taking propensity and risk-taking behaviour than comparable civilian populations.

6.3.3.2 Risk, Personality, and Health Behaviour

There are always anecdotes and myths that surround deployment-related behaviour. For example, that smoking always increases on deployments, that alcohol intake increases post-deployment, along with risky driving behaviour. The research reviewed and included within this report suggests mixed findings that both support and refute some of the assumptions regarding deployment-related health behaviour. To paraphrase Sir Isaac Newton, for every anecdote there is an equal and opposite anecdote.

Contrary to popular opinion, there are fewer studies than are assumed in the domain of military risk-taking; and this is especially the case for deployment-related and health-related risk studies. There are relatively few prospective, repeated measures studies across the deployment cycle and this highlights the need for such studies to help inform and educate those interested in the military health domain.

A study of military health behaviours on an operational deployment [16] found that although risk-taking personality was a significant predictor of current and future health behaviours, it only accounted for a maximum of 7% of the variance in multiple regression models. In fact, past behaviour and similar behaviour were found to be the strongest predictors, accounting for up to 44%. All of this suggests that the risk-taking personality tends to influence the individual's propensity to approach or withdraw from a specific risk behaviour, but the repeated reinforcement of that behaviour has a stronger influence (and predictive value) rather than personality *per se*.

The associations between risk and health behaviours in the civilian domain has been significantly researched and established; however, there is less evidence within the domain of military deployments. Therefore, there still appears to be a need to study the risk mechanisms that underpin military health behaviours on deployments, as well as to develop military models of risk and the associations and causal pathways that influence military behaviour.

Conducting this research will help to inform the assumption that the military are all risk-takers and/or "adrenaline junkies". The truth is that not enough research has been conducted (in terms of both *amount* and *breadth* of research) to provide the necessary evidence-base. To this effect, there is therefore a need for more military risk-taking studies, which need to address the methodological issues highlighted in the systematic review, as well as the methodological issues highlighted in this report previously (see the chapter on alcohol consumption).

6.3.4 Role of Deployment Experiences

Anecdotal evidence indicates that some Soldiers engage in more high-risk behaviors post-deployment (as discussed in [19]). While deployed, many soldiers are under conditions of high physical, psychological, and emotional stress which is linked to mental health issues [20]). Killgore et al. [19] argued that the effects of prolonged exposure to emotional stressors may impact brain regions (specifically the limbic system) in such a way that soldiers may have difficulty adjusting to a non-wartime environment upon returning from a deployment. Some evidence has shown that soldiers with Post-Traumatic Stress Disorder (PTSD) have diminished activity in the limbic system and prefrontal cortex suggesting low basal arousal levels [21]. It should be noted that increased risk propensity and actual risk behaviours are not limited to soldiers who are suffering from PTSD or other traumas. Given the research currently available, the extent to which deployment and combat experiences (particularly the frequency and intensity of those experiences) impact a soldier's perception of risk and risk propensity post-deployment is not yet known.

6.4 PRIORITIES FOR FUTURE RESEARCH

As previously discussed, research on health behaviours in military forces and the behaviour changes that may occur during the deployment cycle is underway. However, there is much progress to be made before an understanding of the relationship between combat deployment and health risk behaviours is achieved and, subsequently, appropriate intervention and prevention techniques are developed and implemented. The RTG identified eight priorities for research to progress in this area of study:

- To document the pattern of behaviour across the deployment cycle and also collect data on potential correlates including but not limited to cognitive abilities, stable and dynamic personality factors, demographics, symptoms of distress and mental disorders, and combat exposure. At present, few studies are working to accomplish this first goal using longitudinal design.

- To develop and validate a comprehensive model of how deployment influences health behaviours.
- To identify which external factors influence health risk behaviour (e.g., combat experience, deployment characteristics, social structure). Existing hypotheses postulate that combat experience and perceived threat may influence one's ability to accurately appraise risk in the environment. It is also suggested that intense combat exposure may be related to increased violent behaviours post-deployment.
- To identify who is at risk as defined by internal factors including but not limited to stable and dynamic personality traits, demographics, and military occupation/trade. It would also be advantageous to explore potential differences between Army, Navy, and Air Force services.
- To address the mechanism driving health risk behaviours and changes in risk propensity. Specifically, to address the meditation by mental health problems and other potential underpinning "proximate causes".
- To explore the role of schedule (rest and relaxation) and temporal aspects of post-deployment health risk behaviour. For instance, to understand when, if ever, increased risk behaviours begin to taper off and risk propensity begins to decrease or return to baseline. This information would be valuable for determination of the optimal time point for effective prevention trainings and interventions. Likewise, it would beneficial to understanding the pattern of behaviour change over time post-deployment.
- To explore cultural differences in health risk behaviors and behavior change across the deployment cycle such that interventions and training may be structured to best fit the needs of each culture and Nation.
- To explore a larger spectrum of health risk behaviors to include sexual health.
- Finally, to develop interventions to attenuate health risk behaviours and evaluate the effectiveness of these techniques. To do so, however, an understanding of the optimal time stamp for the intervention and mechanisms driving the behaviour (e.g., mental health, social/behavioural factors, deployment sanctions) must be adequately achieved. Likewise, considerations for accessibility, affordability, utility, and efficiency must be made.
- This entire research domain would benefit from more mixed-method research designs that utilised both quantitative and qualitative data. Such methods help to provide not only the numbers and statistical analysis, but also the contextual factors that underpin the perceptions and behaviours of military personnel; thus it is not imperative to measure the '*what*' but also understand the '*why*'.

In summary, the use of longitudinal, repeated measures studies that capture the full range of potential covariates and mechanisms and adopt a mixed method design would help to unpack the complexity of the mechanisms that influence risk perceptions, risk-taking and health behaviours across military deployments.

6.5 PREVENTION AND CONTROL PRIORITIES

While the additional research on the effect of deployment on health risk behaviours described above is clearly essential, military organizations will want to know what they can do right now to help mitigate this effect. The Task Group's five recommendations are as follows.

6.5.1 Priority Behaviours to Target

First and foremost, the three behaviours targeted by the Task Group (tobacco use, risky driving, and risky drinking) should be the top priorities for prevention and control efforts. They have powerful effects on health and well-being of personnel and hence have powerful effects on their functioning in the workplace.

There is strong evidence of a causal link with deployments, so military organizations have a special obligation to what they can to mitigate this effect. Moreover, all have countermeasures of proven efficacy to apply.

6.5.2 Address Risk Behaviours Primarily as Public Health Problems, Not Deployment Health Problems

Second, military organizations should continue to tackle these health risk behaviours as *public health problems* rather than *deployment health problems*. This is because they are prevalent and impactful in the non-deployed population as well, and it seems likely that the same types of individual-level and environmental interventions will be effective in both populations. As noted above, the associations with deployment are modest at best, and are most pronounced in those exposed to significant combat. Special targeting of this deployed population for such interventions around the time of deployment makes sense provided that similar attention is paid to the larger non-deployed population. It is possible that there will one day be specific interventions that work particularly well in the deployed population, but at present RTG-164 could not identify any with strong evaluation data behind them.

6.5.3 Mitigate Distress and Mental Disorders

Third, continued attention is needed to the mitigation of distress and mental disorders. As noted above, there is evidence that these at least partially mediate the linkage between deployment and health risk behaviours. Data is particularly strong for risky drinking. Mitigation efforts of course include primary prevention strategies such as resilience training, and there has been enormous attention to this area of late [22]-[24]. However, no prevention effort will be 100% effective. For this reason, military organizations need to do what they can to reverse the sad truth that most individuals with mental disorders are not in care, many reach care only many years after disorder onset, and many receive less than ideal care. Will efforts to mitigate mental disorders pay dividends when it comes to deployment-related risk behaviours? Time will tell, but efforts in this area will clearly lead to other benefits to service members and to military organizations.

Unfortunately, three factors will conspire to erode the impact of mitigation of distress and mental disorders on deployment-related health risk behaviours:

- As alluded to in the previous chapter, health risk behaviours can persist even after the factors that triggered them have abated;
- The link between mental disorders and health risk behaviours is driven in part by shared substrates as opposed to a cause-effect relationship; and
- Many factors other than distress and mental disorders lead to onset and persistence of health risk behaviours.

For these reasons, mitigation of distress and mental disorders is expected to have a limited (but still valuable) effect on health risk behaviours, whether deployment-related or not. In other words, mitigation of mental disorders cannot be the cornerstone of efforts to mitigate deployment-related health risk behaviours: These behaviours need to be targeted specifically with effective interventions. The main benefits of mitigation of mental disorders will lie elsewhere.

6.5.4 Use Sound Principles for Incorporation of Risk-Related Messages

Fourth, until it is clearer what precise role that changes in risk perception play in deployment-related health risk behaviours, the general principles surrounding the effective incorporation of risk-related messages in prevention and control efforts should be followed.

6.5.5 Leverage Environmental Interventions

Finally, environmental interventions are powerful tools to influence health behaviour. In tackling health risk behaviours, military organizations should leverage the have control that they have over a much broader range of environmental factors than the typical employer.

6.6 REFERENCES

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