

Evaluation of an Enhanced Post-deployment Health
Screening Program for Canadian Forces Members
Deployed on Operation APOLLO (Afghanistan/SW Asia)

Preliminary Findings and Action Plan

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Preface

Enhanced post-deployment screening has been a recommendation of a number of reports and boards of inquiry, including the Thomas Report, the Croatia Board of Inquiry, and the SCONDVA report. As a result, an enhanced health screening program was developed by Canadian Forces medical and mental health experts in an attempt to better and earlier identify some of the post-deployment health concerns of CF members. The new process was first applied to the first rotation (“Roto 0”) of members deployed on Op APOLLO, part of Canada’s land, sea, and air contribution to the war on terrorism in Afghanistan and SW Asia. This report documents the preliminary findings of the evaluation of this program.

The conventional post-deployment medical examination occurs within 30 days of return to Canada. It is mainly designed to provide an opportunity for members who had health problems while deployed to discuss them with a Medical Officer. Time pressures do not allow in-depth discussion of psychosocial issues, and members are usually as eager as the Medical Officers to have the whole process behind them. Moreover, the immediate post-deployment period is characterized by such rapid and dramatic psychosocial flux that identifying individuals with normal vs. pathological reactions is difficult. Out of recognition of the limitations of the immediate post-deployment medical exam, a visit with a social worker sometimes occurs a month or so after return, but this is erratic and the content is variable. Finally, because some deployment-related health problems have a delayed onset, it is easy to see how some problems have gone undetected by these procedures.

In addition, some CF members are not accessing health care for deployment-related health problems, or they are seeking care late in the course of their illness, at which point the prognosis is poorer and substantial damage to personal well-being and social and professional relationships have already occurred. While CF members have excellent access to quality medical care and psychosocial services, care-seeking may be delayed due to fear of stigmatization (“If I seek care people will think that I am weak”), fear of consequences, (“If they know how distressed I am, my military career might suffer”), optimism (“These symptoms will go away eventually”), stoicism (“A good soldier doesn’t complain”), denial (“There’s nothing wrong with me”), and cognitive distortions (“There’s no point in going to the doctor; they won’t be able to help me anyway”).

It is important to point out that this program was not conceived as a research study. Instead, *its purpose was to identify individual CF members who were having physical or mental health problems after deployment, and to refer them for appropriate care.* In this regard, the program was a resounding success. In addition, the data collected during the screening process was used for statistical purposes, in order to both evaluate the program and to better understand the health of CF members after deployment.

These findings should be viewed as preliminary. Because of the acute interest in the findings of this program and because of planned changes as a result of the preliminary analysis, the decision was made to release certain parts of the results before data collection and analysis were complete. The data has not yet been subjected to the extremely stringent data quality control measures that would precede a research

publication, and simple, largely univariate statistical procedures are used in this report. More sophisticated analysis directed by a statistician will provide a much deeper understanding of the contributors to ill-health in this sample, and it may also change the statistical significance of some of the findings. This means that some marginally significant findings may change to non-significant ones, and the converse may occur as well. Nevertheless, the findings are striking enough that the general observation of disappointing levels of ill health in those who participated in Op APOLLO will stand. Findings that are expected to be especially prone to significant adjustment will be highlighted in the body of the report.

While the observation of disturbing levels of impaired physical and mental well-being is very concerning, the screening program itself was a major success: Many individuals with problems were identified through it, and all of these were referred for definitive care. As will be demonstrated, members evaluated the program very highly. And, in contrast to other deployments such as the Persian Gulf conflict, Somalia, or Croatia, this improvement in post-deployment care was undertaken proactively, in advance of any systematic health problems being reported. Finally, the process generated valid, comprehensive deployment-health data of the sort that numerous groups have called for. *This enhanced post-deployment screening process therefore represents a major step forward for the CF.*

The evaluation of the screening program is presented in qualitative rather than quantitative terms, meaning that the specific numerical results of the survey instruments, for example, are not presented. These results have been suppressed because a research manuscript is in preparation, and premature release of too many specific details will jeopardize its ultimate publication. Failure to appropriately publish these findings in a scientific journal would mean that this significant information would not have the impact on the scientific community that it deserves. Ideally, the publication will be fast-tracked by a major medical journal, making a final research publication available by the fall of 2003.

It is hoped that the timing of the release of this preliminary report and its level of detail will strike a balance among the public's and CF members' interests in timely reporting of the results, the Chain of Command's need to make timely decisions regarding deployment health matters, and the scientific community's legitimate expectations of scientific rigour.

The important limitations of this data need to be emphasized from the beginning. First, the deployment activities of Roto 0 of Op APOLLO were very different from other recent CF deployments. Ground troops (the PPCLI Battle Group, which comprises more than a third of the sample) were involved in the first Canadian combat mission since the Korean War. The Battle Group sustained 4 combat deaths and a number of serious injuries in the friendly fire incident at Tarnak Farm. The naval component intercepted, boarded, and searched vessels with potentially armed and hostile crews. Surface-to-air missiles were a potential threat to aircrew. And all troops in the area were potential targets of terrorist attacks. These real and potential threats are associated with some deployment-related health outcomes. In addition, at the time of the analysis of the data, only about 2/3 of the 3,402 Roto 0 participants had been interviewed, and not all participants consented to the secondary use of their clinical data. The group remaining to be interviewed consists

almost exclusively of naval forces who deployed from CFB Esquimalt. For reasons described in the body of the report, the ultimate inclusion of the Esquimalt contingent in the dataset will improve somewhat the apparent health status of the Op APOLLO Roto 0 group as a whole.

Other limitations include the lack of pre-deployment data to serve as a baseline, the absence of follow-up data to determine if Op APOLLO participants are getting better or worse over time, the lack of data on the ultimate medical diagnoses of those members in whom concerns were identified, and the lack of data on the environmental and other exposures of the cohort (which could be used to identify associations between particular exposures and particular outcomes).

The language, terminology, and emphasis of the Executive Summary are all geared towards laypeople and non-medical military decision-makers. The subject matter of the remainder of the report is technical in nature, and it is written with an intended audience of health care professionals and researchers.

This report consists of eight sections:

1. An **Executive Summary** that provides a brief overview of the program, its findings, and the preliminary action plan. Most recipients of this report will likely limit their reading to this preface and the Executive Summary.
2. An **Introduction**, which includes:
 - 2.1. A review of what is known about the adverse health effects of deployment, both recent and historic, including discussion of post-combat syndromes, post-traumatic stress disorder (PTSD), other mental illnesses, and the phenomenon of medically unexplained physical symptoms (MUPS).
 - 2.2. A review of various CF Forces Health Protection strategies, which are intended to minimize the adverse health impact of military service and deployment.
 - 2.3. A review of available data on the physical and mental health status of CF members, along with a summary of recent general health promotion activities.
and
 - 2.4. A discussion of the military activities undertaken on Roto 0 of Op APOLLO and the potential exposures of concern that might have been encountered in preparation for or during deployment.
3. A **Methods** section, which describes the survey instruments used, the content and the process of interview and data collection, the data analysis strategy, and the ethical aspects of the program.
4. A **Results** section, which presents the preliminary findings of the program in general terms. This section includes sub-sections on:
 - 4.1. Physical health status (including physical symptoms);
 - 4.2. Mental health status;
 - 4.3. Interviewers' impressions and recommendations; and
 - 4.4. Participants' anonymous evaluation of the program.

5. A **Discussion** section, which provides:
 - 5.1. Interpretations of the findings, placing them in the context of other scientific work in the field of deployment health; and
 - 5.2. A discussion of the important limitations of the preliminary data presented herein;
6. A **Conclusion** section that summarizes the most significant findings of the program.
7. An **Action Plan** that details the planned responses to the findings described herein.
8. A **Reference List**.

1. Executive Summary

Background: Some recent CF deployments have been associated with increased rates of long-lasting mental distress, mental illness, and medically unexplained physical symptoms (“MUPS”) such as fatigue, troubles with memory and concentration, sleep disturbance, joint/limb pain, and others. Similar problems have been seen after historical deployments as well.

Irrespective of the controversy regarding the causes of deployment-related illnesses, the CF has taken a number of concrete steps to better prevent, identify, and treat them, including a new, mandatory health screening interview with a mental health professional 4 to 6 months after return. This process was piloted for all CF members on Roto 0 of Op APOLLO. It proved to be well received by members and was very successful in identifying health problems that might otherwise have gone un-addressed

Interview Protocol: Participants completed 3 standard, validated health questionnaires and then were interviewed by a mental health professional. Afterwards, the interviewer identified potential concerns and made recommendations for further evaluation and care. Data is available for 72% of the first 2,000 members (from all three branches) who have completed this process.

Preliminary Findings: Key results of the preliminary analysis are as follows:

- This process was successful in identifying individuals with problems much more effectively than the historical post-deployment assessment practices.
- There are highly significant deficits in the average mental and physical well-being of Op APOLLO participants compared to that of the general Canadian population of the same age and sex. This does not mean that every participant’s health is sub-par; in contrast, most appear to be well.
- The magnitude of these differences in well-being is greater than those caused by major health problems like diabetes, heart disease, and arthritis.
- The most prominent differences were in the areas of bodily pain, general health perceptions (how healthy people perceive themselves to be), energy/vitality, and mental distress.
- The pattern and degree of physical ill health were nearly identical to that of US Gulf War veterans 6 years after their return, while the mental health and social functioning of the Op APOLLO cohort were substantially worse.
- Members of the PPCLI battle group had worse health, on average, than other Op APOLLO participants.
- The pattern of physical symptoms did not show evidence of a new or unique symptom syndrome.
- Symptoms suggestive of PTSD were identified by the interviewer as a ‘major’ concern in 3.5% and a ‘minor’ concern in 4.7% of participants.

- The interview process was very well received by members, who found it to be thorough, sensitive, and helpful.

Interpretation: The pattern and magnitude of health deficits seen are consistent with those seen in veterans of other recent deployments, such as the 1990 – 1991 Persian Gulf conflict. Some of these deficits are likely to be deployment-related. Although no comparable pre-deployment data are available for comparison, this is a reasonable inference of the results of these findings viewed in the context of what is known about the deployment activities, how deployments affect health, and the baseline health status of CF members. As such, current Force Health Protection and other measures have not had the desired impact on post-deployment health.

There are important limitations to this evaluation that need to be considered in its interpretation:

- Because the deployment experiences of those on Op APOLLO (particularly those of the PPCLI Battle Group) were unique, these results must not be considered to be reflective of the health status of members on other CF deployments.
- The data collection and entry process is not yet complete. The vast majority of those whose data is not yet available for analysis are the 1,200 members of naval contingent based in Esquimalt. For reasons noted in the body of the report, their ultimate inclusion is most likely to improve rather than worsen the average health of the Op APOLLO Roto 0 cohort.
- The nature of the statistical analysis is preliminary; more sophisticated models will fine-tune the conclusions, adjust for potential confounding factors, and provide better estimates of the statistical confidence of the findings.
- Comparable pre-deployment data are not available, precluding a confident estimate of the extent to which the health deficits noted are related to participation in Op APOLLO.
- Longitudinal data that would demonstrate whether the health of the cohort is getting better or worse is also not available.
- This process did not provide firm diagnostic data on the members in whom problems were identified.
- These conclusions are based upon self-reported symptoms, rather than objective laboratory or clinical findings.
- Data on environmental and other exposures are not available; these would have allowed an exploration of these as potential causes of ill health.

The uncertainties implied by these results have been considered in the formulation of the action plan.

Reponses: A number of other steps are being taken as a consequence of these findings, including but not limited to re-briefing medical officers (if needed) on the appropriate management of post-deployment health problems, implementation of a similar pre-deployment screening program for Op ATHENA Roto 0, continuation of this interview process for other rotations and deployments, the incorporation of similar health

questionnaires into the Periodic Health Exam to provide needed baseline data, and the convening of a conference to set a research agenda for occupational stress injury research in the CF.

2. Introduction

Background: Some recent CF deployments have been associated with increased rates of long-lasting mental distress, mental illness, and medically unexplained physical symptoms such as fatigue, troubles with memory and concentration, sleep disturbance, joint/limb pain, and others. While the nature and extent of these problems have been best documented for veterans of the Persian Gulf conflict in 1990 – 1991, substantial anecdotal evidence supports increased rates of illness and impaired well-being in participants of other recent deployments, particularly those to Somalia, Rwanda, and some rotations to the former Yugoslavia. Other nations have also reported post-deployment health problems from their own deployments (such as a “Cambodia Syndrome” (The Netherlands) and a “Chechnya Syndrome” (Russia).

Similar health problems have been seen after military conflicts dating back at least as far as the Crimean War in the mid-1800’s. While the specific symptoms noted after each conflict have not changed much over the years, the causes attributed to them have varied substantially. After the Vietnam War, American veterans attributed a variety of post-deployment health problems to exposure to the chemical “Agent Orange,” which was widely used as a defoliant. Extensive research into this possibility ended with the conclusion that Agent Orange was unlikely to be the cause of the veterans’ symptoms or illnesses. In contrast, the psychological trauma of battle and deployment conditions was identified as the cause of a newly recognized psychiatric condition known as post-traumatic stress disorder (PTSD). While some thought PTSD to be an entirely new illness, subsequent research showed evidence of it in a substantial fraction of veterans of conflicts dating back as far as World War I.

When veterans of the Persian Gulf conflict began developing symptoms, scientific attention initially focused on a range of personal and environmental exposures as a potential cause. Among the agents suspected were vaccines, pyridostigmine bromide (a medication given to protect against a nerve agent), depleted uranium, low levels of chemical warfare agents, oil well fire smoke, and others. Some of these agents were also cited as a cause of illness in veterans of other deployments, such as depleted uranium in the Balkans. A number of expert panels have concluded that these agents are unlikely to be the cause of symptoms or illnesses in veterans of the Persian Gulf conflict. In contrast, the stress of combat and deployment has been identified as a causative factor, and some have also implicated the additional stress of ongoing publicity about the adverse health effects of service in the Persian Gulf.

Much of the controversy surrounding illnesses in veterans of the Persian Gulf conflict has centred on the unfruitful argument as to whether there is or is not such a thing as “Gulf War Syndrome.” Nearly all researchers point out that the preponderance of evidence suggests that the patterns of symptoms and diagnoses are not unique to veterans of that conflict; indeed one study showed that 15% of a non-deployed population met conventional symptom criteria for “Gulf War Syndrome.” The rates of symptoms are, however, much higher in veterans of the Persian Gulf conflict. Such symptoms are also common in the general population. Veterans have interpreted the message that their health problems are not phenomenologically unique as an indication that their health problems are not real, not serious, or not related to their service in the Persian Gulf.

Clearly though, their problems are real, often serious in that they can be disabling, and are often clearly linked to their service. Accordingly, Veterans' Affairs Canada will compensate veterans for service-related disability provided that a temporal relationship can be established between the onset of their health problems and their military service.

Medically unexplained physical symptoms ("MUPS") have been a prominent feature of illnesses in veterans of the Persian Gulf conflict. Fatigue, complaints of cognitive dysfunction, pain complaints, and abdominal complaints have been especially prominent. But such symptoms have been seen in historical conflicts as well, as well as in the aftermath of other traumatic events. In addition, identical unexplained physical complaints are seen in non-deployed veterans and in the civilian population, albeit at lower prevalence rates. These unexplained symptoms are a substantial burden to those who have them, and they contribute heavily to disability, which may be worse than that occasioned by serious medical illnesses that cause similar symptoms. In many individuals, their medically unexplained physical symptoms cohere into recognizable symptom syndromes like chronic fatigue syndrome or irritable bowel syndrome, though this coherence should not be interpreted as implying that the pathophysiology is any better understood than that of symptoms that do not cohere into specific patterns.

The causes of the unexplained symptoms are not known, but there appear to be both biological and psychosocial contributors. Most patients with significant unexplained physical symptoms have some degree of distress or mental illness, and this often predates the onset of their symptoms. Factors that predispose people to MUPS have been identified, along with factors (including stress) that can trigger them in those predisposed to them. Finally, factors that perpetuate symptoms once they emerge have also been identified.

While the attribution of psychological symptoms to psychological causes (like stress) is readily accepted by most people, the attribution of physical symptoms to psychological causes is less readily accepted. There is, nevertheless, a vast literature that demonstrates that stress is capable manifesting as physical symptoms, the symptoms appear to be able to persist long after the stress that triggered them has abated. In addition, there is an entire group of psychiatric disorders (the "somatoform" disorders) that are characterized by unexplained physical symptoms. Indeed, many ill veterans would meet formal diagnostic criteria for one or more somatoform disorders.

The explanation of stress as a contributor to post-deployment illnesses engendered a mixed reaction among afflicted veterans. Most advocacy groups interpreted the official attributions as being dismissive or as evidence of the failure of the government to take responsibility for the care of those who became ill as a result of their service to their country. Some invoked elaborate conspiracy theories to explain the discrepancies between the research findings and their own experiences. The slow and sometimes insensitive reaction of the military medical community to the veterans' health problems helped foster and sustain an atmosphere of suspicion and distrust. Health care professionals caring for ill veterans nevertheless reported that many veterans have been willing to accept the role that stress played in the genesis of their condition, and surveys have documented high levels of satisfaction among veterans who took part in comprehensive clinical evaluations for veterans of the Persian Gulf conflict.

Why did attention focus on environmental and other exposures as the cause of illnesses in veterans of this Persian Gulf Conflict? In historical conflicts, the proposed causes, ranging from the concussive effects of exploding artillery rounds on the brain (so-called “Shell Shock”) in World War I to the psychiatric effects of battlefield trauma (“Battle Fatigue”) in World War II, were linked to the prevailing medical theories and social constructions of illness of their time. The initial focus on cardiac signs and symptoms (so-called “Soldier’s Heart”) in the aftermath of the American Civil War occurred at a time when there was intense interest in cardiac physiology and development of relevant diagnostic tools, including a functional stethoscope. The focus on neurological trauma after World War I was associated with a corresponding explosion of interest in neurological structure and function. The broad integration of Freudian and other psychological theories between World War I and World War II likely contributed to the focus on psychological problems after the latter conflict.

The health problems of veterans of the Persian Gulf Conflict occurred at a time when environmental causes of illnesses were (and still are) of acute interest to Western societies. Notorious environmental catastrophes such as Love Canal, Chernobyl, and many others captured and maintained public attention. Interest in organic foods has skyrocketed over the past decade, and the use of cosmetic pesticides has been banned in some areas. “Sick Building Syndrome” and “Multiple Chemical Sensitivity” have been described as identifiable syndromes.

Suspicion of prescription medications and use of vitamins, herbal remedies, and other alternative therapies have exploded, explaining some veterans’ concerns that medications they took while deployed (such as pyridostigmine bromide for protection against chemical weapon exposure) might have led to their illnesses. Vaccines, another proposed cause of illness in veterans, have come under increasing scrutiny in the general public, and some parents are electing to not immunize their children against common diseases or to do so on a more leisurely pace.

Impaired immunity has been a focus of attention for veterans, and this has occurred during the period of intense interest in the functioning of the immune system, triggered in large measure to the worldwide HIV epidemic.

The above explanation of the causal attributions of illnesses following the Persian Gulf conflict are not intended to suggest that the illnesses themselves are faddish or fabricated. Instead, it is meant to demonstrate how current social factors help determine attributions and the creation of illness constructs.

The growing attention to the role that stress plays in both mental and physical illnesses, makes the strong backlash against this explanation for veterans’ illnesses difficult to understand. Several features might explain this apparent discrepancy: First, individuals who succumb to stress-related illnesses might be viewed as weak, and this would be at odds with the value system of military culture. Secondly, stress-induced physical illnesses seem to be more socially acceptable than stress-induced mental illnesses. For example, there is no shame in a hard-driving senior officer having a heart attack as a consequence of work stress, while having a stress-induced nervous breakdown would be potentially shameful. One wonders whether ill veterans would readily recognize that

deployment stress might cause health problems in other veterans, but that their own symptoms are due to a physical exposure.

Irrespective of the controversy regarding the causes of deployment-related illnesses, the CF has taken a number of concrete steps to better prevent, identify, and treat them. Because unit cohesion and morale are known to buffer the adverse effects of traumatic stress, a number of structural changes have been made to enhance these in deployed units. Deploying units receive much more comprehensive briefings on deployment health threats and deployment stress both before and during deployment. A number of measures have been undertaken to improve sanitation and hygiene in theatre. While available evidence suggests that the current health problems of veterans of the Persian Gulf conflict are not caused by environmental exposures, it is clear that there are potential environmental hazards in CF theatres of operation. Accordingly, the deployable and centralized environmental medicine capabilities have been greatly enhanced. Educational programs on deployment health, medically unexplained physical symptoms, and stress-induced illnesses have been delivered to CF Health Services staff. Mental health services for members with operational stress injuries are being continually enhanced to meet recommendations of various stakeholders, including the Ombudsman.

Still, it was acknowledged that these preventive efforts still could not protect CF members from all deployment-related health problems. And there was evidence that significant mental and physical health concerns that were not always detected by these traditional post-deployment assessment practices. Accordingly, a new, mandatory health screening interview with a mental health professional 4 to 6 months after return was developed. Its purpose was to identify individuals who might be having difficulties, and to refer them for further evaluation and treatment if needed. This process was piloted for all members on the first rotation (“Roto 0”) of Op APOLLO, and it focused on conditions known to be deployment-related, including operational stress injuries and unexplained physical symptoms.

Over the past few years, several random surveys of CF members have shown that their self-reported health status appears to be poorer in some ways than the general Canadian population of the same age and sex. The reasons for this are not well understood, though there is evidence that some of it may be attributable to the effect of previous deployments.

In response to these general health deficits, the CF has undertaken a number of general health promotion initiatives. A newly established Force Health Protection section aims to actively promote better health among CF members through the “Strengthening the Forces” health promotion program. A FHP staff of health promotion experts are developing or have implemented current, military-specific, evidence-based programs to help CF members enhance general health and wellness as well as cope with deployment stress. Through the CF Personnel Support Agency, a team of 35 health promotion directors and managers has been assigned to bases and wings to deliver these program elements. Examples are:

- Social Wellness, including suicide prevention, stress management and anger management, family violence prevention, healthy families and spiritual health;
- Addiction Free, including drug and alcohol, smoking, gambling and other

addictions;

- Nutritional Wellness, including nutrition, healthy weight and heart health; and
- Active Living and Injury Prevention.

In addition, a FHP Epidemiology section has been established to identify and analyze potential linkages between ill health and military occupational exposures. Key initiatives include:

- Conducting a wide-ranging health status assessment through regular Health and Lifestyle Information Surveys. The first in 2000 provided baseline health data and will be followed up regularly starting in 2004;
- The initiation of a prospective health study which will follow CF members' health status starting at enrolment and throughout their career to assist in identifying the causes of post-deployment illnesses;
- A linkage study to identify cases of cancer or death of retired CF members to ensure there are no long-term occupational health effects; and
- Enhanced injury surveillance to identify preventable causes of injury.

Finally, a Post-deployment Health Section of the Directorate of Medical Policy has been established. It has been tasked with research, education, and the development and implementation of clinical policy on post-deployment health matters. This enhanced screening program has been the Section's first major project.

Op APOLLO Activities: The Land, Sea, and Air components all contributed to Op APOLLO.

CF maritime units from both CFB Halifax and CFB Esquimalt provided Canada's first response to the events of September 11 during Op APOLLO. HMCS HALIFAX and VANCOUVER were redeployed from their initial missions, and HMCS IROQUOIS, CHARLOTTETOWN, and PRESERVER deployed with 10 days notice. The stresses of such a short lead-time were compounded by an indeterminate mission end-date and heightened force protection measures against both conventional and biological terrorist threats. Once the Canadian Task Group arrived in the Arabian Sea it assumed escort duties for aircraft carrier and USMC amphibious ready groups and patrolled potential maritime escape routes from Afghanistan with the goal of interdicting Taliban or Al Qaeda leadership.

Naval boarding party personnel were involved in ship inspections for suspected terrorists, a physically and mentally exhausting task. Ship's combat departments were kept in continuous 1 and 2 watch rotations with little opportunity for sunlight or rest. Engineering and supply personnel were kept extremely busy with maintaining the Task Group's combat effectiveness at sea, while air detachments put in many hours of dedicated labour resulting in a very successful mission-completion rate for the Sea King helicopters.

Life on board ship is characterized by crowding, lack of privacy, extreme temperatures, and noise, all of which take their toll on the crew over time. The concurrent heightened level of tension between India and Pakistan and the potential threat of being attacked as

per the USS Cole were often-quoted sources of concern, while high temperatures and highly demanding work program affected crews as a whole. Sailors and maritime helicopter personnel spent more continuous days at sea than at any other time since the Korean War, with port visits for repair and re-supply often months apart. This change in naval operations, coupled with the increased vigilance mandated by force protection and mission requirements, tested the reserves of all personnel deployed at sea.

The National Support Unit (NSU) deployed to the Gulf consisted of several hundred, primarily air force, support personnel. The principal bases contributing members included Trenton, Greenwood, Winnipeg, and Shearwater. The NSU's role was to provide administrative, logistical and medical support as well as coordination functions to the Army, Navy, and Air force elements deployed in the region as part of Op Apollo. The NSU was co-located with the CF air elements (CC130 Hercules transport and CP-140 maritime patrol aircraft) deployed to the region. Personnel were physically located on a small host nation airbase in the middle of the desert, approximately 50 km from a large, modern city, which offered many western conveniences. The threat of terrorist attack, while real, was not perceived as a major source of stress.

CF members in the NSU were housed in large, temporary aluminium trailer facilities having a capacity of approximately 40 people, living two per room. Each trailer had adequate, clean toilet facilities. Comfortable dining and recreation facilities were available. Most of the support trades were fortunate enough to be able to work in air-conditioned spaces most of the day. However, certain trades such as aircraft and vehicle maintainers, military police, construction engineers, and others would frequently be required to work outside in extreme temperatures. Because of the proximity to the airfield, high noise levels were a constant annoyance.

The Princess Patricia's Canadian Light Infantry (PPCLI) Battle Group consisted of about 900 men and women. Most belonged to the PPCLI 3rd Battalion (3PPCLI) and related units based at CFB Edmonton, with a sizable contribution from 2PPCLI (based at CFB Winnipeg). The Battle Group was under the operational control of the US 187th Brigade, and its mission was to assist in all aspects of combat operations. Key activities included perimeter security, combat missions, reconnaissance and other patrols, and QRF (Quick Reaction Force) response activities. Over the duration of the deployment the Battle Group did three major missions (Op Harpoon/Anaconda, Op Torii, and Op Cherokee Sky) and many other small ones. Missions and tasks involved a broad range of activities, including, direct combat (particularly sniping), security operations, provision of humanitarian aid, intelligence gathering, exploration and destruction of cave complexes suspected of harbouring enemy combatants, and, for one party, exhuming human remains for forensic purposes.

The Battle Group was based out of Khandehar Airfield, but its members were often in other areas of the country, sometimes for as long as a month at a time. The airfield was approximately 6 to 10 square kilometres and housed approximately 5000 (principally US) soldiers along with the prison for suspected Al Qaeda operatives. The Canadian camp was approximately 600 to 800 metres square. Land was at a premium, as it had to be de-mined prior to use. Accommodations and living conditions were very primitive. Lodging consisted of living in a two-man tent. Initially, there were no shower facilities, and toilet facilities consisted of multi-hole privies; human waste was collected in drums

and burned regularly with the aid of diesel fuel. Water was very scarce initially, but became more plentiful as the deployment progressed. Meals consisted of rations for two meals a day and a single kitchen-prepared meal daily. Challenging hygiene conditions resulted in frequent episodes of gastrointestinal illnesses. There was little contact with family members back home until a satellite phone arrived 6 or 8 weeks into the rotation.

The environmental conditions were also challenging. Temperatures at the beginning of the rotation in February were -5° to -10° Celsius at night and 20° to 30° Celsius during the day. Temperatures gradually increased during the deployment, and at the end of the rotation in July, daytime high temperatures reached 50° to 60° Celsius. The proximity to the airfield resulted in high levels of noise, day and night. Vegetation was limited in most areas, and shade was often difficult to find. Some missions occurred at altitudes of up to 3000 metres. Pervasive dust was a constant nuisance, as were snakes, spiders, and other vermin. Away missions were also physically because they often involved carrying packs and equipment weighing up to 75 kg.

Military threats were numerous. Mines and unexploded ordinance were both ubiquitous; rocket attacks occurred from time to time in some locations. Four CF members lost their lives and a several others were seriously injured in the friendly fire accident in which a US plane mistakenly dropped a 500-pound bomb on members of the battle group who were participating in a live-fire exercise at Tarnak Farm, near Khandehar airfield. Explosions were heard frequently, as combat engineers destroyed ordinance. Contact with the locals usually turned out positively, ambushes or terrorist attacks were a constant threat.

Environmental and Other Exposures on Op APOLLO: A variety of subject matter experts participated in the process of identifying the health hazards CF troops were likely to encounter on Op APOLLO, and provided recommendations to assist in preventing or mitigating these hazards. The process began early in the pre-deployment phase and continued throughout the deployment. It included: the production and dissemination of a Health Threat Assessment (HTA) for Afghanistan that outlined the infectious diseases threat, among others; the promulgation of pre-deployment preventive medicine recommendations to protect troops against a range of communicable diseases and occupational/environmental hazards likely to be encountered in-theatre based on the HTA; medical participation in the strategic reconnaissance; deployment of a DHHAT to conduct soil, air, water and bulk materials sampling to quantify the hazards outlined by the HTA and strategic reconnaissance; analysis of all collected samples at certified civilian laboratories in Canada; a toxicology review of the data generated by the DHHAT, with a human health risk assessment for possible exposures of concern verified by a non-DND toxicologist and reported through the chain to the Deputy Chief of Defence Staff's Environmental Health and Safety Committee; and appropriate in-theatre preventive medicine identification and mitigation measures throughout the deployment.

Apart from the possibility of injuries arising from military operations themselves, the main health hazards identified were those consistent with deployment to an impoverished country that had seen war and internal strife for many years and where, consequently, local public health initiatives and clinical services were minimal or non-existent. Therefore, protection against vaccine-preventable diseases was critical (tetanus, diphtheria, hepatitis, typhus, measles, mumps and rubella, etc.). FHP provided vaccine

recommendations consistent with those of the World Health Organization and Health Canada. Since recommended vaccines were mainly those for which members are supposed to maintain currency, in most cases there should not have been administration of multiple vaccines within a short period of time. Malaria chemoprophylaxis followed conventional civilian protocols; mefloquine or doxycycline were to be taken only by those troops operating in Afghanistan itself, and only commencing 01 April 2002.

As indicated previously, other exposures of concern for Afghanistan included water-, food- and vector-borne diseases, temperature extremes, noise, high altitude, air pollution and dust storms. The FHP pre-deployment message and briefings included recommendations for barrier and personal protection against biting insects, advice on the practice of good field hygiene and sanitation and the usual means to avoid food- and water-borne diseases.

The DHHAT collected numerous soil, air and water samples at a number of CF troop locations to quantify whatever environmental hazards troops might be exposed; none were identified at levels thought to be injurious to human health. Bulk sampling of materials from damaged buildings revealed that asbestos was present in one location, but sampling for airborne asbestos fibres was within normal limits and the identified areas were repaired or encapsulated. The DHHAT and preventive medicine staff also conducted sound level surveys throughout the deployment, and levels measured were well below exposure limits prescribed by the Canada Labour Code. While DU was not used by CF troops, we cannot categorically state that it was not used by non-CF troops or by the Taliban or Al Qaeda. In any case, radiological sampling of soil and air revealed no anomalous readings. There is no evidence that troops were exposed to chemical or biological warfare agents. The toxicological report of analysis of all data provided by DHHAT activities concluded, "it is not anticipated that participation in Op APOLLO exposed CF personnel to significant health risks [toxicologically], nor to any [toxicological] risks greater than would or could be encountered in Canada."

3. Methods

Interview Protocol: All Op APOLLO Roto 0 participants were eligible for the post-deployment follow-up interviews, except for those who were in theatre briefly for a Technical Assistance Visit or those who were not deployed to SW Asia or the Persian/Arabian Gulf. [A number of CF members were deployed to the US Central Command Headquarters in Tampa, FL.] Deployments typically lasted 6 months and took place during the period from October 2001 through August 2002.

Participants first completed 3 standardized health questionnaires, the SF-36 Health Survey (Version 1), an abbreviated version of the PRIME-MD Patient Health Questionnaire (PHQ), and an abbreviated form of the Mississippi Scale for Combat-related PTSD.

The SF-36 measures perceived current health-related quality of life across 8 different dimensions, including physical limitations, bodily pain, vitality (energy level), general health perception, and mental health symptoms. It also measures the extent to which the respondent perceives that any emotional or physical problems interfere with their functioning. The 8 SF-36 scales can be collapsed into two Component Summary Scores reflecting physical and mental health respectively. Details on the SF-36 scales are shown in **Table 1**. The SF-36 has been extensively validated, and as such it is an accurate representation of an individual's health and functioning. There are published norms for the SF-36 for the Canadian general population and for military populations from the US and the UK.

Table 1
Description of the SF-36 Scales

Scale (Abbreviation)	Domain	Sample Question [possible responses]
Physical Functioning (PF)	Limitations in concrete physical actions	Does your health now limit you in moderate activities (such as moving a table, pushing a vacuum cleaner, bowling, or playing golf)? [limited a lot, limited a little, not limited at all]
Role-Physical (RP)	The extent to which any physical health problems interfere with work or other daily activities	During the past 4 weeks, have you had to cut down on the amount of time you spent on work or other activities as a result of your physical health? [yes, no]
Bodily Pain (BP)	The amount of bodily pain and how much it has interfered with normal work	How much bodily pain have you had in the past 4 weeks?

General Health (GH)	How good or poor general health is perceived to be, and the extent to which it is perceived to get worse	In general, would you say your health is...? [excellent, very good, good, fair, poor]
Vitality (VT)	Energy level	How much of the time during the past 4 weeks did you have a lot of energy? [all of the time, most of the time, a good bit of the time, some of the time, a little of the time, none of the time]
Social Functioning (SF)	The extent to which physical health or emotional problems have interfered with social activities	During the past 4 weeks, to what extent has your physical health or emotional problems interfered with normal social activities with family, friends, neighbours, or groups? [not at all, slightly, moderately, quite a bit, extremely]
Role-Emotional (RE)	The extent to which emotional problems have interfered with work and other activities	During the past 4 weeks, have you cut accomplished less than you would like as a result of any emotional problems? [yes, no]
Mental Health (MH)	The degree of anxiety, depression, as well as of positive emotional states like feeling calm, peaceful, and happy	How much of the time over the past 4 weeks have you felt downhearted and blue? [all of the time, most of the time, a good bit of the time, some of the time, a little of the time, none of the time]

The PHQ was designed for screening for common mental illnesses in patients in primary health care clinics. It measures some common physical and mental health symptoms (principally those of depression, anxiety, and alcohol misuse), as well as perceived sources of stress. The recall period for each set of symptoms varies so as to correspond to the standard diagnostic criteria for each condition. For depression, for example, the recall period is 2 weeks. Segments of the original PHQ that deal with eating disorders and reproductive health were not administered.

Standardized scoring algorithms can be applied to the PHQ to generate surrogate diagnoses of depression, two common anxiety disorders, and alcohol abuse; these surrogate diagnoses correlate well with diagnoses ultimately generated by mental health clinicians. There are unfortunately no published general population data for the PHQ; comparative data is limited to primary care populations (those in a family doctor's waiting room) in the US. Since about 1/2 of all patients who present to their primary care clinician do so because they are experiencing symptoms, the rate of symptoms will be higher in a primary care population than that of the general population. The rate of common mental illnesses (particularly depressive and anxiety disorders) is known to be greater in the primary care setting than in the general population.

The Mississippi Scale is one of the most widely used instruments for measuring PTSD symptoms. The original scale has 35 questions, and abbreviated versions using fewer

questions have been reported. The CF Operational Trauma and Stress Support Centres have used an 11-item subset of the Mississippi scale, augmented by an additional 4 items. This survey yields a single score that was believed to correlate well with both distress and PTSD. It was selected for inclusion in the post-deployment screening process because of its high sensitivity and relatively low risk that persons filling in the questionnaire would “self-diagnose” on the basis of the questions asked. While initially thought to be adequately validated, subsequent investigation has shown that there were deficiencies in the validation process.

The specific deficiencies were as follows: First, two different studies of the full Mississippi Scale in US veterans with PTSD (nearly all from the war in Vietnam) identified 10 or 11 out of 35 questions which correlated especially well with the final score and seem to reflect changes in symptoms with treatment. Unfortunately, the abbreviated scale was tested prospectively in only one of the studies, and then only on 95 PTSD sufferers. Identifying items on an instrument that correlate with the final score does not obviate the need to independently test the validity of the abbreviated instrument. The panel of questions selected by the two studies overlapped for only 5 out of 10 or 11 questions, despite the fact that the two populations were similar, suggesting that the factor structure might not be stable. A CF research lab subsequently confirmed the instability of the factor structure. Furthermore, the additional four items added by the CF have not been subjected to the complete rigours of internal and external validity testing. There was also very limited data on the use of any of the abbreviated instruments in distinguishing among subjects with PTSD, subjects with other mental illnesses such as depression, and subjects without any mental illness. Finally, analysis of the Op APOLLO data showed that at least one question (an item on sleep quality) was being answered inconsistently. This item had a reversed scale, and it appears as though some members indicated that they were having terrible sleep difficulties when they meant to indicate the opposite. Because of concerns about the validity of the abbreviated Mississippi scale, the data for this scale are not presented further.

The completion of the questionnaires took about 20 minutes, and the results were then coded and analyzed using a Microsoft Excel spreadsheet template that yielded a report with the eight SF-36 scale scores, a breakdown of physical symptoms, whether the respondent met standard criteria for mental illness on the basis of the PHQ questions, a psychosocial stress inventory, and the Mississippi scale score.

The report was given to a mental health professional, who administered a semi-structured interview lasting approximately 40 minutes with the member and the member’s significant other where possible. In most cases, the interviewer was a social worker or a mental health nurse; virtually all screening staff received at least 3 hours of instruction on common deployment-related health problems and the interpretation of the questionnaires. Some bases used contracted employees for these interviews; others relied on their existing uniformed and civilian staff. The standard interview questions were divided between those on individual mental health issues and those on family and social function and adaptation. Interviews lasted an average of approximately 40 minutes. Afterwards, interviewer completed a single page “Disposition Form,” which listed their concerns (indicating whether the concern was “major” or “minor”) and made recommendations for further evaluation and care, which was coordinated by the member’s primary care

clinician. Interviewers did not suggest or make diagnoses, but rather indicated concerns in particular areas, and suggested referral for further evaluation of these concerns by an appropriate clinician. Currently, clinic appointment records are being reviewed to assure that those members in whom major concerns were identified followed up as recommended. Members were given an anonymous evaluation form at the end of the interview.

Data Entry and Analysis: Data from the questionnaires and the disposition forms were delivered to the Post-deployment Health Section for coding, data entry, and analysis after removal of the member's name, service number, and month and day of birth. Data were coded and entered by a professional data firm using 100% verification. Preliminary statistical analysis was done using SPSS for Windows, Version 11.5. Differences in means were tested using Student's t-test for continuous measures and the chi-squared statistic for ordinal measures; the Bonferroni procedure was used to adjust for multiple comparisons where relevant.

Primary and Secondary Outcome Variables: The primary and secondary outcomes variables were as follows:

Primary:

- Percent of members with recommended referrals for major problems
- Member satisfaction with screening process as judged by their responses on the anonymous evaluation form
- SF-36 Physical and Mental Component Summary Scores
- Prevalence of Major Depressive Syndrome, Minor Depressive Syndrome, Panic Syndrome, Other Anxiety Syndrome (GAD), and Alcohol Abuse as determined by the PRIME-MD PHQ.
- Areas of "major" concern identified by the interviewer on the disposition form.

Secondary:

- SF-36 scale scores.
- Areas of "minor" concern identified by the interviewer on the disposition form.
- Member satisfaction levels as demonstrated by their anonymous evaluation forms.

Ethical Aspects: This follow-up screening program was a clinical process. Nevertheless, the CF Post-deployment Health Section (in the Directorate of Medical Policy) collected and analyzed the data for statistical purposes, in particular to evaluate the findings of this new clinical process. Two different procedures were used for obtaining consent for the secondary use of the data. For the first approximately 600 interviews at CFB Halifax, members were simply informed that their data would be used anonymously for statistical purposes. This approach was reviewed and approved by a number of different CF directorates (including the Health Counsel's Office), and this process was judged to be in compliance with both the Privacy Act and internal CF policies and procedures. Unfortunately, operational demands required that the process commence before the review by the commercial research ethics board. That board, Ethica Clinical Research,

required that the member read an additional disclosure statement and check a box indicating their consent; this process was used for the remainder of the interviews. Because the initial procedure (not requiring formal consent) met internal CF requirements and was consistent with the Privacy Act, this data will be used for internal CF statistical and quality assurance purposes. Only those meeting the higher consent standard will be used for a final research publication.

4. Preliminary Findings

Sample Characterization: Approximately 2,000 out of the 3,200 members who took part of Op APOLLO, Rotation (“Roto”) 0 had completed the post-deployment follow-up interviews as of the end of February 2003. Of these, approximately 550 did not give consent to the research use of the data, leaving 1,443 valid cases (72% response rate). The response rate was similar among the bases doing the interviews. 1,643 members (82%) submitted evaluation forms.

Interviews occurred an average of 156 days (SD = 81) after return from deployment. Members had the option of bringing their spouse/partner/significant other with them to the interview, but in practice only 2% did so. The demographic characteristics of the sample are shown in **Table 2**; analysis of non-respondents is ongoing, but available data suggests that demographic and military characteristics of the sample are representative of the population of Op APOLLO participants as a whole.

This preliminary analysis is limited to univariate models, though bivariate correlations between key demographics and military characteristics and the key outcomes did not suggest any important sources of confounding with one possible exception: Members of the PPCLI Battle Group were interviewed an average of 130 (SD = 65) days after deployment, and all others were interviewed an average of 175 (SD = 86) days after deployment, a statistically significant difference. It is therefore possible that part of the observed differences in the primary and secondary outcome variables seen between the Battle Group and all others are due to the fact that the Battle Group was interviewed 35 days earlier, on average, though exploratory multivariate models suggest that this is not the case.

SF-36 Health Survey Results: Six of the eight SF-36 scale scores were poorer in the Op APOLLO sample than in the Canadian general population of the same age and sex. Statistically significant differences were seen in the Role-Physical, Bodily Pain, General Health Perception, Vitality, Social Functioning, and Mental Health scales, as well as in both the Mental and Physical Component Summary Scores. The magnitude of the differences in both Component Summary Scores was larger than the unique effect of a number of important medical diseases such as diabetes, having had a recent heart attack, or arthritis, suggesting that the differences are not only statistically significant, but also clinically significant as well. The SF-36 scores of members of the PPCLI Battle Group were significantly worse than those other Op APOLLO participants in the Bodily Pain, Vitality, Social Functioning, and Mental Health scales and the Mental (but not Physical) Component Summary Scores.

The pattern and degree of impairments in physical well-being in the Op APOLLO group appeared nearly identical to that of a random sample of US Gulf War veterans approximately 6 years after the conflict; the emotional well-being of the Op APOLLO group appeared to be significantly worse. Finally, the scores of the PPCLI Battle Group appeared worse than US Gulf War Veterans in all but one scale (Physical Functioning). These differences could not be significance tested because the corresponding Gulf War data is not complete enough to adjust for various confounders, though differences in the

age and sex distributions do not appear to be large enough to explain the observed patterns.

Table 2
Demographic and Military Characteristics of Participants (N=1,443)

Characteristic	Participants N* (%)**	Characteristic	Participants N (%)
Gender		Branch of service	
Male	1360 (94.6)	Land	591 (41.2)
Female	77 (5.4)	Sea	552 (38.5)
Age (years)		Air	291 (20.3)
≤ 24	131 (9.6)	Base:	
25 – 34	587 (42.9)	Halifax	671 (46.5)
35 – 44	575 (42.0)	Edmonton	505 (35.0)
45 – 54	75 (5.5)	Trenton	110 (7.6)
Marital status		Other	156 (10.8)
Married or living with partner	968 (67.6)	Part of PPCLI Battle Group	
Divorced	65 (4.5)	No	908 (63.3)
Single (never married)	322 (22.5)	Yes	526 (36.7)
Separated	68 (4.8)	Years in military	
Widowed	8 (0.6)	≤ 5	254 (17.6)
Rank		6 – 10	256 (17.8)
Senior officer	31 (2.5)	11 – 15	371 (25.7)
Junior officer	129 (10.3)	16 – 20	296 (20.5)
Senior NCO	267 (21.2)	> 20	265 (18.4)
Junior NCO	759 (60.4)	Number of previous deployments	
Private/AS/OS	71 (5.6)	None	163 (13.0)
Duty status		1 to 2	581 (46.4)
Regular force	1411 (99.4)	3 to 4	350 (30.0)
Reserves	9 (0.6)	5 or more	158 (12.6)

*Totals might differ slightly due to missing data.

**Totals might not add up to 100% due to rounding.

One item on the SF-36 addresses how the respondent thinks their health has changed over the previous year. This health transition item indicated a disproportionate number of members who indicated that their health was “somewhat worse” than one year ago.

Physical Symptoms from the PRIME-MD PHQ: The first set of questions on the PHQ address some common physical symptoms such as shortness of breath, dizziness, indigestion, stomach pain, etc. These are particularly common symptoms in distressed individuals, and some have been reported as common symptoms in veterans of the Persian Gulf conflict. The respondent can indicate whether they are “bothered a lot,” “bothered a little,” or “not bothered at all” by each symptom. As mentioned in the Methods section, the only comparison data available for the PRIME-MD are from primary care populations, which are expected to have a higher prevalence of physical symptoms and symptoms of mental illness.

There was a greater prevalence of symptoms at the “bothered a lot” level in the primary care comparison group (matched for age and sex) than in the Op APOLLO sample for all 13 physical symptoms covered in the PHQ. The average prevalence ratio was approximately 2.5. In addition, the pattern of the prevalence of the symptoms at the “bothered a lot” level was similar in the two samples, meaning, for example, that back pain was much more common in both groups than were fainting or dizziness. The PPCLI Battle Group was somewhat more symptomatic for back pain, joint/limb pain, and difficult concentrating than other Op APOLLO participants. The last symptom is actually part of the depression symptoms screen, but it is presented here for clarity.

Mental Health Diagnoses from the PHQ: The rate of symptoms suggestive of major depression and alcohol abuse in the Op APOLLO cohort were both slightly below those of the age- and sex-matched primary care population rates of 4.9% and 15.1% respectively. The rates of symptoms suggestive of minor depression, panic disorder, and generalized anxiety disorder were all approximately three times lower than the matched primary care population rates. Minor depression and alcohol abuse were both more prevalent in members of the PPCLI Battle Group.

Interviewers’ Concerns: The interviewers could identify “major” or “minor” concerns about symptoms of depression, PTSD, other anxiety disorders, substance abuse, as well as physical health issues, spouse/partner conflict, or “other.” Major concerns outnumbered minor concerns in each category, and with the exception of especially frequent “minor” physical health issues, no one area stood out as being especially prevalent. 23% of all members received a recommendation for further follow-up evaluation or treatment, and about half of these members had at least one “major” concern identified by their interviewer. Members of the PPCLI Battle Group had increased rates of concerns and referral in almost all areas. The interviewers identified “major” concerns about PTSD symptoms in 3.5% and “minor” concerns in 4.7%. These rates are above those demonstrated in Canadian veterans of the Persian Gulf conflict, but they are well below those cited by some other sources. Experience from the CF’s Operational Trauma and Stress Support Centres suggests that only a fraction of those referred by other mental health professionals for possible PTSD will actually prove to have that formal diagnosis. The rest will have Acute Stress Disorder, sub-threshold PTSD phenomenology, other psychiatric disorders, or non-pathological levels of re-experiencing of traumatic events. While the impact of deployments on the family has received much attention lately, major concerns about marital/family issues were identified in only 4.4% of participants.

Member’s Evaluation: Members evaluated this new, enhanced post-deployment screening process favourably. About 90% or more of the 82% of members who submitted anonymous evaluation forms agreed or strongly agreed with various satisfaction statements such as “My mental health was reviewed in appropriate detail,” “My physical health was reviewed in appropriate detail,” “By the end of the interview, my interviewer understood my current social situation,” and “I felt comfortable sharing personal information with my interviewer.” About ½ agreed that some sort of post-deployment screening should “definitely” occur in addition to the usual post-deployment medical exam; another ¼ agreed that one should “probably” occur. Just under 20% indicated that they were worried that medications, vaccinations, chemicals, or toxins that

they were exposed to in preparation for or during their deployment could have harmed their health. Of those who chose to elaborate on this, their specific concerns covered a very broad range of exposures, though anti-malarial drugs, insecticides, and vaccines were the most commonly cited ones.

5. Discussion

This evaluation of a new, mandatory, enhanced post-deployment medical screening interview demonstrated substantially poorer physical and emotional well-being of Op APOLLO participants compared to the age- and sex-matched Canadian general population. The reasons for this observed difference are likely to be multiple.

While it is possible that all of the difference is the result of their recent deployment, there are other possible explanations as well. First, as mentioned in the introduction, there is evidence from several recent surveys that the self-reported health status of CF members is poorer overall than that Canadian general population. Several explanations can be advanced for the pre-existing poorer health status of the CF. Given that at least some deployments (most notably the Persian Gulf conflict) have been associated with decrements in health status, some of this pre-existing difference presumably reflects the burden of previous deployments in this seasoned military sample with an average of 2.6 previous deployments over more than a decade of military service. It is also possible that the CF disproportionately selected unhealthy or vulnerable members for military service. This is at least theoretically possible because it is clear that CF's recruitment base is not a perfect reflection of the general population. Similarly, it is at least theoretically possible that disproportionate numbers of unusually healthy members left the service. Conversely, though, it could be argued that the separation from service of unhealthy members would result in their leaving behind a disproportionately healthy population.

Nevertheless, three key features suggest that some of the observed differences in health status are due to their recent deployment. First, particularly for those in the PPCLI Battle Group, this was a "difficult" (though very successful) deployment in many ways. The operational stresses mentioned in the Introduction would be expected to produce an increased incidence of operational stress injuries including (but not limited to) PTSD. The substantially poorer mental health status of the PPCLI Battle Group is consistent with just such an effect. Their disproportionate pain complaints might reflect the physical rigours of their deployment experiences, but mental distress and mental illness also enhance pain perception. Nevertheless, since the Battle Group's members have slightly different demographic and military characteristics from the other Op APOLLO participants, it is possible (though unlikely) that these differences will be mitigated after various statistical corrections are made.

Another feature that supports the contention that some of the observed differences were due to deployment to Afghanistan is the magnitude of the differences, which are substantially greater than that seen in any other recent study of the health of CF members. The health status even appears worse than US Gulf War veterans, a group with self-reported health status that is far worse than non-deployed controls.

Finally, the health transition item of the SF-36 indicated that a disproportionate number of members believed that their health was "somewhat worse" than the year before. Longitudinal studies of perceived health status have shown that people are surprisingly accurate in judging health transitions, meaning that those who indicate that their health is somewhat worse have in fact had health deterioration. Several important features, then,

support the contention that some of the observed health status differences are due to deployment on Op APOLLO.

The similar symptom prevalence profile in the Op APOLLO sample and the general population suggests the absence of any particular new symptoms syndrome. If there had been exposure to a particular environmental agent that caused, for example, headache, joint pain, and palpitations, a “spike” in these symptoms would have been expected.

The lack of population-level comparative data from the PRIME-MD PHQ precludes firm conclusions about the specific prevalence of mental illness in the study population. Attempts to locate better comparison data are ongoing. That the rate of physical symptoms and depressive, alcohol, and anxiety disorders is lower than that of the primary care population provides little reassurance, given the substantial elevation of the risk of these problems in the primary care setting. Moreover, because low SF-36 Mental Component Summary Scores correlate very well with serious psychopathology, the substantial deficits in the scores in the Op APOLLO sample strongly suggest that it would have a higher rate of diagnosable mental illness than the general population. The rate of alcohol abuse in the Op APOLLO sample is very similar to that obtained in the recent Health and Lifestyle Survey, which used a different assessment tool (the “AUDIT” test). Much more precise information on the prevalence of mental illness and its correlates, including operational stress, in the CF will be available during the summer of 2003 when the large mental health study’s results are reported.

Most of the problems identified during this screening were psychosocial rather than medical. This might be because the screening process did not include a mandatory medical assessment by a physician. However, the instruments covered physical symptoms and important physical health, health perception, and functional status dimensions, and the interviewers were instructed to refer members with physical complaints for medical evaluation. As indicated above in the section on the members’ evaluations of the process, the vast majority of members still felt that their physical health was reviewed in appropriate detail.

What Illnesses Are Contributing to Ill-health in the Op APOLLO Sample? The specific diagnoses that would account for their disappointing health status are unknown; their ascertainment would require a comprehensive clinical examination similar to those done in the US, the UK, Canada, and elsewhere in the aftermath of the Persian Gulf conflict. Those programs did not reveal any new or unusual diagnoses in the participants. Instead, it showed that there was a wide variety of different diagnoses, among them musculoskeletal problems like back pain or tendonitis, psychiatric diagnoses like depression, and medically unexplained physical symptoms like fatigue and bowel troubles. In addition, there were diagnoses that are common in the general population like asthma, eczema, high blood pressure, and others. Because the deployment experiences of Op APOLLO participants were similar in many ways to those of participants in the Persian Gulf conflict and because the nature of the health problems identified by the questionnaires was also similar, no comprehensive clinical evaluation program for Op APOLLO is planned. Instead, each member’s specific constellation of problems will be individually addressed by their own Medical Officer. Consultation services with post-deployment health experts and other consultants are available in the CF.

Still, some inferences and predictions are possible: The Op APOLLO data viewed in the context of the experience from the Persian Gulf and other conflicts suggest that a comprehensive look at Op APOLLO members would identify:

1. A number of ordinary medical diagnoses like asthma, arthritis, eczema, etc. Some of these would be directly traceable to deployment (for example, back pain might be attributable to a back injury sustained in theatre);
2. A disproportionate burden of mental illness (particularly depression) and mental distress; and
3. A substantial burden of medically unexplained physical symptoms, particularly fatigue (demonstrated in the OP APOLLO data by the significantly impaired SF-36 Vitality scale scores). Many of those with medically unexplained physical symptoms will meet criteria for symptom-based diagnoses like Chronic Fatigue Syndrome, Fibromyalgia, and Irritable Bowel Syndrome.

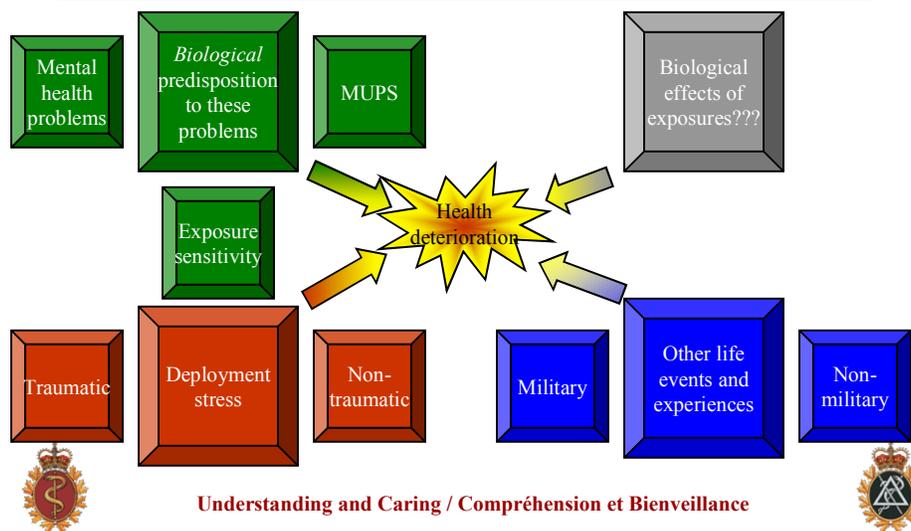
What Is It about Deployment That Seems to Result in Impaired Health and Well-being in Some of Those Who Deploy? Whatever explanation(s) are advanced will have to account for the following features of deployment-related illnesses:

1. *The occurrence of similar constellations of mental health problems and physical symptoms in veteran of previous conflicts dating back at least 150 years.* The suspected physical exposures of the Persian Gulf conflict were more or less new to that theatre (oil well fire smoke, low level chemical warfare agents, depleted uranium, pyridostigmine bromide, etc.), but the subsequent physical and mental health symptoms were not.
2. *The occurrence of similar constellations of mental health problems and physical symptoms in recent veterans who were never deployed to the Persian Gulf.* One study, for example, demonstrated that 15% of US veterans who had never deployed to the Persian Gulf meet formal symptom criteria for “Gulf War Syndrome.”
3. *The occurrence of similar constellations of problems in non-veterans.* Many members of the general population also meet formal symptom criteria for Gulf War Syndrome, and the symptom-based syndromes like Chronic Fatigue Syndrome act more or less the same whether they are deployment-related or not.
4. *The strong (but not absolute) association between mental illness and distress and unexplained physical symptoms in veterans and non-veterans alike.*
5. *The lack of any consistent epidemiological association between any of the putative Gulf War exposures and any particular symptoms or illness (with the exception of the known association between traumatic stress and PTSD).*
6. *The more or less two-fold increase in physical symptoms seen across the board in post-deployment population.* Nearly every physical symptom is more prevalent in veterans of the Persian Gulf conflict.
7. *The absence of an increase in death, common medical illnesses like diabetes, cancer, birth defects, etc. in post-deployment populations.*

The picture that is emerging about the causes of deployment-related health problems is a complex one, in which a wide range of factors can conspire to produce distress or illness in a highly individual way. A proposed model of the different contributors to deployment-related illnesses is shown in **Figure 1**.

Figure 1

Causes of Deployment-related Health Deterioration



Of note is the fact that very few of the factors shown above are of the member's choosing.

One causative factor that accounts well for all of the features of post-deployment illnesses mentioned above is deployment-related stress, both traumatic and non-traumatic. Non-traumatic stresses include prolonged separation from friends and family, the reintegration process, exposure to harsh and unfamiliar environments in theatre, etc. A number of scientific bodies have specifically identified stress as an important factor. This project, of course, was not designed to sort out the various causal factors of deployment-related health deterioration. The prominent mental health symptoms it identified do, however, point to stress as an important contributor.

Clearly though, stress is not a sufficient factor to create post-deployment illnesses. Many individuals who suffer horrific stresses while deployed appear to be resilient and have no long-term consequences. Others suffer terribly after more minor stressors. There are well-established risk factors for PTSD, and many of these are also risk factors for medically unexplained physical symptoms such as chronic fatigue, chronic pain, and others. Data from a variety of contexts suggest that some individuals develop medically unexplained physical symptoms unaccompanied by diagnosable mental illness or even

significant mental distress as a consequence of stressful events. As such, for at least some such patients, prominent medically unexplained physical symptoms likely represent one manifestation of an occupational stress injury.

Biological predisposition is a well-known risk factor for mental illness; depression, bipolar disorder, panic disorder, alcoholism, and many other conditions run in families. There also appear to be biological and genetic factors that predispose people to unexplained physical symptoms such as irritable bowel syndrome, fibromyalgia, and chronic fatigue syndrome.

Other life-stressors, both military and not, can either cause stress-related illnesses (including PTSD, depression, unexplained physical symptoms, and others), or they may aggravate deployment-related stressors and create or worsen health problems.

The stress theory does have certain weaknesses. For the Persian Gulf conflict at least, the association between deployment stress levels and illness/symptom rates, while present, is surprisingly weak. Generally, there should be a dose-response relationship between a “toxic” exposure and the illness it is believed to cause. For example, smoking 2 packs per day of cigarettes would be expected to cause a greater risk of lung cancer than smoking ½ pack per day. Some argue that a major stressor of the Persian Gulf conflict was the constant exposure to adverse health publicity during the post-war period, which might have had a permanently damaging effect on health and well-being. Unfortunately, much of the Persian Gulf conflict research in this area is also weak, and much of it is hampered by the implicit assumption that PTSD is the only manifestation of post-traumatic stress. Data from the Second World War, however, strongly supported a dose-response relationship between combat exposure and psychiatric casualty rate.

Finally, there are some intriguing research findings about the possibilities of biological effects of the interaction of neurologically active agents such as pyridostigmine bromide, pesticides, and low levels of nerve agents. Certain genetically determined characteristics such as the polymorphism of certain isoenzymes involved in metabolism of certain drugs and toxins might make some individuals more susceptible to these toxic effects than others. If this line of research does establish such interactions as a cause of illness, it is likely to apply to only a small number of people who received all three exposures in sufficient amounts, and it will likely only explain a fraction of the symptoms in those exposed. Consideration of all of these factors should make it easy to see how an individual who is exposed to extreme traumatic stressors such as prolonged physical torture might fare more poorly if there were other powerful deployment stressors (perhaps an unusually long deployment), other military stressors (e.g., high operational tempo), other non-military stressors such as marital discord and a chronically handicapped child, a strong family history of, say, depression and irritable bowel syndrome, exposure to neurotoxins, and a biological predisposition to sensitivity to those toxins.

Member’s Evaluation: The favourable evaluation data was something of a surprise. During the planning phase, there was concern that members would view the process as intrusive and that they would not feel comfortable sharing personal information with the interviewers. That proved not to be the case. That said, it is perhaps not surprising that

people would positively evaluate a 40-minute encounter with an empathic mental health professional who shows genuine interest in one's health and well-being.

Limitations: This work has several key limitations. *First and foremost, the health status of those in the sample prior to deployment is unknown.* Still, the line of argument presented in the first portion of this Discussion section permits the cautious conclusion that it is likely that some of the differences noted are a consequence of participation in Op APOLLO.

Secondly, this data is from a single point in time. It is not known whether the health status of the cohort has improved, deteriorated, or stayed the same since the time of data collection. Other data, however, suggest that average post-deployment stress levels are fairly stable from 6 to 18 months after deployment, suggesting that rapid improvement is unlikely. Because the PPCLI Battle Group was interviewed earlier than the others, on the average, it is possible that some or all of the differences demonstrated are due to that phenomenon if health status were to be naturally improving at that time. As alluded to above, exploratory multivariate analysis did not suggest that this was a serious confounder.

This is a preliminary analysis, and some minor aspects of the findings will likely change once data collection and analysis are complete. The lack of epidemiologically sound survey data on PTSD symptoms precludes estimates on the likely rate of PTSD beyond that provided by the interviewer's concerns as identified on the disposition form.

As mentioned in both the Preface and the Executive Summary, this evaluation reflects only the results of 72% the first 2,000 screenings done on the 3,204 participants of Roto 0. The remaining screenings are currently in progress, and nearly all are on naval forces who deployed out of Esquimalt, BC. The demographic and military characteristics and deployment experiences of the Esquimalt contingent are nearly identical to those of the Halifax contingent, for which data collection is nearly complete. Data collection is also nearly complete for the group with the poorest health status, namely the PPCLI Battle Group. The ultimate inclusion of the Esquimalt data will like increase somewhat the observed average health status of the whole of Roto 0.

The conclusions of this analysis are based on self-reported symptoms rather than evidence from biomedical tests or clinical examinations. The concerns identified by the interviewers are not firm diagnoses. Accordingly, some could suggest that it is possible that some or all of the members in this sample just think they are ill. Given that subjective mental and physical symptoms rather than objective signs characterize post-deployment illnesses, self-reported symptoms are what should be measured to define the problem. The symptoms are very real and sometimes very disabling to the veterans who are experiencing them. Nevertheless, it is possible that excessive attention to deployment health issues (including in-depth assessment procedures like this one) will systematically bias members to over-report symptoms and problems as a manifestation of what is called awareness bias.

Finally, from an evidence-based medicine perspective, it does not necessarily follow that early identification of deployment-related health problems will lead to improved outcomes. Still, there is good evidence that screening for depression, at least, in the primary care setting, can be better than usual care. There is no data from high quality,

prospective, randomized controlled trials on the benefits of screening for PTSD, but there are other reasons to believe that early treatment might prevent the gradual unravelling of the life of those afflicted with this serious disorder. Similarly, there is some reason to believe that early recognition and treatment of medically unexplained symptoms may be beneficial.

6. Conclusions

This enhanced post-deployment screening interview program consisting of the administration of several standardized surveys followed by a semi-structured interview by a mental health professional was more successful in identifying individuals with problems than the conventional post-deployment medical examination. Members with problems were referred for individualized care. There are highly significant deficits in the mental and physical well-being of Op APOLLO participants compared to those of the Canadian general population of the same age and sex. The magnitude of these differences is greater than those caused by major health problems like diabetes, heart disease, and arthritis. Especially prominent differences are in the areas of bodily pain, health perception, vitality, and mental distress. Members of the PPCLI Battle Group had worse health, overall, than others.

The pattern and magnitude of the impairments in physical well-being are similar to those of US Gulf War veterans; the emotional well-being of Op APOLLO participants was worse. The pattern of physical symptoms does not suggest any new symptom syndrome. While the process did not yield firm diagnoses, it is likely that Op APOLLO participants had a higher rate of diagnosable mental illness than the age- and sex-matched Canadian general population.

Taken as a whole, then, these findings are consistent with typical post-deployment health impairments. Given the long history of such problems following military conflicts, their observation following Op APOLLO should perhaps be more disappointing than surprising. Despite all of the attention paid to the prevention, detection, and treatment of occupational stress injuries and other deployment-related health problems, the rate of ill-health is still unacceptably high.

This interview process was well received by CF members who perceived it to be sensitive and thorough. An important minority reported concerns about the health effects of various exposures, particularly anti-malarial drugs, vaccines, and insecticides. These represent opportunities to provide effective risk communication interventions to CF members.

7. Action Plan

A number of concrete steps are being taken to protect the health of CF members subject to deployment:

Individualized Care: Members with problems have been referred for individualized assessment and treatment. Given that their problems are likely to cover a broad range of areas, no formulaic diagnostic or treatment approach is appropriate. CF Medical Officers have received specific training in the diagnosis and treatment of deployment-related health problems. In addition, internal medicine specialists with expertise in post-deployment health are available within the CF, and the CF's 5 Operational Trauma and Stress Support Centres provide specialized mental health services for those with operational stress injuries. For members with medically unexplained physical symptoms, the CFMG has disseminated evidence-based clinical practice guidelines originally developed by the US Armed Forces. The educational needs of MO's are being assessed, and additional educational sessions on post-deployment health problems will be offered if requested.

Tracking the Health of Op APOLLO Roto 0 Participants: At present, no structured clinical evaluation program for Op APOLLO participants is planned. Medical Officers will be instructed to be attuned to and to report any unusual symptoms, signs, or diagnoses. The feasibility of re-surveying this group in 6 months or so is being explored.

Investigation of the Contributors to Ill-Health: Much is already known about the causes of post-deployment health problems, and a number of research projects are underway internationally. The CF is developing its Health Information System, which will have an integrated Occupational and Environmental Medicine module to track and investigate patterns of ill-health, including those related to deployment-related exposures. The soon to be implemented Prospective Health Data Analysis Capacity, developed by the Directorate of Forces Health Protection, will allow longitudinal tracking of health data from the time of recruitment and throughout the member's military career. A consensus conference to establish a CF research agenda for occupational stress injuries will be convened this fall; it will have participation of various CF directorates, Veterans' Affairs Canada, veterans' groups, academics, and others.

Monitoring the Health of Other Deployed Members: The successful Op APOLLO process was adapted and implemented for the 1,500 members largely from CFB Petawawa who will be deploying back to Afghanistan this summer as Roto 0 of Op ATHENA. The principal motivation of this was to identify members with pre-existing medical problems that would make deployment inadvisable. The Op APOLLO process is being institutionalized as a routine part of post-deployment care. In part because of the logistical and other disadvantages of timing comprehensive medical assessments around deployments, structured health data collection along the lines of this process is being integrated into the Periodic Health Examination on a regular basis. This will, of course, also enhance sensitivity of the Periodic Health Examination much as it has done for post-deployment screening exams.

8. Reference List