# WOMEN IN THE ARMED FORCES

## NATO SCIENCE AND TECHNOLOGY ORGANIZATION (STO) RESEARCH ON WOMEN IN THE ARMED FORCES (2000 – Present)

### NATO Chief Scientist Research Report

Volume 1
April 2021

DISCLAIMER

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**NATO Chief Scientist Research Report**

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# FOREWORD

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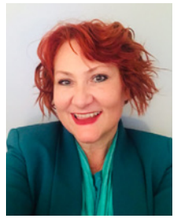
## FOREWORD



Ms Clare Hutchinson

Dr. Bryan Wells

Last year marked the twentieth anniversary of the adoption of United Nations Security Council Resolution 1325 (2000) on Women, Peace and Security. This resolution highlights that the meaningful participation of women in conflict prevention and resolution can lead to a more sustainable and lasting peace. Over the years, NATO has developed its own Women, Peace and Security (WPS) agenda, using the integration of gender perspectives to highlight gender-based differences between women and men to strengthen the core tasks of the Alliance.

Throughout this time, NATO's Science and Technology Organization (STO) has conducted research to support women's roles in NATO armed forces. In 2000 the STO conducted one of its first activities that explicitly considered the impacts of military service on women, exploring the different load carriage performance between servicemen and servicewomen. Twenty years on, there is now a considerable body of STO research that has contributed to our understanding of the different experiences of men and women in the armed forces: from their physical performance, to health provision, to their experiences of sexual harassment and violence.

For the first time, these activities have been gathered together in one place by the team in the Office of the Chief Scientist (OCS) to bring the STO's findings to a wider audience and to highlight not only where we have high-quality evidence informing how women are integrated into NATO forces, but also where there are areas that demand further research. In doing so, we hope that the NATO community and beyond can learn from the STO's insights and appreciate the data we have about the significance of sex and gender in the military. Moreover, we hope that readers of this report will also recognize the research gaps that remain. We must set our sights on continuing to build upon the excellent foundation that the STO has created, driving towards greater collective understanding of the key issues across the Alliance. We must nurture the integration of questions about gender in all of our scientific research and we must learn from the wider NATO community which issues demand our attention and scientific expertise. Here at the STO, it is our belief that evidence-based excellence can magnify the experiences of women service members and ensure that NATO is fully equipped to implement the WPS principles of integration, inclusiveness and integrity.

*Dr. Bryan Wells – NATO Chief Scientist*

*Ms Clare Hutchinson – NATO Special Representative for Women, Peace and Security*



# EXECUTIVE SUMMARY

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This addresses, for a broad audience, the body of NATO Science and Technology Organization (STO) research conducted between 2000 and 2020 on women in the armed forces. The report identifies four central themes which capture the current key areas of research: employment and integration; sexual violence and harassment; kit and equipment; and health.

Figure 1: FET members (Credit: DVIDS)

Overall, the work described in the report provides a solid evidence-based framework for ensuring informed and evidence-based decisions are made on the optimal effectiveness and employment of women in the armed forces.

What is striking is the remarkable comprehensiveness of the STO's work across these themes, considering a range of difficult issues and drawing on national experiences across the Alliance. Few critical areas have not been examined in at least some detail. Furthermore, many ongoing STO research activities will advance our collective understanding of the most pressing questions concerning the full integration of women into NATO militaries. In several cases, NATO Partners have also participated in STO activities, contributing to data analysis quality and the richness of the STO's insights in diverse and varied contexts.

Despite this diversity of research topics, some key findings have emerged that are common across the areas explored:

- Leadership plays a key role in the integration of service women into the armed forces, including to the culture of organizations and to the prevention of sexual harassment and assault.

- Women's physiological differences need to be taken into account to prevent and reduce injury rates, and to ensure kit and equipment is appropriately designed and fitted for all service members.

- Training of service members is critical to the prospects of service women in a range of areas, including in the integration of women into combat roles and the enhancement of women's physical performance.

Figure 2: NATO Allies are deploying more women on operations and missions (Credit: NATO)

These findings indicate the importance of further investigating the factors that influence the experiences of women service members in the armed forces. Linked to this, STO research must be mindful of latent gender biases and dominant discourses that may prejudice the research undertaken. Drawing reliable conclusions relies on unbiased and rigorous research, including interrogating the terms on which the STO's research is conducted.

Finally, as the landscape of warfare rapidly changes and is increasingly shaped by the maturation of emerging and disruptive technologies (EDTs), the questions explored in this body of STO research will likely become more acute and more relevant. Advances in biotechnologies, human augmentation, artificial intelligence, among others, will all need to be aware of the issues associated with sex and gender in the armed forces. It will be even more important for dominant gender norms to be questioned and for new and existing technologies to account for physiological sex-based differences. Moreover, as a growing scientific consensus emerges regarding the non-binary nature of biological sex,[1] STO research will need to better account for this variability as well as be cognizant of non-binary gender expressions.[2] This will be increasingly important as innovations in biotechnologies and human enhancement technologies materialise.

1 See article 'Sex redefined' in *Nature News* published by Springer Nature, Claire Ainsworth: https://www.nature.com/news, 18 February 2015.

2 'Non-binary' gender expressions describe the communication of a gender identity that is neither exclusive to women or men, or is between or beyond both genders. Taking this into account may help STO research take further account of diverse experiences of military service.



# TABLE OF CONTENTS

# INTRODUCTION

# INTRODUCTION

This NATO Office of the Chief Scientist (OCS) report represents an aggregation of the research conducted by the NATO Science & Technology Organization (STO) over 20 years examining women's role in the armed forces. Its primary purpose is to share with the wider NATO community the findings of STO gender research and support NATO's commitment to gender equality and women's inclusivity across Alliance structures and in national armed forces.

The OCS is the STO's executive body closest to political and military leaders at NATO HQ. The OCS supports the NATO Chief Scientist's two essential functions: first as the Chairperson of the Science and Technology Board (STB) and second as the senior scientific advisor to NATO leadership. Beyond providing the executive support to the STB and its chartered responsibilities, the OCS acts as a focal point for the STO Programmes of Work (PoWs) and its users represented at NATO HQ. To that end, the OCS works with the S&T results generated through the STO PoWs and promotes their utilization in the political and military context. Engaging the committees and staff at NATO HQ and beyond, the OCS aims to bring to bear the most relevant and up-to-date S&T results available to inform senior NATO decision-making.

It should be noted that this report is situated within NATO's long-established engagement with gender issues. For example, the Committee on Women in the NATO Forces (now the NATO Committee on Gender Perspectives) has facilitated the sharing of lessons and best practice on the integration of women, including in forward facing roles, for over 40 years.[3]

## HOW TO READ THIS REPORT

The report itself is extensive, providing summaries and analyzes of the STO's relevant activities since 2000.

**Given its length, readers are encouraged to use the Table of Contents to identify particular areas of interest and assess these findings in light of comments made in the report's Conclusion.**

The STO's collaborative research is carried out in seven different technical areas, represented by STO Panels and/or Groups, and at the NATO research laboratory, the Centre for Maritime Research and Experimentation (CMRE). Most of the research summarised in this report comes from two panels, the **Human Factors and Medicine (HFM) panel** and the **System Analysis and Studies (SAS) panel**. The HFM panel's mission is to provide the science and technology base for optimising health, human protection, and the well-being and performance of humans in operational environments. The SAS panel conducts studies and analysis for better decisions in strategy, capability development, and operations within NATO, NATO Nations and partner Nations. Research activities are each given a reference code linking to the panel it was conducted under (e.g., SAS 120). Readers may note some older activity codes that begin with RTO (Research and Technology Organization), the predecessor to the STO.

This report is divided into four broad chapters, providing overviews of four central themes:

1. Employment and integration
2. Sexual violence and harassment
3. Kit and equipment
4. Health

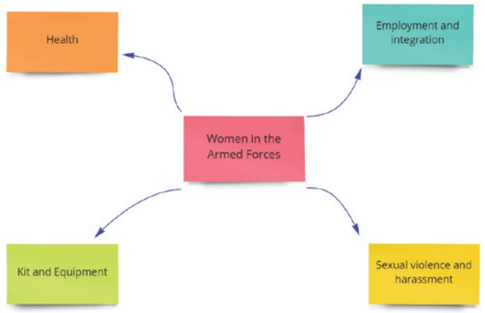



**Figure 3: Diagram showing the four central themes in this report (Design tool credit: Miro).**

These themes align with the NATO Women, Peace and Security agenda, framed around the principles of integration, inclusiveness and integrity.

Because individual STO reports often cover more than one of these four central themes, the same activity sometimes features in more than one chapter.

STO research activities take various forms representing differing degrees of effort, investment, and time. An overview of activities relevant to this report follows:

- Exploratory Team **(ET)** – a feasibility study to establish whether it is worth starting a more extensive activity, usually one year in duration.
- Research Task Group **(RTG)** – a study group, three years in duration unless delayed.
- Research Symposium **(RSY)** – over 100 attendees, 3-4 days in duration.
- Specialist Team **(ST)** – quick reaction.
- Research Specialist's Meeting **(RSM)** – over 100 attendees, 2-3 days in duration.
- Research Workshop **(RSW)** – selected participation, 2-3 days in duration.
- Research Lecture Series **(RLS)** – junior and mid-level scientists.

Each research activity summary lists the type of activity conducted and central conclusions. Ongoing activities are also listed, and expected completion dates are provided for readers who wish to follow these activities' progression and release of final reports.

## TERMINOLOGY

These activities are built upon national efforts and do not rely on any approved STO-wide language. As such, they may demonstrate inconsistencies in their use of language. The distinction between 'sex' as a biological marker and 'gender' as a social marker[4] is generally respected in the studies and reflected in the summaries and analysis described herein.[5] Some activities that consider cultural issues relating to women are predominantly referring to dominant gender norms and the demand to institute more inclusive normative regimes. Other activities (such as those in the Health and Equipment chapters) are concerned primarily with markers of physiological difference. Here, the reader should remain aware that there is a growing scientific consensus emerging regarding the non-binary nature of biological sex.[6] Therefore, it may instead be useful to think in terms of secondary characteristics, e.g. hormonal health, uterine or testicular health, and so on to account for the variations within the conventional terms we use to categorise groups of people.[7] As such, when reference is made to the differences between women and men, readers should perhaps be aware that there is a degree of diversity contained even within the moniker 'woman' or 'man' or 'gender' itself. Indeed, readers may also note that 'sex' and 'gender' are mutually constitutive. Drawing too much of an analytical distinction between the two can obscure the myriad ways in which they combine to create and reproduce inequalities.

## ACCESSING ACTIVITY REPORTS

It is a welcome reflection of the fullness of the STO's research in this area that this report provides only a snapshot of the detail contained in the individual papers, symposia, and findings. Many of these papers are open access. Interested readers are invited to consider the results in their totality if they wish by clicking on the link provided at the end of each activity summary.

Alternatively, the reader is encouraged to use the 'Publications' search function on the STO website and search for the activity code or title you are interested in: <http:\www.sto.nato.int>.

3 For more information on the wider history of NATO's work on gender issues and equality see Katharine A.M. Wright, Matthew Hurley, & Jesus Ignacio Gil Ruiz. *NATO, Gender and the Military : Women Organising From Within*. Vol. First edition, Routledge, 2019.

4 Gender: 'The social differences and relations between women and men, which are learned through socialization and determine a person's position and value in a given context' (NATO Terminology Database).

5 It may also be noted that the sex/gender distinction itself is contested and it is sometimes argued that the distinction entails a degree of biological determinism i.e. that a woman's social, psychological and behavioural traits are considered to be inevitable, being determined by her biological states.

6 See article 'Sex redefined' in *Nature News* published by Springer Nature, Claire Ainsworth: https://www.nature.com/news, 18 February 2015.

7 Even secondary sex characteristics may be, in part, products of social conditioning. For example, uniformity in muscular shape, size and strength within sex categories is not caused entirely by biological factors, but is contributed to by exercise opportunities. These exercise opportunities can in turn, be influenced by particular social, cultural and even organizational norms regarding ideal-type physical expressions of femininity and masculinity.

# EMPLOYMENT & INTEGRATION

## EMPLOYMENT & INTEGRATION

**Figure 4: Female soldier leaving for deployment code 932608580 (Credit: iStock)**

Across all research activities conducted by the STO concerning women in the armed forces, activities focusing on women's employment and integration in the armed forces are by far the most extensive and far-reaching. This bias perhaps reflects an understandable concern with the cultural, social, and psychological obstacles that have hindered women's participation at all levels in NATO armed forces and that overlap with the physical and practical barriers to women that are explored elsewhere in this report.

Given the nebulous characteristics of 'culture' and other associated factors, it is not surprising that STO research activities have made the best use of qualitative research methods and reviews of past literature to better understand the factors impacting gender integration in military organizations. Many of these activities admirably recognize the shortfalls of their research. For example, the symposium **SAS-137** (*Integration of Women Into Ground Combat Units*), organized on the initiative of RTG **SAS-120** (*Integration of Women Into Ground Combat Units*), critically assessed existing research gaps; the absence of ongoing monitoring and evaluation of women's integration; the inadequate attention paid to women-specific equipment or training that might enhance women's performance; and the uncritical acceptance of existing masculine norms as gender-neutral standards. All are identified as leaving unresolved research questions.

Elsewhere, however, the benefits of mainstreaming gender in research and assessing the socially constructed nature of particular integration aspects may be more thoroughly examined. As is evident in other chapters, gender considerations are frequently considered in exceptional terms in the research. RTG **HFM-107**, which explores military personnel recruitment and retention, includes a dedicated sub-chapter on gender and minority issues. Such attention is welcomed, but advances may be made by routinely integrating the consideration of gender into other areas of research, recognising that it is a factor that intersects with many others and does not exist in isolation.

In other areas, such as RTG **HFM-287**'s examination of inclusive models of military professionalism, the endeavour to develop a 'gender inclusive' model of military professionalism directs readers to think about the ways in which the key terms and concepts that are used in the evaluation of military systems and organizations may themselves be gendered. As a point of departure in future research, it may be beneficial to interrogate the gendered bases of terms and concepts that we may uncritically accept as gender-neutral. This will be especially valuable as military systems and organizations change due to the evolving nature of warfare and face security challenges presented by emerging disruptive technologies.

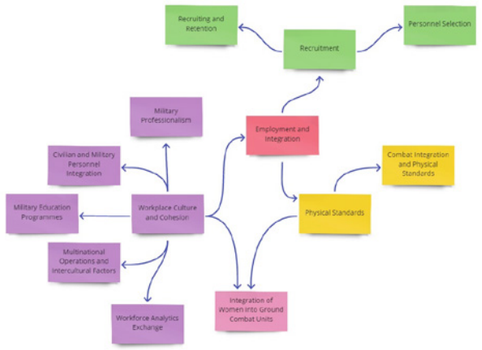



**Figure 5: Diagram offering an overview of STO research activity themes in this chapter (Design tool credit: Miro).**

# RESEARCH TASK GROUPS

# RECRUITING AND RETENTION OF MILITARY PERSONNEL (HFM-107)

## DURATION

May 2003 – December 2006

## OVERVIEW

RTG **HFM-107** was formed to examine military recruitment and retention.

## OBJECTIVES

To foster an understanding of the factors and mechanisms that influence military recruitment, selection, classification, retention, and turnover outcomes.

## APPROACH

**HFM-107** provides an overview of the relationship between gender and minority issues and recruitment and retention of military personnel through literature review.

## FINDINGS

**Research indicates that sex-specific differences exist in the perceived benefits of joining the military and the characteristics deemed attractive in a job.**

**Research also indicates that the degree of perceived equity in a workplace is linked to levels of retention.**

**The literature recommends that new recruits are informed of equal opportunity policies and complaints procedures and that supervisors are trained in workplace harassment, discrimination, and bullying.**

### RECRUITMENT

Differences between young men and women exist in the importance they give to various benefits from joining the military. Women consider factors relating to social interaction and social support benefits as more important than men. Marketing campaigns for the military could be modified to acknowledge this difference, enhancing recruitment for military service.

Findings also indicate that the characteristics of an attractive job appear similar across gender and race. However, the job's attractiveness was determined more by job characteristics such as location and pay for females than males. Also, treatment during the recruiting process is suggested to be weighted heavily for minorities, including racial minorities. Finally, aptitude selection tests may need to be assessed for adverse impact. Group differences in test performance result in a disproportionate treatment of members in a designated minority group.

**Figure 6: New recruits in a training classroom code 1004304324 (Credit: iStock)**

### RETENTION

Research on gender and minority issues related to retention indicate that perceived fairness in the workplace is linked to retention. Therefore, it is essential to ensure equity in the military to reduce dysfunctional turnover. Greater satisfaction is associated with greater fairness in reward distribution. Research by McIntyre et al. (2002) displays the importance of a work group's perception of equal opportunity fairness in influencing occupational commitment, job satisfaction, and perceived workgroup efficacy. All these factors may be linked to dysfunctional turnover. Therefore, workgroup equal opportunity fairness may also be important in managing dysfunctional turnover.

### SEXUAL AND/OR RACIAL HARASSMENT, DISCRIMINATION, AND BULLYING

With regards to sexual and/or racial harassment, discrimination, and bullying, the literature reviewed recommends that new recruits be informed of equal opportunity policies and complaints procedures. The literature also recommends that supervisors are trained regarding this behaviour and that exit interviews are conducted to determine what role this behaviour may have played in the performance and retention of personnel. Educational training programmes for employees may also improve military members' behaviour and attitudes towards gender and cultural diversity, particularly relating to overt behaviours.

## ACCESS THIS ACTIVITY

To read more on the findings from this activity and other issues explored, please click **here.**



# MULTINATIONAL MILITARY OPERATIONS AND INTERCULTURAL FACTORS (HFM-120)

## DURATION

September 2003 – December 2006

## OVERVIEW

RTG **HFM-120** was formed to consider the impact of intercultural factors that influence multinational military collaboration.

## OBJECTIVES

To increase awareness and understanding of the impact of intercultural factors on multinational military operations.

## APPROACH

A literature review was undertaken, organized around seven topics: organizational factors; leadership and command; teams; pre-dispositional and psychosocial factors; communication; technology; and societal factors.

This summary focuses on the gender component of how intercultural factors may impact multinational military operations. Further insights might be generated by taking account of more recent literature on this topic (the original study was completed in 2006), accounting for cultural changes driven by increasing recognition of the problem and broader societal dynamics.

## FINDINGS

**Culturally-rooted gender differences in multinational military operations can contribute to tension or misunderstanding, both in the interaction between contingents as well as between contingents and the host population.**

**Differential treatment between deployed men and women may interfere with effective operations and successful mission accomplishment.**

**Cultural sensitivity and awareness may wish to be promoted through pre-deployment programmes and training for all military personnel.**

### GENDER COMPONENT

Factors discussed in the literature that may create tension or the possibility of misunderstanding in multinational military operations include:

- Stereotypes
- Hierarchical rigidity
- Differences in interaction and serving status
- Ethnic and religious groupings
- Cultural and religious attitudes toward women
- The composition of military contingents that vary on the basis of gender

Owing to cultural and religious reasons, the involvement of women can be offensive to some populations. It can also make it difficult for some military personnel to take orders from women. Interaction between contingents may also be affected by women's presence in one force and their absence in others. Even when contingents come from less traditional societies where women have assumed a wide variety of roles, there may be difficulties for some troops who have less experience working with women in uniform and combat. The presence of women in what has traditionally been an all-male environment can create stress and strains in a coalition, hindering effective cooperation and good working relationships. Female-led communication and leadership may also be negatively impacted.

Meanwhile, female personnel coming from less traditional societies where women enjoy equal rights with men may experience frustrating situations in more traditional host countries. While their male counterparts may be allowed to socialize with locals, leave bases, or enjoy leisure activities, the same freedoms may not be extended to female personnel. The impact on morale among mixed-gender contingents of differential treatment between men and women may interfere with effective operations and successful mission accomplishment. Such restrictions may mean that female personnel feel less prone to remain in the forces on return home.

### TRAINING

Although covering different terrain, there were several common conclusions reflected throughout the report. One of the most compelling was the call for efforts to instil greater cultural sensitivity and awareness through pre-deployment programmes and training for all military personnel.

Possible strategies for addressing this need include:

- Pre-deployment training and resources available during deployment that are relevant to the specific deployment context
- Joint or multinational training
- Cultural issues being integrated into all military training courses starting at the most basic levels

## ACCESS THIS ACTIVITY

To read more on the findings from this activity and other issues explored, please click **here**.

# CIVILIAN AND MILITARY PERSONNEL INTEGRATION AND COLLABORATION IN DEFENCE ORGANIZATIONS (HFM-226)

## DURATION

February 2012 – February 2016

## OVERVIEW

RTG **HFM-226** was formed to research strategies and approaches for effective personnel management of military and civilian workforces in defence organizations.

## OBJECTIVES

- To review and assess current knowledge and research in the area of civilian and military personnel work culture and relations in defence organizations;
- To extend the understanding of civilian and military personnel work culture and relations in defence organizations through theoretical analysis and empirical studies;
- To develop and test a conceptual model of military and civilian work culture and relations, identifying challenges and enablers of effective civilian-military interaction and collaboration in defence organizations; and
- To generate recommendations for best practices for effective personnel management of both military and civilian workforces.

## APPROACH

Existing data sources, databases, as well as policy and strategic documents were examined in order to understand and compare military and civilian workforces within defence organizations, and the policies and directives that guide their management. The Military-Civilian Personnel Survey (MCPS), administered to nearly 8,000 civilian and military personnel working in departments or ministries of defence in 11 Allied and Partner nations, was also developed to identify critical aspects of military-civilian working relations.

## FINDINGS

**Women constitute a lower percentage of the military workforce compared to their representation within civilian defence workforces.**

**Male military and civilian members report a more positive military-civilian workplace environment compared to female military and civilian members.**

**The study's overall results were mixed, perhaps reflecting other factors such as national culture and local workplace dynamics.**

### DEMOGRAPHICS

Within all defence organizations studied, women constitute a lower percentage of the military workforce compared to their representation within the civilian workforce, adding another dimension that may influence military and civilian personnel's work culture and relations. Although within the civilian component of defence organizations, the ratio of males to females is considerably more balanced than it is within the military component. In most cases, women constitute a minority of civilian personnel.

### WORKPLACE MEASURES

Analysis of the MCPS indicates various cross-national variations in gender differences in military-civilian personnel culture and work relations. One typical pattern emerged cross-nationally: on several workplace measures, male military employees reported experiencing a more positive military-civilian workplace environment compared to both female military and civilian employees (as well as male civilian employees). Overall, female military members reported the lowest level of job satisfaction among the four groups. This suggests there may be multiple advantages for male military personnel navigating through a military-civilian workplace and are consistent with a traditional masculine model of military culture.

Some of the findings reflect a more varied pattern, notably concerning female military members' high perceived organizational support and female civilians' high job satisfaction. Female civilian employees reported fewer adverse effects on career development due to working in a military context and reported being less affected by the rotational military cycle than male civilian employees. Furthermore, this study's mixed results suggest that the role of gender in the military-civilian context may reflect other factors not examined in this study, such as national culture and local workplace dynamics.

### FUTURE RESEARCH

Future research could investigate possible explanations for gender differences and identify unique challenges for female civilian employees, particularly those working in defence organizations. The results of this descriptive gender-based analysis require validation with future research, taking into account considerations such as sample size and the issue of practical versus statistical significance. In many cases, the magnitude of the gender differences described appeared to be relatively small. Nevertheless, given the recurring nature of some of the patterns observed, further research on gender in the context of defence organizations seems warranted.

## ACCESS THIS ACTIVITY

To read more on the findings from this activity and other issues explored, please click **here**.



# COMBAT INTEGRATION: IMPLICATIONS FOR PHYSICAL EMPLOYMENT STANDARDS (HFM-269)

## DURATION

June 2016 – June 2019

## OVERVIEW

When RTG **HFM-269** formed, all ten Allied nations that were represented had either already lifted, or were planning to lift, exclusions of women joining combat roles within their Armed Forces. A fundamental element that has supported the opening of combat roles to women has been the development of role-related, age-, and sex-free Physical Employment Standards (PES). HFM-269 aimed to identify best practices for the development of PES in Combat Integration. While included under the 'Integration' theme, elements of this RTG also addressed health issues.

## OBJECTIVES

- Develop a research framework for designing PES to eliminate the potential for gender bias and develop agreed usage of terminology;
- Provide advice and guidance on injury prevention and physical training strategies linked to PES for Combat Integration, specifically:
  - Facilitate international research efforts to monitor Musculoskeletal risk through longitudinal investigations;
  - Identify female-specific training strategies for achieving and maintaining PES.
- Produce a final technical report with practical recommendations for designing PES to support Combat Integration.

## APPROACH

**HFM-269** offers an extensive literature review using case studies as examples to illustrate various methods of developing evidenced-based PES as employed by ten countries, including considerations of scientific and legal defensibility. The approaches and ongoing research to develop and implement PES by the participating nations are summarised. The report also provides data on male and female physical performance through a review of all available published research using physical selections tests, including the influence of physical training and task simulation performance.[8]

8 Reilly, T.J., Sharp, M.A., Cao, M., and Canino, M.C. (2019). A Database of Predictor Test Sex Bias for Development of Military Physical Employment Standards. Work; In Press.

## FINDINGS

**Designing PES that accurately reflect the job/task will reduce sex-based differences compared to traditional fitness testing metrics and represent a more valid selection of the right performer for the job.**

**The introduction of PES that reflect the physical demands of a job-role will result in a reduction in MSKI risk and positively influence job-related physical training.**

**Compared to men, women experience some performance-enhancing benefits resulting in better preservation of lean mass and faster recovery following stressful long duration Military Field Exercises.**

**Additional research is needed to better understand physiologically-appropriate timelines for return to duty and the implementation of safe physical training programs during pregnancy and post-partum.**

**Personnel and health care providers need to be educated on the medical issues that may follow pregnancy.**

### DEVELOPMENT OF PES

The report provides recommendations for PES development and asserts the need for scientifically valid, role-related, and legally defensible PES.

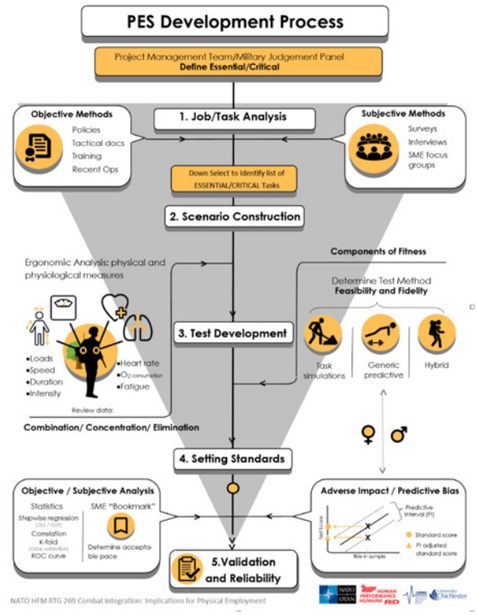



**Figure 7: PES Development Process (Credit: HFM-269 STO Technical Report).**

A review is presented of current international practices to develop, implement, and manage PES for the selection and retention of military personnel in various international Armed Forces branches. Where possible, this has described the research process and evidence base that underpins the PES, testing standards, and considerations relating to the application of the PES.

The report describes how the development of PES should include an analysis to determine sex-specific differences in physical performance. Such findings would likely indicate an antiquated process, material that requires redesign (or new material), and a modernisation of physical training strategies or other actions that organizations can take to minimise sex differences in the workplace.

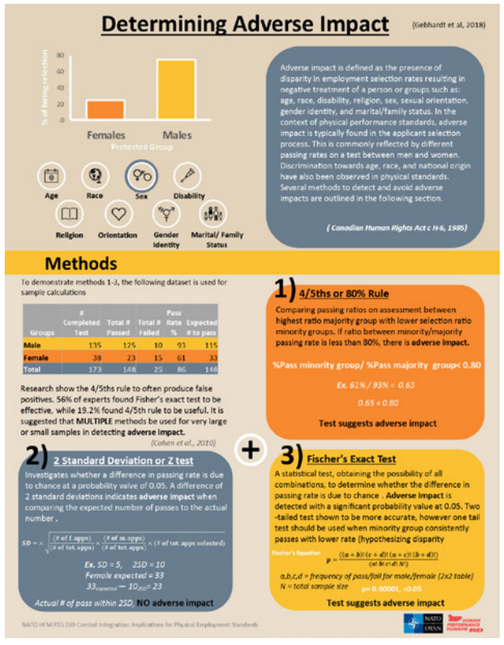



**Figure 8: Summary of the three Methods to Evaluate Adverse Impact According to Gebhardt[9] (Credit: HFM-269 STO Technical Report).**

## PHYSICAL AND PHYSIOLOGICAL DIFFERENCES BETWEEN MALE AND FEMALE SOLDIERS

Men are generally of greater stature, body mass, and lean body mass than women.10 Although the average man is stronger than the average woman, there is an overlap in strength such that the strongest women are as strong as, or stronger than, the weakest men. Given a generally smaller body size and lesser strength to move the same object, the average woman must use a greater percentage of her capacity than the average man; nevertheless, heavy physical tasks tend to require team efforts. In high intensity activities involving both men and women, women use exactly the same amount of energy as men when expressed in terms of body weight or fat free mass. In general, moderately trained women have VO2max (maximal oxygen consumption or maximal aerobic capacity) levels 15% – 30% lower than moderately trained men in absolute terms and about 10% lower in relative terms. However, these differences are largely inconsequential when applied to the performance of military tasks with the exception of load carriage tasks such as heavily loaded marching. In addition, combined resistance and aerobic training programs have proven to be effective in improving women's performance on physically demanding tasks and PES, such as lifting and load carriage. The actual upper limits of female soldier performance are yet to be fully realised as the full integration of women into all jobs and roles in some military forces is relatively recent and the adaptation of training strategies to better suit women is still evolving.

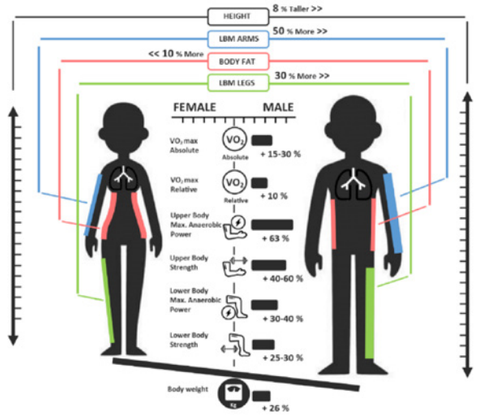



**Figure 9: Physical and physiological differences between the average man and woman as Reported in the Literature and Reviewed by Roberts et al.[11] and Reilly et al.[12] (Credit: HFM-269 STO Technical Report).**

## PES AND MSKI PREVENTION

Personnel serving in ground combat occupations and combat support occupations carry the heaviest loads for longer durations and often (but not always) lift or carry the heaviest equipment. Musculoskeletal Injury (MSKI) rates are typically higher among women – although this may be, in part, a reflection of women being more likely to report an injury. When controlling for age, aerobic capacity and other physical characteristics, female recruits' injury risk is similar to that of male recruits, noting that there are still likely to be sex differences in injury causation. In addition, cardiovascular medical evacuations in theatre are often more frequent than those related to musculoskeletal injury; US data indicates that 95% of cardiovascular related medical evacuations are males. Furthermore, normal age-related declines in physical capacity may impact women more than men, given that women are on average required to work at higher relative intensities to complete occupational training and tasks. Physical training, however, can mitigate age-related declines in physical and physiological capacity.

The introduction of age- and sex-free scientifically-developed PES that reflect the physical demands of a job should result in a reduction in MSKI as a person-job fit is assessed at selection and maintained throughout a career. This will impact the physical training service personnel undertake and should therefore be protective. NATO militaries should develop injury surveillance programs, establish baseline injury rates, and monitor trends in injury rates, types, causes, and outcomes such as restricted duty after implementing PES.

## SEX DIFFERENCES IN THE PHYSIOLOGICAL RESPONSES TO PROLONGED MILITARY WORK

Women appear to experience more significant physiological straining for the same amount of physical activity in military settings, likely due to females having an on average lower muscle mass and aerobic fitness. Nevertheless, women expend the same relative energy (kJ per kg body weight per day) as men in the same intensive training, where less energy is required to move smaller bodies through space. However, women seem to experience smaller reductions in absolute lean body mass, lower muscle fatigue and improved recovery than men following strenuous Military Field Exercises (MFEs). Further research should include men and women together to examine sex differences in response to MFEs. This research should recognize that cognitive and physical performance in MFEs is largely affected by fatigue resistance and other factors that may be differently observed in women than men (e.g., women have the 'oestrogen advantage' in bioenergetics but are also more likely to suffer from poor micronutrient status, such as low iron levels). If role-related PES were performed to an individual best effort before and after MFEs, sex- or physical fitness- specific differences in performance impairment could be determined.

## PHYSICAL TRANSITION FOLLOWING CHILDBIRTH

Reductions in physical performance capacity typically occur following pregnancy and major injury or illness. Return to duty policies should consider specialised physical training and strategies, including timing, for safe physical testing. Earlier policies were quick to retire a soldier following a significant state change but most armies today recognize the capability for recovery and embrace the willingness of soldiers to return to full participation, considering the need to retain experienced performers. Current physical training guidelines support reasonable cardiovascular training through a normal pregnancy. However, as pregnancy progresses there is also an increased risk of falling and musculoskeletal injuries.

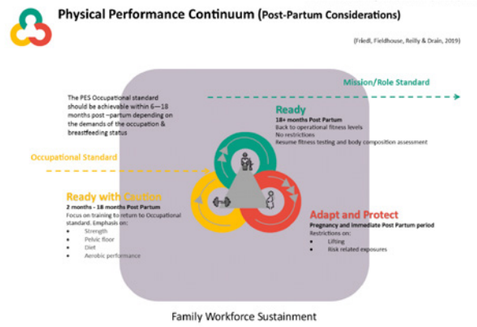



**Figure 10: Post-Partum considerations for the Physical Performance Continuum. (Credit: HFM-269 STO Technical Report).**

Post-partum considerations can include general deconditioning, body composition changes with increased ligament laxity, back and pelvic girdle pain, abdominal musculature weakness, changes in bone mass density exacerbated by lactation, pelvic floor dysfunction, with associated pelvic organ prolapse, and incontinence. Risk factors and the efficacy of prevention and treatment strategies are often poorly understood, but occupational fitness and a full return to work can be achieved with proper physical training and quality health care. Until now, these conditions have been under-reported as too few personnel engage with health care providers, and women typically suffer in silence. This may lead to not only performance decrements but also to increased health risks; for example, fear of urinary leakage from a chronic post-partum incontinence has been associated with voluntary dehydration, leading to an increased risk of heat illness. Improved awareness among medical care providers, including routinely asking patients if they are having difficulties that require discussion and possible intervention, needs to be part of an improved education process.

The RTG recommends further consideration of women in the workplace and specific evidence-based recommendations for PES and physical training guidelines, including pregnancy and postpartum.

## ACCESS THIS ACTIVITY

The study also discusses the need to develop a strategy for updating and validating PES, as well as methods that the military services might use to motivate personnel to meet and exceed physical fitness standards and physical recovery timelines and policies for soldiers recovered from illness or amputation.

To read more on the findings from this activity, please click **here**.

9 Gebhardt, D. (2019). Personal Communication at Meeting 5/6 of HFM 269, Melbourne Australia, 2018.

10 Roberts, D., Gebhardt, D.L., Gaskill, S.E., Roy, T.C., and Sharp, M.A. (2016). Current Considerations Related to Physiological Differences Between the Sexes and Physical Employment Standards. Applied Physiology Nutrition and Metabolism; 41: S108-120.

11 Roberts, D., Gebhardt, D.L., Gaskill, S.E., Roy, T.C., and Sharp, M.A. (2016). Current Considerations Related to Physiological Differences Between the Sexes and Physical Employment Standards. Applied Physiology Nutrition and Metabolism; 41: S108-120.

12 Reilly, T.J., Sharp, M.A., Cao, M., and Canino, M.C. (2019). A Database of Predictor Test Sex Bias for Development of Military Physical Employment Standards. Work; In Press.

# INTEGRATION OF WOMEN INTO GROUND COMBAT UNITS (SAS-120)

## DURATION

November 2015 – April 2020

## OVERVIEW

RTG **SAS-120** was formed to research the social, cultural, and psychological factors that impact gender integration in military organizations, focusing on integrating women into ground combat units. Members of RTG SAS-120 also took initiative and arranged the symposium *Integration of Women into Ground Combat Units* (**SAS-137**), for more information click **here**.

## OBJECTIVES

- To identify the influence of social, cultural, and psychological factors of gender integration in ground close combat units and their impact on combat effectiveness;
- To identify effective processes and strategies for the integration of women in ground close combat units;
- To identify appropriate methodologies for monitoring, measuring, and assessing integration; and
- To share best practices through collaboration.

## APPROACH

**SAS-120** conducted comprehensive reviews of the related published literature, as well as internal defence studies related to the integration and participation of women in the military and combat units and roles. An annotated bibliography of unpublished internal defence studies and an updated categorised research bibliography on 'Gender and Military Issues' were also produced.

Members of RTG **SAS-120** also took initiative and arranged the symposium *Integration of Women into Ground Combat Units* (**SAS-137**), for more information click **here**.

## FINDINGS

**Operational effectiveness can be enhanced by the participation of women in combat teams.**

**Leaders play an essential role in promoting inclusion to ensure that unit cohesion remains strong and that marginalised and under-represented members are effectively integrated.**

**Task cohesion has a more significant impact on team performance than social cohesion.**

**Targeted recruitment efforts are an essential step in ensuring that interested and capable women will have an opportunity to engage in ground combat roles as their military career choice.**

## UNIT PERFORMANCE

As a result of both experience and emerging security challenges, it is increasingly recognized that gender equality and operational effectiveness may be achieved simultaneously. Indeed, operational effectiveness can be enhanced by women's participation in combat teams, as seen in the use of female engagement teams (FETs) in Iraq and Afghanistan to search compounds and women, and access critical intelligence.

**Figure 11: FET member in Afghanistan (Credit: DVIDS).**

## UNIT COHESION

Leaders play an essential role in planning, implementing, communicating, and monitoring an inclusion strategy to ensure strong unit cohesion. Experience indicates that exposure to women in ground combat roles increases comfort and confidence levels among male combat team members. A comprehensive study conducted among infantry soldiers in Norway confirmed that close exposure to female soldiers through a mixed room policy improved men's attitude towards female soldiers, reduced discrimination toward females, and improved group cohesiveness within the platoon. The study also found higher motivation for continued service and reduced levels of bullying and sexual harassment.

Integration concerns related to the social cohesion of all-male teams have been challenged by research that demonstrates that task cohesion has a more significant impact on team performance, suggesting that extreme social cohesion can undermine team performance.

High social cohesion can also be correlated with hypermasculinity among all-male groups. Such hypermasculinity has significant downsides as these attributes can place the group at risk for negative, competitive, and even violent or criminal behaviours, including the denigration of women. Such actions do not represent the values of the society that they are tasked to represent.


**Figure 12: Different subjective expressions from military respondents on experienced cohesiveness in teams.[13] (Credit: SAS-120 STO Pre-Released Technical Report).**

## UNIT CULTURE

Successful combat integration requires a culture shift and long-term leadership commitment to culture change. Shared experiences of under-represented members in the military are frequently characterized by a visible token presence that results in: increased performance pressure; social exclusion; role entrapment; and minorities conforming to the dominant group's behaviours and attitudes. Integrating women into existing structures and processes designed for men risks losing opportunities to take advantage of gender diversity to enhance military capabilities to respond to emerging and unexpected threats. For example, some of the first women to be introduced to combat arms training in Canada identified social and cultural barriers that impact the motivation and ability to meet physical performance standards. Furthermore, female physical performance is often assessed against the most physically capable men rather than against minimum job-related standards. Women who fight to meet such ideal standards can become vulnerable to injury in a training regimen that is designed for men.

Leaders need to communicate commitment towards inclusion to every community member and conduct a comprehensive self-assessment of leadership actions. Key enablers of organizational change include a stated vision; goal planning; identification of the environmental conditions required for the change plan to succeed; visible and sustained sponsorship of change by leaders; organizational alignment; defined roles of employees involved in the change; training and guidance for employees; and evaluation of performance.

## RECRUITMENT OF WOMEN

Efforts to target the recruitment of women into ground combat roles have been limited. Notwithstanding the relatively low tendency for women to seek military service in ground combat roles, efforts to provide women with accurate information and opportunities to join the military in any role is an essential step in ensuring that interested and capable women will have an opportunity to engage in ground combat roles as their military career choice. Targeted recruitment efforts aimed at people from diverse groups may also help to aid military recruitment problems, especially in countries where demographics indicate an ageing and increasingly diverse society.

## FURTHER FINDINGS

For an overview of findings from **SAS-120** on bullying, harassment, and sexual misconduct, please click **here**.

## ACCESS THIS ACTIVITY

To read more on the findings from this activity, please click **here**.

13 Harrell, M.C. and Miller, L. (1997). *New Opportunities for Military Women: Effects upon Readiness, Cohesion, and Morale*. Santa Monica, CA: RAND Corporation. https://www.rand.org/pubs/monograph_reports/MR896.html.

# DEVELOPING A CULTURE AND GENDER INCLUSIVE MODEL OF MILITARY PROFESSIONALISM (HFM-287)

## DURATION

April 2017 – April 2020

## OVERVIEW

RTG **HFM-287** was established to rethink military professionalism in light of gender and diversity.

## OBJECTIVES

Until very recently, little emphasis has been placed on how gender and diversity fit into theories of military professionalism. The goal of RTG **HFM-287** was to clarify the conceptual and practical challenges that one faces when developing a model or models of military professionalism that will be more robust to evolving needs.

## APPROACH

Amongst the five participating nations, the approach was to identify unique aspects of the military culture, while also examining military professionalism. It was supported by a thorough examination of the academic literature on the military profession. Three countries focused on gender aspects in particular: Bulgaria, Canada, and Sweden. It is noted that differing national approaches could mean that comparisons are difficult to make.

## FINDINGS

**Theories of military professionalism, previously dominated by a fixation on masculinity and legitimised violence, are changing as operational priorities and threats diverge, and as diversity increases amongst service members.**

**Despite several decades of increasingly inclusive military recruitment and retention policies aimed at soldiers from ethnic, religious, and sexual minorities, NATO's professional military culture still tends to be male-dominant.**

### BULGARIA

This chapter noted the results from surveys carried out in the Bulgarian Armed Forces during the period 2013 – 2017, with both sexes reporting equal opportunities for professional realisation in the defence institution. Although measures to remove legislative and organizational barriers to guarantee gender equality appear to be working, the chapter noted the problem remains of gradually overcoming prejudices and stereotypes, a process the author determined will require focused policy, systematic work, and education.

### SWEDEN

Semi-structured interviews were conducted with 16 female personnel in the Swedish Armed Forces about their professional military experiences and experiences around gender, status, and support. The women in the study understood that they are in a disadvantaged position as a minority and gain most from not opposing the masculinity norm and attempting to gain legitimacy among the men. For this reason, they adapt to the prevailing norms. This accommodation may be through self-censoring of their differing views and experiences or refraining from criticism of the culture. The women's resistance against the male-dominated organization is often cautious in nature; for example, by joking about making men think in a gender-equal way, and only using carefully chosen moments to make a stand. The women also described themselves as happy and structured, which reinforces the gender-stereotyped image of women. It was also noted that younger women were more likely than older female personnel to express their femininity at work, whereas the older generation may have refrained from doing so.

When subjects such as gender inequality in terms of salary, derogatory jargon, or male-dominated culture were raised, the study's participants were careful to state that these issues were not unique to the armed forces. The study also considered the provision of gender equality education.

### CANADA

Interviewing 125 members of the Canadian Armed Forces (CAF), selected across military occupation and demographic group, it was ascertained via qualitative analysis that military unprofessionalism was attributed to the following themes:

- Alcohol in the military;
- Aspects of military culture;
- Individual characteristics (negative); and
- Subcultures in the military.

Furthermore, leadership was determined by CAF participants as essential to the professionalism and unprofessionalism of their subordinates. Participants thought that those who became role models had to provide support to their subordinates and their chain of command. Some participants felt that an absence of consistent organizational communication and consistent response to unprofessional behaviour affected the military's professionalism.

## ACCESS THIS ACTIVITY

To read more on the findings from this activity and its country-specific findings on military professionalism, please click **here**.



# SYMPOSIUMS

# INTEGRATION OF WOMEN INTO GROUND COMBAT UNITS (SAS-137)

## OVERVIEW

In February 2019, members of RTG *Integration of Women into Ground Combat Units* (**SAS-120**) took initiative and arranged the **SAS-137** symposium on the integration of women into ground combat units. Data and literature identified during this symposium then helped inform the findings of RTG **SAS-120**, please click **here** for more information.

## APPROACH

Nine countries participated including Australia, Japan, and India, with presentations offered that adopted a variety of techniques, including literature review, data analysis, and interview/survey analysis. This summary focuses on the key takeaway findings on integration from the symposium. For detail, the reader is encouraged to examine the papers and presentations from **SAS-137** (see 'Access this activity' below).

## FINDINGS

**Significant cultural barriers persist regarding women's integration into combat roles.**

**Militaries are recommended to recognize and value diversity in their training and personnel policies, thereby contributing to an overall culture of inclusion and aiding integration.**

**Physical requirements are recommended to be clearly established, clearly aligned with the job requirements, and gender-neutral.**

### SOCIAL, CULTURAL, AND PSYCHOLOGICAL ASPECTS OF INTEGRATION

A variety of research was presented on the social, cultural, and psychological aspects of gender integration in ground combat units and the impact on combat effectiveness. The consensus was that concerns about integration, such as unit morale, cohesion, and readiness, were either unlikely to materialise or could be addressed in implementation. Nonetheless, research indicates that significant cultural barriers persist regarding women's integration into combat roles. These barriers persist even though successfully integrating women into combat arms has benefits, increasing the available pool of talent and capabilities and decreasing the civilian-military gap.

Suggested approaches to tackle this issue diverge, particularly as replication might not be possible within each nation's specific context, yet some strategies gained a consensus in the symposium. These approaches include militaries recognising diversity in their training and personnel policies, contributing to an overall inclusion culture, fostering social support, boosting morale, and leadership-driven unit culture change to aid integration.

Of note are two studies examining the Norwegian Army Special Operations Commando (NORASOC), experiment of creating a women-only platoon, the *Jegertroppen*, in 2014. Findings indicate that the *Jegertroppen* project yielded a cadre of highly motivated, specially trained elite women soldiers and that the project was largely considered a success. The *Jegertroppen* women were found to have worked collaboratively. They were mutually supportive, suggesting that when diversity is valued the stereotypical 'queen bee' behaviour of undercutting other women and complying with existing gender stereotypes is absent. Therefore, valuing diversity in terms of unit culture helps integrate minorities and addresses training opportunity disparities. This valuing of diversity is especially important as many Jegertroppen women have become disillusioned. Few of them have been integrated into NORASOC, and they are not being retained as anticipated.

### PHYSICAL EMPLOYMENT STANDARDS (PES) AND TRAINING

Presentations on PES and training agreed that job requirements must be clearly established. The assessment and selection criteria must be clearly aligned with the job requirements and be gender-neutral. A presentation examining the recent development of physical standards for combat occupations within the US Marine Corps offered an example of gender-neutral and operationally relevant physical standards. As a result, the pass rate for men and women infantry candidates were 99.5% and 81.5% respectively based on recent data. Similarly, a presentation on the development of a push up or pullup option given to US Marine Corps members regardless of the gender indicated, using data from 2016, that most women chose the pull-up option. Such a choice may provide better opportunities for women to aspire to achieve optimum upper body strength. The presentation emphasised this initiative's significance to gender integration and the strong correlation of the pull-up option to performance on physically demanding tasks. Findings from the then-ongoing RTG on *Combat Integration: Implications for Physical Employment Standards* (**HFM-269**) were also presented, please click **here** for more information.

**Figure 13: US Army physical test event (Credit: DVIDS).**

### RECOMMENDATIONS

The symposium recommended the following:

NATO should host a resource portal where countries can post original research and review other countries' research as they seek to integrate their ground combat units or increase the percentages of women.

NATO should identify and publish a set of minimum physical, occupational standards for common ground combat occupations to reduce extreme standards designed to keep most, otherwise qualified, women out of ground combat occupations.

NATO should publish a set of research gaps to help countries identify what research remains and what questions have already been answered and by whom.

## FURTHER FINDINGS

Sexual harassment and sexual assault were also examined during this symposium, please click **here** for these findings.

## ACCESS THIS ACTIVITY

To read more on the findings from this activity, please click **here**.

# ONGOING RESEARCH

## INTEGRATING GENDER AND CULTURAL PERSPECTIVES IN PROFESSIONAL MILITARY EDUCATION PROGRAMMES (HFM-307)

### ACTIVITY TYPE

RTG

### DURATION

December 2018 – December 2021

### OVERVIEW

RTG **HFM-307** is examining the teaching and curricula needed for national level Professional Military Education (PME) to develop the capacities of senior generalist staff officers to understand and apply gender and cultural perspectives across the scope of potential duties.

### OBJECTIVES

To provide those responsible for the national PME of senior officers with recommendations to effectively integrate gender and cultural perspectives in all other PME topics. This work will also address key gaps in the literature, including understanding national differences in achieving UN and NATO objectives and understanding the unique features of teaching for the military profession.

### APPROACH

Integrative research will be conducted to:

- Map the existing curricula for participating nations and, based on this mapping, examine how and why the application of common UN and NATO policies results in different curricula;
- Examine the education applied in graduate-level learning in the behavioural sciences specifically related to developing gender and cultural perspectives in the senior officer cohort;
- Evaluate the techniques which may be applied when delivering learning which challenges assumptions; implicit biases or associations; socially-constructed identities, beliefs, expectations and stereotypes; and, professional identities and theories which senior leaders have developed over many years of service; and
- Draw on best practices in the design, delivery and assessment of complex or transformative learning in senior officer PME.

### FINDINGS

This study is due to conclude in December 2021, and a final technical report will subsequently be published.

## WORKFORCE ANALYTICS EXCHANGE: STANDARDS FOR MILITARY PERSONNEL DATA (HFM-ET-189)

### ACTIVITY TYPE

Exploratory Team

### DURATION

January 2021 – January 2022

### OVERVIEW

**HFM-ET-189** will enable increased Military Workforce Analytics exchange by developing and validating a set of NATO standards for military personnel data. Increased information sharing among nations could have important benefits:

1. Benchmarking: Sharing statistics allows the benchmarking of workforce management outcomes. For example, comparing the officer-to-enlisted ratio or the proportion of women in uniform between nations puts national figures into context.

2. Tool Sharing: Access to more or better workforce analytics tools expands national capabilities and provides some degree of validation. Value is also found in using small tools, such as spreadsheet models designed for simple tasks like attrition forecasting, or data visualisation.

### OBJECTIVES

Based on the content of existing national military personnel reports and areas of interest for information sharing, the activity plans to identify relevant personnel data and analytical elements of interest for sharing among nations.

A set of standards for military personnel data and analytics products exchange will be negotiated and outlined. The standards will be applied to national data sets to produce a statistical digest comparing national military workforces (the benchmarking component). They will also create interface adaptors for sample analytical tools shared with participating nations (the tool sharing component).

### FINDINGS

This study is due to conclude in January 2022 and a report will subsequently be produced summarising findings and recommending the next course of action (e.g., symposium, lecture series, or research task group).

## ADVANCES IN MILITARY PERSONNEL SELECTION (HFM-290)

### ACTIVITY TYPE

RTG

### DURATION

March 2018 – March 2022

### OVERVIEW

RTG **HFM-290** is investigating the approaches taken by NATO militaries to select military personnel. Military personnel selection, an already complicated process, is additionally challenged by emerging societal and technological changes. Of interest to this group is (i) an increasingly diverse applicant pool, (ii) technological advances in assessment tool development, and (iii) demands for assessing a range of knowledge, skills and abilities relevant to reliable and dependable personnel performance. By March 2022, this RTG will provide recommendations on approaches to select military personnel.

### OBJECTIVES

- To capture military personnel selection strategies currently used by NATO nations to address their organization's diversity needs (e.g., gender, language, reserve groups).

- To identify best practices in developing and evaluating selections tools and processes to identify and reduce barriers to diverse groups.

- To identify current practices and challenges within NATO nations surrounding computerised and online testing in military selection.

- To identify opportunities for maximizing efficiency in selection assessment using emerging technology (e.g., automated/ remote testing).

- To develop a common definition of the integrity construct and identify related measures for use in military selection and examine the potential effectiveness of including integrity measures in military selection.

### APPROACH

The approach used to gather information on diversity and gender issues from the ten participating nations was a combination of a survey, interviews with nation representatives, and a literature review.

### FINDINGS

This study is due to conclude in March 2022, and a final technical report will subsequently be published.

# PERSONNEL RETENTION IN THE ARMED FORCES (HFM-318)

## ACTIVITY TYPE

RTG

## DURATION

May 2021 – May 2024

## OVERVIEW

RTG **HFM-318** aims to build on existing research on retention-related issues in the Armed Forces, as well as to conduct primary empirical research to provide an analytically rigorous understanding of this critical personnel issue. This activity will build on RTG **HFM-107** (*Recruiting and Retention of Military Personnel*), for more information click **here**.

## OBJECTIVES

- Review and assess current research to identify the main work and organizational factors related to retention and attrition in the military.
- Share and exchange methods, tools, and capabilities for empirical research in this domain.
- Develop and conduct a multinational personnel survey on military retention. This will result in a cross-national scientific survey instrument to measure personnel retention and the drivers thereof.
- Conduct an international survey of subject matter experts to inform the factors affecting retention and attrition and to identify strategies for increasing retention.
- Identify and provide recommendations of retention-related practices, policies, programs, and strategies for increasing retention.

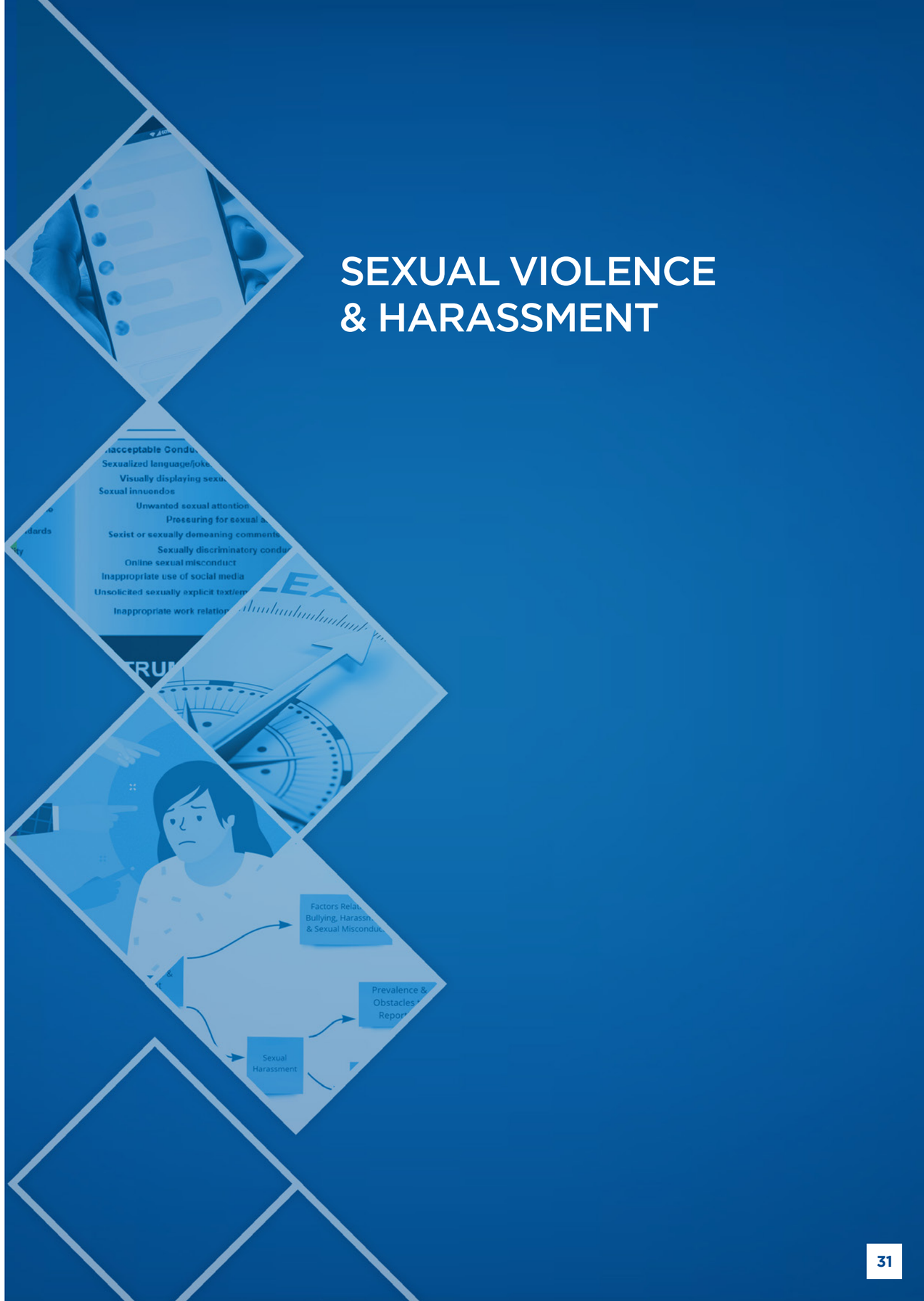
## APPROACH

RTG **HFM-318** will provide an exchange of policies, strategies, and programs for facilitating the retention of military members. A main focus will be to develop empirical methods and tools for collaborative cross-national inquiry, which will result in a pooling of resources and scientific approaches that can be leveraged by the participating nations.

This study will include exploring the main reasons for both retention and attrition by key demographic variables, including gender. Given the importance of increasing women's representation rates and women's meaningful participation in the armed forces of the participating nations, identification of gender differences will be an important focus, and recommendations based on these findings will be developed.

## FINDINGS

This study is due to conclude in May 2024, and a final technical report will subsequently be published.



## SEXUAL VIOLENCE & HARASSMENT

STO research activities make a valuable contribution to assessing the vast body of literature relating to sexual violence and harassment and presenting new evidence from across the Alliance based on qualitative methods. In many cases, these studies are naturally bounded, drawing on small sample sizes and limited in their ability to control for all variables that may influence the incidence and experience of sexual violence and harassment. The most frequently used methods for studying sexual violence and harassment have emerged from the qualitative social sciences, a focus that is reflected in STO activities. However, the topic does not automatically preclude quantitative analysis from being undertaken. Future research may seek to use statistical analysis to determine the probability of certain relationships and sexual harassment and assault. For example, both quantitative methods (Malamuth & Ceniti, 1986; Malamuth, Feshbach, Fera, & Kunath, 1988) and qualitative methods (Russell, 1988) have implicated exposure to pornography as a contributing factor in the commitment of rape. These studies reinforce the importance of STO research activities building upon the invaluable data and research conducted within Alliance nations and NATO to inform their analysis on this topic.

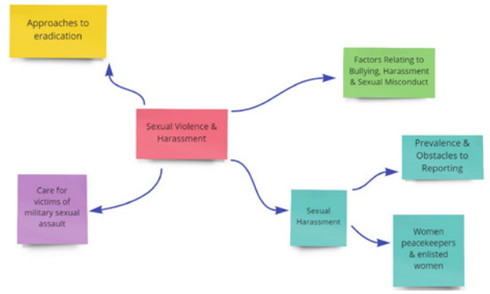



**Figure 14: Diagram offering an overview of STO research activity themes in this chapter (Design tool credit: Miro).**

# RESEARCH TASK GROUPS

# INTEGRATION OF WOMEN INTO GROUND COMBAT UNITS (SAS-120)

## DURATION

November 2015 – April 2020

## OVERVIEW

RTG **SAS-120** was formed to research the social, cultural, and psychological factors that impact gender integration in military organizations, focusing on the integration of women into ground combat units.

## OBJECTIVES

- To identify the influence of social, cultural, and psychological factors of gender integration in ground close combat units and their impact on combat effectiveness;
- To identify effective processes and strategies for the integration of women in ground close combat units;
- To identify appropriate methodologies for monitoring, measuring, and assessing integration; and
- To share best practices through collaboration.

## APPROACH

**SAS-120** provides an overview of factors related to bullying, harassment, and sexual misconduct in the military context through a literature review.

## FINDINGS

**The positive role modelling and commitment of leaders in ensuring a fair environment for all soldiers is a source of empowerment for women and men who may be at particular risk for bullying and harassment, as well as for bystanders to take positive action.**

**Many factors are at play for increased risk of occurrence of bullying and sexual harassment, which build on negative attitudes towards women and resistance to policies such as affirmative action.**

**Bullying, harassment, abuse of power, sexual coercion, and assault represent a continuum of harm and present significant barriers to women in ground combat occupations.**

**When heightened or extreme forms of masculinity characterize military culture, typically labelled 'hypermasculinity', there is an increased risk for inappropriate sex- and gender-based social dynamics.**

**It is important that organizational practices are not exclusive to male-perpetrator-female-victim issues.**

In 2015, after extensive research and consultation regarding risk factors to unit morale, cohesion and readiness, and the successful integration of women into previously closed combat roles, the US Army concluded that the most significant risk factors are soldier concerns about sexual harassment and sexual assault. These risks underscore the imperative of including strategies and leadership capacity to prevent and respond to bullying, harassment, and sexual misconduct as women are introduced into combat units. Research from the symposium **SAS-137** *Integration of Women into Ground Combat Units* (click **here** for more information) reveals that qualified enlisted women face extreme harassment situations that are causing them to reclassify out of ground combat occupations or to leave the military altogether.

The study indicates that sexual harassment is associated with the recipients' gender or harassment of a sexual nature that is unwanted and is broadly understood to include two types:

- Threats to make employment-related decisions based on compliance with requests for sexual favours; and
- The creation of a hostile work environment, which occurs when the sexual behaviour has the purpose or effect of unreasonably interfering with an individual's work performance or creates an intimidating, hostile, or offensive working environment.

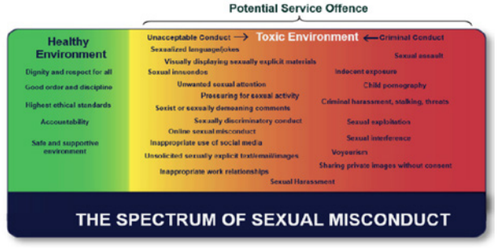



**Figure 15: Spectrum of Sexual Misconduct Behaviours.[14] (Credit: SAS-120 STO Pre-Released Technical Report).**

14 Government of Canada (2019) Spectrum of Sexual Misconduct, Public Service and Military, The Operation HONOUR Manual, https://www.canada.ca/en/department-nationaldefence/services/benefits-military/conflict-misconduct/operation-honour/training-educationalmaterials/spectrum-sexual-misconduct.html, accessed 28 Feb 2020.



There is an agreement in the literature that bullying, harassment, abuse of power, sexual coercion, and assault represent a continuum of harm. This continuum recognizes the relationship between those behaviours that can be interpreted as the least harmful and those behaviours recognized as having significant potential to cause psychological and physical harm. It is noted that although the focus is typically on face-to-face manifestations, bullying and sexual misconduct can take various forms including online and via mobile social media platforms. Although some of those behaviours (e.g. sexualised language and jokes) are frequently tolerated in work environments and may be perceived to be less harmful or not harmful at all, such actions contribute to risk for increasingly toxic transgressions.

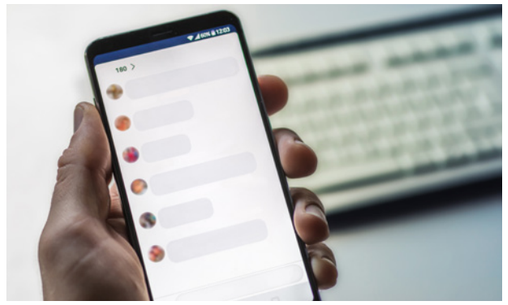


**Figure 16: Bullying and sexual misconduct can occur online and via mobile apps code 1130883330 (Credit: iStock)**

## WORKPLACE CLIMATE AND CULTURE

Climate-based risk factors for bullying and harassment include tolerance of sexual harassment; limited presence, accessibility, and effectiveness of the organizational response; and organizational leaders' insufficient commitment to address harassment. This is relevant to the risk of harassment for both men and women. Although individual-level factors are among the most researched areas related to helping or bystander behaviour, it has also been claimed that organizational factors (such as the impacts of gender balance and masculinity) are the most significant predictors of the occurrence of sexual harassment. The literature suggests that higher proportions of women in a working environment can mitigate problematic aspects of masculinity.

When heightened or extreme forms of masculinity characterize culture – typically labelled 'hypermasculinity' – there is a particular risk for inappropriate sex- and gender-based social dynamics. One Norwegian model suggests that mixed-gender accommodation can reduce negative attitudes and decrease resistance toward women in leadership and combat roles. This model also noted that many interconnected factors are at play for increased risk of occurrence of bullying and sexual harassment. These factors build on negative attitudes towards women and resistance to policies such as affirmative action and include:

- The presence of alcohol
- The proportion of women
- Age distribution
- Formal and informal rank distribution
- Masculine culture
- Traditions and rituals
- Marital status of members
- The negative behaviours of individuals with strongly negative dispositions toward the presence of women

Organizational climate surveys can provide an opportunity for members of a unit to share their satisfaction levels and experiences confidentially. Similarly, the concept of an 'ethics audit,' which highlights the importance of establishing context to enhance the moral functioning in an organization, provides a potential tool for leaders to utilize. It is also crucial that organizational practices are not exclusive to male-perpetrator-female-victim issues. Single perspective strategies can be divisive. These strategies negate consideration of various phenomena that have been revealed in existing research such as male-on-male violence; men facing different but challenging cultural barriers to reporting abuse, and women bullying men in gendered ways.

## LEADERSHIP

Analyzes in the military context reinforce the relationship between leadership and risk, indicating, for example, a relationship between positive ratings of leaders and lower self-reported frequency of sexual harassment, and an association between negative leadership behaviours of military leaders and risk of assault among military women and men. The positive role modelling and commitment of leaders in ensuring a fair environment for all soldiers is a source of empowerment for women and men who may be at particular risk for bullying and harassment.


**Figure 17: Positive leadership plays a role in reducing risk of assault code 685797114 (Credit: iStock)**

Leaders need to understand what constitutes inappropriate conduct such as bullying, harassment, sexual harassment, and discrimination and be aware of the sex- and gender-related dynamics that put vulnerable soldiers at greater risk. Leaders need to be familiar with strategies that can be used to reduce risk. Regardless of the challenges uniquely associated with bullying, harassment, and associated conduct, there is a lower risk for such outcomes within organizations with cultures characterized by respect and the valuing of others. These characteristics are expressed by fairness, transparency, and trust, irrespective of differences among organizational members. Research suggests that transformational leadership, coupled with leader zero tolerance for behaviours such as sexual harassment, will reduce the risk of sexual assault.

In addressing bullying and harassment, there are at least three factors to consider:

- The characteristics of the work environment;
- The respondent; and
- The complainant.

Importantly, leaders' commitment and response when they are made aware of incidents of sexual harassment and gender discrimination have been found to have important positive impacts on reducing risk for inappropriate conduct and improving well-being and retention. The example established by leaders and underlying cultural influences can also impact the likelihood that bystanders, including peers, will intervene to mitigate or come forward to report harmful behaviours in the workplace.

### GENDER BALANCE AND MASCULINITY

The gendered nature of the workgroup has been consistently identified as a risk factor related to behaviours such as sexual harassment and is frequently associated with:

- the low representation of women in male-dominated workgroups, occupations or roles;
- a preference for men in power;
- the value being placed on being assertive, competitive, authoritative, and goal-oriented;
- a lack of tolerance for deviant persons and ideas; and
- an acceptance of rape myths.

These characteristics are frequently captured within conceptions of masculinity. Masculinity makes essential contributions to operational effectiveness and represents characteristics than can be inherent to and further developed by women and men in the military context. Yet, masculinity has also been linked to problematic behaviours in the military, including:

- bullying and workplace aggression;
- devaluation and harassment of certain groups of individuals;
- sex-based discriminatory language and soldier sense of entitlement to the body of a woman soldier; and
- resistance to gender equity.

Masculinity has also been associated with the need for identity supported by order and control, the domination of others, and competitive success. Analyzes of masculinity in the military and para-military context correlate four significant factors of masculinity – showing no weakness, strength and stamina, putting work first, and extreme competitiveness – with cultural dynamics and outcomes such as bullying, harassment, discrimination, gender bias, poor personal well-being, toxic leadership, and police officer misconduct and use of excessive force. However, masculinity is not a homogenous concept, and it is essential to clarify that correlation with adverse outcomes, as discussed, is typically about hypermasculinity assumptions. Such masculinity when excessively dominant can reinforce underlying assumptions that resist socio-cultural change, including the introduction of women into previously all-male environments.

## FURTHER FINDINGS

Findings from **SAS-120** on women's employment and integration into ground combat units can be found by clicking **here**.

## ACCESS THIS ACTIVITY

To read more on the findings from this activity, please click **here**.

# SYMPOSIUMS

# IMPACTS OF GENDER DIFFERENCES ON CONDUCTING OPERATIONAL ACTIVITIES (HFM-158)

## OVERVIEW

In October 2008, the **HFM-158** symposium addressed issues related to women's growing involvement in NATO military forces. All dimensions of women's integration were considered in this symposium: physiology, anthropometry, pathology, training, psychology, and sociology.

## APPROACH

Two papers were presented on the topic of sexual harassment from Canada and the Netherlands.

- **Canada**: this study offers a literature review and a qualitative analysis of interviews conducted in 2003 with 26 women employed in the Canadian Regular Force combat arms on this topic.

- **The Netherlands**: this paper evaluates two cases of sexual harassment in the Royal Netherlands Navy, which occurred in the early 2000s. The paper first describes the cases and the cooperation between actors involved in managing the two cases. Subsequently, to scrutinise the system of care for military personnel, the paper examines data assessing redeployment early interventions collected during group debriefs in 2003 and 2004 where service members filled in a checklist.

Further insights regarding sexual harassment in the contemporary armed forces might be generated by taking account of more recent literature and data collection on this topic, in recognition of the steadily increasing proportion of women among NATO militaries, which could contribute to the validity of the data presented. Moreover, in both papers, the sample size used was small and ought to be expanded in the future. Controlling for additional variables may also help refine the particular impacts of sexual harassment compared to other cultural factors. Finally, the symposium's Technical Evaluation Report recognized a need to explore this topic in multinational operational environments, suggesting that an RTG could be set up to evaluate specific risks of sexual harassment in a multi-cultural, coalition environment.

## FINDINGS

**Obstacles to sexual harassment reporting exist; including fear of re-victimisation and retaliation, denigration for violating gender norms, and fear of being blamed by the perpetrator or organization.**

**Sexual harassment is more prevalent when personnel perceive that such behaviours are tolerated and when there is a lack of commitment from senior leaders and the organization to eradicate it.**

### CANADA

The literature review indicated that the military's tradition as a male-dominated organization and where job duties are stereotypically masculine correlated with higher levels of sexual harassment and discrimination. Such experiences have been negatively associated with job-related outcomes, including lower job satisfaction, commitment, and productivity.

A decrease in sexual harassment self-reports in the military in the early 2000s may be attributed to several factors, including zero-tolerance policies, anti-harassment programmes, and senior management's commitment to reduce harassment. However, the literature also suggests that a decrease in harassment self-reports may be attributed to fear of losing one's job, being derogated or viewed as a troublemaker by colleagues, or believing that the complaints process would be counterproductive. Other obstacles to sexual harassment reporting included fear of re-victimisation and retaliation, denigration for violating gender norms, and fear of being blamed by the perpetrator or organization.

**Figure 18: Fear of victim-blaming or retaliation present an obstacle to sexual harassment reporting code 1150297294 (Credit: iStock).**

Analysis of 26 interviews of women employed in the Canadian Regular Force combat arms indicates that six non-commissioned female members did not feel safe reporting harassment and believed that reports would be dismissed. After comparing their reports with the literature, the paper notes that harassment is more prevalent in the military when personnel perceive that such behaviours are tolerated and when there is a lack of commitment from senior leaders and the organization to eradicate harassment. The paper recommends the following to deal effectively with sexual harassment:

- Clear and direct demonstration of intolerance for sexual harassment from military leaders in training and employment through seminars, workshops, meetings or newsletters.

- Include all levels of leaders to convey intolerance for sexual harassment directly.

- Conduct a review of the present harassment reporting system to ensure the safety of those reporting harassment and avoid backlash and retaliation among peers.

- Examine the effects of various types and lengths of anti-harassment training to implement the most effective training programme.

### THE NETHERLANDS

Aiming to examine lessons in the management of cases of sexual harassment within the Netherlands Armed Forces, the paper utilizes data collected from the responses of three naval units and a randomly selected marine battalion company to checklists on the quality of redeployment early interventions in 2003 and 2004. The respondents' data suggests that group adaptation sessions during transit home were 'highly appreciated by a vast majority of the deployed personnel'.

However, respondents from one frigate involved in one of the prominent sexual harassment cases indicated greater disagreement that their story could be told, that the debriefing provided room for positive and negative experiences, and that they were less satisfied with the ability of the debriefing to help them adapt or find help. This response could indicate less positive experiences of group debriefs or bad experiences during deployment itself as well as a possible 'conspiracy of silence' aboard this frigate concerning prohibited behaviours. Limits to the data set included some data missing as not all items were incorporated in every checklist, and respondents were mainly male.

The paper concludes by comparing the survey results with a large-scale research study completed in 2006, which examined sexual harassment in the British Armed Forces. The British research respondents were solely women, and the research indicated a worse working environment in terms of sexual harassment for British servicewomen than for their Dutch counterparts. The paper proposes that further examination of sexual harassment cases in a joint combined international context might offer a more complete understanding of the findings and associated recommendations.

## FURTHER FINDINGS

Findings from activity **HFM-158** on kit and equipment can be found here. Findings on military health can be found **here**.

## ACCESS THIS ACTIVITY

To read more on the findings from this activity, please click **here**.

# HEALTH SURVEILLANCE AND INFORMATICS IN MISSIONS: MULTIDISCIPLINARY APPROACHES AND PERSPECTIVES (HFM-254)

## OVERVIEW

In October 2015, **HFM-254** members met for a symposium on the expanding field of health surveillance and medical informatics.

## APPROACH

Examining care for victims of military sexual assault, a paper from the US presented the results of a pilot Military Sexual Assault Assessment and Treatment Program (MSATP). This program is a 16-week pilot course that combines online instruction, in-person panel discussions, and simulation events to educate advanced practice graduate nursing and medical students across the uniformed services in the assessment and treatment of military sexual assault. Thirty graduate nursing students completed the MSATP and pre- and post-program surveys conducted.

## FINDINGS

**An evidence-based online instruction program, in-person panel discussions, and simulation events can increase the knowledge, confidence, and skills needed to assess and treat victims of sexual assault.**

though this study assessed a small sample size of graduate nursing students and did not include long-term follow up, results presented at the symposium were positive. Significant increases in confidence were found to assess and treat sexual assault victims. Knowledge and interview skills were high at the end of the training, but communication skills and dispelling rape myths were mixed. Program satisfaction scores were generally high, as were the evaluations of the program's content, organization, and effectiveness in meeting target objectives.

Overall, an evidence-based online instruction program, in-person panel discussions, and simulation events can increase the knowledge, confidence, and skills needed to assess and treat victims of sexual assault. Finally, the paper captures a research gap, noting that this exercise could be replicated with larger, more diverse samples from all NATO countries and that future research could include the use of a control group as well as a longitudinal format.

## ACCESS THIS ACTIVITY

To read more on the findings from this activity, please click **here**.

# INTEGRATION OF WOMEN INTO GROUND COMBAT UNITS (SAS-137)

## OVERVIEW

In February 2019, members of RTG *Integration of Women into Ground Combat Units* (**SAS-120**) took initiative and arranged the SAS-137 symposium on the integration of women into ground combat units. Data and literature identified during this symposium then helped inform the findings of RTG SAS-120, please click here for more information.

## APPROACH

A paper from India and a presentation from the United States examined sexual harassment and sexual assault in the military.

- **United States**: Interviews and surveys were conducted with ten women officers and ten enlisted women who have newly integrated into ground combat units in the US army.
- The symposium also received a submission from the Defence Institute of Psychological Research, Indian Ministry of Defence, on the challenges of integrating of women in peacekeeping operations.

Greater validity of the findings on sexual harassment and sexual assault may be achieved by conducting further interviews and surveys of this nature with many women working in the military context, particularly from different countries. See ongoing RTG Sexual Violence in the Military (**HFM-295**), for more information, please click **here**.

## FINDINGS

**Sexual harassment and assault is a significant issue faced by female personnel, including among women peacekeepers and enlisted women.**

**Responsible and responsive leadership and support systems may help in preventing and responding to sexual harassment and assault.**

A key finding in the American paper was that enlisted women face harassment and assault at levels not experienced by women officers, while simultaneously having fewer resources and support systems necessary to cope with their experiences. This lack of a support structure significantly impedes their ability to succeed as they integrate into combat arms units.

Recommendations for improving integration included:

- Implementing a peer bonding programme to create social support networks during initial training;
- Assigning enlisted women in cohorts upon initial introduction of women to previously all-male domains and units; and
- Screening and training male leaders on their duties and responsibilities in terms of successful integration and monitoring the unit environment.

In the paper submitted by India, it was noted that one of the significant challenges women peacekeepers tend to face is sexual harassment and assault.

## ACCESS THIS ACTIVITY

To read more on the findings from this activity, please click **here**.

# ONGOING RESEARCH

## SEXUAL VIOLENCE IN THE MILITARY (HFM-295)

### ACTIVITY TYPE

RTG

### DURATION

June 2018 – June 2021

### OVERVIEW

RTG **HFM-295** is investigating the approaches taken by NATO militaries to eradicate sexual harassment and violence within the military. This RTG will provide recommendations on the approaches to measurement and develop a set of principles to define sexual harassment and violence and reporting mechanisms to ensure joint NATO interoperability.

### OBJECTIVES

- To review existing legislation, policies, and reporting mechanisms relating to sexual violence in the military across NATO countries;
- To propose best definitions of sexual assault, sexual harassment, and sexual misconduct;
- To identify best practices for collecting self-reported prevalence data and information on sexual violence;
- To review measurement tools available across NATO countries; and
- To develop and pilot test a standard survey for assessing the prevalence of sexual violence in NATO militaries.

### APPROACH

The main research study focuses on developing the NATO Sexual Harassment and Assault Survey and pilot testing this survey across the seven participating nations through cognitive interviews.

Cognitive interviewing is a method used in the design and refinement process of survey development for pre-testing survey questions to minimise the potential for misinterpretation. The technique evaluates an individual's mental processing and the social context that shapes the respondent's response, identifying culturally specific items or variations by country or context. Cognitive interviewing can also better inform the evaluation of the quality of survey evidence and improve the data's validity.

All cognitive interviews have been conducted, and the results are being compiled.

### FINDINGS

This study is due to conclude in June 2021, and a final technical report will subsequently be published.

# KIT & EQUIPMENT

## KIT & EQUIPMENT

**Figure 19: Female soldier with kit code 470702782 (Credit: iStock).**

The symposiums held by the STO present research that employ quantitative methods to investigate gender differences and their impact on the suitability of kit and equipment for women. They also explore the soldiers' ability to conduct operational activities associated with particular kit and equipment requirements. It is notable that while there is a robust body of research from the STO that looks specifically at these questions, the vast majority of studies exclusively consider male subjects/volunteers. Notably, the study of female subjects is thus frequently treated as an area of special attention rather than being routinely integrated into STO research activities. It would be valuable to mainstream the inclusion of female research subjects in STO activities in the future. This is particularly important in health, kit and equipment related activities, where findings may significantly benefit from gender disaggregation to understand better how design choices may better accommodate women in the armed forces. Research such as that conducted under **HFM-158,** paper 12 (Mollard, R. et al. *Caractérisation de la diversité morphologique de la population militaire, masculine et féminine française / Morphological Diversity of the Male and Female French Military Population*) may better reflect future models of gender mainstreaming.

Most of this area's activities rely on statistical analysis to identify relationships between gender and other variables. As is natural with such research, the correlation between variables does not automatically mean that the change in one variable is the cause of the change in the other variable's values. There is necessarily a degree of speculation in researchers' explanations of possible causation. The authors of the studies recognize this, and readers of this report should note this. For example, body fat levels – which is a variable used across some of the studies – is associated and not associated with load carriage performance. In this case, the reader should be mindful that it is likely that subjects who exhibited good load carriage performance would do even better if they lost excess body fat.

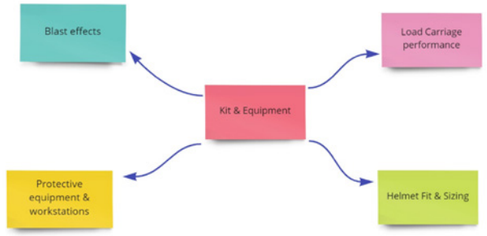



**Figure 20: Diagram offering an overview of STO research activity themes in this chapter (Design tool credit: Miro).**

# SPECIALIST'S MEETINGS

# SOLDIER MOBILITY: INNOVATIONS IN LOAD CARRIAGE SYSTEM DESIGN AND EVALUATION (RTO-MP-056)

## OVERVIEW

In June 2000, NATO, Partners for Peace and non-NATO nationals from 10 countries met for a Specialist's Meeting sponsored by the HFM Panel to discuss soldier mobility through innovations in load carriage system design and evaluation.

Load carriage systems (LCS) are critical to soldier mobility, survival, sustainability and soldiers' ultimate performance on the battlefield. These include clothing and personal equipment designed to carry the soldier's battle and sustainment loads and must allow the soldier to complete all missions and tasks in all military environments and scenarios with minimum impact on performance.

Figure 21: Soldier with load code 899666982 (Credit: iStock).

## APPROACH

Six papers and the first keynote address were presented, either wholly or partially examining the gendered aspects of load carriage. The papers used various research methods, including literature review, quantitative data analysis, and qualitative data analysis.

Additional insights regarding gender differences and load carriage might be generated by considering more current data collection and literature on this area. This is especially true as there has since been a steadily increasing proportion of women among NATO militaries and also considering the small sample sizes of female soldiers used in some of the papers.

## FINDINGS

**Differences in loaded march times between men and women persist even when differences in body size and body composition are considered.**

**If consideration is given to women's anthropometry in military pack systems, the time gap between men and women may decrease.**

**Women have a higher incidence of musculoskeletal injuries when carrying a heavy load during basic training.**

**Carrying loads around the waist appears to be the optimal load-carrying configuration.**

**A combined approach of improving load distribution across the body, combat load carts, and physical training have been demonstrated to enhance soldier mobility.**

### LOAD CARRIAGE PERFORMANCE OF FEMALE SOLDIERS

The first keynote lecture addressed sex differences in load carriage, noting that women walk with shorter stride length and greater stride frequency compared to men. As loads increase, women's stride length decreases while that of men does not show significant change, and women also show a more pronounced increase in the time both feet are on the ground than do men. Differences in march times between men and women persist even when differences in body size and body composition are considered. An independent predictor of march time (when gender was included in the equation) was shoulder breadth.

On questionnaires, women commented more often than the men that the pack straps were uncomfortable, hip belts ill-fitting, and rucksacks unstable. Since pack systems have been designed primarily based on the anthropometry of men, this suggests that if consideration is given to women's anthropometry in military pack systems, the time gap between men and women may decrease. Studies do not reveal a "best" way of carrying loads that applies to all situations. A combined approach of improving load distribution across the body, combat load carts, and physical training have been demonstrated to enhance soldier mobility.

One concern has been women's performance in heavy load carriage situations where they are expected to perform equally to men based on common task criteria. On average, most women have smaller anthropometric dimensions with less muscle mass and a smaller aerobic capacity, resulting in a more significant physiological demand for a given load. Hence, finding strategies that allow women to succeed yet not risk operational effectiveness are essential.

Two papers from the US studied female load carriage performance based on time during a running course and an army obstacle course. Several measures were taken to assess performance on the circuit while carrying three different loads. Circuit time was best predicted by measuring aerobic capacity and muscular endurance, with body size also important. The variables studied could be used as a first-level screening if the selection criteria are set sufficiently low (i.e., one standard deviation below the mean) to guarantee that women who could perform the job are not falsely excluded. Furthermore, both papers found no significant correlations between body fat levels and loaded performance in a healthy weight, physically fit cohort. One of the studies found that increased fat levels were associated with faster loaded run times in one instance. This is likely because subjects with a greater fat mass were found to also have a greater fat-free mass, presumably including muscle tissue. Nevertheless, because fat provides no benefit in lifting or carrying heavy loads, the subjects who did well carrying the backpack loads would likely do even better if they lost excess fat. This loss assumes that they could maintain their fat-free mass.

Combining age and sex data on maximal aerobic consumption, a paper from the Netherlands recommended a load limit value based on metabolic tolerance by sex and age to load carriage at a speed of 1.33 meters per second. The recommended load limit for young soldiers would be 32 kg for men and 19 kg for women. It should be noted that this load limit is the sum of the mass of the backpack, clothing/equipment, and footwear. These recommended load limits also decrease with age.

### BIOMECHANICS OF LOAD CARRIAGE

A paper from the US noted that various load configurations on healthy men, but not women, have been examined. Women have a higher incidence of musculoskeletal injuries when carrying a heavy load during basic training. Appropriate leg and trunk muscle strength and secure design of boots appeared to be critical for women to function in jobs that require loaded walking. This paper also noted that women with strong shoulder muscles demonstrated less trunk and shoulder deviations when walking with a heavy load around the waist or back.

This paper also studied the influence of load location on biomechanical and physiological measures. The researchers placed a 10kg load on women in a shoulder-based backpack, around the waist, and diagonally across one shoulder. This aligned with a similar paper at the symposium from Canada, which placed a 36kg load on men in high, medium, and low pack locations and balanced on the body's front and back. Both studies saw similar results to previous studies, with balanced loads or loads around the waist having less impact on gait. Therefore, carrying the load around the abdomen appears to be the optimal load-carrying configuration. The biggest concerns for these strategies are heat dissipation and overuse injuries from the lower limb and back.

## ACCESS THIS ACTIVITY

To read more on the findings from this activity and other issues explored, please click **here**.

# SYMPOSIUMS

## STRATEGIES TO MAINTAIN COMBAT READINESS DURING EXTENDED DEPLOYMENTS (HFM-124)

### OVERVIEW

In October 2005, **HFM-124** members assembled for a symposium on a range of human performance challenges that threaten combat readiness.

### APPROACH

A paper from the US examined the principles of helmet fit to optimise sizing to determine the minimum number of aviator helmet sizes to accommodate the population's full anthropometric variability. This was done by analysing data collected on helmet fit mapping and size optimisation from a sample of 27 individuals who were chosen as they represent the US naval aviation and Joint Strike Fighter populations.

The data on helmet fit was collected using a stratified, mixed-gender sample size of 27 participants drawn to represent the head size and shape of the Joint Strike Fighter population. Asian- and African-American participants were explicitly included to examine the effects of racial anthropometric variability on fit. An issue to note in the study was that helmet sizing technicians scored mask fit as an automatic pass for any subject for whom the correct size was not available. This means that, because the extra-small narrow mask was not available throughout testing, mask fit problems for petite females were not captured.

### FINDINGS

**Female participants were more likely to experience greater neck-offset and reduced helmet slippage than male participants.**

**Two helmet sizes would likely accommodate 99% of both males and females with specific shape and size modifications, and a new fit adjustment concept.**

The 3-D scans of participants wearing the test helmets indicated that the female participants were more likely to experience greater neck-offset than the male participants. Neck offset was defined in this study as the distance from a mock-up ejection seat back to the subject's neck. This offset is important since poor head position caused by the helmet against the seat can cause neck fatigue and discomfort and possible misalignment or spinal injury during an ejection seat sequence.

Helmet slippage was also measured, with all participants experiencing helmet slippage in this study. The female participants were more likely to experience the least slippage. However, it was noted that some female participants in this study tended to shake their heads less vigorously than the male participants. In any case, slippage did not correlate significantly with any of the other categories of helmet fit, indicating that improving the helmet's fit in these categories will not improve the stability of the helmet on the head in its current design.

Overall, applying a fit mapping method indicated that just two helmet sizes would likely accommodate 99% of both males and females with specific shape and size modifications, and a new fit adjustment concept. This was a significant finding since the manufacturer's design approach predicted that as many as five sizes might be needed, meaning that cost savings would likely accrue for both designer and customer. The study concluded that this information could only be obtained by fit testing on live human participants, appropriately sampled to represent the population of interest.

### ACCESS THIS ACTIVITY

To read more on the findings from this activity and other issues explored, please click **here**.

## IMPACTS OF GENDER DIFFERENCES ON CONDUCTING OPERATIONAL ACTIVITIES (HFM-158)

### OVERVIEW

In October 2008, the **HFM-158** symposium addressed issues related to women's growing involvement in NATO military forces. All dimensions of women's integration were considered in this symposium: physiology, anthropometry, pathology, training, psychology, and sociology.

### APPROACH

Three papers were presented relating to the topic of kit and equipment. The papers used various techniques, including literature review, analysis of anthropometric data from live participants, and analysis of military selection data.

Further insights regarding gender differences in military kit and equipment might be generated by taking account of more recent literature and data collection on this topic. Moreover, the symposium's Technical Evaluation Report recommended a workshop or a specialist meeting with the HFM and AVT (Applied Vehicle Technology) Panels. This joint engagement would help integrate gender anthropometric specificity as early as possible into new vehicle design. It would also promote anthropometric ergonomics within the defence industry.

### FINDINGS

**Men and women have statistically significant body proportion differences.**

**Anthropo-ergonomy applied early on in the design process could help solve equipment and workstation problems.**

#### PROTECTIVE EQUIPMENT

Two papers both demonstrated using computed imaging, 3D models, and anthropometric measures that men and women have statistically significant body proportion differences. Even when size and weight are close, male and female body proportions differ for significant anthropometric measures. While women are smaller than men for many body measurements, including shoulder breadth, women are larger than men in seated hip breadth. This difference explains why many types of protective equipment, including parachute harness, flight suit, anti G suit, and head and face protective gear need to be further tailored specifically to women's proportions when worn by female operators. If not, the poor fit will lead to discomfort, inefficacy, and women's safety during operations could be jeopardised.

**Figure 22: Paratrooper protective equipment code 946600524 (Credit: iStock).**

#### WORKSTATIONS

The larger hip size in women accompanied by the smaller sizes in most other areas, including height and length, is vital for workstations and seats. It may mean that control layouts will need to accommodate a large hip area with a short sitting height.

These physical differences also mean that women will often have a lower centre-of-gravity than men, which should give them an advantage for g-tolerance (provided the anti-g suit fits them) and control an ejection seat easier. However, a paper from Spain outlined the example of Spanish female aviation candidates who were physically disqualified due to their body weight being under the minimum required for optimal functioning of an ejection seat. Anthropometric minimum requirements appeared the primary factor for rejection of females, with female candidates experiencing the same rate of rejection or performing better than males in the evaluation of visual requirements. Anthropo-ergonomy applied early on in designing such equipment could help solve these equipment and workstation problems, which is particularly important if some systems and equipment remain in service for several decades.

Finally, of interest is a paper from South Africa that analyzed the ergonomic requirements for an armour crew. They determined that although more male soldiers than female soldiers complied with strength requirements, many more women than men fitted into the armour vehicle's confined environment, with men often being too tall.

### FURTHER FINDINGS

Findings from **HFM-158** on sexual harassment and sexual assault can be found **here**. Findings on military health can be found **here.**

### ACCESS THIS ACTIVITY

To read more on the findings from this activity, please click **here**.



# ONGOING RESEARCH

# VALIDATION OF MODELING AND SIMULATION METHODOLOGIES FOR HUMAN LETHALITY, INJURY AND IMPAIRMENT FROM BLAST-RELATED THREATS (HFM-341)

## ACTIVITY TYPE

RTG

## DURATION

March 2021 – March 2024

## OVERVIEW

**HFM-341** aims to build upon the work of **HFM-270** *'Framework for Modelling and Simulation of Human Lethality, Injury, and Impairment from Blast-Related Threats,'* which created a framework for connecting blast threat effects to computational modelling. RTG HFM-341 will validate an integrated multi-disciplinary computational framework to develop better protective equipment for warfighters rapidly and more efficiently.

## OBJECTIVES

The objective of **HFM-341** is to develop standardised methodologies and criteria to validate computational models and simulation approaches established in HFM-270 for blast-related injuries to mounted and dismounted personnel and what is required to prevent injury, impairment, and lethality prediction.

The RTG will utilize the latest scientific, experimental, and combat theatre data to include prediction of the performance of protective equipment in blast explosions and combat scenario predictions. The outcome will be the approach and criteria to validate component computational models and simulation techniques.

## APPROACH

The RTG will leverage previous, ongoing, and planned blast injury biomedical research and computational modelling efforts among the participating nations taking a multidisciplinary approach. It will lead to validation of a framework for modelling human lethality, injury, and impairment across the spectrum of blast-related threats and identify the gaps in understanding injury mechanisms from both mounted and dismounted blasts. In parallel with the development of blast injury mechanisms, the validation strategy will also support other efforts to create and evaluate effective blast injury protection systems.

A gender aspect will be considered, especially concerning the lack of scientific literature regarding blast exposure on women soldiers.

## FINDINGS

This study is due to conclude in March 2024, and a final technical report will subsequently be published.



## HEALTH

Figure 23: Health factors code 1127069581 (Credit: iStock).

While the topic of health would appear to be an area for fruitful exploration of sex-specific needs and experiences, such considerations were found to be limited across the body of STO research activities. In general, these aspects played a minor role in more wide-ranging activities that investigated physical performance and mental health questions. Nonetheless, the activities summarised below covered an admirable range of essential issues. These considerations include physical performance, physical testing standards, women's physiological resiliency and injury rates, fitness levels, sex-specific nutritional needs, mental health and the health effects of leadership and peer behaviour. However, while this demonstrates a wide breadth of subjects considered, the depth they have been researched demands far more attention. As with other research areas, the topic of health would also significantly benefit from routinely mainstreaming questions of sex and gender. This would entail using both male and female research subjects as a matter of course and being consistently mindful of the role sex-specific differences might play in the findings and proposed solutions to ameliorate key health concerns.

Furthermore, there are several sex-specific considerations that might strike readers as particularly glaring absences. First, there is no evidence of STO activities exploring women's hygiene habits while in the field environment, including genitourinary concerns. Given existing reporting of vaginal and urinary tract infections and menstrual cycle symptoms during deployments, this would appear to be a noteworthy absence. Second, pregnancy is also underexplored in the body of STO research activities. Unintended pregnancies are more common in the military than in the civilian population.15 More research into the use of contraceptives by women in the military and the effects of pregnancies on readiness and the responsiveness of the military health system would be logical additions to the body of STO research activities. Finally, there is limited sex-disaggregated research on discussion topics relating to psychological/social health. Several factors related to women's lived experiences might be identified as differentiated from those of men. Such factors include the effects of deployment on children, domestic violence, family advocacy, and structural issues. Longitudinal studies on the impact of combat-related stress on female veterans might provide us with a more well-rounded understanding of combat exposure's long-term psychological health effects and contribute to how we define military readiness.

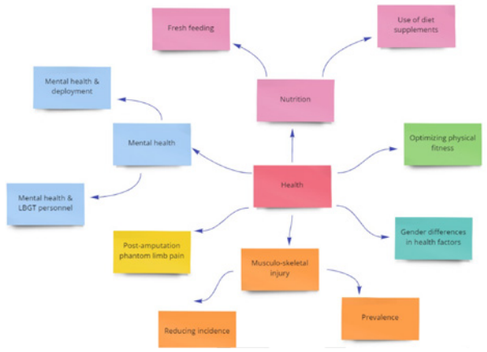



Figure 24: Diagram offering an overview of STO research activity themes in this chapter (Design tool credit: Miro).

15 Holt K, Grindlay K, Taskier M, Grossman D Unintended pregnancy and contraceptive use among women in the US military: a systematic literature review. Military Medicine 2011; 176(9): 1056-64.



# RESEARCH TASK GROUPS

# OPTIMISING OPERATIONAL PHYSICAL FITNESS (HFM-080)

## DURATION

April 2003 – December 2006

## OVERVIEW

RTG **HFM-080** was formed to examine optimising operational physical fitness.

## OBJECTIVES

To determine the physical fitness requirements of military personnel to better prepare military personnel for physical task requirements, to prevent physical overburdening, and to reduce injuries.

## APPROACH

HFM-080 members reviewed mission essential task lists (METL) and the type of missions undertaken by NATO forces past and present. Members identified the physically demanding tasks of digging, marching, and the handling of manual materials as being the vital everyday tasks performed in recent and current NATO missions. Much of the study takes the form of a literature review and analysis.

## FINDINGS

**Women's physiological differences affect core aspects of marching, including speed, energy expenditure, and the likelihood of injury associated with load carriage.**

**It is recommended that the combat load be reduced for all soldiers and in the same way, regardless of sex.**

**Men and women have average differences in physiological capacity, especially aerobic capacity and strength, which cannot be overcome by training.**

**There is no linear correlation between physiological performance and the military performance of a soldier.**

### MARCHING

For marching, management of the soldier's load is essential to find a proper balance of firepower and mobility of the unit. Women's physiological differences were identified as affecting core aspects of marching, including speed, energy expenditure, and the likelihood of injury associated with load carriage. Nonetheless, it was determined that the approach to lowering the weight of the combat load for all soldiers, regardless of sex, should be the same – a combination of providing soldiers with lighter systems while also offloading all equipment that is not immediately needed in a firefight.

### DIGGING

The **HFM-080** team reviewed research on the role of digging and shovelling in developing screening protocols to assess physical fitness. Some of the literature judged that a single minimum physical fitness standard for men and women could be justified. There were similar correlations between success in everyday emergency tasks and overall physical performance when controlling for sex. Other reviewed studies considered differences in stress tolerance on certain parts of the body – for example, vertebral stress – and subsequently proposed lower threshold limits for the average woman than the average man. A study conducted with the Royal Netherlands Army exposed the key factors that differentiated women's performance from men for a digging task, identifying variables including fat-free mass and estimated maximum aerobic power as being especially critical.

### MATERIALS HANDLING

This chapter reviewed recommended limits or standards for lifting as well as lifting and carrying (L-L&C) in NATO countries, recognising that limits differed for men and women based on physiological capacity. Women may be limited in their ability to contribute to team lifting, including groups of women who tend to lift lighter loads than other gender combinations. The chapter also assessed the impact of training on performance, finding that exercises designed to increase upper body strength could enhance women's performance.

### PHYSICAL REQUIREMENTS OF SPECIAL MILITARY OCCUPATIONS

The HFM team conducted a dedicated assessment of complex Special Forces Operations' physical requirements, with the Austrian Special Forces. Despite identifying core physiological requirements (coordinative abilities, reaction speed, aerobic, strength and anaerobic endurance), the study concluded that there is no linear correlation between physiological performance and the military performance of a soldier. Therefore, whether cut-off values match with Special Forces, operational demands must be evaluated in practice. Also, as sex and gender differences were not considered, there is scope to assess whether women would reach suitable cut-off levels for Special Forces operators. Such high physical standards for Special Operations Forces are often regarded as unattainable for women.

Figure 25: Physical training.

### INTRINSIC AND EXTRINSIC FACTORS AFFECTING OPERATIONAL PHYSICAL PERFORMANCE

This section offered an overview of factors outside the training realm that influence performance on military tasks. These factors are either individual (intrinsic) or environmental (extrinsic), and cannot wholly be overcome by additional physical conditioning. Among these categories, gender was considered an innate factor explicitly, and the impact of gender on physical performance was judged to be differentiated in muscular strength and endurance capacity.

This section also found that lifestyle factors and biological variability are likely to be better predictors for endurance capacity than gender and indicate that some trained women could reach comparable levels of endurance capability to men. However, physiological differences contribute to a widespread distinction in strength-based tasks and improvements generated through strength-training activities cannot yield comparable average levels between men and women.

Figure 26: Woman training code 1150353002 (Credit: iStock).

## ACCESS THIS ACTIVITY

To read more on the findings from this activity and other issues explored, please click **here**.

# SYMPOSIUMS

## IMPACTS OF GENDER DIFFERENCES ON CONDUCTING OPERATIONAL ACTIVITIES (HFM-158)

### OVERVIEW

In October 2008, the **HFM-158** symposium addressed issues related to women's growing involvement in NATO military forces. All dimensions of women's integration were considered in this symposium: physiology, anthropometry, pathology, training, psychology, and sociology.

### APPROACH

Various papers were presented from Allied and Partner nations on the topic of military health. The papers used multiple techniques, including literature review, analysis of anthropometric data, and survey analysis. Further insights regarding gender differences in military health might be generated by taking account of more recent literature, and data collection on this topic, primarily as some of the studies use a small sample size.

### FINDINGS

**Separate training for male and female recruits can decrease injury rates while improving pass rates.**

**Training does not reduce the gender performance gap.**

**Women soldiers experience a higher incidence of stress fracture injury.**

**Sex differences may exist regarding sleep deprivation, fat metabolism during endurance activities, and receptiveness to stimulant intake.**

**Sex-specific nutrition and education are needed to respond to the different needs of men and women.**

**Stress coping strategies and anxiety levels may differ between genders.**

### PHYSICAL PERFORMANCE

Two papers studied women's experience in the British Army's "Gender Fair Training" programme, which aimed to maximise the number of recruits completing initial training by minimising medical attrition associated with training injuries and to optimise training benefits. Results indicated that medical attrition rates decreased in female soldiers whilst first-time pass rates increased. A similar approach in the Israeli Defense Forces (IDF) showed the same positive results with increases in aerobic fitness in the female recruits. However, the training did not reduce the gender performance gap; men at the end of the training still had greater aerobic and anaerobic fitness.

Similarly, a paper examining the Austrian Armed Forces showed that in almost all general and specific physical performance areas, women showed a lower absolute performance with the largest differences being in strength-based and complex tests, such as specific military tasks. Gender-specific physical education and training programmes should be developed, applied and evaluated.

A collaborative study between the US and Israel that assessed the bone health status of recruits entering basic training in the IDF reported more stress fractures in female recruits and identified significant sex differences in key parameters of bone health. Significant sex differences in bone mineralisation, geometry, and strength remain evident after adjusting for body size, which may contribute to a decreased ability to withstand the demands of novel, repetitive exercise in untrained individuals entering military recruit training. Furthermore, pre-existing stress injuries of the tibia were seen in newly recruited females for a combat unit, which may be related to excessive training before recruitment. The study concluded that the contribution of inherent sex differences in bone strength to the higher incidence of stress fracture injury in women warrants further study.[16]

### ENDURANCE EFFORTS

A US paper evaluated sleep deprivation in male and female Army helicopter pilots, not finding significant gender-specific operational flight skills decrements in these conditions, where many factors including individual motivation may affect performance. A French study observed that women are more sensitive to sleep deprivation and slow-release caffeine intake than males. Metabolism of these compounds seems to be different between men and women, likely in part due to the influence of oestrogens, leading to variations of either tolerance or efficacy of these fatigue countermeasures.

A US study which examined female fat metabolism in military operations found that energy costs per kg body weight are the same between men and women participating in the same activities,

16 The efforts of this international collaboration led to two key papers being published. Jepsen, K. J., Centi, A., Duarte, G. F., Galloway, K., Goldman, H., Hampson, N., ... & Evans, R. K. (2011). Biological constraints that limit compensation of a common skeletal trait variant lead to inequivalence of tibial function among healthy young adults. *Journal of Bone and Mineral Research*, 26(12), 2872-2885. Jepsen, K. J., Evans, R., Negus, C. H., Gagnier, J. J., Centi, A., Erlich, T., ... & Moran, D. S. (2013). Variation in tibial functionality and fracture susceptibility among healthy, young adults arises from the acquisition of biologically distinct sets of traits. *Journal of Bone and Mineral Research*, 28(6), 1290-1300.

including at the upper limits of sustained physical activity. However, women appear to be more efficient than their male colleagues in managing their fat stores when food and rest are limited in these extreme endurance efforts. It remains to be determined if performance (mental and physical) is better sustained in women than in men because of this difference in lipolysis and metabolic efficiency.

### NUTRITIONAL NEEDS

Female military personnel are at risk of iron deficiency and anaemia, as insufficient iron intake, regular iron losses through menstruation, and the effect of increased physical activity may affect iron balance. A US study found that the prevalence of iron deficiency and iron-deficiency anaemia in women went respectively from 13% and 6% before training to 33% and 21% after completion of the US Army Basic Combat Training. Physical performance is affected by iron deficiency and needs to be addressed by providing specific nutrition to cover higher iron needs.


**Figure 27: Anaemia (low red blood cell count) is a risk for female military personnel code 507480060 (Credit: iStock).**

Specific nutrition needs were also supported by two further studies presented at the symposium. A paper from Poland examined the nutritional status of more than 150 women in military service in the Polish Army using anthropometric examination. Disturbances in bone mineralisation of different intensity were found in 72.7% of the women. Changes typical for osteopenia and osteoporosis were found among 46% and 26.7% of the examined women respectively. These results indicate that modifying nutritional norms and adjusting to women's dietary demands would appear necessary, including offering nutritional education.

### PSYCHOLOGICAL FACTORS

A paper from France found that stress coping strategies and anxiety levels may differ between sexes with women exhibiting higher trait and state anxiety scores and lower mindfulness scores, while also displaying faster recovery responses to stressful events.

Another presentation indicated how psychosociology could affect men and women's performance through a survey conducted in the Canadian Air Cadet Glider community. This study explored the statistic that female pilots were more involved than male pilots in glider incidents. It did so by addressing the associated complex psychosocial environment, where performance can be affected by many factors, including anthropometric and physical characteristics and the group dynamic and the gender-specific behaviour patterns observed in the training setting. The complexity of these relationships is even more significant when you add the threat of sexual harassment as a potential inhibiting factor, as was discussed after the presentation.

## FURTHER FINDINGS

Findings from **HFM-158** on sexual harassment and sexual assault can be found here. Findings on kit and equipment can be found **here**.

## ACCESS THIS ACTIVITY

To read more on the findings from this activity, please click **here**.

# HUMAN PERFORMANCE ENHANCEMENT FOR NATO MILITARY OPERATIONS (SCIENCE, TECHNOLOGY AND ETHICS) (HFM-181)

## OVERVIEW

In October 2009, the **HFM-181** symposium addressed a range of topics in human performance optimisation and enhancement.

## APPROACH

Two papers examined gender aspects concerning skeletal health.

- **UK**: In four investigations, blood-borne markers of bone resorption and bone formation and other bone-associated factors were measured before, during and up to four days after acute bouts of weight-bearing exercise.

- **USA**: Over 840 civilian and military men and women participated in this study that examined blood samples for measuring levels of baseline serum creatine kinase (CK), which is typically used to diagnose and manage the breakdown of skeletal muscle during exercise. The study sought to analyze how baseline CK levels are affected by ethnicity, gender, and genetics.

## FINDINGS

**Higher rates of musculoskeletal injuries in women soldiers may be contributed to in part by lower overall physical fitness upon entry to training.**

**Blood-borne markers to diagnose skeletal muscle breakdown during exercise vary significantly depending on ethnicity, gender, genetics, and body mass index.**

### UK

Based on their results, persons who more frequently experience higher exercise intensities might more frequently experience unfavourable changes in bone turnover during periods of repeated bouts of acute exercise. In part, this might explain why physical fitness on entry into training is a risk factor for lower limb stress fracture injuries. Correlating this finding with the literature, female recruits may enter training with an overall lower fitness standard than their male counterparts and, therefore, may experience higher relative exercise intensities.

**Figure 28: There is a higher risk of stress fracture injuries in females code 490861268 (Credit: iStock).**

### USA

Results from this study included the finding that mean baseline CK was significantly lower in women than men. Also examining ethnicity and genetics factors, the study concluded that baseline CK levels vary considerably depending on ethnicity, gender, genetics, and body mass index. Therefore, the laboratory upper limits of 'normal' should be developed to account for ethnic and gender differences. Significantly, ethnic- and gender-specific ranges for CK may assist operational medicine in diagnosing the breakdown of skeletal muscle during exercise and safely returning warfighters to duty.

## ACCESS THIS ACTIVITY

To read more on the findings from this activity and other issues explored, please click **here**.

# MENTAL HEALTH AND WELL-BEING ACROSS THE MILITARY SPECTRUM (HFM-205)

## OVERVIEW

In April 2011, the **HFM-205** symposium addressed mental health and well-being across the military spectrum, including the incidence of mental health problems related to deployments and their prevention and treatment.

**Figure 29: Mental health code 1210226489 (Credit: iStock).**

## APPROACH

Two papers partially examined gender and military mental health.

- **UK**: four studies concerning the psychological effect of continued combat exposure and repeated deployments are reviewed. One of these studies examined troops deployed to Iraq towards the end of the UK involvement in Iraq. The Operational Mental Health Needs Evaluation in Iraq (OMHNE-I) was carried out in Iraq in early 2009.

- **USA**: offers a review of literature on deployment-related factors that have been associated with risk for mental health problems and suicide.

## FINDINGS

**Deployed women experience higher rates of mental health distress and diagnoses than deployed men.**

### UK

The study examined over 600 participants and noted that a higher risk of psychological distress was associated with younger age, female gender, weaker unit cohesion, poorer perceived leadership and non-receipt of a pre-deployment stress brief.

### USA

The literature indicates the highest rates of mental health diagnoses in deployed personnel occur in females, followed by separated or divorced service members, and finally by members of minority races/ethnicities. In a meta-analysis of 85 data sets from studies examining Post-Traumatic Stress Disorder (PTSD), female gender was a crucial variable in enhancing the risk of mental health problems following traumatic exposure. Likewise, the US paper noted a study from 2006, which reviewed over 1200 consecutive medical evacuations from Iraq and Afghanistan between 2001 and 2004 for psychiatric reasons. This review stated that psychiatric evacuees within the first six months of their service (80%), were more likely to be female, younger than 31 years old, African-American or Hispanic, enlisted and National Guard/Reserve. The sparse knowledge base about mental health and deployment in unique populations, including female service members, National Guard and reservist members, and minorities was noted.

The literature review also discussed a 2005 study which indicated that deployment length was related to increases in depression and PTSD in male soldiers but not in female soldiers, indicating that this particular effect may be moderated by gender.

## ACCESS THIS ACTIVITY

To read more on the findings from this activity and other issues explored, please click **here**.



# EVIDENCE-BASED LEADER INTERVENTIONS FOR HEALTH AND WELLNESS (HFM-302)

## OVERVIEW

In April 2019, the **HFM-302** symposium explored current evidence-based leader interventions that support military personnel health and wellness from a holistic perspective to optimise individual and group functioning in operational and non-operational settings.


**Figure 30: Health and well-being code 612490612 (Credit: iStock).**

## APPROACH

A paper from the US assessed sexual and gender minorities' relationship with their mental health using survey analysis. Two hundred forty-eight lesbian, gay, bisexual and transgender (LGBT) service members and two hundred and ninety-six non-LGBT service members completed a comprehensive survey assessing morale, cohesion anxiety, depression, PTSD, and suicidality. Responses examine for moderating effects of morale and unit cohesion on the relationship between group membership and mental health outcomes.

## FINDINGS

**While morale and cohesion moderate the mental health of service members for both LGBT and non-LGBT service members, the effects were not uniform across outcomes.**

**Unit cohesion moderated the relationship between LGBT status and anxiety, while unit morale moderated the relationship between depression and PTSD and LGBT status.**

**Morale and unit cohesion failed to moderate the relationship between LGBT status and suicidality.**

The findings replicate and extend the importance of morale and cohesion in moderating service members' mental health for both LGBT and non-LGBT service members. Regardless of sexual orientation, unit cohesion and morale were associated with mental health outcomes. Yet, the importance of morale and cohesion for LGBT service members was even more evident. When morale and cohesion are low, it appears that LGBT service members report worse outcomes than their cisgender-heterosexual peers. When unit cohesion and morale are high, their outcomes are superior to their cisgender-heterosexual counterparts.

The benefits of high morale and cohesion were not uniform among the groups. Non-LGBT service members benefited to a greater extent as morale and unit cohesion increased than did LGBT service members. These findings indicate that leaders should include other important markers of acceptance and inclusion in unit wellbeing assessments that go beyond morale and cohesion, emphasizing the increased importance of unit leadership on ensuring the full integration and acceptance of LGBT service members.

The symposium's Technical Evaluation Report notes that the gaps in evidence-based leader interventions for health and wellness in the military are near-universal and constitute a significant research gap desperately needing attention. Diverse groups such as women and other minority groups merit further attention in this respect.

## ACCESS THIS ACTIVITY

To read more on the findings from this activity and other issues explored, please click **here**.

# ONGOING RESEARCH

## REDUCING MUSCULO-SKELETAL INJURIES (HFM-283)

### ACTIVITY TYPE

RTG

### DURATION

September 2017 – June 2021

### OVERVIEW

RTG **HFM-283** was formed to examine musculoskeletal injuries (MSkI) in the military population and identify effective preventative measures.

### OBJECTIVES

To examine preventive measures to reduce MSkI by:

- Promoting the sharing of information among participating nations
- Identifying the causes and associated risk factors for MSkI
- Identifying existing and novel strategies/ technologies that may reduce the injury burden
- Linking to other on-going STO-activities.

### APPROACH

This RTG is reviewing the literature with the aim of producing guidance usable by military commanders.

### FINDINGS

This study is due to conclude in June 2021, and a final technical report will subsequently be published.

A review of literature scientific literature on risk factors for MSkI has also been prepared and submitted for publication in a peer-review journal. One of the review findings is that there is good evidence that being female increases the risk of MSkI.

## DIET SUPPLEMENTATION FOR MILITARY PERSONNEL (HFM-326)

### ACTIVITY TYPE

RTG

### DURATION

March 2020 – January 2023

### OVERVIEW

RTG **HFM-326** was formed to research the frequency and form of diet supplement use, potential physiological benefits, and the risk of adverse effects in military personnel. To date, the STO has not focused on the use of nutritional supplements in military personnel, and there is currently no guidance informing individuals of supplement safety/risk with the application of this risk to military performance.

### OBJECTIVES

This activity's overall objective will be to produce guidance regarding nutritional supplement use, including educational material.

To achieve this, the work will:

1. Explore the literature and other available data (including ongoing research projects) related to supplementation use, including possible physiological benefits and risks.
   - Explore data on dietary supplement use stratified by sex.

2. Provide recommendations for further studies, which will enable a harmonised approach to collect data on the frequency and forms of supplement use in military populations.

### APPROACH

The primary objective of HFM-326 will be a literature review. The activity will also consider educational materials for use by member nations regarding dietary supplement safety and efficacy.

### FINDINGS

This study is due to conclude in January 2023, and a final technical report will subsequently be published.

## PERFORMANCE NUTRITION FOR FRESH FEEDING DURING MILITARY TRAINING AND OPERATIONS (HFM-325)

### ACTIVITY TYPE

RTG

### DURATION

March 2020 – March 2023

### OVERVIEW

RTG **HFM-325** was formed to examine fresh feeding in military training and operations. This RTG plans to appraise: cultural, ethnic, religious, and other issues identified in the nutrition provided in joint operations and host nations; optimal nutritional and food-based guidelines; and gender-specific nutritional requirements and preferences.

Historically, regarding the study's potential gender aspect, research on military nutrition and food preferences has been based on a predominantly male population. With the increased integration of female soldiers, there is a need to identify any gender-specific considerations that would shape future military nutritional guidelines.

### OBJECTIVES

1. Standardise the requirements for nutrition and food variety in fresh feeding operations;

2. Establish the optimal energy and nutritional requirements for fresh feeding in training exercises;

3. Establish food-based requirements for fresh feeding; and

4. Identify gender-specific considerations for military nutritional guidelines.

### APPROACH

To be determined.

### FINDINGS

This study is due to conclude in March 2023, and a final technical report will subsequently be published.

# CONCLUSION

# CONCLUSION

***Women in the Armed Forces*** provides a review of the extensive research conducted since 2000 by the NATO Science and Technology Organization (STO) and its predecessor on gender issues in the Armed Forces. This NATO Office of the Chief Scientist (OCS) report has drawn upon the published findings of research activities undertaken by the STO's network of over 6,000 active scientists, analysts, and researchers, the world's largest collaborative research forum in the field of defence and security.

The report aims to aid the understanding of military, civilian, and NATO decision-makers and audiences on women's employment in the Alliance's Armed Forces, especially as the number of women in Allied militaries is steadily increasing. In particular, it has focused on four central themes:

1. Employment and integration
2. Sexual violence and harassment
3. Kit and equipment
4. Health

Ultimately, the work described in the report provides a solid evidence-based framework for ensuring informed decisions are made on the optimal effectiveness and employment of women in Allied Armed Forces.

## SUMMARY OF RESEARCH GAPS

As is detailed in the report, efforts have been made to carve out space in the STO research agenda to explore gender issues in the armed forces. Gaps remain nonetheless. It is perhaps surprising that given these efforts, questions concerning sex and gender have not been more widely integrated into STO research activities. It is more often than not the case that the investigation of "women's issues" is included as a minor research component or separated into distinct research activities. Far less common is a drive to integrate sex and gender questions into wider research streams, recognising that such questions may play a role in areas beyond their obvious immediate relevance. For instance, many other STO research areas may benefit from re-evaluation to consider whether male subjects were presumed to be the norm or whether sex-based differences were fully considered.

Future research in the area of Women in the Armed Forces may wish to consider the research gaps identified below and build on these in both current and future research activities.

It should be noted that many of these research areas are equally valid for men and it is not the intention of this report to suggest that some problems are, or should be considered as, unique to women. Nonetheless, the research gaps identified below acknowledge the differential lived experiences of women and the need to address their historical underrepresentation in many areas of research.

| | |
|---|---|
| **Employment and Integration** | **Gap 1: Lack of longitudinal research.**<br><br>**Gap 2: Lack of evaluation of the gendered nature of terms used to assess 'integration' and 'culture'.**<br><br>**Gap 3: Limited up-to-date research on the role of intercultural factors.**<br><br>**Gap 4: Lack of research on the impact of deployment on the function of families for women in the armed forces.**<br><br>**Gap 5: Research that explores the manifestation and persistence of masculine norms in the military context as the primary research aim.**<br><br>**Gap 6: Longitudinal studies on the shifting gender norms within NATO and NATO armed forces and the impact (if any) of these changing norms on women's experiences.**<br><br>**Gap 7: Lack of research exploring the co-constitution of sex and gender, for example as this relationship may affect recruitment, military culture, the operational context, and physical standards and training.**<br><br>**Gap 8: Limited research on how gender intersects with other factors to shape the experiences of personnel.**<br><br>**Gap 9: Limited research on issues affecting LGBT personnel.** |
| **Kit and equipment** | **Gap 1: Lack of research on optimal physical training methods for men and women.**<br><br>**Gap 2: Limited up-to-date investigation of human factors and ergonomics regarding equipment size and suitability for women.**<br><br>**Gap 3: Need to operationalise kit-fitting technologies in military field settings. This should include in different and extreme climatic operational environments, especially in light of climate change.**<br><br>**Gap 4: Limited use of diverse participants including women in the breadth of STO research on kit and equipment specifications.**<br><br>**Gap 5: Lack of research on receptiveness of female combatants to adopting sex-specific kit and equipment.**<br><br>**Gap 6: Lack of qualitative research on female personnel's experiences of using military kit and equipment.** |
| **Health** | **Gap 1: Lack of evaluative tools to assess current resilience and mental health programmes and lack of documented outcomes of these programmes, specific to the needs of women.**<br><br>**Gap 2: Limited availability and attention to opportunities for research regarding the impact of combat-related stress on female veterans.**<br><br>**Gap 3: Lack of sex-specific hygiene and self-care education, specifically concerning genitourinary hygiene during operations.**<br><br>**Gap 4: Lack of research that identifies differences in rates and severity of traumatic brain injury in women.**<br><br>**Gap 5: Lack of research on the effectiveness of psychological health and treatment programmes for women.**<br><br>**Gap 6: Lack of research in developing and validating psychological screening tools related to combat-related duties, specific to sex.** |
| **Sexual Harassment and Violence** | **Gap 1: Limited use of quantitative tools in cross-national and international measures to evaluate incidence of, and reasons for, sexual harassment and violence.**<br><br>**Gap 2: Lack of standard setting for 'red lines' of unacceptable behaviour including sexual harassment, bullying, and sexism.**<br><br>**Gap 3: Lack of exploration of sexual harassment in the context of multinational operational environments.**<br><br>**Gap 4: Lack of longitudinal research exploring the long-term impacts of sexual harassment and violence.** |

# APPENDICES

# APPENDIX A – BIBLIOGRAPHY

Many activity reports detailed in this report are open access and interested readers are invited to consider the findings in their totality if they wish by clicking on the title below.

Alternatively, go to the 'Publications' search function on the STO website and search for the activity code or title you are interested in: < http:\www.sto.nato.int >.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## APPENDIX B – NATO GENDER INTEGRATION ROLES AND RESPONSIBILITIES

**Women, Peace and Security (WPS)** – Led by a Special Representative for Women, Peace and Security and based within the Office of the NATO Secretary-General, WPS works to integrate gender perspectives across NATO's three core tasks (collective defence, crisis management and cooperative security) and throughout its political and military structures.

**IMS Office of the Gender Advisor (IMS GENAD)** – The IMS Office of the Gender Advisor reports directly to the Director-General of the International Military Staff (DGIMS). It provides information and advice on gender issues, including implementing United Nations Security Council Resolution (UNSCR) 1325 and related Resolutions. It also serves as the Secretariat for the NATO Committee on Gender Perspectives (NCGP).

**Defence Policy Planning Division (DPP)** – The Data Analysis Unit of DPP began collecting information on female military personnel and gender issues in the armed forces of NATO Allies in 2019. ■

## APPENDIX C – ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| **3-D or 3D** | 3-Dimensional |
| **AVT** | Applied Vehicle Technology Panel |
| **CAF** | Canadian Armed Forces |
| **CK** | Creatine Kinase |
| **DGIMS** | Director General of the International Military Staff |
| **DPP** | Defence Policy Planning Division |
| **EDT** | Emerging And/Or Disruptive Technology |
| **ET** | Exploratory Team |
| **FET** | Female Engagement Team |
| **HFM** | Human Factors and Medicine Panel |
| **IDF** | Israel Defense Forces |
| **IMS GENAD** | IMS Office of the Gender Advisor |
| **LCS** | Load carriage systems |
| **LGBT** | Lesbian, Gay, Bisexual, and Transgender |
| **L-L&C** | Lifting, and lifting and carrying |
| **MCPS** | Military-Civilian Personnel Survey |
| **METL** | Mission Essential Task Lists |
| **MFE** | Military Field Exercise |
| **MSATP** | Military Sexual Assault Assessment and Treatment Program |
| **MSKI or MSkI** | Musculoskeletal Injury/Injuries |
| **NATO** | North Atlantic Treaty Organization |
| **NATO HQ** | North Atlantic Treaty Organization Headquarters |
| **NCGP** | NATO Committee on Gender Perspectives |
| **NORASOC** | Norwegian Army Special Operations Commando |
| **OCS** | Office of the NATO Chief Scientist |
| **OMHNE-I** | Operational Mental Health Needs Evaluation in Iraq |
| **PES** | Physical Employment Standards |
| **PME** | Professional Military Education |
| **PoWs** | STO Programmes of Work |
| **PTSD** | Post-Traumatic Stress Disorder |
| **RLS** | Research Lecture Series |
| **RSM** | Research Specialist's Meeting |
| **RSW** | Research Workshop |
| **RSY** | Research Symposium |
| **RTG** | Research Task Group |
| **S&T** | Science and Technology |
| **SAS** | System Analysis and Studies Panel |
| **ST** | Specialist Team |
| **STO** | NATO Science and Technology Organization |
| **UK** | United Kingdom |
| **UN** | United Nations |
| **UNSCR** | United Nations Security Council Resolution |
| **US** | United States |
| **USA** | United States of America |
| **$VO_2max$** | Maximal oxygen consumption or maximal aerobic capacity |
| **WPS** | Women, Peace, and Security |