

# Pelvic Floor Health in Female Military Personnel: A Narrative Review

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## Abstract

**Background:** A growing female workforce within military forces internationally necessitates comprehensive consideration of this population's unique health requirements within a wide range of military contexts. Pelvic floor health is a key area where support needs vary between sexes because of differences in pelvic anatomy and function.

**Purpose:** To explore what is known about the pelvic floor health of women working in military contexts, specific risk factors and relationships between pelvic floor problems and military occupational health, safety and performance.

**Methods:** Searches of multiple health and Defence databases identified published studies of relevance to this review's aims. Findings of relevance were extracted and synthesised to provide a narrative overview of the topic.

**Findings:** From the available studies, genitourinary infections and urinary incontinence were both found to affect up to one-third of serving women. Some self-management strategies used by servicewomen, particularly when deployed, may have negative health consequences. Serving women also identified environmental, equipment and cultural factors that challenged their ability to manage their pelvic health in occupational contexts.

**Conclusion:** A sizeable proportion of military women experience pelvic floor conditions. Consideration of how to optimise and support the pelvic floor health of female military personnel is required.

**Keywords:** female, military, pelvic floor

**Conflict of Interest:** nil

## Background

Women are a growing population within the Australian Defence Force (ADF), representing 17.9% of the total workforce (Navy 21.5%, Army 14.3%, Air Force 22.1%).<sup>1</sup> Female participation rates within each Service are steadily increasing and projected to meet the 2023 targets set by each Service (Navy 25%, Army 15%, Air Force 25%).<sup>1</sup> In 2018, remaining restrictions on the roles that female military personnel could undertake within the ADF were removed, paving the way for women to assume roles in combat employment categories, which are considered more physically demanding and diverse.<sup>2</sup> The broader and more diverse roles of an expanding female workforce in the ADF necessitates comprehensive consideration of female personnel requirements in areas such as health care, deployment, physical training, load carriage, and equipment and apparel procurement. The health and welfare needs of

female military personnel and veterans have been identified as an area where more Australian data is required.<sup>3</sup> Understanding relevant issues will allow for the provision of appropriate support, training, equipment and health care, and contribute to the ongoing success of women in wide-ranging military roles.<sup>4, 5</sup>

Pelvic health is a key area where the care and support needs vary between the sexes because of differences in genitourinary anatomy and function and their respective roles in reproduction. Pelvic floor health is a broad term encompassing bladder, bowel, sexual and reproductive function, as well as the health of the anatomical structures that house and support these functions. Issues affecting the pelvic floor are often described using the umbrella term 'pelvic floor dysfunction', which encompasses a wide variety of signs and symptoms, such as urinary incontinence, lower urinary tract infection, pelvic organ prolapse,

anorectal dysfunction, sexual dysfunction and pelvic pain.<sup>6</sup> The prevalence of pelvic floor dysfunction in the general population is higher for women than men. For example, urinary incontinence, defined as the involuntary leakage of urine, has been found to affect 18–40% of Australian women aged 20–40 years, compared with 2–5% of men in the same age bracket.<sup>7</sup> Pelvic organ prolapse, which refers to the descent and reduced support of the pelvic organs, has been reported to affect between 3–75% of women, with the large variance explained by differences in diagnostic criteria.<sup>8</sup> In comparison, male pelvic organ prolapse is uncommon; thus, the prevalence rate is rarely reported.<sup>9</sup> Urinary tract infections are also more prevalent in women, affecting 1 in 2 women in their lifetime, compared with 1 in 20 men.<sup>10</sup> Overall, it has been reported that approximately 25% of women have at least one type of pelvic floor dysfunction,<sup>11</sup> and it is not uncommon for women to experience co-existing pelvic floor conditions.<sup>12</sup>

The unique factors identified to increase the risk of pelvic floor dysfunction in women compared with men include differences in pelvic anatomies, such as a shorter and straighter urethra, hormonal fluctuations and changes associated with menstrual cycles and menopause, as well as pregnancy and childbirth.<sup>13, 14</sup> While approximately 15% of women do not experience pregnancy and childbirth,<sup>15</sup> the other aforementioned risk factors, along with ageing and ethnicity, are non-modifiable. Obesity and constipation have also been identified in the literature as risk factors for female pelvic floor dysfunction, along with repetitive loading, heavy lifting and high-intensity land-based physical activity.<sup>16, 17</sup> Positive correlations between exercise intensity and loading have also been demonstrated in several prevalence studies of pelvic floor dysfunction (most commonly urinary incontinence) in female athletes.<sup>18</sup>

The preceding background shows that pelvic floor dysfunction is common for women in the general population, and thus, it will likely affect female military personnel. Many military roles' unique physical work requirements mean that personnel undertake high physical training levels and load carriage tasks.<sup>19</sup> Furthermore, military work is often undertaken in austere environments where sanitation can be problematic.<sup>20</sup> These factors may place servicewomen at an even higher risk of pelvic floor dysfunction than women in non-military contexts. Limitations in the amount and quality of obstetric and gynaecological research in female military personnel have also been identified.<sup>21</sup> Therefore, it is imperative that female military personnel's pelvic floor health needs are further understood to enhance health, wellbeing, safety and occupational performance.

On this basis, this narrative review aimed to explore the types, prevalence and severity of pelvic floor dysfunction in female military personnel; consider the risk factors for these conditions; identify the common strategies women use to maintain and manage their pelvic floor health in military contexts; and explore the implications for their occupational health, safety and performance.

### Methods

A narrative literature review, defined as a literature synthesis without a systematic quantitative methodology,<sup>22</sup> was chosen because it allowed for the presentation of a broad overview of female military pelvic floor health and achievement of the aims outlined above. Published material of relevance was identified through searches of health and military databases (including CINAHL, EBSCOhost, PubMed, Defence Technical Information Centre and WorldCat) and hand searching the reference lists of relevant studies, between December 2019 and March 2020. The key search terms included female, military and pelvic floor, and no date limits were applied. All types of published material were considered for inclusion in the review (i.e. experimental studies, observational studies, military reports and opinion pieces), as long as they: focused on female military personnel; contained data on types, prevalence, severity or risk factors for pelvic floor dysfunction; explored self-management strategies; and/or discussed implications for occupational health, safety and performance. Published material related to sexual or reproductive function and sexual violence were not included in the review as they were outside the aims and scope. Findings of relevance to the review aims were extracted and synthesised to provide a narrative overview of current knowledge on the topic and areas requiring further research.

### Results and discussion

In total, 11 reports from the United States (US) military context were found and provided some initial insights into the prevalence, severity, occupational impacts and self-management strategies used by female personnel for urinary incontinence, pelvic organ prolapse, genitourinary infections and acute pelvic pain (Table 1). No studies were found that examined anorectal dysfunction or persistent pelvic pain in a military context, and no studies focused on pelvic floor dysfunction in female military personnel from other countries, including Australia. The findings of the included studies are synthesised and discussed in the following sections, which address the aims of the review.

**Table 1: Overview of studies included in the literature review**

Authors	Study details	Sample characteristics	Prevalence	Risk factors	Additional findings	Occupational	Self-management strategies
Davis & Goodman (1996)	UI survey of female airborne infantry trainees (Pre & post-training)	N = 512 • 420 nulliparous • 92 vaginally parous Age: 24.5 (21 – 34) 68% Caucasian	Pre-training (UI): • 8% nulliparous • 26% parous Post-training (UI): • 10% nulliparous • 28% parous		9 nulliparous trainees followed up for development of severe UI post-training • 3 UUI • 6 SUI		
Davis et al. (1999)	Cross-sectional survey on UI in active-duty female soldiers	N = 563 Age: 28.3 (18 – 51) Wt: 61.1 kgs Ht: 165.4 cm 75% Caucasian	30% 'problematic' UI	↑ Age ↑ Parity ↑ weight	Onset: 5 yrs Aggravated: • physical training • field activities	31% UI adjusted training/duties Job roles associated with higher UI: • Petroleum techs • Cooks • Supply	Pre-activity voiding or pad use = 68% Fluid restriction = 13 – 19% PFM ex = 19%
Fischer & Berg (1999)	Cross-sectional survey on UI in active-duty female Air Force crew	N = 274 respondents Age: 32.9 years	26% experienced UI • 70% SUI • 32% on-duty • 18% flying	↑ Age ↑ Parity Crew position	89% UI episodes off-duty	Navigators, weapon system operators, electronic warfare operators had higher rates of UI Type of aircraft (high vs lower gravity loads) did not influence UI	
Larsen & Yavorek (2007)	Prospective cohort study nulliparous military cadets Pre & post-training (UI and POP)	N = 116 n = 37 paratrooper Age: 20.7 (19 – 24)	Pre-training: • UI = 15% • POP 1 = 46% • POP 2 = 2% Post-training • UI = 21% • POP 1 = 54% • POP 2 = 22%		Paratrooper trainees ↑ risk of worsening pelvic organ support (RR = 1.57)		Fluid restriction Pre-activity voiding
AHFSC (2014)	Retrospective data analysis (UTI) from US Defence Medical Surveillance System 2000-2013	Active-duty Navy, Army, Air Force, Marines, Coast guard	UTI • 30.4% females • 3.5% males UTI recurrences • 41.3% females • 13% males		Female groups with ↑ incidence • Army & Marine corps • Junior enlisted • Singles Coast guard ↑recurrence	2240 hospital bed days/year 4981 days lost work time/year	
Wright et al. (2006)	Retrospective data analysis acute female pelvic pain presentations (combat environment)	N = 150 pelvic pain (14% gynae cases) Age: 28 (15 – 53) 98% female army 45% active duty 41% reserves	19.3% pelvic pain (unknown cause) 16% UTI 6.7% LUTS		75% only seen once	75.3% returned to active duty 8.7% medical evacuation	
Lowe & Ryan-Wegner (2003)	Cross-sectional survey female active duty and reserve Navy, Army & Air Force (deployed past 5 years)	N = 841 Age: 28.3 (18 – 56)	18.4% UTI (deployed) 30.1% VVI	Previous infection ↑ no. behavioural factors Austere environment characteristics (VVI only)	50% reported >4 behavioural factors: • Holding urine • Tampons • Antibiotics • OCP • Non-cotton underwear • Douches • Sexual intercourse • Steroid use	Deployed living conditions: • 52.5% tent • 18.5% barracks • 15.5% ship • 13.5% other	

Authors	Study details	Sample characteristics	Prevalence	Risk factors	Additional findings	Occupational	Self-management strategies
Czerwinski et al. (2001)	Cross-sectional survey on feminine hygiene practices in military (all Services)	N = 880 usable surveys Age: 41 (20 – 65) Navy 23% Army 42% Air Force 29% Marine 6%			Maintaining hygiene when deployed more challenging – less, privacy, less facilities, unsanitary	Deployed settings – impacts shower and handwashing frequency, choice of sanitary items and underwear	Sanitary items Douching Handwashing Showering
Criner (2008)	Cross-sectional survey of female military personnel with SUI	N = 69 Age: 40 (19 – 62) BMI: 25.4 (17.2 – 44.1) Ht: 163cm Wt: 66.7kgs 68% Officers 30% nulliparous 94% mild-mod SUI			13% sought help 42% withheld feelings 51% refused to think about problem	↑ field barriers = more coping strategies ↑ field barriers = ↓ QOL ↑ symptom distress = ↓ QOL in field	78% PFM ex 78% panty liners 71% ↓ fluid intake 67% underwear changes 62% ↑ voiding 17% avoided ex 8.7% avoided strenuous work
Wilson & Nelson (2012)	Ethnographic study on female genitourinary management in deployed settings	N = 43 Age: 27 (20 – 49)			↓ use of medical services: • ↓ trust • ↓ education • ↓ privacy • ↓ experience • ↓ resources • ↓ cleanliness • provider gender • stigma	Challenges: • Uniforms (heavy, hot, restrictive) • Laundry • Toilet facilities • Shower facilities • Supply availability • Weather • Prophylactic antibiotics • Lack of privacy • Job requirements/ hours	Planning ahead Bringing own supplies Maintaining hygiene Voiding as able FUDD Hydration Underwear changes Menstrual control Support from home
Steele & Yoder (2013)	Narrative review of female military urinary practices				Recommendations: • CPG on GU health in deployed settings • Pre-deployment self-care modules • Equipment provision (FUDD, antimicrobial underwear, female-specific uniforms - research	Field challenges: • ↓ privacy • Crowded living • unsanitary conditions • ↓ toilet/shower/laundry facilities • Safety/security concerns • uniforms/equipment	Urinary practices: • Restrict fluid intake • Delayed voiding • Squatting over bottles • Pads

Abbreviations: UI = urinary incontinence, SUI = stress urinary incontinence, UUI = urge urinary incontinence, PFM ex = pelvic floor muscles, POP1 = pelvic organ prolapse stage I, POP2 = pelvic organ prolapse stage II, UTI = urinary tract infection, LUTS = lower urinary tract symptoms, VVI = vulvovaginal infection, OCP = oral contraceptive pills, QOL = quality of life, ex = exercise, FUDD = female urinary diversion device, CPG = clinical practice guideline, GU = genitourinary

### Prevalence, severity and risk factors

Prevalence data in female US military personnel have been reported for urinary incontinence,<sup>23-26</sup> pelvic organ prolapse,<sup>26</sup> genitourinary infections,<sup>27-29</sup> and acute pelvic pain.<sup>28</sup> Urinary incontinence prevalence rates for female military personnel and trainees were reported to range from 8–30%;<sup>23-26</sup> which is on the lower end of prevalence rates reported for the general population of Australian women aged 20–40 years (18–40%)<sup>7</sup> and female athletes (19–70%).<sup>18</sup> The slightly lower range of prevalence rates in female military personnel studies may be due to their generally younger age and lower parity, which are commonly reported risk factors for urinary incontinence in women.<sup>11,30</sup> Key limitations of the available prevalence data for urinary incontinence were there was only a limited range of military roles and contexts included in studies, and none from a Navy context, and the available studies were conducted between 13 and 24 years ago.<sup>24, 26</sup>

The severity of female military personnel's urinary incontinence symptoms has not explicitly been investigated but was briefly reported in two studies.<sup>23, 31</sup> In the survey of US Army women by Davis and colleagues (1999), 31% of women with urinary incontinence stated that it was at a level they deemed a 'social or hygienic problem'. The severity of symptoms was influenced by the activity performed, physical training, field activities and recreational exercise most commonly contributing to symptoms. In addition, over 25% of women with symptoms experienced them greater than 50% of the time during physical training.<sup>23</sup> However, it is not clear from the information reported how severe the symptoms experienced were and how, if at all, they influenced occupational performance. In a cross-sectional survey exploring 69 female US servicewomen's coping strategies with stress urinary incontinence, 94.2% reported that their symptoms were mild to moderate,<sup>31</sup> which is similar to general population studies. For example, 74% of Australian women reported their urinary incontinence symptoms as 'slight', with the severity of symptoms increasing with age.<sup>7</sup> While the available information suggests that urinary incontinence symptoms are predominantly mild to moderate for female military personnel, the impact of these symptoms on occupational performance is unclear.

The influence of military training on the prevalence of urinary incontinence was assessed in two US studies of female military trainees.<sup>24, 26</sup> Small increases in the percentages of women reporting urinary incontinence post-training were reported (2–6%). While these increases were not statistically

significant, they suggest there may be a relationship between higher levels of physical training or loading and the risk of urinary incontinence. Lending support to this possibility, nine nulliparous trainees who developed severe urinary incontinence after their training were followed up by Davis and Goodman (1996). Three of these women developed urge urinary incontinence, or urinary leakage associated with a feeling of urgency, and the remaining six severe stress urinary incontinence, or involuntary urinary leakage with physical exertion.<sup>6</sup> Physical examination of the six women with stress urinary incontinence revealed co-existing bladder prolapse, or descent and bulging of the bladder into the anterior wall of the vagina, which was not detected on pre-training pelvic examination. Five of these women identified a particular event (landing from parachute jump/lifting a heavy load) that preceded the onset of symptoms, which indicates that particular types of loading may contribute to changes in pelvic floor support and symptom development.

Similarly, a relationship between type and dose of physical training and the prevalence of stress urinary incontinence has also been reported in female athletes. Athletes more frequently engaged in higher impact activities (i.e. jumping) and higher training levels reported a greater prevalence of urinary incontinence.<sup>16</sup> Limited details were provided in the available military studies about the types and intensities of training activities military cadets and trainees were engaged in, and how these differed from their usual physical activities. The duration of training and the reassessment period were also not clearly defined. Larsen and Yavorek (2007) reported that training (and subsequent reassessment) was undertaken over the summer months,<sup>26</sup> indicating a reasonably short duration of training. Therefore, the effects of ongoing high physical training and occupational task loads were not considered and require further investigation. However, these findings suggest that the types and amount of physical loading female military personnel undertake in the workplace could impact the development and severity of urinary incontinence symptoms. Reviewing military training programs and considering how training is scheduled and progressed regarding pelvic floor stress may be a simple strategy for preventing or minimising the risk of urinary incontinence.

The prevalence of pelvic organ prolapse and pelvic organ support changes after initial training in nulliparous female US military cadets were assessed in one study.<sup>26</sup> Prior to training, 46% were assessed to have stage I pelvic organ prolapse (lowest point of prolapse >1cm above hymen<sup>32</sup>) and 2% stage II prolapse (lowest point between 1cm above and below

hymen<sup>32</sup>). These findings are not dissimilar to those from population-based studies for stage I pelvic organ prolapse in women aged 18–83 years.<sup>8</sup> After training, a decrease in pelvic organ support was found, with 54% of cadets assessed as stage I and 22% with a stage II prolapse. Female cadets participating in paratrooper training (n = 37) were also found to be at an increased risk of worsening pelvic organ support (RR = 1.57) compared with other trainees. Again, these findings allude to a potential relationship between the level of loading experienced by military women and pelvic floor symptoms, which may have implications in military roles requiring a high volume of heavy load carriage or intense physical training. Occupational factors have previously been linked with the risk and severity of pelvic organ prolapse, with labourers and factory workers shown to be at greater risk than other occupational categories.<sup>33</sup> However, a causal dose-response relationship between physical activity, repetitive loading on the pelvic floor and pelvic organ support has yet to be confirmed,<sup>34, 35</sup> with stronger relationships between pelvic organ prolapse and ageing, parity and the number of vaginal deliveries consistently found within the literature.<sup>35</sup> Females within the military will experience ageing, and many will also experience pregnancy and birth during their careers, while also undergoing high levels of physical and occupational loading. Therefore, strategies to prevent and manage pelvic organ prolapse need to be considered within military training programs.

Fourteen per cent of women presenting for gynaecological care within a combat environment were found to be affected by acute pelvic pain.<sup>28</sup> One-quarter of these presentations were attributed to genitourinary infections, but 19% had no clear aetiology. Urinary tract infections are a significant issue for female military personnel, with reported prevalence rates of 18–30.4%, which is much higher than in men (3.5%).<sup>27, 29</sup> Recurrence rates for women are also higher (41.3%) when compared with men (13%).<sup>29</sup> The risk of infection is also higher in women who have previously had a urinary tract infection.<sup>27</sup> Vulvovaginal infections are characterised by symptoms of vulvovaginal itching, burning, pain and discharge, and have a reported prevalence rate of 30.1% in deployed settings.<sup>27</sup> Similar to urinary tract infections, previous vulvovaginitis history was a key risk factor, along with medication use (i.e. steroids, antibiotics, oral contraceptives), delayed voiding and tampon use.<sup>27</sup> Poor sanitation in deployed environments, as well as more challenging toilet practices due to the work context, location, apparel and equipment, may also be contributing factors to genitourinary infections.<sup>20, 36</sup> The aforementioned issues associated with deployments highlight

common occupational challenges that female military personnel face in maintaining and managing their pelvic floor health.

### Occupational Challenges

A range of occupational challenges has been identified that may negatively impact female military personnel's pelvic floor health, particularly in austere field and deployed environments. Moreover, these challenges and their potential impacts on the pelvic floor, may influence work performance and negatively impact military operations. In an ethnographic study of female military personnel and their genitourinary management in deployed settings, Wilson and Nelson (2012) categorised the challenges for military women under three broad headings: (1) those coming from the work environment; (2) those associated with equipment; and (3) those associated with workplace culture. Servicewomen's common environmental challenges included the climate, availability and cleanliness of bathroom and laundry facilities, crowding, decreased privacy, safety and security concerns, and variable availability of supplies, i.e. sanitary items.<sup>20, 31, 36, 37</sup> The climate can influence pelvic floor health in different ways. For example, hot and humid climates are associated with increased sweat and heat in the genital region, increasing bacterial growth and risk of infection. Areas with high risks of malaria may require personnel to take prophylactic antibiotics, which many women feel increases their risks of genitourinary infection.<sup>36</sup> Several studies have shown that antibiotic use can increase vaginal bacterial growth and the risk of vulvovaginal infections, particularly in women with previous infections.<sup>38, 39</sup> Coupled with often limited access to clean bathroom and laundry facilities, maintaining the level of hygiene required to minimise the risks of genitourinary infections then becomes difficult.<sup>20, 27, 36, 37</sup>

Equipment can also pose a challenge to maintaining female pelvic floor health, with restrictive and heavy uniform fabrics reported to increase heat and moisture retention in the genital region, predisposing women to genitourinary infections. Uniform design and the need to wear protective gear or carry additional equipment and weapons can make toileting in the field awkward, time-consuming, and where there are no facilities, embarrassing and dangerous due to exposure.<sup>20, 36</sup> It may also pose a safety and security risk to the individual and their unit.<sup>20</sup>

The setting's culture may also influence pelvic floor health by impacting self-care and health-seeking behaviours. The level of pre-deployment education offered by units influenced women's knowledge of

strategies to prevent and manage common pelvic health conditions and the level of trust women had in their Commanding Officers and healthcare providers.<sup>36</sup> Many women reported that they were reluctant to seek health care while deployed due to the need to seek permission and a lack of trust in medical providers. A lack of confidentiality, experience, supplies, clean and safe healthcare environment, and the gender of the medical provider all influenced servicewomen's trust and decision making about accessing health care for pelvic floor dysfunction while deployed. Moreover, gossip generated and perceived stigma about their promiscuity also created barriers to self-management and pelvic floor health-seeking behaviours for servicewomen.<sup>36</sup> For many women this led them to seek information and advice from other sources, such as trusted colleagues and family members, ignore symptoms or delay seeking medical treatment until after they had completed their deployment.<sup>36</sup>

### Self-management strategies

Female military personnel utilise a wide variety of self-management strategies to prevent and manage symptoms (Table 1).<sup>20, 23, 31, 36</sup> The most common strategies include maintaining genital hygiene, utilising methods to control menstruation, altering fluid intake and voiding patterns, using sanitary items to manage periods and episodes of urinary incontinence, changing underwear frequently, and pelvic floor exercises to improve bladder and bowel control. The strategies utilised have been reported to vary between when women are home and when in deployed settings. In deployed settings, women needed to plan ahead, bring additional supplies of sanitary items and self-management treatments (i.e. fungal creams), order items online or request care packages from home, utilise larger absorbency sanitary items to account for changeover delays, and wear cotton undergarments.<sup>36, 37</sup> Modifying aspects of physical training or work roles was a strategy utilised by some military women to reduce their symptoms of urinary incontinence.<sup>23</sup> However, very few servicewomen completely avoided exercise or strenuous work tasks (8–17%).<sup>23, 31</sup>

Of concern for military organisations, is that some of the self-management strategies used by female personnel to manage their pelvic floor health at work may be associated with a range of negative consequences. Limiting fluid intake was a common strategy identified by women to reduce the need to urinate in environments that may pose challenges, or to minimise the risk of urinary incontinence episodes.<sup>20, 23, 27, 31</sup> However, when fluid intake is limited, the risks of dehydration increase, which may

lead to reductions in occupational performance, and an increased risk of heat-related illness and urinary tract infections. Alterations in voiding patterns, such as delaying voiding or frequently voiding, can also have negative consequences. Prolonged holding can lead to pain and urinary tract infections and increase the risk of urinary incontinence episodes. On the other hand, voiding at any opportunity with low bladder volumes may lead urinary frequency and urgency issues. Frequent use of panty liners, pads and tampons to manage urinary incontinence, menses or vaginal discharge may increase the heat and moisture around the genital region, increasing the risk of genitourinary infections. Regular changes of sanitary items may also not be possible in the field due to the nature of the work or a lack of suitable toilet facilities. This further increases the risks of infection, and in the case of internal sanitary items like tampons, more serious sequelae such as toxic shock syndrome, which can be life-threatening.<sup>40</sup> In austere field environments, limited handwashing facilities may likewise increase the risks of infection. Moreover, avoidance of healthcare services may lead to recurrent or more serious genitourinary infections (i.e. pyelonephritis) or health issues. By understanding the common self-management approaches used by servicewomen and their risks, pragmatic prevention and management strategies can be developed and tested.

### Prevention and management strategies

Strategies for maintaining and managing pelvic floor health of servicewomen in the varied military workplace environments were not a primary focus for this review. However, the review findings demonstrated that a sizeable proportion of women in military roles experience pelvic floor dysfunction at work. Therefore, if military organisations can help servicewomen prevent and manage pelvic floor dysfunction to optimise their health and occupational performance, this warrants consideration and further research.

Improving pre-deployment 'women's health' programs is one recommended preventative measure,<sup>20</sup> and was tested in one study using a health promotion model. Trego and colleagues (2018) investigated the 'reach, effectiveness, adoption, implementation and maintenance of a pre-deployment female genitourinary health program'. The program objectives were to educate military women on challenges in maintaining pelvic floor health in austere environments, signs, symptoms and rates of common health issues, strategies for preventing problems and the use of valuable equipment such as female urinary diversion

devices (FUDD). The program was well-accepted by military units and implemented as instructed. Of the 1087 women eligible to participate, 41% chose to complete the education program. A decrease in diagnoses of common genitourinary conditions at an organisation level was seen 12 months after program implementation. At twelve months, many women continued to use the FUDD, but at an organisational level, 22 out of 35 units had no plans for continuing to use the program in their routine training. Therefore, women's health education programs may be beneficial in the short term for improving genitourinary health outcomes, but require organisational support for their implementation and maintenance.<sup>41</sup>

Some research has also been undertaken on prevention and management options for genitourinary infections. Self-diagnosis and management kits to overcome some of the factors limiting women from seeking health care for genitourinary symptoms in the field were developed, tested and found to be simple, accurate and well-accepted.<sup>42</sup> In addition, women were able to use them accurately with minimal training levels (20-minute video). The advantages of the kits were that they allowed women to quickly and discreetly diagnose genitourinary infections and commence management in a timely fashion with minimal use of healthcare resources. Early treatment may also prevent more severe complications and minimise potential occupational impacts.<sup>20</sup>

Education programs and self-management kits, such as those described above, are positive examples of the types of strategies that can be used by military organisations to prevent and manage pelvic floor dysfunction in female personnel, and further research in how to optimise their design and use is warranted. Other well-researched management strategies, such as pelvic floor muscle training, commonly used to treat pelvic floor dysfunction in the general female population, should also be considered when developing pragmatic, resource-efficient and effective prevention and management strategies for female military personnel.

### Limitations of the literature within the review

Female pelvic floor dysfunction incorporates a wide variety of health issues. A limitation of the available research reports included in this review is that they have only considered a limited number of conditions within pelvic floor dysfunction—urinary incontinence, pelvic organ prolapse and genitourinary infections. To enable a complete understanding of the pelvic health of female military personnel and

how it influences occupational performance, other conditions, such as anal incontinence, persistent pelvic pain, and sexual dysfunction also need to be considered in future research, as well as the co-existence of multiple pelvic health issues. Many of the available studies were over five years old and may not accurately represent contemporary military women and the wide variety of roles they undertake. No published data providing insights into the Australian military context, where the culture, resources and support provided might be different from those in other regions of the world, were found. The review was also unable to identify any available studies that could provide comparisons of female pelvic floor health between different Services.

### Conclusions

This narrative review is the first known review to broadly explore pelvic floor health in female military personnel by synthesising available research on prevalence, severity, risk factors, occupational impacts and self-management. From the limited volume of evidence available, pelvic floor dysfunction was commonly experienced by servicewomen. Environmental, equipment and cultural factors (particularly in austere field and deployed settings) were shown to present challenges for women in maintaining their pelvic health at work. In addition, behavioural factors associated with managing genitourinary function at work, such as altered voiding patterns and fluid restriction, posed risks to occupational health and safety. Some initial research into implementing organisational-based approaches to preventing and managing pelvic floor dysfunction in female military personnel has shown some positive results. By identifying and understanding female military personnel's pelvic floor health needs, risk mitigation strategies can be informed, and Defence force capability optimised.

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### References

1. Defence People Group. Women in the ADF report 2017 - 2018: A supplement to the Defence Annual Report 2017-2018. 2019.
2. Orr RM, Pope R, Coyle J, Johnston V. Occupational loads carried by Australian soldiers on military operations. *Journal of Health Safety and the Environment*. 2015;31(1):451-67.
3. AIHW. A profile of Australia's Veterans 2018. 2018;Cat. no. PHE 235(Canberra: AIHW.).
4. Epstein Y, Fleischmann C, Yanovich R, et al. Physiological and medical aspects that put women soldiers at increased risk for overuse injuries. *Journal of Strength & Conditioning Research*. 2015;29:S107-S10.
5. Nindl BC. Physical Training Strategies for Military Women's Performance Optimization in Combat-Centric Occupations. *Journal of Strength & Conditioning Research* 2015:S101-S6.
6. Haylen BT, De Ridder D, Freeman RM, Swift SE, Berghmans B, Lee J, et al. An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic floor dysfunction. *Neurourology & Urodynamics*. 2010;29:4-20.
7. Hawthorne G. Measuring incontinence in Australia. The Department of Psychiatry, The University of Melbourne. Department of Health and Ageing (DoHA). 2006.
8. Wilkins MF, Wu JM. Epidemiology of Pelvic Organ Prolapse. *Curr Obstetric Gynecol Rep*. 2016;5:119-23.
9. Poylin VY, Irani JL, Rahbar R, Kapadia MR. Rectal-prolapse repair in men is safe, but outcomes are not well understood. *Gastroenterology Report*. 2019;7(4):279-82.
10. Kidney Health Australia. Urinary Tract Infections. 2018.
11. Wu JM, Vaughan CP, Goode PS, Redden DT, Burgio KL, Richter HE, et al. Prevalence and Trends of Symptomatic Pelvic Floor Disorders in U.S. Women. *Obstetrics & Gynecology*. 2014;123(1):141-8.
12. Gyhagen M, Åkervall S, Milsom I. Clustering of pelvic floor disorders 20 years after one vaginal or one cesarean birth. *International Urogynecology Journal*. 2015;26(8):1115-21.
13. Uustal Fornell E, Wingren G, Kjolhede P. Factors associated with pelvic floor dysfunction with emphasis on urinary and fecal incontinence and genital prolapse: an epidemiological study. *Acta Obstet Gynecol Scand*. 2004;83(4):383-9.
14. Seshan V, Al Khasawneh E, Al Hashmi IH. Risk factors of urinary incontinence in women: a literature review. *International Journal of Urological Nursing*. 2016;10(3):118-26.
15. US Census Bureau. Percentage of childless women in the US, 2018. 2019.
16. Nygaard IE, Shaw JM. Physical activity and the pelvic floor. *Am J Obstet Gynecol*. 2016:164-71.
17. Bø K. Urinary incontinence, pelvic floor dysfunction, exercise and sport. *Sports Medicine*. 2004;34(7):451-64.
18. Teixeira RV, Colla C, Sbruzzi G, Mallmann A, Paiva LL. Prevalence of urinary incontinence in female athletes: a systematic review with meta-analysis. *International Urogynecological Journal*. 2018;29(12):1717-25.
19. Orr RM, Johnston V, Coyle J, Pope R. Reported Load Carriage Injuries of the Australian Army Soldier. *Journal of Occupational Rehabilitation*. 2015;25(2):316-22.
20. Steele N, Yoder LH. Military Women's Urinary Patterns, Practices, and Complications In Deployment Settings. *Urologic Nursing*. 2013;33(2):61-78.
21. Englert RM, Yablonsky AM. Scoping review and gap analysis of research related to the health of women in US Military, 2000-2015. *JOGNN: Journal of Obstetric, Gynecologic & Neonatal Nursing*. 2019;48:5-15.
22. Allen M. *The SAGE Encyclopedia of Communication Research Methods*. 2017.
23. Davis G, Sherman R, Wong MF, McClure G, Perez R, Hibbert M. Urinary incontinence among female soldiers. *Military Medicine*. 1999;164(3):182-7.
24. Davis GD, Goodman M. Stress Urinary Incontinence in Nulliparous Female Soldiers in Airborne Infantry Training. *Journal of Pelvic Surgery*. 1996;2(2):68-71.
25. Fischer JR, Berg PH. Urinary Incontinence in United States Air Force female crew. *Obstetrics & Gynecology*. 1999;94(4):532-6.

26. Larsen WI, Yavorek T. Pelvic prolapse and urinary incontinence in nulliparous college women in relation to paratrooper training. *International Urogynecological Journal*. 2007;18:769-71.
27. Lowe NK, Ryan-Wenger NA. Military women's risk factors for and symptoms of genitourinary infections during deployment. *Military Medicine*. 2003;168(7):569-74.
28. Wright Jr J, Albright TS, Gehrich AP, Dunlow SG, Lettieri CF, Buller JL. Pelvic Pain Presenting in a Combat Environment. *Military Medicine*. 2006;171(9):841-3.
29. AFHSC. Urinary tract infections, active component, U.S. Armed Forces, 2000-2013. *Medical Surveillance Monthly Report*. 2014;21(2):7-11.
30. Nygaard IE, Barber MD, Burgio KL, Kenton K, Meikle S, Schaffer J, et al. Prevalence of symptomatic pelvic floor disorders in US women. *JAMA: Journal of the American Medical Association*. 2008;300(11):1311-6.
31. Criner JA. Coping strategies by military women with stress urinary incontinence. 2008. p. 1-42.
32. Madhu C, Swift S, Moloney-Geany S, Drake MJ. How to use the Pelvic Organ Prolapse Quantification (POP-Q) system? *Neurourology and Urodynamics*. 2018;37(S6):S39-S43.
33. Woodman PJ, Swift SE, O'Boyle AL, Valley MT, Bland DR, Kahn MA, et al. Prevalence of severe pelvic organ prolapse in relation to job description and socioeconomic status: a multicenter cross-sectional study. *International Urogynecological Journal*. 2006;17(4):340-5.
34. Shaw JM, Nygaard IE. Role of chronic exercise on pelvic floor support and function. *Current Opinion in Urology*. 2017;27(3):257-61.
35. Nygaard IE, Shaw JM, Bardsley T, Egger MJ. Lifetime physical activity and pelvic organ prolapse in middle-aged women. *American Journal of Obstetrics and Gynecology*. 2014;210(5):477.e1-12.
36. Wilson C, Nelson JP. Exploring the Patterns, Practices, and Experiences of Military Women Who Managed Genitourinary Symptoms in Deployed Settings. *Journal of Obstetric, Gynecologic & Neonatal Nursing*. 2012;41(2):293-302.
37. Czerwinski BS, Wardell DW, Yoder LH, Connelly LM, Ternus M, Pitts K, et al. Variations in feminine hygiene practices of military women in deployed and noncombat environments. *Military Medicine*. 2001;166(2):152-8.
38. Pirotta MV, Garland SM. Genital Candida species detected in samples from women in Melbourne, Australia, before and after treatment with antibiotics. *J Clin Microbiol*. 2006;44(9):3213-7.
39. Xu J, Schwartz K, Bartoces M, Monsur J, Severson RK, Sobel JD. Effect of Antibiotics on Vulvovaginal Candidiasis: A MetroNet Study. *The Journal of the American Board of Family Medicine*. 2008;21(4):261-8.
40. ANSES. Opinion of the French Agency for Food, Environmental and Occupational Health & Safety on the safety of feminine hygiene products. French Agency for Food, Environmental and Occupational Health & Safety. ANSES Opinion Request No. 2016-SA-0108:1-21. 2018.
41. Trego LL, Steele NM, Jordan P. Using the RE-AIM Model of Health Promotion to Implement a Military Women's Health Promotion Program for Austere Settings. *Military Medicine*. 2018;183:538-46.
42. Ryan-Wenger NA, Lowe NK. Evaluation of Training Methods Required for Military Women's Accurate Use of a Self-Diagnosis and Self-Treatment Kit for Vaginal and Urinary Symptoms. *Mil Med*. 2015;180(5):559-64.