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Andrea M. Peters

Michael A. Washington

Lolita Burrell

James Ness

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Rethinking Female Urinary Devices for the US Army

Andrea M. Peters, Michael A. Washington, Lolita Burrell, and James Ness

Contributing Researchers

Sarah Morrow, Iris Yu, and Massimo Menguito

ABSTRACT: As women assume more combat roles in the US military and continue to operate in austere environments with varied mission sets, the Department of Defense must rethink its approach to equipment and uniform development to accommodate female anatomical differences. This article analyzes the results of a study conducted during the Sandhurst Military Skills Competition at the United States Military Academy to determine the effectiveness of commercial off-the-shelf products the Army has adopted to aid female urination—products used by competition participants that may not be the best or healthiest options for women.

Keywords: urology, female urinary diversion device, women, inclusion, combat

In 1943, the Women's Army Corps passed into law and allowed women to enlist or commission in the Army with all the rank, privileges, rights, and benefits of their male counterparts. Although legislation is a good start, the soldier archetype cannot be legislated. It is forged through the practices and traditions of the organization. While the Army has taken steps to transform the soldier archetype to include women, much room for improvement exists.

Army women, like men, must operate in uniforms, protective outer garments with weapons, hydration gear, and communication devices among predominately male peers and leaders. While uniform accommodations have been made for men concerning the location of the button fly on all trousers and the design of undergarments, current uniforms impede urination for women. As a result, women limit fluid intake to avoid the embarrassment of the common female stance (the squat position), and adjust their tolerance level of privacy and discretion.¹ Experts have observed in austere environments with

1. Anne L. Naclerio et al., "The Concerns of Women Serving in the Afghanistan Theater of Operations," *Military Medicine*, White Paper (2011), <https://www.globalsecurity.org/military/library/report/2011/womens-concerns-afghanistan.pdf>; and Nancy Steele and Linda H. Yoder, "Military Women's Urinary Patterns, Practices, and Complications in Deployment Settings," *Urologic Nursing* 33, no. 2 (March–April 2013), <https://doi.org/10.7257/1053-816X.2013.33.2.61>.

limited facilities and close proximity to others, the common female stance is humiliating, dangerous, and hard to accomplish.²

Although limiting fluid intake allows Army women to restrict the need to urinate in the field, they face potential health consequences such as the risk of urinary tract infections, incontinence, vaginitis, and other infections of the urethra and possibly the kidneys.³ The Program Executive Office Soldier and the Natick Soldier Systems Center recognized these health threats and provided a commercial off-the-shelf solution: female urinary diversion devices (FUDDs), which became available in the Government Services Administration inventory around 2015 or 2016 as women were being filtered into combat arms positions once coded for men. This exciting development started with cultural support teams who augmented special operations units to fill the critical limiting gap of leveraging Afghan women in the fight against Islamic extremism in Afghanistan.⁴ Research also points to sustaining the inclusion of women in combat arms as more evidence reveals the “band of brothers” contrived exclusions have no merit.⁵ Still, relatively few resources and little attention have been paid to the issue of female urination or the equipment hastily accepted to deal with the long-standing problem.

The Freshette and Shewee urinary devices offered solutions to the problems experienced by females in the field. They were added in response to good customer reviews from the outdoor adventurer community and had not been systematically tested for ground troops in military field training or deployed conditions to validate their effectiveness or level of acceptance.⁶ The Freshette was previously studied by military personnel as a solution for aviators and a way to reduce the damaging effects of limiting fluid intake and delaying fluid voiding.⁷

2. Nancy M. Steele, “A Female Urinary Diversion Device for Military Women in the Deployed Environment” (Bethesda, MD: Uniformed Services University, 2016).

3. Elodi J. Dielubanza and Anthony J. Schaeffer, “Urinary Tract Infections in Women,” *Medical Clinics of North America* 95, no. 1 (January 2011), <https://doi.org/10.1016/j.mcna.2010.08.023>; Armed Forces Health Surveillance Center (AFHSC), “Urinary Tract Infections during Deployment, Active Component, U.S. Armed Forces, 2008–2013,” *Medical Surveillance Monthly Report* 21, no. 3 (March 2014); Carla Hawley-Bowland, “Lady J” and “Freshette Complete System”: *A Field Trial for the Active Duty Woman* (El Paso, TX: William Beaumont Army Medical Center, 1995); and “Urinary Tract Diseases and Conditions Stress Urinary Incontinence: Study Findings from David L. Howard et al. Provide New Insights into Stress Urinary Incontinence (Complications of Sling Surgery for Stress Urinary Incontinence among Female Military Beneficiaries),” (Atlanta, 2018).

4. Ellen Haring, review of *Ashley's War: The Untold Story of a Team of Women Soldiers on the Special Ops Battlefield*, by Gayle Tzemach Lemmon, *Parameters* 45, no. 2 (Summer 2015).

5. Lena P. Kvarving, review of “Beyond the Band of Brothers: The US Military and the Myth That Women Can't Fight,” by Megan Mackenzie, *Internasjonal Politikk* 74, no. 2 (2016).

6. Lijing Wang et al., “Anthropometric Measurements of the Female Perineum for Design of the Opening Shape of Urination Device,” *International Journal of Industrial Ergonomics* 46 (March 2015): 29–35, <https://doi.org/10.1016/j.ergon.2015.01.004>; and Hawley-Bowland, “Lady J” and “Freshette”; and Department of Defense (DoD), “Defense Department Advisory Committee on Women in the Service (DACOWITS) 2009 Meeting Minutes,” website, <https://dacowits.defense.gov/Reports-Meetings/2009-Minutes/>.

7. Steele and Yoder, “Military Women's Urinary Patterns”; Hawley-Bowland, “Lady J” and “Freshette”; and Victoria Tepe et al., “Women in Combat: Summary of Findings and a Way Ahead,” Supplement, *Military Medicine* 181, no. S1 (January 2016): S109–18, <https://doi.org/10.7205/MILMED-D-15-00409>.

A 2012–16 survey that analyzed the Freshette with a sample size of 94 deployed military women during Operation Enduring Freedom resulted in the recommendation of implementing this FUDD for use in austere environments.⁸ While the study provided much-needed data on one model, further research and discussion were needed to understand the importance of these devices when integrating women into all dimensions of Army life.

Based on the sustainment of women in combat arms positions, our research team evaluated these commercial off-the-shelf products for their ability to facilitate easy and comfortable female urination and sustain combat effectiveness. As a doctoral candidate at the University of Miami, Lieutenant Colonel Andrea Peters conducted a series of studies on female urination in austere environments with an eye toward transforming policy into practice. Her research affirmed prior work that identified this topic as a key concern for women in both combat and support services.

Her findings revealed urinary aids influenced the reduction of urological infections, however, female soldiers and Army leaders lacked awareness and education on the benefits of these devices.⁹ These results propelled the study team to understand why there is a lack of education and employment and how the team could apply human systems integration to improve urogynecological health and mental well-being, thus making women more effective teammates. The goals of the Sandhurst study were to build on previous studies, take them a step further by outlining empirical evidence to influence and develop device-use policies, provide a standard for future product analysis, and to serve as a model for the design and development of products that will better meet the needs of female servicemembers in a variety of operational environments.

Policy Background

Women have officially served in the US Army with equal benefits and protections since July 1943 under the Women's Army Corps and have trained and aided in all types of Army units in limited capacities from the Medical Service Corps to special operations.¹⁰ These limited military occupational specialties excluded women from combat arms roles and branches like infantry, armor, and field artillery. While the early 1990s saw the expansion of women's roles in the military, including serving on combatant ships and piloting combat aircraft, the Military Leadership Diversity Commission observed women were still marginalized due in part to long-held assumptions

8. Steele, "Female Urinary Diversion Device"; Steele and Yoder, "Military Women's Urinary Patterns."

9. Andrea Peters, "Female Urination in Austere Environments: A Mixed Methods Analysis" (PhD diss., University of Miami, 2020), 53–57 and 106.

10. "History," Women in the Army, accessed May 16, 2020, <https://www.army.mil/women/history/>.

that women would negatively affect unit cohesion and were more prone to physical and mental limitations in combat.¹¹ In March 2009, the Defense Advisory Committee on Women in the Services discussed the policy limiting the roles of women in combat arms, the individual experiences of the soldiers, and the implications of changing these roles. Attendees, both officer and enlisted, argued women were already serving in combat and the role limitations only caused divisions within units that are supposed to thrive on cohesion.¹²

In the process of reviewing legislation, policy, and perceptions of the operational environment, the Military Leadership Diversity Commission discovered the lack of both empirical data correlating female fitness requirements and battlefield performance and supporting research on the increase of female mental-health issues when compared to male servicemembers.¹³ When Sergeant Leigh Ann Hester stood her ground in a firefight in Iraq (she later earned the Silver Star for her achievement) and the female engagement teams and combat support teams made impactful gains in Afghanistan, the military and the US government were reminded of the combat potential of women.¹⁴ The women's actions and accomplishments served as the impetus for the Army to examine how it might provide opportunities for women to serve in combat roles.

In 2013, the Department of Defense opened all Army branches to women, and in December 2015, another historic decision opened all combat roles previously coded male to women.¹⁵ In 2016, Acting Secretary of the Army Patrick J. Murphy demonstrated the new policy also represented a shift in the attitude of military leadership. He stated, to the Army and the world, that women are capable of performing every job in the Army to the highest standards. He also recognized the critical role leaders hold in integration.¹⁶

The Army's change in policy and attitude necessitated updates to infrastructure, regulations, education, and practices to integrate women fully into the Army. Although conceptually realized, the updates and implementations were—and are—slow due to a lack of attention, budget limitations, and time

11. Military Leadership Diversity Commission (MLDC), *Women in Combat: Legislation and Policy, Perceptions, and the Current Operational Environment*, Issue Paper no. 56 (Washington, DC: MLDC, 2010), <https://www.hsdl.org/?view&did=716213>.

12. DoD, "DACOWITS 2009 Meeting Minutes."

13. MLDC, *Women in Combat*.

14. Sean McClain Brown, "7 Bad-ass Women Who Made Military History," Military.com, <https://www.military.com/history/7-bad-ass-women-who-made-military-history.html>.

15. "History," Women in the Army; and C. Todd Lopez, "Army Describes Plans for Integrating Women into Combat," US Army, June 19, 2013, https://www.army.mil/article/105814/army_describes_plans_for_integrating_women_into_combat.

16. J. D. Leipold, "Army Reveals Plan to Fully Integrate Women into All MOSs, Combat Units," US Army (website), March 22, 2016, https://www.army.mil/article/161770/army_reveals_plan_to_fully_integrate_women_into_all_moss_combat_units.

constraints. Women, however, still face the problem of how to urinate in the field safely and effectively. While the inclusion of women in combat has renewed conversations on the subject, women across multiple force sustainment branches (formerly combat service support branches) have dealt with the lack of equipment for their most basic needs. These concerns arose as early as 1775 when women served unofficially as cooks and nurses in the Revolutionary War.¹⁷ Health-care officials serving during Operation Enduring Freedom testified to the lack of urinary accommodations for women on foot marches and convoy missions—and even in unit base designs.¹⁸

A safe and practical method of urination has been a primary concern of female servicemembers for decades. While the Army has shifted its attitude toward women in combat, it has failed to address the fundamental role female urinary safety plays in fully integrating women into the ranks. Thus, the following sections evaluate the FUDDs the Army has already approved to assess their effectiveness.

Materials and Methods

The study team leveraged the United States Military Academy autumn squad lane competition, referred to as Sandhurst, to address the lack of systematically focused field tests regarding female urination tools and practices. The annual competition consists of 36 teams, with approximately one female cadet on each team. The teams face challenges that closely mimic real combat scenarios.

Female participants were informed of the study and participated in an information session where they could ask questions and handle the devices. The women returned for a second session where they could ask more questions, pick up devices (Freshette and Shewee), and select operational camouflage trousers of their choice—either the unisex trouser traditionally issued to men and women or the alternate more formfitting trouser with elastic in the waistband and a shorter button fly. Participants were also asked to consent formally to the study, though this step was not required by the institutional review board.¹⁹

A total of 16 women, ranging between 18 to 22 years old, picked up devices; 15 women returned the devices after the competition, and 14 women completed the closeout survey. Additionally, to provide more insight to Army leaders, the study team carefully analyzed pre- and post-swabs of the devices to determine the propensity of bacteria growth and the resulting implications.

17. "History," Women in the Army.

18. Steele and Yoder, "Military Women's Urinary Patterns."

19. Karen Peck, e-mail message to Lieutenant Colonel Andrea Peters, October, 10, 2019.

Variables

Prior to Sandhurst, the female cadets selected either the Freshette device or the Shewee device. The outcome variables below were measured via a survey using a Likert scale to understand the women's attitudes and opinions toward the new devices.

- Overall satisfaction
- Design
- Ease of use
- Ease of cleaning
- Ease of storage
- Carrying case
- Durability
- Size
- Color
- Compatibility with unisex trouser
- Compatibility with alternate trouser

The scale consisted of seven response options ranging from extremely satisfied to extremely dissatisfied. The seven options allowed a midpoint of neutrality and a more straightforward approach to removing incomplete and inaccurate information due to system or respondent errors.²⁰

Field Use: Sandhurst Military Skills Competition

On October 18, 2019, study participants began the competition in tactical formations for an 18- to 24-hour grueling competition. The Sandhurst Military Skills Competition dates to 1967 when the Royal Military Academy Sandhurst exchange officer presented the United States Military Academy with a British officer's sword to use as a competition prize. Academy leadership, eager to provide the corps of cadets with a regimental-skills competition that would enhance professional development and military excellence in basic soldier skills, developed the competition with the award being the British officer's sword.²¹ Upon inception, the goal was to train and compete to enhance teamwork and to shoot, move, and communicate effectively in combat situations.²²

Each competition area tests a different aspect of small-team combat operations and creates stress to stretch the participants—just like combat missions do in a deployed environment. The lanes and events include functional fitness, the M9 pistol range, the M203 grenade-launcher range, zodiac water course, land navigation, bivouac, night tactical road march, obstacle course, leader's reaction

20. Gail M. Sullivan and Anthony R. Artino, "Analyzing and Interpreting Data from Likert-Type Scales," *Journal of Graduate Medical Education* 5, no. 4 (2013): 541–42, <https://doi.org/10.4300/JGME-5-4-18>.

21. "Sandhurst Competition," Wikipedia, the Free Encyclopedia (website), last modified December 2017, https://en.wikipedia.org/wiki/Sandhurst_Competition; and Chris Ophardt and Brandon O'Connor, "2021 Seven Things to Know about Sandhurst," United States Military Academy, March 26, 2021, <https://www.westpoint.edu/news/2021-seven-things-know-about-sandhurst>.

22. "Sandhurst Competition."

course, rifle marksmanship, call for fire, combat swimming, and a burden—a small-team, critical-thinking event that also called for strength and agility.²³ Upon completion of the competition, 15 participants returned devices to the study team to analyze the pre- and post-bacterial activity on the devices and extension tubes using Mueller-Hinton agar plates divided into fours and cotton-tipped swabs soaked in Luria-Bertani (LB) media (most common medium to grow bacteria) to swab each device and inoculate the dishes. The dishes were incubated for 24 hours, and microscans were completed to identify bacteria, if present.

Survey Results

The survey results yielded an overall positive response, ranging between extreme dissatisfaction and extreme satisfaction and revealing room for improvement of the devices. Specifically, 50 percent of the respondents were moderately satisfied with the overall device, design, and durability; however, 57.15 percent indicated they were between slightly satisfied to slightly dissatisfied in the ease of storage. A total of 76.92 percent of the respondents wanted improvements in the carrying case. The Freshette came in a plastic bag that was too small to handle effectively when urine coated the device, and the Shewee had no ventilation for the case.

Additionally, the responses revealed more negative opinions when using the devices with the operational camouflage trousers. Seven women (58 percent) were in the midrange of opinion when using the device with the unisex trouser and four women (57 percent) when using the alternate trouser. Participants expressed mostly negative opinions about the ease of cleaning, with 43.34 percent ranging between slightly satisfied to moderately dissatisfied. Their responses indicated a need or desire to wash these devices and more guidance on how to do so effectively. The Likert scale responses were confirmed through qualitative responses and analyzed through affinity clustering. Analysis revealed nine out of 14 (64 percent) women washed their devices by rinsing with sink water, flushing with canteen water, or using soapy water. The graphical representation of the female Sandhurst competitors' satisfaction levels in figure 1 (below) provides a visual representation of the opinion data.

23. Ophardt and O'Connor, "2021 Seven Things."

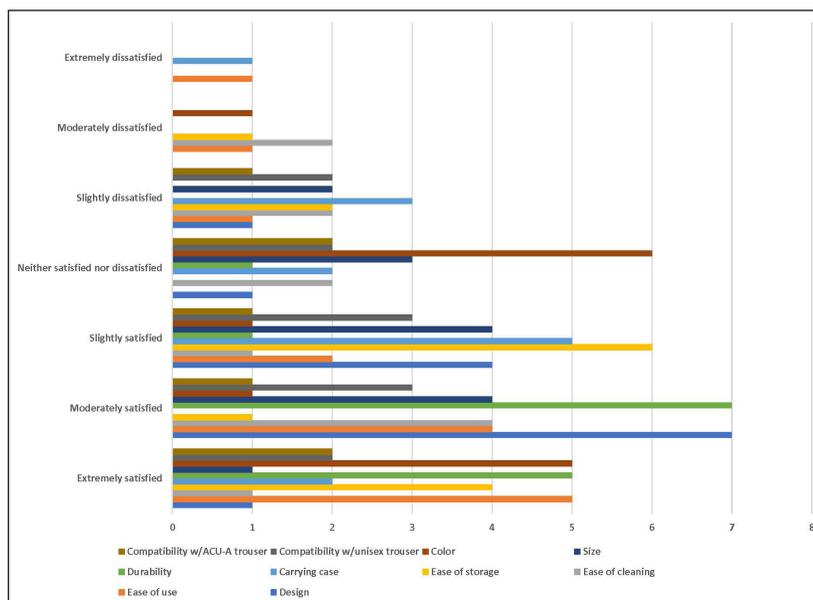


Figure 1: Respondent Satisfaction Scale

Figure 1 confirms the primarily positive response of having the urinary aid. It also shows the range of opinions and indicates there is room for improvement to adapt the devices specifically for military use. The affinity clustering of the survey's qualitative data revealed requirements for the resizing of the collection cup and spout angle due to the urine splash and cup compromise, developing a carrying case for ease of storage, altering trouser design due to limited anatomical access, using proper cleaning solutions, and providing education due to the current lack of availability.²⁴

The preliminary swabbing of the Shewee tube resulted in one colony forming unit consistent with *Staphylococcus* spp., while post-swabbing of the devices revealed more interesting and concerning results.²⁵ The post-microbial swabbing occurred for eleven Freshette devices and four Shewee devices upon completion of the competition. The resulting number of device types were based on the women choosing the device they liked best or were most comfortable using. The results revealed one Freshette device with possible *Lactobacillus* (normal female bacteria flora) species of 1000x gram stain and another device with possible gram-positive *Corynebacterium* (a normal skin bacterium). The most concerning findings were discovered on one Freshette and one Shewee device. A 1000x gram stain on a blood agar plate, revealed possible *Proteus* spp. (swarming bacterial species), a common cause of urinary-tract infections.²⁶ The microscan confirmed the

24. Peters, "Female Urination Austere Environments."

25. Peters et al., "Detection Potential Pathogenic Bacteria."

26. Peters et al., "Detection Potential Pathogenic Bacteria."

presence of the swarming bacteria and further analysis revealed the bacterium also forms biofilms. The most concerning finding was the identification of *Proteus mirabilis* isolates resistant to tetracycline, piperacillin/tazobactam, and aztreonam while the other isolate was only resistant to tetracycline.

Implications for Integration

Genuine integration and equity occur gradually within organizations as psychosocial change must strike a balance with existing physical support systems. Integrating women into the military is similar; however, the understanding and updating of tools, policies, and procedures to meet the needs of the female anatomy have been seriously neglected. The Freshette and Shewee devices seem to answer the long-standing concern of how to facilitate female urination in austere environments by providing a tool pioneered by and designed for outdoor adventurers.

The Army must reevaluate the efficacy of these devices for soldiers as military women are deployed operationally. Thus, the one-size-fits-all approach will not work as an enduring solution due to time constraints and varied mission sets ranging from foot marches to mounted tasks. The Sandhurst study helped provide attitudes and opinion data concerning the FUDDs and illuminated the possibility of resulting infections from device usage, thereby posing a major concern for open and free use of FUDDs without redesign or specific education on proper sanitation. In particular, the devices must be reevaluated for basin size, spout angle, carrying case accessibility, and, most importantly, for proven antimicrobial features. Currently, the limited cup volume can cause urine to splash or sit on the body causing moisture-associated skin damage and irritation.²⁷

Additionally, both the unisex trousers and the alternative trousers complicate usage since neither account for the position of female anatomy. If the Army deems it more feasible to maintain the current General Services Administration inventory devices and trousers, leadership can consider a twofold approach that will allow quick wins and the ability to protect and enhance the female force while working toward the broader goal of a more-inclusive Army culture. The approach must address policy and procedural changes from the larger Army perspective and most important, this cultural shift will happen because lower-level Army leaders buy into the concept and its execution.

27. Mikel Gray, "Incontinence-Related Skin Damage: Essential Knowledge," *Wound Management & Prevention* 53, no. 12 (December 2007).

Recommendations for the Army

The following recommendations for the Army will help update policy and procedures to aid in female inclusivity and safety as a forethought—not an afterthought.

- Provide all female soldiers with a urinary diversion device.
- Update the *Common Table of Allowance* 50-900, *Clothing and Individual Equipment*, and the *Organizational and Clothing Individual Equipment* lists to reflect the issuance of the urinary devices that can be replaced every two years based on need.
- Update packing lists to include these devices as an inspectable item.
- Provide natural cleaning wipes and spray with every issued urinary device and allow the reissue of these expendable items throughout the year.
- Teach women in basic training about the devices and proper vaginal and urinary-tract care in garrison and in less-than-ideal environments.
- Update current *Field Hygiene and Sanitation*, Training Circular 4.02-3, to educate the force, both males and females, on urinary-tract infections, their development, their possible impact, their treatment, and their prevention.²⁸
- Normalize the use of urinary aids for women and for all military members in cold-weather climates to afford a more expedient and safer means to urinate in dangerous temperatures. The aid may even be a useful tool for both sexes for nuclear, biological, and chemical situations, but research must be done to validate this assumption.

The above recommendations meet the Army where it currently stands and will help the service prepare for the 15 percent female force that continues to populate previously male-coded positions. The Army's return to combined-arms maneuver and wide-area security, combined with the increased number of women within combat positions, requires a strategic approach to providing the appropriate tools and equipment for women in these environments. Furthermore, the recommended steps highlight the fact that bacteria inhabit all regions of the world, and bacteria are a perennial threat for military forces during training and deployments regardless of sex.²⁹ The reexamination of female needs and desires

28. Headquarters, Department of the Army (HQDA), *Field Hygiene and Sanitation*, Training Circular 4-02.3 (Washington, DC: HQDA, 2015).

29. Peters et al., "Detection Potential Pathogenic Bacteria."

will ultimately provide force multiplication and reduce the unnecessary cognitive and physical load on women, their teams, and their leaders.

Although the above top-level recommendations are for the Army, command teams can also influence education and change in the psychosocial approach to female urination tools and procedures. As previously stated, cultural changes cannot be legislated; instead, they must be adopted and implemented within organizations. For a fully inclusive Army culture to take root, Army leaders must embody a broader perspective and command style. This shift in perspective will also alter behaviors and influence positivity to the lowest ranks as more cohesive and supportive teams are crafted and nurtured.

Army Leader Recommendations

The points below are a continuation of recommendations specific to Army leaders to help them influence cultural and cognitive shifts in perspective. The assumption is the uniform and current equipment resources remain constant. Leaders can begin the shift by ensuring unit surgeons, medics, and lower-level leaders of both sexes are educated on the use and care of devices. Because of the nonautomatic nature of acquiring FUDDs, leaders will need to purchase these devices from the General Services Administration inventory to ensure female servicemembers have adequate tools to lessen the safety concerns of urination in austere environments and ease inconvenience.

Once Army leaders are trained and devices are received, units must:

- Provide in-depth use and cleaning instructions for females within the formation
- Educate leaders on the proper integration within the formation to lessen the negative stigma some women have experienced concerning the use of an assistance device.
- Educate users on the varied uses within hardstand latrines, mobile latrines, and open-field conditions.
- Educate or reinforce the user's knowledge on vaginal health and the proper care of the device.

- Account for all team members when a tactical stop is integrated into movement plans and plan for female urination which includes personal and device sanitation. These stops will take longer for females with or without urination aids. Leader time hacks should account for the frequency and the length of time needed for the entire team whether in training or executing a real-world mission.

Conclusion and the Study's Broader Significance

The full breadth of the study team's research, not just Sandhurst, revealed alarming issues concerning women, urinating, urination devices, and the attitudes of male counterparts. Although the specific examples below deal with urination situations, the occurrences paint a bigger picture of the state of the Army's prevailing male dominance mindset.

A participant during the preliminary research studies revealed how she was forced to urinate between two vehicles in the middle of a busy road in Iraq, responding jokingly that half of Iraq had seen her bare backside. Though amusing, what impact could this situation have had culturally on how Iraqis view Americans and furthermore, women? There were accounts of a woman taking tactical pauses with her unit and the unit leaving her behind, not realizing she was still urinating due to being out of sight from teammates.³⁰ In a real-world mission, this woman could have found herself left behind and cut off from her team in potentially dangerous territory. In casual conversations, some cadets have mentioned comments made by male counterparts of "you want to pee like a man," or "what is that" as the woman is urinating that precede excuses like "it was just a joke and you're being emotional."³¹ Additionally, when women were asked how they feel about urinating in close proximity to men, most replied they were uneasy and embarrassed but have "sucked it up and drove on."³²

The latter mindset is why women have been successful in the military and specifically the Army. Their desire to succeed and their resilience in operating within a noninclusive culture propels them forward. While females continue to seek success by any means available, the Army has been slow to provide structurally safe opportunities as revealed by the comments provided above and others revealed in previous studies.

If the military is serious about executing the *Army People Strategy*, leadership must recognize the achievement of strategic goals such as readiness,

30. Peters, "Female Urination Austere Environments."

31. Jacob E. Ziadeh, capstone meeting with Lieutenant Colonel Andrea Peters, January 2021.

32. Peters, "Female Urination Austere Environments."

diversity, professionalism, and full integration will require the Army to acknowledge the key role women play whether that acceptance includes providing more command opportunities or better accommodation of urination needs.³³ By exploring an often-ignored subject, the study team revealed the lack of full-system integration concerning clothing, equipment, tools, and most importantly, people. The study engaged qualitatively and quantitatively, showing the lack of resources crafted for women, including Army attempts to fit commercial-off-the-shelf devices to female soldiers, which violates proper user-focused design thinking. The study also exposes the psychological gaps in understanding and execution as related to women fitting into an organizational system designed for men that has not been redesigned for the needs of women. Redesigning does not equate to lowering standards or weakening the approach. Instead, redesign will enhance a unit's combat effectiveness.

Future research can help support enhanced readiness by examining the impact of field environments on the female system. Building on the work outlined in this article, future researchers should consider examining the effects of dehydration on the female system, delayed and/or restricted voiding and the effects on the female body, how to improve uniform design for urination and defecation in the field, FUDD sanitation, menstruation in austere environments while using the FUDD or another aid, and other health areas that could enhance or potentially hinder female performance during operations. Additionally, small-team dynamics or interoperability should be studied to provide data points of successes and areas for improvement psychosocially concerning the addition of female members in previously all-male units. Further evaluation will create a better understanding of the natural areas of integration and the more challenging areas that may need additional support in shifting the perspectives and attitudes of both men and women to foster a climate of trust, understanding, and dependability.

Although the Freshette and Shewee devices give Army women an alternative option to the common female stance they should not be considered an end to the conversation about female urination in the military. As this study shows, both devices may be susceptible to swarming bacterium that also causes biofilms and is resistant to some urinary-tract infection antibiotic medications due to its gram-negative composition. These findings and recommendations are the start to more in-depth research and how leadership can provide Army women with a better, more reliable solution that will not inhibit their combat effectiveness. The translation of this research into actionable strategies for effective cleaning, user instructions, device and uniform alterations, and Army personnel education

33. "Army People Strategy," US Army, accessed January 26, 2022, <https://people.army.mil/>.

is an example of how the military should approach new tools, equipment, and clothing with an eye to the full integration of female soldiers.

Andrea M. Peters

Lieutenant Colonel Andrea M. Peters, US Army, serves in the United States Military Academy Department of Behavioral Sciences and Leadership. She holds a bachelor of science degree in mechanical engineering FOS aerospace engineering from the United States Military Academy, a master of science degree in business administration from the University of Phoenix, a master of science degree in civil engineering from Missouri University of Science & Technology, and a PhD in industrial engineering FOS human factors engineering from University of Miami.

Michael A. Washington

Lieutenant Colonel Michael A. Washington, US Army, serves in the United States Military Academy Department of Chemistry and Life Science. He holds bachelor of science and master of science degrees in biological sciences from California State University, East Bay and a PhD in emerging infectious disease from the Uniformed Services University of the Health Sciences.

Lolita Burrell

Lieutenant Colonel Lolita Burrell, US Army, serves in the United States Military Academy Department of Behavioral Sciences and Leadership. She holds a bachelor of science degree in psychology from Delaware State University and a PhD in medical psychology from the Uniformed Services University of the Health Sciences.

James Ness

Colonel James Ness, US Army, serves in the United States Military Academy Department of Behavioral Sciences and Leadership. He holds a bachelor of science degree in experimental psychology from the Florida Institute of Technology and a master of science degree and PhD in developmental psychology from Virginia Polytechnic Institute.

Contributing Researchers

Sarah Morrow

Second Lieutenant Sarah Morrow, US Army, was an engineering psychology major in the United States Military Academy Department of Behavioral Sciences and Leadership and a member of the class of 2020.

Iris Yu

Second Lieutenant Iris Yu, US Army, was an engineering psychology major in the United States Military Academy Department of Behavioral Sciences and Leadership and a member of the class of 2020.

Massimo Menguito

Cadet Massimo Menguito is a chemistry major in the United States Military Academy Department of Chemistry and is a member of the class of 2022.

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