

Association of workplace toilet access with urinary tract symptoms and productivity loss among female workers

Yu Min LEE¹, Jae Yoon KIM², Hyoungseob YOO³ and Mo-Yeol KANG^{3*}

¹Department of Occupational and Environmental Medicine, Severance Hospital, Yonsei University College of Medicine, Republic of Korea

²Department of Urology, Sanggye Paik Hospital, Inje University College of Medicine, Republic of Korea

³Department of Occupational and Environmental Medicine, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Republic of Korea

Received September 9, 2024 and accepted January 14, 2025

Published online in J-STAGE January 23, 2025

DOI <https://doi.org/10.2486/indhealth.2024-0160>

Abstract: This study investigated workplace toilet access related to lower urinary tract symptoms (LUTS) among women in the Korean workforce. A cross-sectional survey was conducted to determine demographic characteristics, occupational risk factors, and urinary tract symptoms among employed Korean women. Occupational risk factors included two survey questions about access to toilets at work. LUTS were assessed using the overactive bladder symptom score (OABSS) and international consultation on incontinence questionnaire-urinary incontinence short form (ICIQ-SF). Health-related productivity losses (HRPL) were estimated using the work productivity and activity impairment questionnaire for urinary symptoms (WPAI-US). Multiple logistic regression was used to determine the association between workplace toilet access and LUTS. In addition, generalised linear regression analysis was performed to assess HRPL according to workplace toilet access. Of the 1057 participants, 260 (24.6%) and 294 (27.81%) had overactive bladder and urinary incontinence, respectively. More than 50% reported poor access to toilet. Multiple logistic regression analysis showed that the lower the access to toilets in the workplace, the higher the incidence of LUTS and the higher HRPL. In conclusion, restricted access to toilets at work are associated with poor urinary health and loss of productivity.

Key words: Toilet facilities, Urinary bladder, Overactive, Urinary incontinence, Workplace, Productivity

Introduction

To access and use toilet facilities without restriction is not only a matter of human dignity but is also crucial for maintaining good health¹. Restricted access to toilets may

conceivably place individuals at risk for lower urinary tract symptoms (LUTS). Women are more prone to LUTS due to physiological factors such as a shorter urethra and hormonal changes during menstruation, pregnancy, and menopause². These challenges could be further exacerbated by workplace barriers, including insufficient toilet facilities, lack of privacy, and limited breaks, especially in male-dominated industries where workforce planning often neglects women's basic needs. Nevertheless,

*To whom correspondence should be addressed.

E-mail: snaptoon@naver.com

©2025 National Institute of Occupational Safety and Health

in many workplaces, toilet issues are often viewed as a minor grievance, thereby shifting the responsibility onto individuals rather than addressing them as problem within the working environment. Recently, problems related to the use of toilets by female workers have been revealed in various industries and occupations, such as construction, service, manufacturing, and transportation³⁻⁵. More than 1 in 10 full-time working women reported consistent deprived access toilets at their workplace even in the United States⁴.

LUTS comprise various clinical manifestations, including storage symptoms like urinary incontinence (UI), urgency, frequency, nocturia, and emptying symptoms such as slow urine flow, intermittent urination, urinary hesitancy, urinary retention, terminal dribble, feelings of incomplete bladder emptying, and other indicative urological symptoms⁶. These symptoms can have a significant impact on daily activities and health-related quality of life as well as impose significant economic burdens on individuals, healthcare systems, and the society⁷. Individuals with LUTS are likely to experience urinary symptoms even at work⁸, particularly in settings with limited access to toilets, which can make symptom management difficult⁹. While suppressing the urge to urinate is a normal physiological and social response, recurring postponed voiding may increase bladder discomfort, urgency, and incontinence¹⁰. Thus, urinary symptoms may be induced or influenced by bladder practices adopted to manage LUTS or normal urinary urges, depending on the role requirements and workplace environment¹¹.

Previous studies have addressed the impact of workplace environments on urinary health, particularly among women. For instance, research has shown that restricted toilet access is associated with increased risks of urinary incontinence and urgency among female healthcare workers¹² and service industry employees¹⁰. Additionally, study in the United States have linked low occupational control over toilet use with a higher prevalence of LUTS⁴. Despite these findings, most studies have focused on single occupations or limited settings, providing insufficient insight into the broader working population.

Moreover, prevailing evidence suggests that female workers with LUTS are substantially less productive because of lack of concentration, performing physical tasks, and managing time¹³. Restrictions on toilet access at work may also contribute to work productivity impairments¹⁴. Despite this, most studies on this topic have not evaluated toilet access in terms of labour productivity loss.

In South Korea, approximately 66% of women aged

40 and older experience LUTS¹⁵, and this prevalence increases to 77.2% among employed women¹⁶. With the aging workforce, the prevalence of LUTS among working women is expected to rise significantly over time¹⁷. Given this increasing prevalence of LUTS among female workers, it is important to investigate the influence of workplace factors on urinary health. In this context, therefore, our study investigates the relationship between workplace toilet access and LUTS among female workers. Additionally, we also sought to investigate whether women with restricted their toilet usage at work reported a higher degree of productivity loss from absenteeism and presenteeism.

Methods

Survey participants were recruited in November 2022 via an online survey platform. The study population was selected based on specific inclusion and exclusion criteria. Participants had to be employed women between the ages of 19 and 70, and those outside of this range were excluded. This online survey was performed based on the panel of those who voluntarily participated in this survey. A total of 1,057 participants completed the initial screening process at baseline. Participants were required to provide complete answers to questions designed to gather the necessary information in order to be included in the study.

We designed a quantitative questionnaire based on a literature review to identify occupational factors of urologic health problems in working women. The survey consisted of demographic information (e.g. age, job categories, and workplace characteristics where toilet are not available), risk factors for urological symptoms (drug history, surgical history, menopause, and experience of childbirth), toilet access in the workplace, causes of toilet restrictions (Response to why I couldn't get to the toilet when I needed to use it at work last week: Too busy, Lack of replacement manpower, Far away from workplace, Insufficient number of toilet seats, Dirty toilet hygiene, and others), urological symptoms, and labour productivity.

Occupational risk factors included two survey questions about access to toilets at work: A) 'I cannot go to the toilet at will during my shift'; and B) 'At least once during my workday in the past week, I wanted to go to the toilet but could not'.

LUTS were determined using the overactive bladder symptom score (OABSS) and international consultation on incontinence questionnaire-urinary incontinence short form (ICIQ-SF), which have been widely used in the literature¹⁸. The severity of LUTS associated with overactive

bladder (OAB) was assessed using the OABSS, developed and validated in the Japan¹⁹⁾. The relevance and reliability of the Korean version of the OABSS have been previously verified²⁰⁾. We defined the group with OAB symptoms as a total OABSS of 3 or more with an urgency score of 2 or more for Question 3. UI was assessed using the ICIQ-SF tools. The assessment included three items with scores (amount, frequency, and overall impact on quality of life) and an additional item for the self-diagnosis of urine leakage. The total score is obtained by adding the responses to the three items, resulting in a score ranging from 1 to 21. We defined the group with UI symptoms as those with an ICIQ-SF greater than or equal to 5. The Korean version of the ICIQ-SF used in this study was developed and validated by the Korean Society of Urinary Incontinence with permission from Dr. Nikki Cotterill, the author of the English version²¹⁾. The translation process followed standardized procedures, including linguistic adaptation and internal validation, and the final version was published through the ICIQ website after review by the ICIQ committee. This pre-validated version ensures reliability and comparability with the original English version.

Health-related productivity losses (HRPL) were assessed using the work productivity and activity impairment questionnaire for urinary symptoms (WPAI-US). The WPAI includes six questions that reflect decline in work productivity among currently employed workers²²⁾. Absenteeism, one of the reductions in productivity, refers to the extent to which workers are absent from work. This is calculated as the percentage of working hours during which workers were unable to come to work due to health problems over the past 7 d. Presenteeism, another indicator of productivity loss, is defined as going to work but experiencing impairment due to health problems. Lastly, HRPL was defined as the extent to which worker was absent from work or had significant impairment in performing normal work due to health problems in the past 7 d. HRPL was calculated by adding together absenteeism and presenteeism.

Demographic and occupational characteristics of participants were presented as numbers, percentages, means, and standard deviations. Multiple logistic regression analysis was performed to examine the association between workplace toilet access and urinary symptom outcomes. A literature search was performed to identify risk factors associated with symptom outcomes, and select age, job category, drug history, surgery history, menopausal, and multiparous as covariates for inclusion in the adjusted model. In addition, generalised linear regression

analysis was performed to identify the association between workplace toilet access and HRPL. Further, we conducted a stratified analysis by presence or absence of LUTS to reflect the impact of LUTS. Because there may be an interaction between LUTS and toilet access with respect to worker productivity, we stratify to exclude the moderating effect of LUTS on the effect of toilet access on worker productivity. All statistical analyses were performed using the SAS statistical software (version 9.4; SAS Institute Inc., Cary, NC, USA).

Results

The participant characteristics are described in Table 1. Among the 1,057 participants, the mean age was 41.26 yr. Among the participants, 260 (24.6%) had overactive bladder symptoms and 294 (27.81%) had UI, showing different distributions according to the covariates (Table 1). Additionally, 144 participants (13.62%) have both overactive bladder symptoms and urinary incontinence (not shown).

When asked to select the primary reason for toilet restrictions, the most common response was being too busy (55%), followed by lack of substitute personnel when needing to use the toilet (14%) (Fig. 1). Moreover, when asked about the typical workplace setting as a factor that makes it difficult to use the toilet, the most common setting was the customer's workplace, followed by working in a cold or hot place, and working in the transportation sector (Fig. 2).

The association between workplace toilet access and LUTS was analysed using a multiple logistic regression analysis. Level of toilet access restrictions at work (Question a) was positively associated with LUTS (OAB, *p* for trend=0.0007; UI, *p* for trend <0.0001). Also, those who wanted to go to the toilet but could not (Question b), showed a positive odds ratio for LUTS compared to those who could go when they wanted [OAB (OR: 2.58; 95% CI, 1.88–3.54), UI (OR: 2.06; 95% CI, 1.53–2.78)] (Table 2).

Table 3 shows the mean differences in productivity losses according to toilet access at work. The model included age, job category, which may account for occupational environmental factors, and factors that may affect urinary health (drug history, surgery history, menopausal status, and whether women had multiple births) as covariates. Then, the results were presented as% point. Compared to individuals who had not restrictions to the toilet at work, those with restrictions had a higher productivity loss, ranging from 6.67% point for those who rarely had restricted

Table 1. Participant characteristics and lower urinary tract symptoms

	Total sample, number (%)	Overactive bladder symptom, number (%)	Urinary incontinence symptom, number (%)
Total	1,057	260	294
Age (yr)	41.26 ± 10.74		
20–29	193 (18.26)	50 (19.23)	45 (15.31)
30–39	248 (23.46)	56 (21.54)	54 (18.37)
40–49	375 (35.48)	102 (39.23)	130 (44.22)
50–59	175 (16.56)	38 (14.62)	46 (15.65)
60+	66 (6.24)	14 (5.38)	19 (6.46)
Drug history*			
Yes	154 (14.57)	70 (26.92)	76 (25.85)
No	903 (85.43)	190 (73.08)	218 (74.15)
Surgery history†			
Yes	155 (14.66)	61 (23.46)	64 (21.77)
No	902 (85.34)	199 (76.54)	230 (78.23)
Menopause			
Yes	175 (16.56)	34 (13.08)	45 (15.31)
No	882 (83.44)	226 (86.92)	249 (84.69)
Experiences of childbirth			
Yes	438 (41.44)	110 (42.31)	140 (47.62)
No	619 (58.56)	150 (57.69)	154 (52.38)
Job categories			
Higher administrator occupations	9 (0.85)	1 (0.38)	3 (1.02)
Professionals and related workers	25 (2.37)	5 (1.92)	11 (3.74)
Clerical occupation	389 (36.8)	82 (31.54)	106 (36.05)
Sales occupation	119 (11.26)	28 (10.77)	30 (10.2)
Service occupation	281 (26.58)	80 (30.77)	81 (27.55)
Skilled worker	52 (4.92)	12 (4.62)	10 (3.4)
Semi-skilled worker	27 (2.55)	10 (3.85)	8 (2.72)
Unskilled worker	144 (13.62)	39 (15)	41 (13.95)
Agricultural, forestry and fishery worker	11 (1.04)	3 (1.15)	4 (1.36)
Toilet access in workplace			
(A) I cannot go to the toilet at will during my shift.			
Never	489 (46.26)	86 (33.08)	96 (32.65)
Rarely	322 (30.46)	89 (34.23)	97 (32.99)
Usually	165 (15.61)	56 (21.54)	64 (21.77)
Often	67 (6.34)	23 (8.85)	28 (9.52)
Always	14 (1.32)	6 (2.31)	9 (3.06)
(B) At least once during my workday in the past week, I wanted to go to the toilet but couldn't.			
No	512 (48.44)	76 (29.23)	101 (34.35)
Yes	545 (51.56)	184 (70.77)	193 (65.65)

*Diuretics, antidepressants, painkillers, etc.

†Incontinence surgery, lower abdominal and pelvic lumen surgery, uterine surgery, vaginal surgery, etc.

access, to 25.59% point for those who always lacked access. Similar trends were observed for individuals who wanted but were unable to access a toilet in the past week, showing a higher productivity loss of 10.98% point. The stratified analysis shows the association between toilet re-

strictions and HRPL in the group with LUTS compared to the group without LUTS (See middle and right sections of Table 3). Associations between restricted toilet access and HRPL were more consistent among female workers with LUTS than without LUTS. In supplementary analyses,

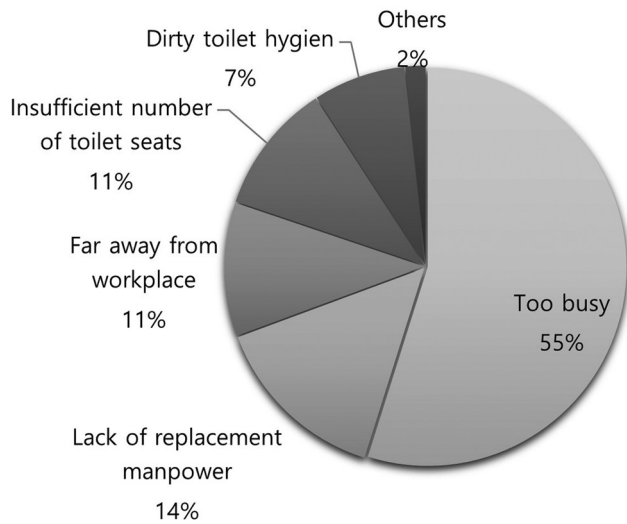


Fig. 1. Response to why I couldn't get to the toilet when I needed to use it at work last week among total 545 participants.

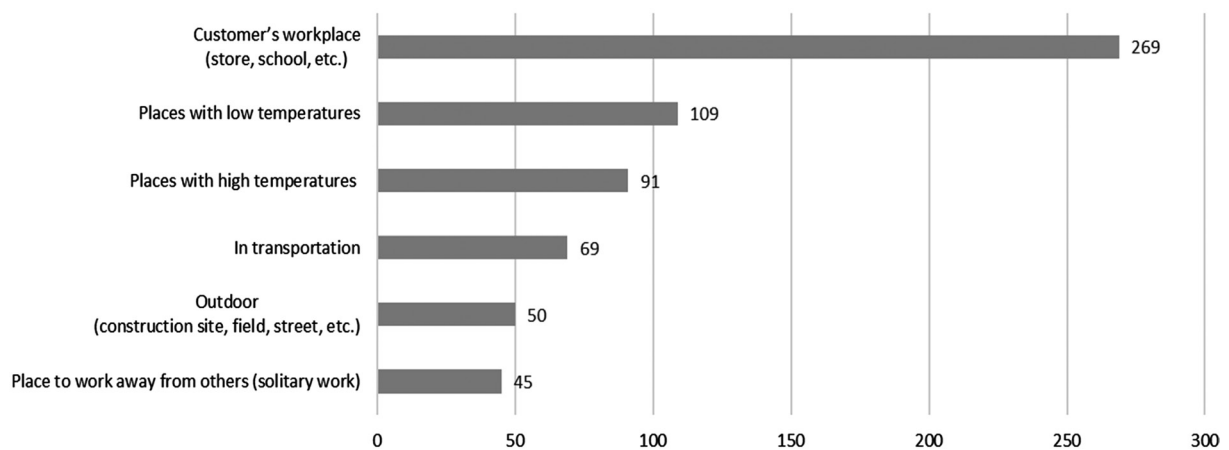


Fig. 2. Occupational environment where toilet is not available.

Table 2. Association between workplace toilet access and urinary symptoms

	Overactive bladder symptoms			Urinary incontinence symptoms		
	Adjusted OR*	95% CI		Adjusted OR*	95% CI	
(A) I cannot go to the toilet at will during my shift.						
Never	(ref)			(ref)		
Rarely	1.662	1.167	2.366	1.824	1.293	2.571
Usually	1.926	1.26	2.942	2.326	1.538	3.518
Often	1.911	1.047	3.486	2.925	1.636	5.228
Always	2.513	0.772	8.177	7.857	2.376	25.98
	<i>p for trend =0.0007</i>			<i>p for trend <0.0001</i>		
(B) At least once during my workday in the past week, I wanted to go to the toilet but couldn't.						
No	(ref)			(ref)		
Yes	2.579	1.879	3.540	2.063	1.533	2.776

*Adjusted; age, job category, drug history, surgery history, menopausal, and multiparous.

OR: Odds ratio.

the association between LUTS and HRPL was examined within different groups of female workers whose access to toilets varied. HRPL due to LUTS was gradually increased as toilet access was more restricted.

Discussion

In this study on the Korean female workforce, restrictions on toilet use at work were significantly associated with an increased risk of LUTS. Moreover, restrictions on toilet use at work reduced labour productivity due to urinary symptoms through increased absenteeism and presenteeism.

Our findings are consistent with previous studies that have demonstrated an association between restricted toilet access and increased prevalence of LUTS¹⁸⁾. For example,

Table 3. Mean differences of health-related productivity loss due to urinary symptoms according to toilet access (Unit: percent point)

	Total			LUTS			No LUTS		
	HRPL	95% CI		HRPL	95% CI		HRPL	95% CI	
(A) I cannot go to the toilet at will during my shift.									
Never	(ref)			(ref)			(ref)		
Rarely	6.67	1.80	11.54	6.20	−0.83	13.23	1.36	−3.20	5.93
Usually	18.73	12.56	24.90	17.87	9.51	26.23	7.23	0.49	13.97
Often	14.60	5.84	23.36	15.36	3.71	27.00	−0.02	−9.63	9.59
Always	25.59	7.44	43.74	32.66	8.83	56.49	−1.54	−21.44	18.36
(B) At least once during my workday in the past week, have you wanted to go to the toilet but couldn't.									
No	(ref)			(ref)			(ref)		
Yes	10.98	7.86	14.09	9.54	4.97	14.11	4.79	1.93	7.64

Unit: percent point.

Estimated by generalized linear model and contrast to reference (Never or No).

Analytic model was adjusted by age, job category, drug history, surgery history, menopausal, and multiparous.

LUTS: Lower urinary tract symptoms; HRPL: health-related productivity loss.

female employees of a large academic medical centre in the United States were surveyed to examine their bladder health and toileting behaviours¹⁰). Among the 182 women who participated in the survey, those who delayed urination for extended periods while at work reported increased odds of urinary urgency (AOR=7.85, 95% CI=1.57–39.24). When the risk factors for UI were examined among women working full-time in the United States⁴), approximately 11% of the 3,062 women reported using the toilet only occasionally or never at work, which was associated with urinary urgency (AOR=1.39, 95% CI=1.04–1.86), stress incontinence (AOR=1.33, 95% CI=1.01–1.76), and UI (AOR=1.52, 95% CI=1.18–1.94). In a study of 66 nurses and 67 controls in 5 nephrology centres in Brazil¹²), nurses were stationed in the dialysis rooms where toilets and water supplies were unavailable in the dialysis rooms, and only water bottles were allowed in nurse workspaces in compliance with infection control regulations. As a result, the prevalence of burning sensation (50% vs. 27%, $p<0.001$), urgency (42% vs. 21%, $p<0.001$), and infection (42% vs. 25%, $p=0.04$) was higher among nurses than control group participants. Moreover, a study conducted in Taipei reported that low occupational control related to toilet use was associated with UI (AOR=2.20, 95% CI=1.37–3.52) among female primary school teachers²³). Beyond these studies, our research broadens the scope by examining diverse occupation, revealing that restricted toilet access and its impact on LUTS and productivity loss are widespread across various job roles and workplace environments, not limited to specific occupational settings.

Workers with restricted toilet access at work may be less

productive due to a combination of factors that include the inability to concentrate, perform physical activities, or complete tasks without interruption. This is supported by findings from various studies. In a USA household survey of 3,364 employed women, as the severity of UI increased, so did the impact on employees' ability to concentrate⁹). Similarly, another American study involving 2,876 male and 2,876 female employees aged 40–65 yr found that OAB was linked to decreased work productivity, specifically highlighting concentration difficulties as a key issue²⁴). Additionally, an Australian study on female nurses and midwives aged 21–67 yr showed that UI notably reduced their ability to concentrate and manage time, further emphasizing the crucial link between urinary health and cognitive function in the workplace²⁵). Compounding these work-based bladder health issues, behaviours such as “waiting too long to urinate at work” can exacerbate nurses' urinary urgency, leading to frequent toilet visits and an inability to focus²⁶). A meta-analysis also underlined that female workers with LUTS faced a significantly higher risk of impaired work productivity, primarily due to concentration and time management issues¹³). Our study adds to this body of evidence by supporting the relationship between restricted toilet access, urinary symptoms, and the resulting impact on job performance within the Korean female working population.

It is necessary to understand the reason for the toilet problems of female workers, which are commonly experienced across various occupations. These could be attributed to several factors¹⁸), including the absence of a usable toilet designated for female workers; inadequate

installation of a sufficient number of toilets in the workplace; lack of provision of proper areas, facilities, sanitation, and safety environment; or insufficient time allocated due to extreme labour demands. Moreover, barriers to toileting can also be ascribed to the job-specific activities of working women. For instance, present findings suggest that working in hot/cold environments, extremely low job autonomy, and working in a closed dust-proof suit can hinder the ability to use toilets when necessary.

Toilet use at work can be summarised as a matter of space, time, and autonomy. When assessing the conditions and environment regarding toilet usage, 'time' is a crucial factor, in addition to the physical 'space' of the toilet within the workplace. In a labour environment with a general lack of workforce, workers do not have enough time to rest and address basic physiological needs during work hours. In this study, more than half of female workers attribute the reasons for restrictions on toilet use to being 'too busy'. Furthermore, breaks during work were arranged to be markedly short, and the right to adequate rest was not guaranteed, making it difficult to use the toilet by creating long waiting times²⁷). 'Autonomy' for one's own labour is another important force that improves access to use by self-adjusting working hours. Among the study participants, the customer's workplace (Door-to-door sales, door-to-door tutors, etc.) was the most commonly mentioned occupational environment in which toilets were unavailable (Fig. 2). Under these conditions, workers may respond in ways that control their body, causing maladaptive behaviour to manage their need to urinate by reducing their fluid and caffeine intake or wearing absorbent products to prevent accidents^{18, 27}).

This study is limited by its cross-sectional design, which prevented causal inferences. In addition, information on symptoms and exposure was gathered using self-administered questionnaires. This method relies on the accuracy of the respondent's memory and is susceptible to non-response and recall biases. Specifically, the restriction on toilet access at work was operationally assessed using unstructured queries. Consequently, the responses provided only contextual information and not objective assessment. Strengths of this study include the similarity of our sample's demographic profile to that of the total female workforce in Korea with a variety of occupations, which increases the likelihood that our sample was roughly representative.

In conclusion, restricted access to toilets at work are associated with poor urinary health and loss of productivity. This has been a neglected health concern, but should

be prioritised for an aging workforce, considering that the prevalence of LUTS increases with age. Fortunately, however, toileting access is modifiable in most cases, and the concomitant work impairments suggested by these findings may be preventable. From an occupational health perspective, restricted toilet access should be viewed as an organizational issue rather than an individual inconvenience. Experts in occupational health emphasize that providing adequate toilet facilities, time for their use, and autonomy is fundamental to promoting worker well-being and preventing conditions such as LUTS. Moreover, the observed productivity losses, driven by both absenteeism and presenteeism, highlight the potential organizational costs of neglecting basic physiological needs in workplace design and management. These findings support the need for employer-driven interventions, such as policy adjustments and infrastructure improvements, to enhance accessibility to toilet at work. At the national level, policymakers should consider incorporating workplace standards for toilet access and hygiene into labour regulations, ensuring that employers provide adequate facilities, time for their use, and autonomy. Future research should explore the effectiveness of such interventions in reducing LUTS and improving labour productivity.

Funding

This work was supported by the National Research Foundation of Korea [NRF-2022R1F1A1066498].

Ethics Statement

Before data collection, all participants provided written informed consent, and anonymity and confidentiality were assured. The study protocol was approved by the Institutional Review Board of the Catholic University College of Medicine (approval no. KC21QISI0562).

Data Sharing

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions

MYK conceived and designed the study. YML analysed the data. All authors were involved in interpreting the results and discussion. YML and MYK drafted the

manuscript. All authors reviewed, approved, and agreed to submit the final version of the manuscript for publication.

Conflict of Interest

All authors declare no competing interests.

References

- 1) World Health Organization (2019) WHO Water, Sanitation and Hygiene Strategy 2018–2025, World Health Organization, Geneva.
- 2) van Geelen H, Sand PK (2023) The female urethra: urethral function throughout a woman's lifetime. *Int Urogynecol J* **34**, 1175–86.
- 3) Markland A, Chu H, Epperson CN, Nodora J, Shoham D, Smith A, Sutcliffe S, Townsend M, Zhou J, Bavendam T, Prevention of Lower Urinary Tract Symptoms (PLUS) Research Consortium (2018) Occupation and lower urinary tract symptoms in women: a rapid review and meta-analysis from the PLUS research consortium. *Neurourol Urodyn* **37**, 2881–92.
- 4) Reynolds WS, Kowalik C, Delpe SD, Kaufman M, Fowke JH, Dmochowski R (2019) Toileting behaviors and bladder symptoms in women who limit restroom use at work: a cross-sectional study. *J Urol* **202**, 1008–14.
- 5) Choi B, Kim JH, Yoon J, Lee H, Kim SS (2022) Health disparities among workers with standing position and limited restroom access: a cosmetics saleswomen study in South Korea. *Int J Health Serv* **52**, 174–82.
- 6) Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, van Kerrebroeck P, Victor A, Wein A (2002) The standardisation of terminology of lower urinary tract function: report from the Standardisation Sub-committee of the International Continence Society. *Am J Obstet Gynecol* **187**, 116–26.
- 7) Agarwal A, Eryuzlu LN, Cartwright R, Thorlund K, Tammela TLJ, Guyatt GH, Auvinen A, Tikkinen KAO (2014) What is the most bothersome lower urinary tract symptom? Individual- and population-level perspectives for both men and women. *Eur Urol* **65**, 1211–7.
- 8) Irwin DE, Milsom I, Kopp Z, Abrams P, Cardozo L (2006) Impact of overactive bladder symptoms on employment, social interactions and emotional well-being in six European countries. *BJU Int* **97**, 96–100.
- 9) Fultz N, Girts T, Kinchen K, Nygaard I, Pohl G, Sternfeld B (2005) Prevalence, management and impact of urinary incontinence in the workplace. *Occup Med (Lond)* **55**, 552–7.
- 10) Palmer MH, Willis-Gray MG, Zhou F, Newman DK, Wu JM (2018) Self-reported toileting behaviors in employed women: are they associated with lower urinary tract symptoms? *Neurourol Urodyn* **37**, 735–43.
- 11) Palmer MH, Athanasopoulos A, Lee KS, Takeda M, Wyndaele JJ (2012) Sociocultural and environmental influences on bladder health. *Int J Clin Pract* **66**, 1132–8.
- 12) Nerbass FB, Santo CE, Fialek EV, Calice-Silva V, Vieira MA (2021) Female nurses have a higher prevalence of urinary tract symptoms and infection than other occupations in dialysis units. *J Bras Nefrol* **43**, 495–501.
- 13) Lin KY, Siu KC, Lin KH (2018) Impact of lower urinary tract symptoms on work productivity in female workers: a systematic review and meta-analysis. *Neurourol Urodyn* **37**, 2323–34.
- 14) Pierce H, Perry L, Chiarelli P, Gallagher R (2016) A systematic review of prevalence and impact of symptoms of pelvic floor dysfunction in identified workforce groups. *J Adv Nurs* **72**, 1718–34.
- 15) Yoo TK, Lee KS, Sumarsono B, Kim ST, Kim HJ, Lee HC, Kim SH (2018) The prevalence of lower urinary tract symptoms in population aged 40 years or over, in South Korea. *Investig Clin Urol* **59**, 166–76.
- 16) Lee YJ, Park J (2023) Sex differences in lower urinary tract symptoms of Korean workers: prevalence, mental health, and associated factors. *Prev Med Rep* **36**, 102470.
- 17) Irwin DE, Kopp ZS, Agatep B, Milsom I, Abrams P (2011) Worldwide prevalence estimates of lower urinary tract symptoms, overactive bladder, urinary incontinence and bladder outlet obstruction. *BJU Int* **108**, 1132–8.
- 18) Yoo H, Kim JY, Lee YM, Kang MY (2023) Occupational risk factors associated with lower urinary tract symptoms among female workers: a systematic review. *Occup Environ Med* **80**, 288–96.
- 19) Homma Y, Yoshida M, Seki N, Yokoyama O, Kakizaki H, Gotoh M, Yamanishi T, Yamaguchi O, Takeda M, Nishizawa O (2006) Symptom assessment tool for overactive bladder syndrome—overactive bladder symptom score. *Urology* **68**, 318–23.
- 20) Jeong SJ, Homma Y, Oh SJ (2011) Korean version of the overactive bladder symptom score questionnaire: translation and linguistic validation. *Int Neurourol J* **15**, 135–42.
- 21) Avery K, Donovan J, Peters TJ, Shaw C, Gotoh M, Abrams P (2004) ICIQ: a brief and robust measure for evaluating the symptoms and impact of urinary incontinence. *Neurourol Urodyn* **23**, 322–30.
- 22) Reilly MC, Zbrozek AS, Dukes EM (1993) The validity and reproducibility of a work productivity and activity impairment instrument. *Pharmacoeconomics* **4**, 353–65.
- 23) Liao YM, Dougherty MC, Biemer PP, Liao CT, Palmer MH, Boyington AR, Connolly A (2008) Factors related to lower urinary tract symptoms among a sample of employed women in Taipei. *Neurourol Urodyn* **27**, 52–9.
- 24) Sexton CC, Coyne KS, Vats V, Kopp ZS, Irwin DE, Wagner TH (2009) Impact of overactive bladder on work productivity in the United States: results from EpiLUTS. *Am J Manag Care* **15** Suppl, S98–107.
- 25) Pierce H, Perry L, Gallagher R, Chiarelli P (2018) Severity of urinary incontinence and its impact on work productivity

- among nurses and midwives in urban Australia. *Aust N Z Cont J* **24**, 7–15.
- 26) Wan X, Wu C, Xu D, Huang L, Wang K (2017) Toileting behaviours and lower urinary tract symptoms among female nurses: a cross-sectional questionnaire survey. *Int J Nurs Stud* **65**, 1–7.
- 27) Hartigan SM, Bonnet K, Chisholm L, Kowalik C, Dmochowski RR, Schlundt D, Reynolds WS (2020) Why do women not use the bathroom? Women's attitudes and beliefs on using public restrooms. *Int J Environ Res Public Health* **17**, 2053.