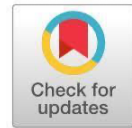


Effectiveness of a Genital Hygiene E-Guide in Improving Knowledge, Attitudes, and Practices Related to Urinary Tract Infection Prevention Among Adolescent Girls



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ABSTRACT

Urinary tract infections (UTIs) are common among adolescent girls and are strongly associated with anatomical characteristics and inadequate genital hygiene practices. Digital educational interventions may improve preventive health behaviors by enhancing knowledge, attitudes, and hygiene practices. This study aimed to evaluate the effectiveness of a genital hygiene e-guide on knowledge, attitudes, and practices related to urinary tract infection prevention among adolescent girls. A quasi-experimental one-group pretest-posttest study was conducted among 32 female students in a senior high school selected through purposive sampling in Blora Regency, Indonesia. Participant received a web-based genital hygiene e-guide, and knowledge, attitudes, and practices were assessed using a structured questionnaire before and after the intervention. Paired t-tests were performed with a significance level of $p < 0.05$, 95% confidence interval, and effect sizes were calculated using Cohen's d . Following the intervention, significant improvements were observed in knowledge (47.19 ± 8.13 vs. 94.38 ± 6.19), attitude (51.75 ± 7.39 vs. 91.16 ± 3.09), and practice (49.38 ± 6.19 vs. 91.72 ± 2.79) (all $p < 0.001$). Very large effect sizes were observed for knowledge ($d = 6.53$), attitudes ($d = 6.96$), and practices ($d = 7.98$). In conclusion, the genital hygiene e-guide is highly effective in improving knowledge, attitudes, and practices among adolescent girls. This digital-based intervention has strong potential as a promotive and preventive strategy to reduce the risk of UTIs and can be utilized as an accessible health education tool in school settings. Further controlled studies with larger populations are warranted to confirm these findings.

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INTRODUCTION

Urinary tract infections (UTIs) are one of the most common bacterial infections affecting females worldwide and remains a major public health concern across all age groups. Approximately 50–60% of women experience at least one episode of UTI during their lifetime, with adolescents girls being particularly vulnerable because of anatomical, hormonal, and behavioral factors that facilitate bacterial colonization of the urinary tract. In Indonesia, reproductive and urinary tract health problems among adolescent girls continue

to receive considerable attention due to high prevalence of inadequate genital hygiene practices and limited reproductive health literacy. These findings highlight the importance of preventive interventions targeting adolescent girls to reduce the burden of UTIs.(1) Anyone can get a urinary tract infection (UTI), but females are at greater risk due to anatomical and physiological factors, including a shorter urethra that facilitates bacterial entry into the urinary tract.(2) Poor genital hygiene increases the likelihood of bacterial contamination of the urethra and contributes to the development of lower urinary tract symptoms, including dysuria, urinary frequency, and suprapubic pain.(3–5) Consequently, improving preventive behaviors among adolescent girls is essential to reduce the burden of UTIs and promote reproductive health.

Adolescence is characterized by substantial physical, psychological, and social changes that influence health-related behaviors, including inadequate genital hygiene practices. During this developmental period, adolescent girls begin to independently manage menstrual and genital hygiene, yet many continue to demonstrate inadequate hygiene practices because of insufficient knowledge, misconceptions, embarrassment when discussing reproductive health, and limited access to accurate health information. Poor genital hygiene remains a common reproductive health concern among adolescent girls. An Indonesian cross-sectional study reported that 48.8% of adolescent girls practiced poor genital hygiene, while another study found that 23.6% experienced symptoms suggestive of urinary tract infection (UTI). These findings indicate that inadequate genital hygiene and UTI-related symptoms remain common among Indonesian adolescents, underscoring the need for effective school-based health education interventions.(6) In addition, unhealthy behaviors such as delaying urination, inadequate fluid intake, inappropriate perineal cleansing techniques, and improper menstrual hygiene management further increase susceptibility to urinary and reproductive tract infections.(4,5)

Health education is therefore a fundamental strategy for improving adolescents' knowledge, attitudes, and preventive behaviors related to genital hygiene.(3) Numerous studies indicate that inadequate knowledge and negative attitudes regarding genital hygiene correlate with a heightened prevalence of UTI symptoms in adolescent girls.(7) So, educational interventions are a key part of efforts to stop bad things from happening. Digital-based educational methods, such as e-learning and e-guides, have become increasingly popular due to their flexibility and accessibility. Compared with conventional face-to-face education, digital media allow adolescents to access educational materials repeatedly at their own pace while maintaining privacy when learning about sensitive reproductive health topics. The e-guide includes practical information on proper genital hygiene, UTI prevention, and self-assessment activities, which may enhance adolescents' knowledge, attitudes, and hygiene practices.(7) Such characteristics make e-guides particularly suitable for promoting genital hygiene practices among adolescent girls.

Although digital health education has demonstrated positive effects on adolescent health literacy, there is a paucity of research specifically investigating the efficacy of e-guides in enhancing genital hygiene practices as a preventive strategy for UTIs among adolescent girls, particularly within Indonesian school environments.(8) Most prior research has concentrated on traditional educational methodologies or general e-learning approaches. However, reproductive health education in schools often remains limited by insufficient instructional time, students' discomfort in discussing sensitive topics, and restricted access to reliable information. As a result, adolescents may continue to exhibit inadequate genital hygiene practices despite existing educational efforts. Furthermore, previous interventions have rarely explored practical, self-paced e-guide media specifically designed for genital hygiene education, highlighting the need for more accessible and targeted educational strategies.(9) This gap underscores the necessity for research to assess the efficacy of e-guides as a medium for adolescent reproductive health education.

Therefore, this study aimed to evaluate the effectiveness of a web-based genital hygiene e-guide in improving knowledge, attitudes, and genital hygiene practices among adolescent girls as a strategy for urinary tract infection prevention. The findings are expected to provide evidence supporting the integration of digital educational media into school-based reproductive health promotion programs and contribute to the development of accessible preventive interventions for adolescent reproductive health.

METHOD

This study employed a quasi-experimental one group pre-test post-test design to evaluate the effectiveness of a web-based genital hygiene e-guide in improving urinary tract infection (UTI) prevention behaviors among adolescent girls. A control group was not included because the intervention was undergoing preliminary evaluation prior to larger-scale implementation.⁽¹⁰⁾ The study was conducted at a Senior High Schools (SMA) in Blora Regency, Central Java, Indonesia between January and December 2025. The participants were 32 female students in grades X–XI, aged 15–18 years who were recruited using purposive sampling. The sample represented all students who met the eligibility criteria and agreed to participate during the study period. Inclusion criteria were female adolescents who had experienced menarche, were willing to participate by providing written informed consent, were able to access the web-based e-guide using a personal digital device and attended all study activities. Students with diagnosed chronic urogenital disorders, those currently receiving treatment for urinary tract infections, or those who failed to complete the intervention or post-intervention questionnaire were excluded. Information regarding previous exposure to genital hygiene education was also collected to describe participant characteristics. No participants withdrew from the study; therefore, complete data from all 32 participants were included in the final analysis. The intervention consisted of a web-based genital hygiene e-guide containing educational materials on genital hygiene concepts, urinary tract infection risk factors, proper hygiene practices, and prevention strategies. The e-guide was delivered in a text-and-image format and was accessed independently by participants over a one-week period. Participants were allowed to access the materials from home using their personal devices. To encourage engagement, reminder messages were sent periodically during the intervention period. Participant adherence was monitored through access records and completion of the educational materials before the post-test assessment. The intervention occurred during a structured educational session facilitated by the researcher, while respondents independently accessed the e-guide. A structured self-administered questionnaire was used to assess knowledge, attitudes, and genital hygiene practices before and after the intervention. The questionnaire consisted of three domains: knowledge (20 items), attitudes (12 items), and practices (15 items). Knowledge and practice items were scored dichotomously (correct = 1, incorrect = 0), whereas attitude items were rated using a four-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree). Raw scores for each domain were transformed to a standardized 0–100 scale using the formula:

$$\text{Standardized score} = (\text{Observed score} / \text{Maximum possible score}) \times 100$$

Higher scores indicating better knowledge, more positive attitudes, and more appropriate genital hygiene practices.

The questionnaire was developed based on the literature regarding genital hygiene and urinary tract infection prevention and was reviewed by experts to establish content validity before data collection. Content validity was evaluated by experts in maternal and adolescent reproductive health before data collection. The instrument was subsequently pilot tested among adolescents with characteristics similar to those of the study participants. Internal consistency reliability was evaluated using Cronbach's alpha, with a coefficient of ≥ 0.70 considered acceptable for research purposes.

Data were analysed using IBM SPSS Statistics version 25 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize participant characteristics and outcome variables. Continuous variables were presented as means and standard deviations, whereas categorical variables were reported as frequencies and percentages.

The normality of continuous variables was assessed using the Shapiro–Wilk test before inferential analysis. Because all outcome variables met the assumption of normality, differences between pre- and post-intervention scores were analysed using paired *t*-tests. Statistical significance was established at $p < 0.05$ with 95% confidence intervals (95% CI). To quantify the magnitude of the intervention effect, Cohen's *d* effect sizes were calculated based on the standardized mean difference between pre- and post-intervention scores and interpreted according to conventional criteria (0.2 = small, 0.5 = medium, and 0.8 = large).

This study was approved by the Health Research Ethics Committee of Poltekkes Kemenkes Semarang (Ethical Approval No. 1032/EA/F.XXIII.38/2025). Written informed consent was obtained from all participants before enrolment. Participant confidentiality and anonymity were maintained throughout the study by using coded identification numbers and securely storing all research data. Participation was voluntary, and participants were informed of their right to withdraw from the study at any time without academic or personal consequences.

RESULTS

Baseline Characteristics of Participants

The baseline characteristics of the participants are presented in Table 1. The mean age of the participants was 16.72 ± 0.63 years, ranging from 16 to 18 years, while the mean age at menarche was 9.72 ± 1.17 years, with a range of 8–12 years.

Table 1. Baseline Demographic Characteristics of the Participants (n=32)

Variable	Mean $\pm$ SD	Min-max
Age	16.72	16 – 18
Age of Menarche	9.72	8 – 12

Baseline Genital Hygiene and Urinary Habits

The baseline behavioural characteristics related to genital hygiene and urinary habits are presented in Table 2. Nearly half of the participants (43.8%) reported routinely holding urine, while 68.8% had not yet practiced appropriate genital hygiene. Regarding fluid intake, 50.0% consumed less than 1.8 L of water per day.

Genital health complaints were common among the participants. Vaginal discharge was reported by 31.3%, dysuria by 21.9%, and both vaginal discharge and dysuria by 15.5%, whereas 31.3% reported no genital complaints. The most frequently reported occurrence of genital complaints was once per month (40.6%).

These baseline findings indicate that a considerable proportion of participants exhibited behaviours potentially associated with an increased risk of urinary tract infection prior to the intervention.

Table 2. Baseline Genital Hygiene Practices, Urinary Habits, and Genital Health Characteristics of the Participants (n=32)

Variable	Frequency	Percentage (%)
Holding urine-habit		
No	18	56.2
Yes	14	43.8
Total	32	100
Genital Hygiene Practice		
Correct	11	34.3
Incorrect	21	65.7
Total	32	100

Variable	Frequency	Percentage (%)
Water Consumption		
>2 Liter	4	12.5
1,8 – 2 Liter	12	37.5
<1,8 Liter	16	50
Total	32	100
Genital Disorder		
No disorder	10	31.3
Vaginal discharge	10	31.3
Dysuria	7	21.9
Vaginal Discharge and Dysuria	5	15.5
Total	32	100
Frequency of complaints		
0 times/month	12	37.5
1 times/month	13	40.6
2 times/month	7	21.9
>2 times/month	0	0
Total	32	100

Association Between Genital Hygiene Practices and Genital Complaints

The association between genital hygiene practices and genital complaints is presented in Table 3. Participants with inappropriate genital hygiene practices experienced genital complaints more frequently than those who practiced appropriate genital hygiene. Statistical analysis demonstrated a significant association between genital hygiene practices and the occurrence of genital complaints ($p < 0.001$). These findings indicate that inadequate genital hygiene practices were significantly associated with genital health complaints among adolescent girls.

Table 3. Association Between Genital Hygiene Practices and Genital Health Complaints Among Participants (n = 32)

Genital Hygiene Practice	Complaints No complaints	Dysuria	Vaginal discharge	Dysuria & Vaginal discharge	Total	P value
Correct Hygiene Practice	4 (36.4%)	7 (63.6%)	0 (0%)	0 (0%)	11 (100%)	<0.001
Incorrect Hygiene Practice	3 (14.3%)	1 (4.8%)	10 (47.6%)	7 (33.3%)	21 (100%)	
Total	7 (21.9%)	8 (25%)	10 (31.3%)	7 (21.9%)	32 (100%)	

Association Between Urinary Retention Habit and Genital Complaints

The relationship between the habit of holding urine and genital complaints is presented in Table 4. Participants who reported routinely holding urine experienced dysuria and combined genital complaints more frequently than those who did not report this habit. Statistical analysis revealed a significant association between urinary retention habits and genital complaints ($p < 0.001$). These findings suggest that urinary retention behaviour was significantly associated with the occurrence of genital health complaints among the study participants.

Table 4. Association Between Urinary Retention Habits and Genital Health Complaints Among Participants (n = 32)

Habit	Type of Complaints No complaint	Dysuria	Vaginal Discharge	Dysuria & Vaginal Discharge	Total	P value
Not holding in urine	5 (29.4%)	1 (5.9%)	10 (58.8%)	1 (5.9%)	17 (100%)	<0.001

Habit	Type of Complaints				Total	P value
	No complaint	Dysuria	Vaginal Discharge	Dysuria & Vaginal Discharge		
Holding in urine	2 (13.3%)	7 (46.7%)	0 (0%)	6 (40%)	15 (100%)	
Total	7 (21.9%)	8 (25%)	10 (31.3%)	7 (21.9%)	32 (100%)	

Effect of the Genital Hygiene E-Guide on Knowledge, Attitudes, and Practices

Changes in knowledge, attitudes, and genital hygiene practices following the intervention are summarized in Table 5. To facilitate comparisons across questionnaire domains with different scoring ranges, all raw scores were transformed into a standardized 0–100 scale, with higher scores indicating better outcomes.

Following the intervention, participants demonstrated statistically significant improvements across all outcome variables. Mean knowledge scores increased from 47.19 ± 8.13 to 94.38 ± 6.19 , representing a mean improvement of 47.19 points (95% CI: 44.10–50.28; $p < 0.001$; Cohen's $d = 6.53$). Mean attitude scores increased from 51.75 ± 7.39 to 91.16 ± 3.09 , corresponding to a mean difference of 39.41 points (95% CI: 36.85–41.97; $p < 0.001$; Cohen's $d = 6.96$). Similarly, mean practice scores increased from 49.38 ± 6.19 to 91.72 ± 2.79 , with a mean improvement of 42.34 points (95% CI: 40.10–44.58; $p < 0.001$; Cohen's $d = 7.98$).

Table 5. Changes in Knowledge, Attitudes, and Genital Hygiene Practices Before and After the E-Guide Intervention (n = 32)

Variable	Pre-intervention Mean $\pm$ SD (0–100 scale)	Post intervention Mean $\pm$ SD (0–100 scale)	Mean Difference	p-value	Cohen's d	95% CI Mean Difference
Knowledge	47.19 $\pm$ 8,13	94.38 $\pm$ 6.19	47.19	<0,001	6.53	44.10–50.28
Attitudes	51.75 $\pm$ 7,39	91.16 $\pm$ 3.09	39.41	<0,001	6.96	36.85–41.97
Practices	49.38 $\pm$ 6,19	91.72 $\pm$ 2.79	42.34	<0,001	7.98	40.10–44.58

The large effect sizes observed across all outcome measures indicate that the genital hygiene e-guide produced substantial improvements in participants' knowledge, attitudes, and genital hygiene practices following the educational intervention.

DISCUSSION

The results demonstrated that the genital hygiene e-guide significantly improved knowledge, attitudes, and genital hygiene practices among adolescent girls following the intervention ($p < 0.001$), accompanied by exceptionally large effect sizes (Cohen's $d = 6.53$ – 7.98). These findings indicate substantial improvements across the measured outcomes and suggest that the e-guide has potential as a digital educational tool for promoting healthy genital hygiene behaviors. The findings are broadly consistent with previous evidence showing that digital interventions can improve adolescents' sexual and reproductive health knowledge and attitudes, although changes in health-related behaviors tend to be more difficult to achieve and sustain.(11,12) Furthermore, the baseline findings indicated that a considerable proportion of respondents still engaged in potentially inappropriate health behaviors, including inadequate genital hygiene practices, habitual urine holding, and insufficient fluid intake. Such behaviors are relevant to urinary and genital health, as previous studies have identified inappropriate genital hygiene and delayed voiding as behavioral factors associated with genital infection and urinary tract infection (UTI).(6) (13)(14)(15) These findings underscore the importance of preventive educational interventions that address modifiable health behaviors during adolescence.

The effectiveness of the intervention may be explained partly by the accessibility and learner-centered characteristics of the e-guide. The intervention was designed to provide concise, structured, and visually supported educational content that participants could access independently and review repeatedly. Digital health education can facilitate convenient access to health information and may be particularly appropriate for sensitive reproductive health topics because adolescents may value privacy, anonymity, and confidentiality when seeking such information.(16)(17) A recent systematic review of digital interventions targeting school-age adolescents reported generally positive effects on sexual health knowledge and attitudes, while also emphasizing that behavioral outcomes may be more difficult to modify through digital interventions alone.(11) Similarly, evidence mapping research on digital knowledge-translation tools for adolescent sexual and reproductive health has highlighted privacy, anonymity, and convenience as important advantages of digital approaches.(17) Thus, the accessibility and private nature of the e-guide may have facilitated engagement with the intervention and provided opportunities for repeated exposure to the educational content.

The present findings are also consistent with previous studies demonstrating that structured educational interventions can improve knowledge, attitudes, and health-related practices among female students. Eltelt et al., for example, reported significant improvements in knowledge, attitudes, and self-care practices regarding vaginal infections following implementation of an instructional system design model among female university students.(18) Although their intervention and target population differed from those of the present study, the findings support the proposition that systematically structured reproductive health education can improve multiple dimensions of health-related outcomes. Furthermore, systematic reviews of digital interventions among adolescents have reported beneficial effects on sexual health knowledge and attitudes across various digital formats, including web-based interventions, mobile applications, text messaging, and digital games.(11,12) These findings suggest that the educational content, organization, accessibility, and suitability of the medium may be important determinants of intervention effectiveness.

The intervention resulted in statistically significant improvements across all outcome variables. Effect size analysis indicated a substantial intervention effect, suggesting that the e-guide was associated with meaningful improvements in knowledge, attitudes, and genital hygiene practices.(19,20)(21) However, the exceptionally large effect sizes observed in the present study should be interpreted cautiously. First, participants demonstrated relatively low baseline scores, providing substantial room for improvement following the intervention. Second, the transformation of questionnaire scores into a standardized 0–100 scale may have affected the magnitude of the calculated mean differences and consequently the standardized effect sizes. Third, the one-group pretest–posttest design without a control group limits the ability to determine whether the observed changes were attributable exclusively to the intervention. Improvements may also have been influenced by repeated exposure to the questionnaire, increased awareness of the study topic, or other external factors during the study period. Importantly, evidence from systematic reviews of digital adolescent health interventions generally indicates positive but more modest effects, particularly for behavioral outcomes.(11,12) Therefore, the exceptionally large effect sizes observed in the present study should be considered in the context of the study design, baseline scores, measurement procedures, and sample characteristics rather than interpreted as evidence that the e-guide is unequivocally superior to other educational approaches.

From a clinical and public health perspective, these findings have potential implications for adolescent reproductive health services. The e-guide could be considered as a supplementary educational resource for midwives, school nurses, and other health professionals working with adolescents. In school settings, the intervention could potentially

be integrated into School Health Unit (UKS) activities and existing reproductive health education programs. Digital interventions may offer practical advantages in terms of accessibility and confidentiality, which are particularly relevant when addressing sensitive adolescent reproductive health issues.(11,12,17) However, the e-guide should be regarded primarily as a health-promotion and educational tool rather than as a clinically validated intervention for preventing UTI. Although inappropriate genital hygiene behaviors have been associated with genital infections, and delayed voiding has been associated with UTI risk, the present study did not directly measure UTI incidence or microbiological outcomes.(6,14) Therefore, claims regarding UTI prevention should remain appropriately cautious. The scalability and accessibility of digital educational materials nevertheless make this approach promising for strengthening school- and community-based health promotion, particularly in settings where adolescents have regular access to digital technology.

Nevertheless, this study has several limitations that should be considered when interpreting the findings. First, the study was conducted in a single senior high school involving a relatively small sample of adolescent girls, which may limit external validity and generalizability to adolescents from different educational, cultural, socioeconomic, or geographical settings. Second, the study relied primarily on self-reported questionnaires to assess knowledge, attitudes, and practices, which may be susceptible to recall bias and social desirability bias. Self-reported behavioral outcomes may therefore overestimate the extent of actual behavioral change. Third, no objective biological outcomes, such as urinalysis, urine culture, or clinically confirmed UTI diagnoses, were included. Consequently, the study cannot establish whether the observed improvements in genital hygiene practices translated into a reduction in actual UTI incidence. This distinction is important because evidence from previous digital sexual health interventions indicates that improvements in knowledge and attitudes do not necessarily translate into comparable changes in biological health outcomes.^{18,23} Fourth, participants were aware that they were receiving an educational intervention and subsequently completing an evaluation, which may have influenced their responses and behaviors. This possibility of a Hawthorne effect should therefore be considered when interpreting the magnitude of the observed improvements. Finally, the absence of a control group prevents the effects of the e-guide from being clearly separated from testing effects, maturation, or other time-related influences.

Future research should employ randomized controlled trial designs involving multiple schools and more diverse adolescent populations to strengthen causal inference and external validity. Comparative studies should also evaluate the e-guide against conventional face-to-face education or blended educational approaches to determine whether digital delivery provides additional benefits. Longer follow-up periods are needed to assess whether improvements in knowledge, attitudes, and genital hygiene practices are sustained over time, as previous evidence suggests that some benefits of digital interventions may diminish after the intervention period.¹⁸ In addition, future investigations should incorporate objective clinical indicators, including urinalysis, urine culture, or clinically confirmed UTI diagnoses, alongside behavioral outcomes. Such approaches would allow researchers to determine whether improvements in educational and behavioral outcomes translate into measurable reductions in urinary or genital health problems. Future studies could also investigate whether repeated digital reinforcement, personalized feedback, or integration with school-based health services enhances the sustainability of behavioral change.

CONCLUSION

The genital hygiene e-guide significantly improved adolescents' knowledge, attitudes, and genital hygiene practices following the intervention ($p < 0.001$), with very large effect sizes across all outcome domains (Cohen's $d = 6.53\text{--}7.98$). These findings indicate that the e-

guide is an effective digital educational resource for promoting healthy genital hygiene behaviors among adolescent girls. Although this study did not directly evaluate urinary tract infection incidence, the observed improvements in preventive behaviors suggest that the intervention may contribute to reducing urinary tract infection risk through better hygiene practices. Given its accessibility and ease of implementation, the e-guide has the potential to be incorporated into school-based reproductive health education and digital health promotion programs. Future randomized controlled studies involving larger and more diverse populations, longer follow-up periods, and objective clinical outcome measures are warranted to confirm these findings and evaluate their long-term effectiveness

AUTHOR CREDIT STATEMENT

BPH was responsible for developing the research idea, formulating the problem, determining the research design, collecting data, analyzing data, and writing the thesis. **AF** provided guidance, input, and supervision during the planning and implementation stages. **ES** and **RR** provided methodological guidance and refined the thesis writing to ensure its adherence to scientific principles.

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DECLARATION OF COMPETING INTEREST

There is no conflict of interest in this research. This research does not involve other parties that could influence the results.

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