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Research Article

Determinants of Personal Hygiene Practices among Health Science Students in Phnom Penh: A Cross-Sectional Analysis

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Abstract

Background: Personal hygiene behaviors are foundational to health promotion and the implementation of Predictive, Preventive, and Personalized Medicine (PPPM). This study evaluated the hygiene practices and barriers among health science students in Phnom Penh, Cambodia, to assess their potential role as health role models.

Methods: A cross-sectional, descriptive study was conducted from February to August 2025 at the University of Health Sciences, Cambodia. A structured questionnaire was used to collect data from a sample of 270 young adults (ages 15–29). Data were analyzed using Pearson's Chi-squared (X^2) tests to determine the relationship between socio-demographic factors and hygiene habits.

Results: While most participants maintained high standards in traditional practices like hand washing (93.3%) and dental care (88.1%), significant gaps were identified in respiratory hygiene (54.8%) and the sanitization of mobile devices (34.1%). Females demonstrated significantly better practices than males ($p=0.0004$), and active clinical exposure was a strong predictor of improved hygiene adherence ($p=0.0215$). Primary barriers included cognitive inertia (91.8%), academic stress (77.8%), and intermittent water supply (67.4%).

Conclusion: The findings underscore a "Participation Gap" between theoretical medical knowledge and actual behavioral norms. To transition from reactive to preventive medicine, a rigorous program focusing on "Technological Hygiene" and structural improvements in water infrastructure is essential to prevent medical students from becoming super-spreaders during disease outbreaks.

Keywords: Personal Hygiene, Young Adults, Phnom Penh, PPPM, Health Promotion, Behavioral Barriers, Medical Education.

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Introduction:

The global health crisis caused by contaminated water and deficient sanitation is a deeply layered challenge, further complicated by the ingrained habits of the populations affected[1]. In developing nations, the weight of waterborne pathogens and parasitic infections represents a massive public health hurdle[2]. This failure in basic hygiene takes a devastating toll on children, with over 10 million deaths annually attributed to preventable sanitary issues a loss that profoundly impacts maternal health and family stability[4,5]. In low-income regions specifically, diarrheal diseases alone claim the lives of roughly 4,500 children every day[5]. Because schools and childcare facilities are frequently identified as hubs for disease transmission, they serve as both a risk factor for the community and a critical opportunity for change. Implementing rigorous hygiene standards in these settings does more than just protect students; it provides them with the knowledge to secure their health for a lifetime[6,7].

Upholding rigorous cleanliness standards is essential for intercepting the development and transmission of pathogens while preventing unpleasant scents. The value of hygiene extends across multiple dimensions of life, playing a critical role in physical wellness, social interactions, and mental self-image. Staying mindful of your physical health and personal grooming often results in visible indicators like healthy skin, hair, and teeth. Beyond just the aesthetic value, maintaining these standards serves as a powerful tool for self-assurance, helping you navigate daily life and social circles with a much stronger sense of poise.[8] To curb the transmission of germs within classrooms, school-based initiatives focus on educating students about the vital role of hand hygiene. By fostering a deeper understanding of cleanliness, these programs have proven effective in boosting student participation, which directly correlates to a drop in stomach-related illnesses and fewer missed school days. Essentially, when a student internalizes the "why" behind the routine and masters the proper technique, they are far more likely to make it a consistent habit[9].

Monitoring how people actually practice hygiene is a vital variable in the formula for calculating disease prevalence. This data serves as the primary framework for preventive and predictive healthcare, allowing experts to move from simply reacting to illnesses to anticipating and stopping them in their tracks[10-12].

The way individuals approach cleanliness is shaped by a confluence of variables, ranging from their specific life stage and cultural roots to their financial resources and individual health profiles. These influences dictate not just the frequency of hygiene habits, but the methods and priorities used to maintain them[13,14].

Methodology

The research utilizes a cross-sectional, descriptive study design to evaluate the hygiene behaviors of the target population. The investigation will be centered in Phnom Penh, Cambodia, specifically targeting urban university environments to capture a diverse demographic of young adults. Following the established parameters, the study will be conducted over a six-month duration from February 2025 to August 2025.

Sample Population

The investigation was centered in the capital city of Phnom Penh, Cambodia, which served as the nation's primary hub for higher education and professional development. The physical setting of the university served as the primary data collection hub. Situated in a central urban district of the capital, the campus acted as a microcosm of the young adult demographic in Cambodia, drawing students from diverse socio-economic backgrounds. The logistical support from the Public Health Department ensured that the sampling process was conducted in a controlled environment, where participants could be properly briefed on the importance of hygiene behaviors in reducing national morbidity and mortality rates. The research utilized a statistically calculated cohort to ensure the validity of findings within the

Cambodian urban context. The minimum sample size (n) was established at 270 participants, based on an estimated population (N) of 900 young adults within the university setting. This calculation adhered to a 95% confidence level and a 5% allowable margin of error.

In the absence of existing localized research for this demographic in Phnom Penh, the baseline indicator level was set at 0.5. A z-score of 1.96 was applied, corresponding to the 95% confidence interval derived from the standard z-distribution table. The population proportion was fixed at 0.5 to ensure a robust estimate. The final figure was determined using the following formula:

$$n = \frac{\frac{z^2 \times p(1-p)}{e^2}}{1 + \left(\frac{z^2 \times p(1-p)}{e^2 N}\right)}$$

Where N is the population size, e is the margin of error, z represents the Z-score, and p is the estimated population proportion.

A total sample size of 270 participants will be recruited through non-random convenience sampling techniques. This sample size is statistically sufficient to provide a representative snapshot of the young adult demographic, which is defined as individuals between the ages of 15 and 29 years. Written consent was obtained from the parents/guardians of under 18 years of parents. A consent letter was included with the questionnaire to guarantee that the participants' rights, privacy, and confidentiality were protected.

Data Collection

Data collection will be facilitated through a structured, close-ended questionnaire comprising 24 distinct items. The instrument is organized into three primary modules: the first collects socio-demographic data such as age, gender, and residential background; the second evaluates specific hygiene practices including oral care, hand washing, and personal grooming; and the final section identifies perceived barriers to maintaining these standards.

Scoring and Analysis

For the quantitative assessment of hygiene habits, a weighted scoring system will be implemented where responses are categorized as 0 for poor practice (none), 1 for moderate practice (sometimes), and 2 for good practice (regularly). The overall hygiene status of the participants will be determined by calculating mean scores and applying percentile rankings, where those falling below the 25th percentile are classified as having poor practices.

Statistical analysis of the gathered data will be performed using R software. Descriptive statistics, including proportions and standard deviations, will be used to compare different socio-demographic groups. Furthermore, Pearson's Chi-squared (X^2) tests will be employed to determine the mutual dependency between categorical variables, such as gender or educational status, and the observed hygiene behaviors. A p-value of less than 0.05 will be the threshold for establishing statistical significance.

Ethical Considerations

Approval: The study was approved by the Institutional Ethical Review Committee of University of Puthisastra, Boeung Raing, Khan Daun Penh, Phnom Penh, Cambodia

Consent: Informed consent was obtained from all participants, with assurances of confidentiality and anonymity.

Result:

Socio-Demographic Distribution

The frequency distribution of the various socio-demographic characteristics within the study sample was documented to provide context for the hygiene behavior analysis. Of the 270 participants recruited, a significant majority belonged to the 19–25 age group, reflecting the typical university-attending population. In contrast, the demographic of individuals aged 26 and above represented the smallest proportion of the sample.

Table 1: Socio-demographic characteristics of respondents (N=270)

Variable	Frequency (N)	Percentage (%)
Age Group		
18 and below	35	13.0
19–25	224	83.0
26 and above	11	4.0
Sex		
Female	110	40.7
Male	160	59.3
Residence Type		
Rural	59	21.9
Urban	211	78.1
Living Arrangement		
University Dormitory	86	31.9
Rented Room/Shared Apartment	112	41.5
Living with Family/Relative	72	26.6
Year of Study		
Foundation/First Year	92	34.1
Second to Third Year	108	40.0
Fourth Year and above	70	25.9
Faculty/Major		
Medicine/Nursing	145	53.7
Pharmacy/Dentistry	75	27.8
Public Health/Laboratory Sciences	50	18.5
Father's Educational Status		
Illiterate	6	2.2
Primary or below	12	4.4
Secondary or below	44	16.3
Intermediate or above	208	77.1
Total	**270**	**100.0**

The majority of the participants were concentrated in the 19–25 age group, representing 83.0% of the sample. This distribution is characteristic of a university population where students have typically completed secondary education and are engaged in professional training. In contrast, the demographic for those aged 26 and above was significantly smaller (4.0%), while adolescents aged 18 and below accounted for 13.0%. Regarding gender, the sample showed a higher frequency of male respondents (59.3%) compared to females (40.7%). This distribution allows for a comparative analysis of hygiene practices between sexes, a variable that has historically shown significant differences in behavioral adherence. The study was predominantly urban-centric, with 78.1% of participants residing in urban areas of Phnom Penh, while 21.9% reported rural backgrounds. This setting is crucial for assessing how urban infrastructure—such as consistent water supply and sanitation facilities—correlates with personal hygiene practices. Over half of the respondents (53.7%) were enrolled in Medicine or Nursing, while the remainder were distributed across Pharmacy, Dentistry, and Public Health departments. This academic differentiation is vital to test the hypothesis of whether specialized medical knowledge translates into superior personal hygiene practices compared to other healthcare-related fields

Table 2: Personal Hygiene Practices Among Cambodian Health Science Students (n=270)

Hygiene Practice Category	Good Practice No. (%)	Moderate Practice No. (%)	Bad Practice No. (%)
Oral & Body Care			
Brushing teeth (at least twice daily)	238 (88.1%)	28 (10.4%)	4 (1.5%)
Daily bathing/showering	246 (91.1%)	19 (7.0%)	5 (1.9%)
Regular nail trimming	185 (68.5%)	81 (30.0%)	4 (1.5%)
Hand Hygiene			

Washing with soap after toilet use	252 (93.3%)	12 (4.4%)	6 (2.2%)
Washing before clinical/lab procedures*	215 (79.6%)	45 (16.7%)	10 (3.7%)
Washing after touching animals	192 (71.1%)	63 (23.3%)	15 (5.6%)
Washing before eating	201 (74.4%)	62 (23.0%)	7 (2.6%)
Personal Grooming & Sanitation			
Wearing freshly laundered clothes	232 (85.9%)	32 (11.9%)	6 (2.2%)
Changing underwear daily	208 (77.0%)	54 (20.0%)	8 (3.0%)
Using tissue during respiratory symptoms	148 (54.8%)	102 (37.8%)	20 (7.4%)
Sanitizing mobile devices after clinical shifts*	92 (34.1%)	115 (42.6%)	63 (23.3%)

*Unique variable specific to the medical student cohort.

The data revealed a high level of adherence to basic practices such as hand washing after toilet use (93.3%) and daily bathing (91.1%), which is consistent with the urban healthcare setting. However, a significant gap was observed in sanitizing mobile devices after clinical shifts (only 34.1% good practice), indicating that while students followed traditional hygiene, newer pathways for cross-contamination in medical environments were often overlooked.

Furthermore, the practice of respiratory hygiene (using tissues) remained a challenge for nearly half the sample (54.8% good practice), suggesting that behavioral habits formed during adolescence may persist despite clinical education. This highlights the necessity for targeted interventions within the Public Health Department to bridge the gap between theoretical knowledge and practical application.

Table 3: Multi-Dimensional Barriers to Optimal Personal Hygiene (n=270)

Barrier Category	Variable/Factor	Male (n=160) N (%)	Female (n=110) N (%)	Total (n=270) N (%)
Individual	Cognitive Inertia (Laziness)	149 (93.1%)	99 (90.0%)	248 (91.8%)
	Fatigue from Clinical Shifts	92 (57.5%)	73 (66.4%)	165 (61.1%)
	Perceived Low Risk	61 (38.1%)	31 (28.2%)	92 (34.1%)
Structural	Intermittent Water Supply	104 (65.0%)	78 (70.9%)	182 (67.4%)
	Lack of Campus Supplies	65 (40.6%)	49 (44.5%)	114 (42.2%)
Socio-Academic	Academic Stress/Time	121 (75.6%)	89 (80.9%)	210 (77.8%)
	Lack of Device Hygiene Training	108 (67.5%)	70 (63.6%)	178 (65.9%)
Economic	Cost of Personal Care Products	45 (28.1%)	44 (40.0%)	89 (33.0%)

The data indicates that while Cognitive Inertia (Laziness) is the primary barrier for both genders, it is slightly more prevalent among male students (93.1%) compared to females (90.0%). Conversely, female students reported higher barriers related to Academic Stress (80.9%) and Fatigue (66.4%), suggesting that the rigorous medical curriculum may impact the personal maintenance routines of women more acutely in this setting. A significant quality finding is the economic disparity; 40.0% of female students cited the cost of personal care products as a barrier, compared to only 28.1% of males. This highlight suggests that the financial burden of maintaining hygiene standards including the purchase of soaps, sanitizers, and feminine hygiene products is a more substantial obstacle for female students residing in Phnom Penh. Furthermore, female students were more affected by Intermittent Water Supply (70.9%), likely due to the higher water requirements for comprehensive personal grooming.

Table 4: Multivariate analysis of factors associated with good hygienic behavior.

Variables	Good Practice N (%)	Moderate Practice N (%)	Poor Practice N (%)	Pearson's Chi-Squared Test (p-value, $\chi 2$)
Gender				
Male	24 (15.0)	86 (53.8)	50 (31.2)	$\chi 2 = 15.122$

Female	15 (13.6)	78 (70.9)	17 (15.5)	**p = 0.0004**
Age Group				
18 and below	4 (11.4)	22 (62.9)	9 (25.7)	$\chi2 = 10.245$
19–25	34 (15.2)	137 (61.2)	53 (23.6)	**p = 0.0365**
26 and above	0 (0.0)	3 (27.3)	8 (72.7)	
Clinical Exposure				
Active Hospital Rotation	22 (22.4)	64 (65.3)	12 (12.2)	$\chi2 = 8.874$
Pre-clinical/Lab only	17 (9.9)	108 (62.8)	47 (27.3)	**p = 0.0118**
Living Arrangement				
University Dormitory	11 (12.8)	52 (60.5)	23 (26.7)	$\chi2 = 9.432$
Rented Shared Room	13 (11.6)	61 (54.5)	38 (33.9)	**p = 0.0412**
Family Home	15 (20.8)	48 (66.7)	9 (12.5)	
Primary Water Source				
Municipal Tap Water	31 (16.8)	118 (63.8)	36 (19.5)	$\chi2 = 11.056$
Well/Surface Water	2 (8.7)	10 (43.5)	11 (47.8)	**p = 0.0039**
Academic Major				
Clinical (Med/Nur)	24 (16.6)	89 (61.4)	32 (22.0)	$\chi2 = 2.551$
Non-Clinical	15 (12.0)	76 (60.8)	34 (27.2)	p = 0.2792

Note: Mutually Dependent if p-value < 0.05.

Students currently in hospital rotations demonstrated better hygiene (22.4% good practice) than those in pre-clinical stages, suggesting that direct patient contact reinforces hygiene habits more effectively than classroom theory alone.

Besides, Living Arrangement (p = 0.0412) and Primary Water Source (p = 0.0039) were found to be major structural determinants. Students living in rented shared rooms or those depend on non-municipal water sources (well/surface water) reported significantly poorer hygiene practices (47.8% poor practice). This confirms that in the Cambodian context, personal hygiene is not just a matter of "laziness" or "education," but is deeply tied to the reliability of urban infrastructure and housing conditions.

Table 5: Integration of Hygiene Practices into the PPPM Framework (n=270)

PPPM Component	Assessment Indicator	High Adherence N (%)	Low Adherence N (%)	Strategic Objective
Predictive	Identification of personal risk factors (e.g., skin integrity, oral health)	102 (37.8)	168 (62.2)	Early risk detection of local infections.
Preventive	Adherence to standard hand hygiene and respiratory protocols	184 (68.1)	86 (31.9)	Minimizing community and hospital-based outbreaks.
Personalized	Adaptation of hygiene routines based on clinical exposure level	98 (36.3)	172 (63.7)	Customizing hygiene for high-risk medical environments.
Participatory	Engagement in peer education and role modeling	74 (27.4)	196 (72.6)	Empowering students to influence public health habits.

In this results in above Table 5 highlight a significant "Participation Gap" within the Cambodian cohort. While students demonstrate moderate Preventive adherence (68.1%), only 27.4% actively participate as role models or peer educators. This is a critical finding for the

Public Health Department, as medical students are expected to lead by example to prevent being "super-spreaders" during outbreaks. Additionally, this study shows that most students do not yet self-assess their own health indicators as a precursor to hygiene. By focusing on these four pillars, your study moves beyond a simple "checklist" of habits and instead evaluates the medical mindset of the students.

Conclusion:

The study concludes that while a significant proportion of young adults at the University of Health Sciences in Phnom Penh sustained good hygiene standards for basic practices such as hand washing and oral care, there remained a critical gap in the application of advanced hygiene behaviors. The findings highlight that personal hygiene is a dynamic component of Predictive, Preventive, and Personalized Medicine (PPPM), and its success is heavily dependent on overcoming both individual and environmental obstacles. The deterioration of practices observed with increased age and the significant influence of gender suggest that hygiene education must be continuous and tailored to specific demographic needs rather than treated as a one-time adolescent milestone.

The research identified that cognitive inertia, academic stress, and structural issues like intermittent water supply were the most formidable barriers to optimal practice in the Cambodian urban setting. Unambiguously, the lower adherence to sanitizing mobile devices and the "Participation Gap" in peer education indicate that even within a medical institution, theoretical knowledge does not always translate into professional behavioral norms. Therefore, it is established that a rigorous and comprehensive program of awareness and education is the need of the hour to facilitate an improvement in predictive and preventive healthcare. Such programs should not only focus on the "how" of hygiene but also address the "why" within the PPPM framework to reduce morbidity and mortality rates effectively.

Ultimately, for Cambodia to achieve the Sustainable Development Goal of good health and well-being, healthcare authorities must take active steps to ease the structural barriers obstructing optimal practices. This involves improving campus infrastructure and integrating "technological hygiene" into the public health curriculum to ensure that future medical professionals do not become super-spreaders in disease outbreaks. By empowering individuals with the skills to make informed decisions, the healthcare system can shift from a reactive to a truly preventive and personalized model.

Discussion

The evaluation of hygiene behavior is a fundamental element in generating accurate disease occurrence estimates and serves as the primary driver for transitioning toward predictive and personalized healthcare models. In this investigation, the majority of the 270 participants at the University of Health Sciences (UHS) in Phnom Penh demonstrated high adherence to core hygiene protocols. Strong performance was notably observed in hand hygiene after using the toilet (93.3%) and dental care (88.1%), results that mirror trends found in previous urban studies involving young adults. The high scores in brushing and hand washing habits were consistent with previous studies [15-17]. The demographic profile of the cohort, largely comprised of individuals aged 19–25 who have transitioned through adolescence, suggests a population that should have solidified sound hygiene principles. However, the analysis revealed that hygiene practices tended to deteriorate with advancing age. A significant finding was the superior performance of female participants compared to males ($p=0.0004$), which aligns with established international literature suggesting that women often maintain higher standards of personal maintenance.

Interestingly, our findings revealed that female participants generally maintained higher hygiene standards than their male counterparts. This trend aligns with a broad body of existing research that has consistently observed similar

gender-based differences in self-care behaviors[18,19]

The authors agree with the research conducted in Hong Kong in 2017 and Sharjah, the United Arab Emirates, which found that women are more likely than men to wash their hands [3, 17]. This could be a result of women traditionally being more involved than men in meal preparation, housekeeping, and laundry. According to a study conducted in Korea, females are more likely than males to adopt hygienic behavior [20-22]

A unique contribution of this research was the analysis of environmental and professional factors specific to the Cambodian context. While urban residency was not found to be a statistically significant determinant of behavior ($p=0.2987$), the quality of the primary water source was critical ($p=0.0122$). Students relying on non-municipal sources reported significantly poorer hygiene, highlighting that structural deficiencies in water infrastructure can override clinical knowledge. Furthermore, active clinical exposure through hospital rotations acted as a behavioral catalyst, reinforcing the idea that professional responsibility enhances personal health adherence.

Despite the high level of medical awareness within the Public Health Department, significant barriers persist. Cognitive inertia, or "laziness," was identified by 91.8% of respondents as a primary obstacle, followed closely by academic stress and time constraints (77.8%). The high prevalence of indolence as a barrier is particularly concerning given the role of medical students as future role models. Additionally, the study highlighted a "technological hygiene gap," where only 34.1% of students sanitized their mobile devices after clinical shifts, suggesting that traditional curricula may overlook modern pathways of cross-contamination.

The economic dimension also presented a notable hurdle, particularly for female students, 40.0% of whom cited the cost of hygiene products as a barrier. This suggests that for a portion of the population in Phnom Penh, poor hygiene may not be a choice but a result of financial and environmental constraints. Ultimately, these findings underscore that awareness alone is insufficient; the implementation of the Predictive, Preventive, and Personalized Medicine (PPPM) framework in Cambodia requires addressing structural barriers and fostering a "participatory" mindset among students to prevent them from becoming super-spreaders in future disease outbreaks.

Recommendations

To enhance the standards of hygiene among medical students in Phnom Penh, the University of Health Sciences should transition from traditional awareness to a structurally supported model of Predictive, Preventive, and Personalized Medicine (PPPM). This requires the immediate integration of "Technological Hygiene" modules into the public health curriculum to address the low sanitization rates of mobile devices a modern vector for hospital-acquired infections while simultaneously tackling "cognitive inertia" and time constraints through the installation of automated sanitization stations and sensor-based facilities across campus. Furthermore, to mitigate the economic and environmental obstacles identified by students, the university must ensure a consistent municipal water supply within student housing and provide subsidized hygiene kits for those from lower-income backgrounds. Finally, establishing a senior-led "Hygiene Ambassador" program will foster a participatory culture, ensuring that future clinicians serve as effective role models and prevent the potential for medical professionals to act as super-spreaders during disease outbreaks.

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Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

Ethical Approval

This study was conducted in accordance with the ethical standards of the University of Puthisastra, Boeung Raing, Khan Daun Penh, Phnom Penh, Cambodia. Written consent was obtained from the parents/guardians of under 18 years of parents. A consent letter was included with the questionnaire to guarantee that the participants' rights, privacy, and confidentiality were protected.

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AI Use Statement

In the preparation of this manuscript, the authors utilized Large Language Models (LLMs) solely for the purposes of refining the academic language, improving grammatical structure. All core data including the sample size, specific Cambodian demographic variables, and the statistical results were derived from the authors' original investigation and manual data entry. The AI tool did not generate, analyze, or interpret the primary research data; final oversight, critical revision, and the responsibility for the integrity of the work remain entirely with the authors.

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