Section: Community Medicine

Original Research Article

HAND HYGIENE AWARENESS, PRACTICES, AND PERCEIVED BARRIERS AMONG OUTPATIENTS AND THEIR CAREGIVERS: A CROSS-SECTIONAL STUDY

Patil Sujata Rajendra[1], Salve Shobha Bansi[2], Andrea Almeida[3]

[1]*Assistant Professor, Department of Community Medicine, MGM Medical College & Hospital, Chh. Sambhajinagar, Maharashtra, India.*
[2]*Professor and Head of the Department, Department of Community Medicine, MGM Medical College & Hospital, Chh. Sambhajinagar, Maharashtra, India.*
[3]*Junior Resident Department of Community Medicine, MGM Medical College & Hospital, Chh. Sambhajinagar, Maharashtra, India.*

Received *: 05/02/2026*
Received in revised form *: 24/03/2026*
Accepted *: 09/04/2026*

Corresponding Author:
Dr. Patil Sujata Rajendra,
Assistant Professor, Department of Community Medicine, MGM Medical College & Hospital, Chhatrapati Sambhajinagar (Aurangabad), Maharashtra, India.
Email: drsujatadasgupta@gmail.com

DOI:10.70034/ijmedph.2026.16.2.74

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (2); 444-449

ABSTRACT

Background: Hand hygiene remains a critical yet underutilized public health intervention for preventing infectious diseases and curbing antimicrobial resistance, especially in low-resource settings. Despite increased awareness during the COVID-19 pandemic, sustained behavioural change in community settings remains limited. This study assesses the attitudes and practices related to hand hygiene among patients in outpatient departments, and to identify common barriers across sociodemographic groups.

Materials and Methods: A cross-sectional study was conducted among 1109 participants attending multiple centre OPDs of a tertiary care hospital's field practice area. Data was collected using a structured interviewer administered pre-validated questionnaire through face-to-face interviews. Convenience sampling was used; descriptive and inferential statistics were applied to assess associations.

Results: Most participants were from rural areas (72.1%). Awareness was highest for handwashing after toilet use (91.4%), but lower for after coughing/sneezing (33.6%) and caregiving (38.5%). Barriers included soap unavailability (49%), self-reported lack of awareness (38.4%), time constraints (32.6%), and lack of clean water (30.7%). Urban residents reported significantly higher consistent soap use than rural counterparts ($p = 0.023$). Positive attitudes were significantly associated with better hand hygiene practices ($p < 0.00001$).

Conclusion: Despite good awareness of key hand hygiene moments, actual practices remain inconsistent, with significant rural-urban disparities and structural barriers. Interventions must go beyond information dissemination to address access, affordability, and behaviour change, especially in rural settings.

Keywords: Hand hygiene, knowledge-attitude-practice (KAP), outpatient care, caregivers, barriers, rural health, infection prevention, India.

INTRODUCTION

In 2025, handwashing remains a crucial preventive and public health measure that, though indirectly and directly responsible for disrupting the chain of transmission of several infectious diseases as well as preventing the ingestion, inhalation, or transportation of dirt, dust and other potentially harmful particles is still often overlooked or given little importance to.

The foundation of modern hand hygiene practices can be traced back to Ignaz Semmelweis, who in the mid-19th century, demonstrated a significant reduction in maternal mortality by introducing handwashing with chlorinated lime solution in

obstetric clinics. His findings, though initially ridiculed, were among the first statistically backed evidence linking hand hygiene with infection prevention.[1] Subsequent decades have reinforced these findings, with studies consistently confirming that hands are a primary vehicle for the transmission of multiple pathogens including Staphylococcus aureus, Escherichia coli, and Clostridium difficile,[2] as well as other potential illness-causing agents such as pollutants.

In India, diarrheal diseases continue to be a major public health concern, especially among children under five, contributing significantly to morbidity and mortality. According to the Global Burden of Disease estimates, diarrhoea remains one of the top five causes of death in this age group.[3] These infections are largely preventable through improvements in water, sanitation, and hygiene (WASH) practices, among which hand hygiene is the most cost-effective and immediately actionable intervention.

Inadequate hand hygiene contributes to the global threat of antimicrobial resistance (AMR), as contaminated hands often aid in the transmission of resistant organisms, particularly in healthcare and community settings.[4] The burden of these diseases is often exacerbated in regions facing water scarcity, where lack of access to safe water limits regular handwashing and increases vulnerability to outbreaks.[5]

The effectiveness of hand hygiene is also influenced by the type of cleansing agent used. Evidence consistently shows that washing hands with soap and water is superior to using water alone in removing dirt, organic matter, and a broad spectrum of microorganisms, including enteric pathogens. Alcohol-based hand sanitizers, when used correctly, are highly effective against many viruses and bacteria, particularly in settings where soap and water are unavailable. However, their efficacy is reduced in visibly soiled hands or in cases involving certain spore-forming organisms like Clostridium difficile.[6] In contrast, reliance on just water or alternative cleansing agents such as ash or mud is still practiced in some rural settings and offers limited microbial protection and may even increase the risk of contamination due to improper technique or unclean water sources.[7]

Importantly, the inaccessibility or unaffordability of soap, hand sanitizers, or clean water remains a major structural barrier, especially in public toilets, and rural households. Among other barriers in low- and middle-income countries (LMICs) like India, studies have also identified various individual, institutional, and structural obstacles, including lack of infrastructure (soap, water), time constraints, and low perceived susceptibility to illness.[8] Addressing these disparities is essential for ensuring that hand hygiene messages translate into sustainable behaviour change.

In India, barriers extend into the sociocultural realm, with some traditional or religious practices inadvertently affecting compliance. For instance, in certain contexts, handwashing is ritualistically practiced before meals or religious activities, but this does not always align with scientifically recommended moments for hand hygiene such as after coughing, toileting, or patient contact.[9,10]

The COVID-19 pandemic brought an unprecedented global emphasis on hand hygiene as one of the cornerstones of disease prevention. This was reflected in heightened awareness campaigns, availability of hand rubs, and visible shifts in public behaviour.[11] However, evidence suggests that this uptick in compliance was temporary, with habits regressing once immediate threats subsided.[12] This scenario underscores a critical gap: while awareness may increase during health crises, the translation to sustained behavioural change remains limited.

Rationale for the present study: Understanding the current attitudes and practices related to hand hygiene among patients and their caregivers in outpatient settings is essential. Such settings represent a key point of contact between the community and the healthcare system and are often overlooked in surveys and intervention efforts. By identifying knowledge gaps, attitudinal barriers, and behavioural patterns, this study aims to understand hand hygiene compliance in the outpatient context in India, so that effective interventions may be planned for the same.

Objectives of this study were to assess the knowledge, attitudes, and practices of patients and their caregivers about hand hygiene and its role in preventing diseases and to identify common barriers faced by patients and caregivers in maintaining ideal hand hygiene and compare the same across various demographic variables.

The cross-sectional study was conducted across multiple outpatient centres affiliated with the teaching hospital's field practice area. The settings were chosen to capture a diverse and predominantly rural and a smaller but sizeable urban population, representing a mix of populations to reveal any possible differences due to difference in awareness, availability of water or other resources, etc. Participants included patients and their caregivers present at the time of the study visit. Patients and their accompanying caregivers/relatives attending the OPD, aged 18 years and above, who provided consent.

Sampling Technique and Sample Size

A convenience sampling method was employed until the desired sample size was attained. Participants were recruited over a period of two months, in the period leading up to World Handwashing Day, as the findings were used to design IEC interventions for the same. After receiving clearance from the Institutional Ethics Committee, data collection was started and continued until the pre-decided sample size of 1200 was reached. 91 study participants were omitted

from the final analysis because of the incomplete and missing responses.

Data Collection Procedure: A structured interviewer administered questionnaire was developed based on CDC hand hygiene guidance and relevant material.[13][14][15] The tool included sections on sociodemographic characteristics, knowledge of key hand hygiene moments and methods, self-reported practices, and perceived barriers. Each section was designed for independent assessment. The content of the questionnaire was validated by the ethics committee and then it was pre-tested on a group of outpatients to ensure clarity. This was used for in-person interviews at each centre. Face-to-face interviews were conducted by resident doctors and interns posted at the respective health training centres. Prior to data collection, all interviewers were oriented regarding the study objectives, questionnaire content, and standardized interviewing procedures to ensure uniformity in data collection and minimize interviewer bias. After each interview, the participants were educated on correct handwashing techniques as part of the Information, Education, and Communication (IEC) activity.

RESULTS

A total of 1109 participants were included in the study, 850 were patients and 259 were caregivers, comprising 49.9% males (n = 553) and 50.1% females (n = 556). The majority of participants belonged to the 25–34 years (28.9%) and 18–24 years (21.5%) age groups, followed by 35–44 years (22.3%). A larger proportion of respondents were from rural areas (72.1%).

In terms of educational background, 22.2% had completed higher secondary education, 21.0% had finished high school, and 15.2% had studied up to middle school, and 11.5% of respondents had no formal education.

Regarding monthly family income, over half of the participants (53.1%) reported earning between ₹10,000 and ₹30,000, while 26.8% had a monthly income of less than ₹10,000.

Table 1: Knowledge Related to Hand Hygiene Among Study Participants (n = 1109)

Knowledge Domain	Response	No. of Responses	Percentage (%)
Crucial Moments for Handwashing	Before Eating	887	80.0
	After Using the Toilet	1,014	91.4
	After Coughing/Sneezing	373	33.6
	Before and After Caring for a Sick Person	427	38.5
	After Touching Animals or Their Waste	576	51.9
Preferred Method of Handwashing	Water Only	117	10.5
	Water and Soap	937	84.5
	Water and Sanitizer	49	4.4
	None of the Above	6	0.5
Belief About Effectiveness of Hand Sanitizer	Believes Hand Sanitizers are as Effective (True)	729	65.7
	Believes They Are Not as Effective (False)	380	34.3
Diseases Preventable by Proper Handwashing	Respiratory Infections (e.g., cough, cold, COVID)	592	53.4
	Gastrointestinal Infections (e.g., diarrhoea)	459	41.4
	Others (e.g., fever, skin infections)	240	21.6
	Don't know	145	13.1

Note. Participants were allowed to select multiple responses in some sections.

Participants demonstrated varying levels of knowledge regarding key moments for hand hygiene. The majority recognized the importance of handwashing after using the toilet (91.4%) and before eating (80.0%). However, awareness was lower for other crucial situations such as after coughing or sneezing (33.6%), before and after caring for a sick person (38.5%), and after touching animals or their waste (51.9%).

When asked about the preferred method of handwashing, 84.5% of participants correctly identified the use of water and soap, while 10.5% reported using only water, and a small proportion used hand sanitizer (4.4%) or reported no specific method (0.5%).

In terms of perception, 65.7% of respondents believed that hand sanitizers are as effective as handwashing with soap and water, while 34.3% disagreed with this notion.

Regarding diseases preventable through proper hand hygiene, 53.4% of participants identified respiratory infections such as cough, cold, and COVID-19. 41.4% mentioned gastrointestinal infections, and 21.6% identified other illnesses like fever or skin infections. Notably, 13.1% of participants reported that they did not know which diseases could be prevented through hand hygiene.

Table 2: Attitudes and Practices Regarding Hand Hygiene Among Study Participants (n=1109)

Attitude & Practice Domain	Response	No. of Responses	Percentage (%)
Importance of Handwashing in Preventing Diseases	Very important	536	48.3
	Somewhat important	495	44.6
	Not important	24	2.2
	I don't know	54	4.9
Importance of Teaching Children About Handwashing	Very important	636	57.3
	Somewhat important	396	35.7
	Not necessary	31	2.8
	No opinion	46	4.1
Practice of Using Soap Each Time While Handwashing	Yes, always	243	21.9
	Yes, but not always	665	59.9
	No, I usually just use water	193	17.4
	I don't use soap at all	8	0.7
Handwashing with Soap and Water After Coughing or Sneezing	Always	139	12.5
	Often	360	32.5
	Sometimes	279	25.2
	Rarely	200	18.0
	Never	131	11.8
Handwashing After Using the Toilet	Using soap and water every time	555	50.0
	Sometimes just use water	443	39.9
	Use water with ash but not soap	73	6.6
	Always use only water	38	3.4
Barriers to Practicing Proper Hand Hygiene	Lack of clean water	340	30.7
	Unavailability of soap	544	49.0
	Time constraints	361	32.6
	Lack of awareness	426	38.4
	No barriers	288	26.0

Note. Participants were allowed to select multiple responses in some sections.

Participants demonstrated a largely positive attitude toward hand hygiene. Nearly half of them (48.3%) believed that handwashing is very important in preventing diseases, and 44.6% considered it somewhat important. Similarly, 57.3% of respondents believed that teaching children about proper handwashing is very important, and 35.7% rated it as somewhat important.

In terms of practice, only 21.9% of participants reported that they always used soap during handwashing, while the majority (59.9%) stated they used soap but not consistently. About 17.4% used only water, and 0.7% reported never using soap.

After coughing or sneezing, only 12.5% of participants said they always washed their hands with soap and water, 32.5% did so often, and 25.2% sometimes. A notable portion washed their hands rarely (18.0%) or never (11.8%) in such situations.

When it came to handwashing after using the toilet, 50.0% of respondents consistently used soap and water, while 39.9% used only water sometimes. An additional 6.6% used water with ash but no soap, and 3.4% reported always using only water.

Reported barriers to practicing proper hand hygiene included unavailability of soap (49.0%), lack of awareness (38.4%), time constraints (32.6%), and lack of clean water (30.7%). Interestingly, 26.0% of participants indicated that they did not face any barriers to hand hygiene.

Table 3: Association of Gender and Place of residence and Consistent Use of Soap During Handwashing Among Study Participants (n = 1109)

Variable	Category	Used Soap Every Time	Did Not Use Every Time	Total	p-value
Gender	Male	447	106	553	0.368
	Female	461	95	556	
Residence	Rural	642	158	800	0.023*
	Urban	266	43	309	

Note: Chi-square test was used to assess associations.

Statistically significant at p < .05.

Out of 1109 study participants, 447 males (80.8%) and 461 females (82.9%) reported using soap every time they washed their hands. The difference in consistent soap use between males and females was not statistically significant (p = 0.368).

However, a significant association was observed between place of residence and soap use. Among rural participants, 642 out of 800 (80.3%) consistently used soap during handwashing, compared to 266 out of 309 (86.1%) in urban areas. This difference was statistically significant (p = 0.023), indicating that urban residents had better compliance with consistent use of soap during handwashing. (see Table 4)

Table 4: Reported Barriers to Handwashing by Gender and Place of Residence Among Study Participants (n = 1109)

Barrier	Male (n = 553)	Female (n = 556)	Total (n = 1,109)	p-value	Urban (n= 309)	Rural (n= 800)	Total (n= 1109)	p-value
Lack of clean water	172	168	340	0.748	93	247	340	0.801
Unavailability of soap	272	272	544	0.748	174	370	544	0.002
Time constraint	164	197	361	0.040	100	261	361	0.933
Lack of awareness	201	225	426	0.158	100	326	426	0.010
No barrier	146	142	288	0.743	87	201	288	0.302

Note: A p-value of less than 0.05 is considered statistically significant.

Among the reported barriers to handwashing, no statistically significant differences were observed between males and females for lack of clean water (p = 0.748), unavailability of soap (p = 0.748), lack of awareness (p = 0.158), and reporting no barriers (p = 0.743). However, a significant association was noted for time constraints, with a greater proportion of females (35.4%) citing time constraints compared to males (29.7%) (p = 0.040), suggesting that women may experience more practical limitations affecting hand hygiene.

When analysed by place of residence, significant associations were observed for unavailability of soap and lack of awareness. A greater proportion of rural participants reported lack of soap (46.3% vs. 56.3%) and lack of awareness (32.4% vs. 40.8%) compared to their urban counterparts, with both associations reaching statistical significance (p = 0.002 and p = 0.010, respectively). These findings highlight important urban–rural disparities in hand hygiene barriers. (See Table 4)

Out of the 1109 participants surveyed, 317 (28.6%) reported having provided care to a sick or bedridden person either at home or in a hospital setting. The caregiving scenarios described by participants were diverse and included care after childbirth (post-delivery and caesarean section, ~25%), neurological or paralytic conditions such as stroke or hemiparalysis (~17%), age-related or geriatric illness (~16%), chronic illnesses like cancer, myocardial infarction, or heart disease (~13%), and infectious conditions including COVID-19, tuberculosis, and pneumonia (~10%).

Among these 317 respondents, hand hygiene practices during caregiving were also assessed. It was found that 238 (75.1%) participants reported following hand hygiene protocols during all key moments of care, whereas 79 (24.9%) admitted that they did not pay attention to hand hygiene while caring for the sick. These findings highlight a relatively high adherence to hand hygiene among informal caregivers, though a notable proportion still lacked consistent practices during potentially high-risk interactions.

DISCUSSION

The findings of the present study indicate generally encouraging levels of awareness regarding hand hygiene among patients and caregivers. Over 90% recognized the importance of handwashing after using the toilet. 80% of respondents were aware of the importance of handwashing before eating, consistent with the focus on visible contamination and food-related hygiene commonly emphasized in public health messaging. However, awareness and practice were notably lower for other critical moments such as after coughing or sneezing (33.6%) and before or after caring for a sick person (38.5%), indicating partial understanding of hand hygiene's role in interrupting disease transmission, particularly in respiratory and caregiving contexts.

Comparable findings have been documented in other parts of India and low- and middle-income countries. A study by Fazeela et al. (2024) conducted in rural Tamil Nadu reported that while 82.5% practiced handwashing after using the toilet, only 28% did so before eating, with practices strongly influenced by education and socioeconomic status.[16] Ray et al. observed similarly high post-defecation handwashing but poor adherence to correct steps and duration before intervention, underscoring the need for behaviour change initiatives.[17]

Nearly half (49%) of respondents in this study cited soap unavailability as a major barrier, followed by lack of awareness (38.4%) and clean water (30.7%). Caruso et al. (2023) identified similar barriers across community settings, linking them to limited physical opportunity and low prioritization of hygiene, while emphasizing the role of habit and risk perception in sustaining behaviour.[18] Ezezika et al. (2020) likewise noted that environmental context, affordability, and infrastructure critically shape handwashing behaviour.[19] Chirgwin et al. (2021) further demonstrated that WASH programs often focus on short-term behaviour change but neglect sustained adoption and equity considerations, particularly among women and marginalized groups.[20] The urban–rural gap in soap use observed here (p = 0.023) mirrors national estimates by Hareesh et al. (2023), who reported hand hygiene prevalence of 55% before food and 84% after toilet use, influenced by education and access.[21]

CONCLUSION

This study highlights that although awareness regarding hand hygiene is high, especially concerning handwashing after toilet use and before eating, actual practices often fall short, particularly

in contexts like respiratory hygiene and caregiving. Consistent use of soap remains suboptimal, especially in rural areas, where resource-related barriers are more pronounced.

Recommendations: As we find limitations in translation of awareness to attitudes to practices, it is recommended that hand hygiene programs go beyond knowledge dissemination to actively reduce logistical barriers and address attitudinal gaps. A multifaceted approach involving education, infrastructure improvement, and community engagement is necessary to foster sustainable hand hygiene behaviour across all demographics.

Limitations: The study's reliance on self-reported data, especially regarding practices, leaves it vulnerable to recall and social desirability biases. Convenience sampling and that too from a facility-based population, tends to limit generalizability to the broader community. Sociocultural factors were not explored in depth, and qualitative insights were lacking. Additionally, older adults and highly educated individuals were underrepresented. The statistically significant associations do not indicate any causal associations as the design was cross-sectional.

Funding: None

Conflict of Interest: None declared

REFERENCES

1. Best M, Neuhauser D. Ignaz Semmelweis and the birth of infection control. BMJ Qual Saf. 2004 Jun 1;13(3):233–4. doi:10.1136/qshc.2004.010918 PubMed PMID: 15175497.
2. Boyce JM. Hand and environmental hygiene: respective roles for MRSA, multi-resistant gram negatives, Clostridioides difficile, and Candida spp. Antimicrob Resist Infect Control. 2024 Sep 27;13:110. doi:10.1186/s13756-024-01461-x PubMed PMID: 39334403; PubMed Central PMCID: PMC11437781.
3. Estimates of the global, regional, and national morbidity, mortality, and aetiologies of diarrhoea in 195 countries: a systematic analysis for the Global Burden of Disease Study 2016. Lancet Infect Dis. 2018 Nov;18(11):1211–28. doi:10.1016/S1473-3099(18)30362-1 PubMed PMID: 30243583; PubMed Central PMCID: PMC6202444.
4. Salam MdA, Al-Amin MdY, Salam MT, Pawar JS, Akhter N, Rabaan AA, et al. Antimicrobial Resistance: A Growing Serious Threat for Global Public Health. Healthcare. 2023 Jul 5;11(13):1946. doi:10.3390/healthcare11131946 PubMed PMID: 37444780; PubMed Central PMCID: PMC10340576.
5. Biswas SP. Global water scarcity: issues and implications with special reference to India. Int Ver Für Theor Angew Limnol Verhandlungen [Internet]. 1996 Dec 1 [cited 2025 Jul 17]. Located at: world. Available from: https://www.tandfonline.com/doi/abs/10.1080/03680770.1995.11900696
6. Yeasmin D, Dutta NC, Nizame FA, Rahman MJ, Ashraf S, Ram PK, et al. Could Alcohol-Based Hand Sanitizer Be an Option for Hand Hygiene for Households in Rural Bangladesh? Am J Trop Med Hyg. 2021 Mar;104(3):874–83. doi:10.4269/ajtmh.20-0755 PubMed PMID: 33534756; PubMed Central PMCID: PMC7941831.
7. Paludan-Müllera AS, Boesena K, Klerings I, Jørgensen KJ, Munkholm K. Hand cleaning with ash for reducing the spread of viral and bacterial infections: a rapid review - Paludan-Müller, AS - 2020 | Cochrane Library [Internet]. [cited 2025 Jul 17]. Available from: https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD013597/full
8. Diwan V, Gustafsson C, Klintz SR, Joshi SC, Joshi R, Sharma M, et al. Understanding Healthcare Workers Self-Reported Practices, Knowledge and Attitude about Hand Hygiene in a Medical Setting in Rural India. PLOS ONE. 2016 Oct 6;11(10):e0163347. doi:10.1371/journal.pone.0163347
9. Poczai P, Karvalics LZ. The little-known history of cleanliness and the forgotten pioneers of handwashing. Front Public Health. 2022 Oct 20;10:979464. doi:10.3389/fpubh.2022.979464
10. Religious and cultural aspects of hand hygiene. In: WHO Guidelines on Hand Hygiene in Health Care: First Global Patient Safety Challenge Clean Care Is Safer Care [Internet]. World Health Organization; 2009 [cited 2025 Jul 17]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK143998/
11. Alzyood M, Jackson D, Aveyard H, Brooke J. COVID-19 reinforces the importance of handwashing. J Clin Nurs. 2020 Aug;29(15–16):2760–1. doi:10.1111/jocn.15313 PubMed PMID: 32406958; PubMed Central PMCID: PMC7267118.
12. Wang Y, Yang J, Qiao F, Feng B, Hu F, Xi Z ang, et al. Compared hand hygiene compliance among healthcare providers before and after the COVID-19 pandemic: A rapid review and meta-analysis. Am J Infect Control. 2022 May 1;50(5):563–71. doi:10.1016/j.ajic.2021.11.030
13. CDC. Clean Hands [Internet]. 2024 [cited 2026 Jan 9]. About Handwashing. Available from: https://www.cdc.gov/clean-hands/about/index.html
14. CDC. Clean Hands [Internet]. 2024 [cited 2026 Jan 9]. About Hand Hygiene as a Family Activity. Available from: https://www.cdc.gov/clean-hands/prevention/index.html
15. MacLeod C, Braun L, Caruso BA, Chase C, Chidziwisano K, Chipungu J, et al. Recommendations for hand hygiene in community settings: a scoping review of current international guidelines. BMJ Open. 2023 Jun 21;13(6):e068887. doi:10.1136/bmjopen-2022-068887 PubMed PMID: 37344109; PubMed Central PMCID: PMC10314431.
16. Fazeela A, Borkar RS, Mer HT. Assessment of water, sanitation and hand hygiene practices in rural households of Tamil Nadu: A cross-sectional study. J Fam Med Prim Care. 2024 Aug;13(8):3350–4. doi:10.4103/jfmpc.jfmpc_330_24
17. Ray SK, Zaman FA, Laskar NB. Hand washing practices in two communities of two states of Eastern India: an intervention study. Indian J Public Health. 2010;54(3):126–30. doi:10.4103/0019-557X.75734 PubMed PMID: 21245581.
18. Caruso BA, Snyder JS, O'Brien LA, LaFon E, Files K, Shoaib DM, et al. Behavioural factors influencing hand hygiene practices across domestic, institutional and public community settings: a systematic review and qualitative meta-synthesis. BMJ Glob Health. 2025 Sep 16;10(Suppl 7):e018927. doi:10.1136/bmjgh-2025-018927 PubMed PMID: 40957683; PubMed Central PMCID: PMC12443170.
19. Ezezika O, Heng J, Fatima K, Mohamed A, Barrett K. What are the barriers and facilitators to community handwashing with water and soap? A systematic review. PLOS Glob Public Health. 2023;3(4):e0001720. doi:10.1371/journal.pgph.0001720 PubMed PMID: 37074999; PubMed Central PMCID: PMC10115288.
20. Chirgwin H, Cairncross S, Zehra D, Sharma Waddington H. Interventions promoting uptake of water, sanitation and hygiene (WASH) technologies in low- and middle-income countries: An evidence and gap map of effectiveness studies. Campbell Syst Rev. 2021 Dec;17(4):e1194. doi:10.1002/cl2.1194 PubMed PMID: 36951806; PubMed Central PMCID: PMC8988822.
21. Hareesh PV, Rajkumar E, Gopi A, Sri Lakshmi K NV, Romate J. Prevalence and determinants of hand hygiene behavior among Indian population: a systematic review and meta-analysis. Sci Rep. 2024 Jan 31;14(1):2619. doi:10.1038/s41598-024-52444-2.