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Oncology

BEHAVIOURAL SHIFTS IN STERILIMUM USAGE AMONG INDIAN DOCTORS: A PRE- AND POST-COVID-19 STUDY

KEY WORDS: COVID-19, Sterilium, hand hygiene, Indian doctors, behavioural change

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ABSTRACT

Alcohol-based hand sanitizers are generally effective at killing germs, particularly enveloped viruses like coronaviruses. Hand hygiene is a critical measure for preventing healthcare-associated infections (HAIs), with alcohol-based hand rubs (ABHRs) like Sterilium widely adopted in healthcare settings. The COVID-19 pandemic likely influenced hand hygiene behaviours among healthcare workers (HCWs). This study investigates behavioural shifts in the usage of Sterilium, a widely used ABHR, among Indian doctors before and after the COVID-19 pandemic. The objectives were to determine the frequency and patterns of Sterilium usage, assess factors and barriers influencing post-COVID-19 usage, and evaluate doctors' perceptions of Sterilium's efficacy and the lasting impact of the pandemic on their hand hygiene adherence.

INTRODUCTION

Hand hygiene is a cornerstone of infection prevention and control in healthcare settings, significantly reducing the transmission of pathogens and the incidence of healthcare-associated infections (HAIs) (1)

The World Health Organization (WHO) recommends alcohol-based hand rubs (ABHRs) as the preferred method for hand hygiene when hands are not visibly soiled, due to their superior efficacy and convenience compared to soap and water (2)

Despite these guidelines, compliance with hand hygiene among healthcare workers (HCWs) has historically been suboptimal globally, with rates varying widely across regions and settings (3)

A survey among Indian medical undergraduates found that only 43% had received formal training in hand hygiene, suggesting potential deficiencies in early education (4)

The COVID-19 pandemic, starting in early 2020, brought unprecedented focus to hand hygiene, likely prompting behavioural changes among HCWs. (5)

Alcohol-based hand sanitizers have been utilized as an effective alternative to handwashing to prevent the spread of bacterial and viral infections, making it one of the essential protocols in decreasing healthcare burden (6,7).

The emergence of the COVID-19 (Coronavirus Disease-2019) pandemic has risen to be a significant global public health concern and led to extensive use of hand disinfectants given its contagious nature. As of 7 May 2020, a total of 3.8 million reported cases had affected over 200 countries worldwide (8,9)

COVID-19 is an infectious disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which can persist and remain infectious on surfaces for up to 9 days (10,11)

The recent study reveals that transmission of SARS-CoV-2 is possible in the form of aerosol and fomite, and the virus can remain viable and infectious in aerosols for hours and on surfaces for days, depending on the inoculum shed (12)

Hence, it is crucial to interrupt the transmission chain of the virus through contact isolation and strict infection control tools (13,14)

Following face masks, appropriate hand hygiene is of utmost importance as hands may be contaminated from direct contact with patients' respiratory droplets from coughs and sneezes or indirect contact via surfaces, which may then facilitate the transmission and spreading of the disease (15,16)

The 2003 severe acute respiratory syndrome (SARS) outbreak was caused by a novel human coronavirus (CoV) (SARS-CoV) that could survive on surfaces for 24 to 72 h (17)

The studies on SARS-CoV outbreak settings showed that providing efficient handwashing facilities reduced transmission (18)

To date, most effective hand sanitizer products are alcohol-based formulations containing 62%–95% of alcohol as it is capable of denaturing the proteins of microbes and inactivating viruses (19)

There are a few challenges and concerns with regard to this formulation in terms of fire hazards and skin toxicity due to high alcohol content (20)

Methods

A cross-sectional descriptive study was conducted among practicing doctors across India to evaluate changes in Sterilium usage patterns before and after the COVID-19 pandemic, along with associated influencing factors, barriers, and perceptions. The study was carried out between January and March 2025.

Study Tool and Data Collection

Data were collected using a structured, self-administered questionnaire, adapted from the WHO Hand Hygiene Knowledge Questionnaire for Healthcare Workers and modified to include specific items related to Sterilium. The tool was pilot-tested for clarity and relevance before dissemination. It comprised both closed-ended and multiple-response items, and was distributed in both online and paper-based formats to reach doctors across different regions and healthcare setups in India. Participation was voluntary, and all responses were anonymous to ensure confidentiality and reduce response bias.

Variables Collected

The questionnaire covered the following domains:

• Demographic Characteristics: Age, gender, type of practice (private or government), highest medical qualification (MBBS, MD, MS, MCh, others), and years of clinical experience (<5, 5–10, 11–20, >20 years).

• Sterilium Usage Patterns:

◦ Pre-COVID-19 Usage: Frequency categorized as never, occasional (1–2 times/day), frequent (3–5 times/day), and very frequent (>5 times/day).

◦ Post-COVID-19 Usage: Same frequency categories, assessed for change.

◦ Self-Reported Change: Perceived change in usage (substantial increase, moderate increase, no change, moderate decrease, substantial decrease).

• Influencing Factors: Awareness of hygiene importance, fear of infection, institutional practices, personal preference, and patient expectations.

• Barriers to Usage: Skin irritation or dryness, sensitivity to odors, concerns about chemical exposure, allergic reactions, and reduced hand sensitivity.

• Perceptions and Attitudes:

◦ Adherence to hand hygiene protocols post-COVID-19 (maintained, relaxed, reverted to pre-pandemic).

◦ Perceived effectiveness of Sterilium (not effective to extremely effective).

◦ Change in perceived importance of hand hygiene.

◦ Perceived long-term impact on clinical practice (permanent, temporary, or unsure).

Sample Size and Analysis

A total of 540 complete responses were included in the final analysis.

Data were entered and analyzed using SPSS version 25.0. Descriptive statistics (frequencies and percentages) were used for all categorical variables. Chi-square tests were used to assess associations between post-COVID changes in Sterilium usage and independent variables such as practice setting, medical specialty, and years of experience. A p-value <0.05 was considered statistically significant.

RESULTS

Study Population

A total of 540 Indian doctors participated, with a male predominance (64.4%, n = 348). The majority were aged 25–35 years (41.5%), followed by 46–55 years (34.1%). Most respondents were affiliated with private healthcare institutions (74.8%), and over one-third held postgraduate degrees (MD: 34.1%; MS: 14.8%; MCh: 11.9%). Clinical experience varied, with 29.6% having less than 5 years and 25.9% having more than 20 years of practice.

Sterilium Usage Patterns Pre- and Post-COVID-19

Before the COVID-19 pandemic, the majority of doctors reported occasional Sterilium use (44.4%), followed by frequent (25.9%) and very frequent (14.8%) usage, while 14.8% reported no use. In contrast, post-pandemic responses showed a clear shift toward higher usage frequency: 41.5% reported very frequent use and 33.3% reported frequent use, while occasional use and non-use declined to 20.0% and 5.2%, respectively. This change indicates a substantial behavioral shift in hand hygiene practices following the pandemic (Table 1). A chi-square test demonstrated a statistically significant increase in usage frequency post-COVID-19 ($\chi^2 = 49.80, df = 4, p < 0.001$).

Table 1. Comparison of Sterilium Usage Pre- and Post-COVID-19 Among Indian Doctors (N = 540)

Usage Frequency	Pre-COVID-19 n (%)	Post-COVID-19 n (%)
Never	80 (14.8%)	28 (5.2%)
Occasional (1–2/day)	240 (44.4%)	108 (20.0%)
Frequent (3–5/day)	140 (25.9%)	180 (33.3%)
Very Frequent (>5/day)	80 (14.8%)	224 (41.5%)
Total	540 (100%)	540 (100%)

Sterilium Usage Change by Practice Setting, Specialty, and Experience

A significant shift in Sterilium usage patterns was observed across various professional strata. Doctors working in private institutions reported a substantially higher increase in usage post-COVID-19 (51.5%) compared to their counterparts in government settings (29.4%) (Table 2A). Conversely, substantial decreases were more prevalent among government doctors (20.6%) than those in private practice (7.9%).

When analyzed by medical qualifications, MCh specialists exhibited the highest rate of substantial increase in usage (62.5%), indicating strong adherence to heightened hand hygiene protocols. In contrast, MBBS doctors showed the highest rate of substantial decrease (22.9%), highlighting variability in behaviour based on academic background (Table 2B).

Table 2A. Self-Reported Change in Sterilium Usage Post-COVID-19 by Practice Setting (N = 540)

Practice Setting	Substantial Increase n (%)	Moderate Increase n (%)	No Change n (%)	Moderate Decrease n (%)	Substantial Decrease n (%)
Private (n=404)	208 (51.5%)	100 (24.8%)	48 (11.9%)	16 (4.0%)	32 (7.9%)
Government (n=136)	40 (29.4%)	40 (29.4%)	12 (8.8%)	16 (11.8%)	28 (20.6%)

Table 2B. Self-Reported Change in Sterilium Usage Post-COVID-19 by Degree/Specialty (N = 540)

Degree/ Specialty	Substantial Increase	Moderate Increase	No Change	Moderate Decrease	Substantial Decrease
MBBS (n=140)	52 (37.1%)	32 (22.9%)	12 (8.6%)	12 (8.6%)	32 (22.9%)
MD (n=184)	88 (47.8%)	48 (26.1%)	20 (10.9%)	12 (6.5%)	16 (8.7%)
MS (n=80)	32 (40.0%)	20 (25.0%)	12 (15.0%)	4 (5.0%)	12 (15.0%)
MCh (n=64)	40 (62.5%)	16 (25.0%)	4 (6.3%)	4 (6.3%)	0 (0.0%)
Other (n=72)	36 (50.0%)	24 (33.3%)	12 (16.7%)	0 (0.0%)	0 (0.0%)

Experience-wise, early-career doctors (less than 5 years of experience) reported the most pronounced increase in usage (55.0%), reflecting heightened responsiveness to infection control measures. In contrast, the most experienced group

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(>20 years) reported the highest rate of substantial decrease (17.1%), suggesting potential challenges in sustained behavioural adaptation with advancing professional age (Table 3).

Table 3: Self-Reported Change in Sterilium Usage Post-COVID-19 by Years of Clinical Experience (N = 540)

Ex-perience Group	Sub-stantial In-crease	Mode-rate In-crease	No Change	Mode-rate De-crease	Sub-stantial De-crease	Total (n)
< 5 years	88 (55.0%)	40 (25.0%)	16 (10.0%)	4 (2.5%)	12 (7.5%)	160
5–10 years	52 (46.4%)	32 (28.6%)	12 (10.7%)	4 (3.6%)	12 (10.7%)	112
11–20 years	60 (46.9%)	32 (25.0%)	16 (12.5%)	8 (6.3%)	12 (9.4%)	128
> 20 years	48 (34.3%)	36 (25.7%)	16 (11.4%)	16 (11.4%)	24 (17.1%)	140

Factors and Barriers Influencing Sterilium Usage
 Following the pandemic, doctors cited multiple reasons for increased usage of Sterilium. The most prominent facilitator was heightened awareness of hygiene importance, reported by 74.8% of respondents (n=404), followed by fear of infection (51.9%, n=280), institutional practices (44.4%, n=240), personal preference (40.7%, n=220), and patient expectations (14.8%, n=80) (Table 4A).

Among those who reported barriers to continued usage (n=248), the most common issue was skin irritation or dryness (72.6%, n=180), followed by sensitivity to strong odors (30.6%, n=76), concerns about chemical exposure (27.4%, n=68), allergic reactions (12.9%, n=32), and decreased hand sensitivity (11.3%, n=28) (Table 4B).

Table 4. Factors Influencing and Barriers Hindering Sterilium Usage Post-COVID-19

A. Facilitators of Increased Sterilium Usage (N = 540)	
Factor	n (%)
Awareness of hygiene importance	404 (74.8%)
Fear of infection	280 (51.9%)
Institutional practices	240 (44.4%)
Personal preference	220 (40.7%)
Patient expectations	80 (14.8%)

B. Reported Barriers (n = 248)	
Barrier	n (%)
Skin irritation or dryness	180 (72.6%)
Sensitivity to strong odors	76 (30.6%)
Concerns about chemical exposure	68 (27.4%)
Allergic reactions	32 (12.9%)
Decreased hand sensitivity	28 (11.3%)

Perceptions and Adherence to Hand Hygiene Protocols
 Post-pandemic behavioural shifts in hand hygiene were evident. While 37.0% (n=200) of respondents reported maintaining their COVID-era protocols, nearly half (48.1%, n=260) had somewhat relaxed their hygiene measures. A notable 14.8% (n=80) had reverted completely to pre-pandemic routines (Table 5A).

In terms of Sterilium's effectiveness, 45.9% (n=248) considered it very effective, 34.1% (n=184) somewhat effective, and 11.1% (n=60) extremely effective. However, 8.9% (n=48) perceived it as not effective (Table 5B).

Regarding the perceived importance of hand hygiene, 51.9% (n=280) felt it had increased, and 37.0% (n=200) reported it had significantly increased. Only 7.4% (n=40) reported no change, and 3.7% (n=20) perceived a decline (Table 5C).

When asked about the long-term impact, 62.2% (n=336) anticipated a permanent shift in hygiene behaviour, while

22.2% (n=120) were uncertain, and 15.6% (n=84) believed the changes were temporary (Table 5D).

Table 5. Perceptions and Adherence to Hand Hygiene Protocols Among Indian Doctors (N = 540)

A. Adherence to Hand Hygiene Protocols Post-COVID-19	
Response	n (%)
Maintained same protocols	200 (37.0%)
Relaxed protocols somewhat	260 (48.1%)
Returned to pre-pandemic practices	80 (14.8%)

B. Perceived Effectiveness of Sterilium	
Perception	n (%)
Very effective	248 (45.9%)
Somewhat effective	184 (34.1%)
Extremely effective	60 (11.1%)
Not effective	48 (8.9%)

C. Perceived Change in Importance of Hand Hygiene	
Change	n (%)
Significantly increased	200 (37.0%)
Increased	280 (51.9%)
No change	40 (7.4%)
Decreased	20 (3.7%)

D. Perceived Long-Term Impact on Practice	
Anticipated Impact	n (%)
Permanent change	336 (62.2%)
Unsure	120 (22.2%)
Temporary change	84 (15.6%)

DISCUSSION
 This study offers a comprehensive analysis of Sterilium usage patterns among 540 Indian doctors, revealing significant behavioral changes in hand hygiene practices following the COVID-19 pandemic. These findings reflect global trends in increased hand hygiene adherence but also uncover distinct usage patterns across institutional settings, specialties, and levels of experience within the Indian medical context.

Shifts in Frequency and Patterns of Sterilium Usage
 A marked increase in Sterilium usage was observed post-COVID-19, with a significant shift from occasional usage (44.4%) to very frequent usage (41.5%) (Table 1). This aligns with the global surge in hand hygiene compliance during the pandemic. A meta-analysis by Wang et al., reported a pooled hand hygiene adherence of 74% among healthcare workers (HCWs) during the COVID-19 pandemic, an increase from pre-pandemic rates ranging from 5% to 89% (21)

Although our study focused specifically on Sterilium, this significant rise ($\chi^2 = 49.80$, $df = 4$, $p < 0.001$) reflects the widespread behavioural shift driven by heightened infection control measures during the pandemic.

Influence of Institutional Setting, Specialty, and Experience
 Doctors working in private institutions reported a higher rate of substantial increase in Sterilium usage (51.5%) compared to those in government institutions (29.4%) ($\chi^2 = 32.96$, $p < 0.001$) (Table 2A). These findings echo the results of Krishnamoorthy et al., who reported superior compliance in private healthcare settings in Tamil Nadu, likely due to better infrastructure and enforcement of protocols (22)

Specialty-wise, MCh doctors showed the highest increase in usage (62.5%), whereas MBBS-qualified doctors reported the highest rate of substantial decrease (22.9%) ($\chi^2 = 56.48$, $p < 0.001$) (Table 2B). This disparity may stem from greater exposure to intensive care and surgical settings among super-specialists, where strict hand hygiene protocols are routinely enforced.

Notably, early-career doctors (<5 years of experience) demonstrated the highest rate of increased usage (55.0%), whereas those with >20 years of experience reported the

highest rate of decrease (17.1%) ($\chi^2 = 38.68, p < 0.001$) (Table 5). This trend may reflect a greater adaptability among younger doctors, as well as their exposure to more recent infection control training. Modi et al., similarly observed that only 43% of Indian medical undergraduates had formal hand hygiene training, highlighting gaps in education that the pandemic may have helped address (4)

Factors Promoting and Hindering Sterilium Usage

The most frequently cited facilitators of increased Sterilium use included greater awareness of hygiene importance (74.8%), fear of infection (51.9%), and institutional reinforcement of hygiene protocols (44.4%) (Table 3A). These motivators are in line with findings by Lotfinejad et al. (2020), who noted fear of transmission and institutional support as key drivers of compliance during COVID-19 (5)

Similarly, Krishnamoorthy et al. found that 68% of HCWs reported heightened hygiene awareness as a motivator (22)

Despite these positive shifts, barriers were reported by 45.9% of participants. The most common issue was skin irritation or dryness (72.6%), followed by sensitivity to odors (30.6%) and concerns about chemical exposure (27.4%) (Table 3B). These results support earlier observations by Erasmus et al., who cited skin-related discomfort as a major deterrent to regular use of alcohol-based hand rubs (ABHRs) (3)

Although WHO (2025) recommends formulations with emollients to reduce irritation, our findings suggest that discomfort and dermatological side effects remain important barriers to consistent usage among Indian doctors. (23)

Perceptions and Long-Term Impact on Hand Hygiene Practices

Only 37.0% of doctors reported maintaining the strict hand hygiene protocols adopted during the pandemic, while 48.1% had relaxed them somewhat and 14.8% reverted to pre-COVID practices (Table 4A). This partial regression is consistent with international reports, such as Moore et al., who noted a drop in post-pandemic hand hygiene compliance from 80% to 65% in hospitals lacking sustained interventions (24)

Nevertheless, the perceived effectiveness of Sterilium remained high, with 45.9% rating it as very effective and 11.1% as extremely effective (Table 4B). Over half (51.9%) reported increased importance placed on hand hygiene, and 37.0% reported a significant increase in perceived importance (Table 4C). These figures mirror the post-pandemic rise in hygiene consciousness reported globally by Wang et al (21)

Encouragingly, 62.2% of respondents believed that the behavioural changes in hand hygiene would be permanent (Table 4D), underscoring a potentially sustained cultural shift. However, 22.2% remained uncertain, and 15.6% viewed the changes as temporary. This emphasizes the need for continued institutional support, training, and infrastructure. Pittet et al., emphasized that long-term improvements in hand hygiene are best sustained through regular audits, feedback mechanisms, and ongoing education (2)

Strengths and Limitations

The study provides a large, diverse sample of Indian doctors across various specialties and institutions, offering valuable insights into behavioural trends. However, being a self-reported cross-sectional survey, the findings are subject to recall and social desirability biases. Moreover, the focus on Sterilium limits generalizability to other ABHR brands or hand hygiene methods.

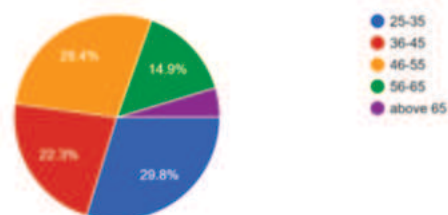
Implications for Practice

Our findings highlight the importance of sustaining post-

COVID gains in hand hygiene by addressing dermatological barriers, improving ABHR formulations, and reinforcing hygiene education across all levels of medical training. Tailored interventions for older doctors and those in government institutions may help bridge remaining compliance gaps.

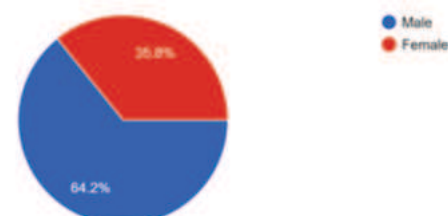
Age

215 responses



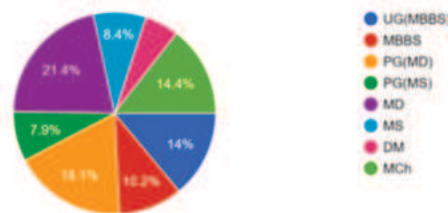
Gender

215 responses



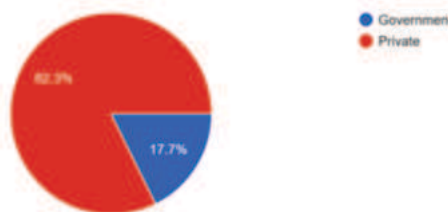
Type of degree

215 responses



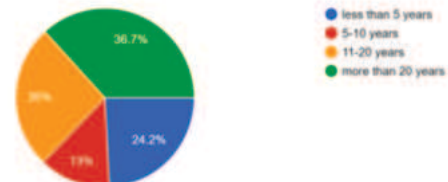
Type of institution of work

215 responses



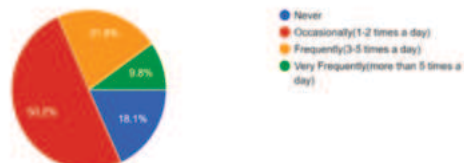
Years of experience

215 responses



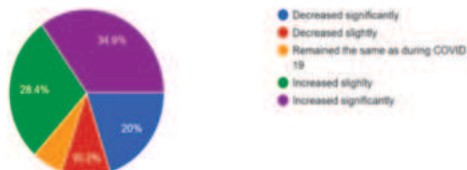
Before COVID 19 pandemic how often did you use sterilium or any other hand sanitizers?

215 responses



Post COVID 19 how has your frequency of sterillium use changed?

215 responses



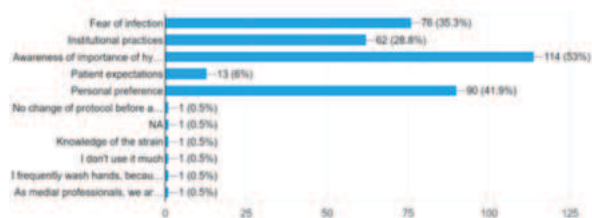
Do you maintain the same hand hygiene protocols(using sterillium or other sanitizers) that were established during COVID 19?

215 responses



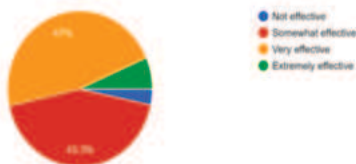
What factors have influenced changes in your use of sterillium?

215 responses



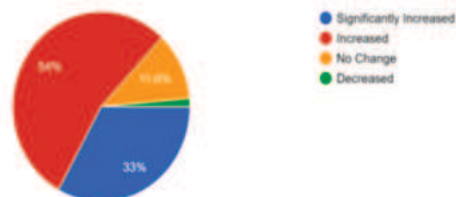
How effective do you believe sterillium is in preventing infections post COVID?

215 responses



How has your perception of importance of hand hygiene changed due to COVID 19?

215 responses



Do you believe that the heightened focus on hand hygiene during COVID 19 will have a long term impact on your practice?

215 responses



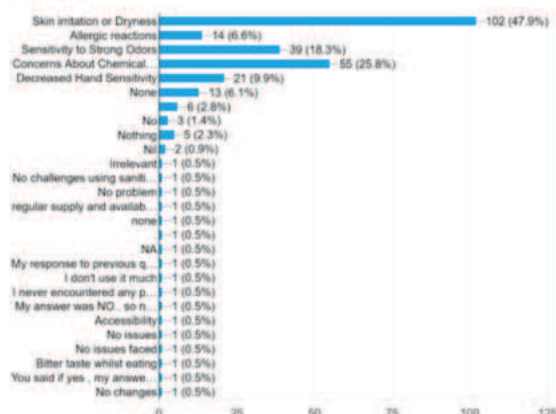
Have you faced any challenges in the frequent use of hand sanitizers in the post-COVID 19 era

215 responses



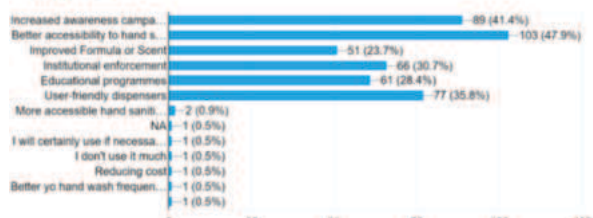
If yes, what challenges have you faced in the frequent use of hand sanitizers in post-COVID 19 era

213 responses



What could help improve compliance with sterillium use in your practice?

215 responses



Do you think the use of sterillium and other hand sanitizers should continue at elevated levels, even if COVID 19 is no longer a major threat?

215 responses



Do you think regular hand hygiene audits should be implemented to ensure compliance in the future?

215 responses



Would you recommend further training or education on hand hygiene and sterillium usage post COVID?

215 responses



CONCLUSION

CDC recommends washing hands with soap and water whenever possible because handwashing reduces the amounts of all types of germs and chemicals on hands. The COVID-19 pandemic significantly increased Sterillium usage among Indian doctors, driven by heightened awareness and institutional practices. While most perceive Sterillium as effective and believe in lasting behavioural changes, barriers like skin irritation and relaxed protocols post-COVID-19 highlight the need for sustained efforts. Healthcare institutions should prioritize skin-friendly ABHRs, continuous education, and compliance audits to maintain improved hand hygiene practices, ensuring long-term patient safety.

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