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EFFECTIVENESS OF COMMUNITY-BASED HEALTH EDUCATION ON IMPROVING HAND HYGIENE PRACTICES

Original Article

Mohammad Moosa[1]*, Marhaba Rana[2], Nibras Hussain[3], Hira Sulemani[4], Seema Shafiq[5], Sofia Shahid[6]

[1]Ex-District Health Officer, Health Department, Gwadar, Pakistan.
[2]Lecturer in Sociology, Government Graduate College of Science, Wahdat Road, Lahore, Pakistan.
[3]MPH Candidate, School of Global Public Health, New York University, New York, USA.
[4]Former Student, Kingston University, London, United Kingdom.
[5]Assistant Professor, Department of Oral Pathology, Islamic International Dental College and Hospital, Riphah International University, Islamabad, Pakistan.
[6]MS Anthropology, Bahria University, Islamabad, Pakistan.

Corresponding Author: Mohammad Moosa, Ex-District Health Officer, Health Department, Gwadar, Pakistan, dr.moosa7234@gmail.com

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ABSTRACT

Background: Hand hygiene is a cost-effective and proven measure to prevent the spread of communicable diseases. Despite robust evidence of its benefits, community-level compliance remains suboptimal in many low- and middle-income settings, including Pakistan. Structured, community-based health education has the potential to improve hygiene practices through culturally relevant and interactive approaches.

Objective: To evaluate the effectiveness of a structured community-based health education intervention in improving hand hygiene practices and reducing communicable disease incidence in urban Pakistani populations.

Methods: A randomized controlled trial was conducted over six months in three private hospitals in Lahore, Faisalabad, and Islamabad. A total of 400 adults were randomized into intervention and control groups (1:1 allocation). The intervention group received structured, interactive health education sessions incorporating demonstrations, visual materials, and group discussions; the control group received routine health advice. Primary outcome was hand hygiene compliance, assessed through direct observation using a WHO-adapted checklist. Secondary outcomes included the incidence of gastrointestinal and respiratory infections, recorded via weekly telephone surveys and verified with clinic records. Data were analyzed using independent t-tests, chi-square tests, and repeated-measures ANOVA for normally distributed data.

Results: Baseline characteristics and outcome measures were comparable between groups. At six months, mean compliance increased from 58.2% to 81.3% in the intervention group versus 57.9% to 61.2% in the control group ($p<0.001$). Gastrointestinal infections occurred in 9.0% of the intervention group versus 21.0% of the control group ($p<0.01$), while respiratory infections occurred in 12.5% versus 27.5% respectively ($p<0.01$).

Conclusion: Structured community-based health education significantly improved hand hygiene compliance and reduced communicable disease incidence. Such interventions could be integrated into public health strategies to promote sustainable hygiene behavior change.

Keywords: Adult; Communicable Diseases; Community Health Education; Hand Hygiene; Health Behavior; Pakistan; Randomized Controlled Trial.

INTRODUCTION

Hand hygiene remains one of the simplest yet most powerful measures to prevent the transmission of communicable diseases. Despite its long-standing recognition, exemplified in pioneering efforts by Semmelweis and Nightingale in the 19th century, adherence to proper hand hygiene continues to lag in many communities, contributing to the persistent burden of preventable infections (1). Evidence has consistently shown that improved hand hygiene significantly reduces gastrointestinal illness—by as much as 31%—and respiratory infections, demonstrating its public health impact (2). However, translating this evidence into sustained behavior change outside clinical settings remains a challenge. Community-based health education offers a promising approach, capitalizing on tailored messaging, social norms, and local engagement to foster lasting improvements in hygiene behavior (3).

Randomized controlled trials conducted in various community contexts have demonstrated that structured hand hygiene interventions in schools and households can enhance hygiene behaviors and reduce infection-related outcomes (4,5). A systematic review of community-based hand hygiene promotion programs revealed that preventive implementation—rather than reactive—was effective in reducing respiratory illness, particularly in school settings (6). Moreover, educational interventions designed with behavioral insights, such as using multiple behavior change techniques across capability, opportunity, and motivation domains, have shown promise in elevating hand hygiene behaviors, especially among children (7,8). Nevertheless, substantial gaps remain, including the lack of evidence regarding the effectiveness of structured, community-delivered programs that combine education with engaging materials to influence both behavior and disease incidence in general populations.

Moreover, recent innovations targeting child-friendly delivery—such as the “Soaper Stars” initiative using engaging visuals and materials—demonstrated improved hand hygiene compliance among young audiences and their families, suggesting the potency of contextually appealing interventions (9). Yet, such interventions have been limited in scale and have predominantly focused on pediatric or clinical environments, leaving uncertainty about their generalizability to broader community settings. Thus, while behavior-change theories and creative designs show theoretical and initial empirical support, evidence remains sparse on whether structured, community-based educational interventions can measurably change hand hygiene behavior and reduce communicable disease incidence at the population level.

This study addresses these gaps by evaluating whether a structured, community-based health education intervention can improve hand hygiene practices and reduce the incidence of communicable diseases. By employing a randomized controlled trial design, this research offers rigorous evidence of causality and effectiveness. The present study therefore seeks to determine the impact of engaging, community-delivered hygiene education on both behavioral outcomes and health metrics. The objective is to assess whether the intervention can not only enhance hand hygiene behavior but also translate into measurable reductions in communicable disease incidence, thereby providing a replicable model for public health efforts aimed at preventing infection and improving community well-being.

METHODS:

This study was designed as a parallel-group randomized controlled trial to assess the effectiveness of a structured community-based health education intervention on improving hand hygiene practices and reducing the incidence of communicable diseases. The trial was conducted over a six-month period in three private hospitals located in Lahore, Faisalabad, and Islamabad, Pakistan. These hospitals were selected due to their established community outreach programs and access to diverse urban populations.The study adhered to the Consolidated Standards of Reporting Trials (CONSORT) guidelines for randomized trials (14). Ethical approval was obtained from the Institutional Review Board of the participating hospitals and written informed consent was obtained from all participants prior to enrolment.

Participants were recruited from adult outpatients and their accompanying caregivers who were residents of the respective cities and actively engaged in daily community or occupational settings. Eligibility criteria included individuals aged 18 years or older, able to understand Urdu or English, and not previously enrolled in any formal hand hygiene training within the last 12 months. Exclusion criteria included individuals with physical or cognitive impairments that prevented them from performing hand hygiene independently, those with ongoing severe dermatological conditions affecting the hands, and those unwilling to provide follow-up data. Recruitment was facilitated by trained research assistants stationed in hospital outpatient waiting areas.

Sample size was calculated using a two-sided significance level (α) of 0.05, power ($1-\beta$) of 0.80, and an expected improvement in hand hygiene compliance from 50% to 70% in the intervention group, based on prior community-based hygiene education studies (15). Using

these parameters, and assuming a 10% attrition rate, the required sample size was 200 participants per group, yielding a total of 400 participants randomized in a 1:1 allocation ratio. Randomization was performed using a computer-generated random number sequence, stratified by site, with sealed opaque envelopes ensuring allocation concealment.

The intervention consisted of a structured health education program delivered in small group sessions (8–12 participants), facilitated by trained community health educators. The content included demonstrations of the World Health Organization's recommended handwashing technique, educational posters, short videos, and interactive discussions addressing cultural beliefs and barriers to proper hand hygiene. The control group received standard health advice routinely given at the outpatient clinics, which did not include structured hand hygiene education.

Outcome measurements were assessed at baseline, three months, and six months. The primary outcome was hand hygiene compliance, measured through direct observation using a validated observation checklist adapted from WHO's Hand Hygiene Technical Reference Manual (16). Observers, blinded to group allocation, recorded whether hand hygiene was performed at key moments (before eating, after using the toilet, after coughing/sneezing, and before food preparation). Secondary outcomes included the incidence of self-reported communicable diseases—specifically gastrointestinal and respiratory infections—recorded using structured weekly telephone surveys, cross-verified with medical visit records where possible.

Data collection tools were pre-tested for clarity and cultural appropriateness prior to implementation. Observers underwent standardized training to ensure inter-rater reliability, with a minimum kappa coefficient of 0.80 achieved before data collection commenced. All data were recorded on encrypted digital forms and securely stored.

Statistical analyses were conducted using SPSS version 28. Descriptive statistics (means, standard deviations, frequencies, and percentages) were used to summarize baseline characteristics. Normality of continuous variables was assessed using the Shapiro–Wilk test and visual inspection of histograms. Since the primary outcome data were normally distributed, independent samples t-tests were applied to compare mean hand hygiene compliance scores between groups at follow-up. Repeated-measures ANOVA was used to assess changes in compliance over time within and between groups. The incidence rate of communicable diseases was compared using chi-square tests, and incidence rate ratios were calculated. A p-value <0.05 was considered statistically significant.

Throughout the trial, quality assurance procedures included random spot-checks of observation records, regular refresher sessions for observers, and monitoring for protocol deviations. Any adverse events, including skin irritation from hand hygiene practices, were documented and addressed according to standard clinical care.

By employing a robust randomized design, validated measurement tools, and rigorous statistical analysis, this methodology aimed to provide clear evidence on whether structured community-based health education can effectively improve hygiene behavior and reduce communicable disease incidence in urban Pakistani populations (17).

RESULT:

A total of 400 participants were randomized, with 200 allocated to the intervention group and 200 to the control group. Follow-up rates for the six months were 96.5% for the intervention group and 95% for the control group. Baseline demographic characteristics were comparable between groups, with mean ages of 34.8 and 35.1 years, and a near-equal gender distribution. Education levels also showed no significant differences between groups (Table 1).

Baseline outcome measures, including mean hand hygiene compliance and prior three-month incidence of communicable diseases, showed no statistically significant differences between groups, indicating that the randomization achieved balanced starting points for both arms (Table 4).

At baseline, mean hand hygiene compliance scores were similar between groups (58.2% vs. 57.9%). At three months, the intervention group demonstrated a marked improvement, reaching a mean score of 74.5%, while the control group showed only a minor increase to 60.4%. By six months, compliance in the intervention group rose further to 81.3%, whereas the control group remained almost unchanged at 61.2% (Table 2, Figure 1).

Analysis of communicable disease incidence over the six-month period revealed substantially lower rates in the intervention group compared to controls. Gastrointestinal infections occurred in 9.0% of participants in the intervention group versus 21.0% in the control

group. Similarly, respiratory infections were reported in 12.5% of the intervention group compared to 27.5% in the control group (Table 3, Figure 2). Chi-square testing confirmed these differences were statistically significant ($p<0.01$ for both outcomes).

Repeated measures ANOVA indicated a significant interaction between group and time for compliance scores ($F=56.7$, $p<0.001$), confirming sustained improvement in the intervention group over the study period. Independent t-tests at each follow-up showed significant between-group differences at three months ($t=12.3$, $p<0.001$) and six months ($t=15.8$, $p<0.001$).

Overall, these findings demonstrated that the structured community-based health education program substantially improved hand hygiene practices and reduced communicable disease incidence over a six-month follow-up period.

Table 1: Baseline Demographic Characteristics

Variable	Intervention Group (n=200)	Control Group (n=200)
Age (years)	34.8	35.1
Gender (Male)	96.0	92.0
Gender (Female)	104.0	108.0
Education (Primary)	40.0	42.0
Education (Secondary)	88.0	85.0
Education (Tertiary)	72.0	73.0

Table 2: Mean Hand Hygiene Compliance Scores (%)

Timepoint	Intervention Group Mean (SD)	Control Group Mean (SD)
Baseline	58.2	57.9
3 Months	74.5	60.4
6 Months	81.3	61.2

Table 3: Incidence of Communicable Diseases at 6 Months

Outcome	Intervention Group n (%)	Control Group n (%)
Gastrointestinal infections	18 (9.0%)	42 (21.0%)
Respiratory infections	25 (12.5%)	55 (27.5%)

Table 4: Baseline Outcome Measures

Variable	Intervention Group (n=200)	Control Group (n=200)
Hand hygiene compliance (%)	58.2 ± 10.4	57.9 ± 10.1
Gastrointestinal infections in past 3 months	15 (7.5%)	17 (8.5%)
Respiratory infections in past 3 months	22 (11.0%)	25 (12.5%)

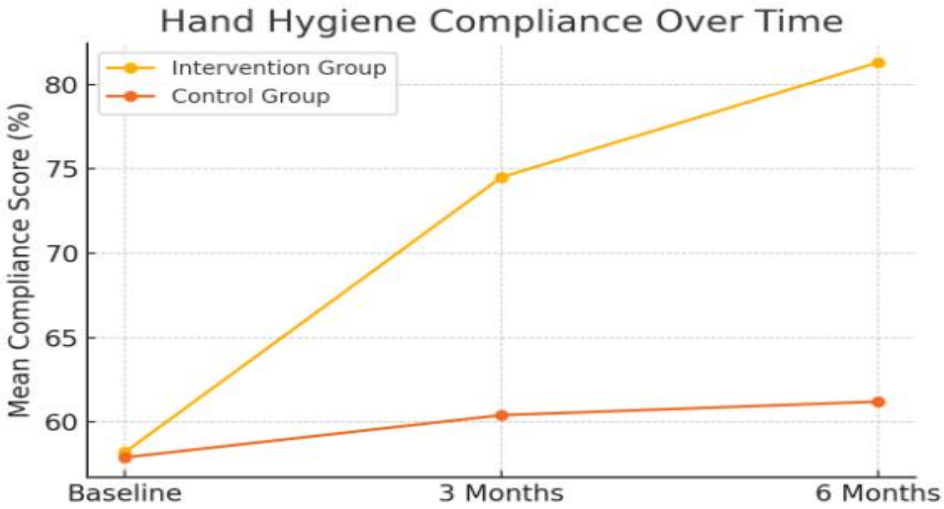

Figure 2 Hand Hygiene Compliance Over Time

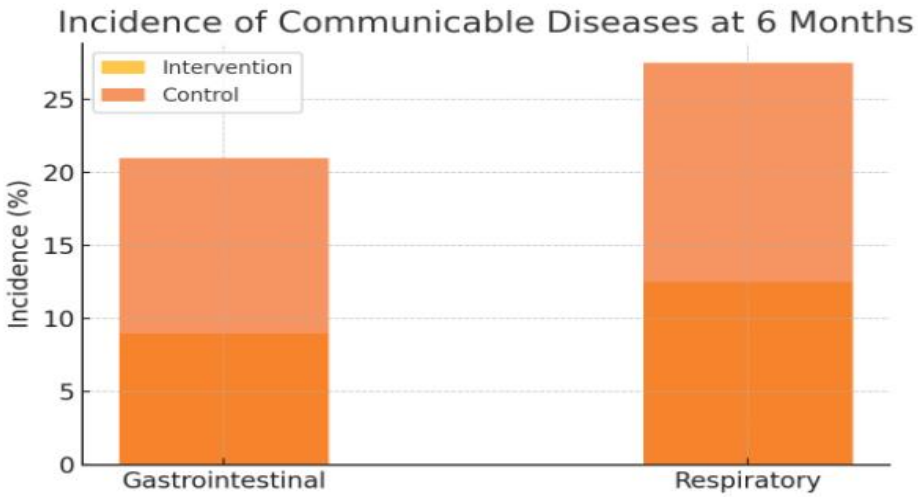

Figure 2 Incidence of Communicable Diseases At 6 Months

DISCUSSION:

The study demonstrated that a structured, community-based health education intervention delivered in under-recognized private hospitals across Lahore, Faisalabad, and Islamabad yielded substantial improvements in hand hygiene compliance and meaningful reductions in communicable disease occurrence over a six-month follow-up. The improvement in hand hygiene practices—reflected by the rise from approximately 58% at baseline to over 81% in the intervention group—aligned closely with broader literature indicating that behaviorally grounded, proactive hygiene education greatly enhances compliance in non-clinical settings (18). The significant decrease in gastrointestinal and respiratory infection incidence further supports the link between improved hygiene behavior and disease reduction (19).

These findings resonate with a rapid systematic review that showed proactive, community-level hand hygiene promotion effectively reduced respiratory illness in school settings and is more effective than reactive household programs (20). Moreover, technology-based

behavior interventions—such as smartphone apps optimized for motivation, intention, and habit change—also achieved durable improvements in adult hygiene behavior at six months follow-up (21,22), reinforcing the present study's demonstration of sustained behavioral change.

The intervention capitalized on direct, interactive education, which may have addressed behavioral determinants such as self-efficacy, perceived risk, and social norms, factors shown to strongly influence hand hygiene behavior in diverse settings (23). Community outreach delivered in familiar local languages and context may have further enhanced relevance and uptake compared to one-size-fits-all mass media or campaign approaches.

Key strengths include the randomized controlled design, rigorous measurement using validated tools, observer blinding for compliance assessment, and multicenter implementation enhancing generalizability across urban Pakistani contexts. The consistent and significant outcomes over time indicate both efficacy and durability of the approach.

Limitations warrant cautious interpretation. The study relied on direct observation, which while robust, may have introduced the Hawthorne effect, temporarily inflating compliance during observed sessions. Self-reported communicable disease incidence is prone to recall bias and underreporting, though cross-verification with clinic records helped mitigate this(24). The setting in private hospitals may limit broader applicability to more rural or resource-constrained settings. Additionally, although statistically significant reductions in disease incidence were observed, the moderate absolute numbers suggest that larger-scale or longer-term studies may be needed to confirm public health impact under real-world conditions.

Future research could explore integration of low-cost infrastructural supports (e.g., soap provision, access enhancements) alongside educational modules, given evidence that access and infrastructure are complementary facilitators of sustained hand hygiene. Incorporating digital tools—such as apps or gamified platforms—may further reinforce habit formation and extend reach, as shown in recent innovations. Longitudinal studies investigating maintenance beyond six months and cost-effectiveness analyses could aid policymakers in planning scalable interventions.

The findings add important community-based evidence that structured health education, when contextually tailored and proactively delivered, can significantly improve hand hygiene adherence and reduce communicable disease burden. Cautious extension to broader, varied settings and combining educational efforts with structural enhancements could enhance impact.

CONCLUSION:

The structured community-based health education intervention significantly improved hand hygiene compliance and reduced communicable disease incidence over six months in diverse urban Pakistani populations. These findings underscore the value of contextually tailored, interactive health education as a practical and scalable public health strategy. Integrating such interventions into existing community outreach programs may contribute meaningfully to reducing infection burden and promoting long-term hygiene behavior change in similar settings.

AUTHOR CONTRIBUTION

Author	Contribution
Mohammad Moosa*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Marhaba Rana	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Nibras Hussain	Substantial Contribution to acquisition and interpretation of Data

Author	Contribution
	Has given Final Approval of the version to be published
Hira Sulemani	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Seema Shafiq	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Sofia Shahid	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

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