

Research Article

Evaluation of Training Effectiveness on Physician Behavior Toward Standard Precautions in High-risk Patient Care

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Abstract

Background: Healthcare facilities struggle to maintain sufficient compliance levels for standard precautions in their infection prevention measures, especially in developing regions. **Objective:** This study aims to evaluate the effectiveness of training on standard precautions in physicians' behavior in the high-risk patient care departments. **Methodology:** A 2-hour SP training evaluated its impact on physician behavior in high-risk clinical zones at two tertiary hospitals in Bangladesh through this quasi-experimental research. Data analysis was done by using MS Excel and SPSS version 26.0 software. **Results:** Pre-training compliance together with post-training evaluations among 120 physicians showed that their compliance reached statistically significant improvements in all areas including hand hygiene (82%) and PPE use (75%), sharps safety (89%) and surface disinfection (78%) which led to a total increase from 55% to 82% ($p < 0.001$). Physicians compliance with the training intervention improved significantly, going from 55% to 82% ($p < 0.001$) in terms of hand hygiene (58% to 82%), PPE use (45% to 75%), sharps safety (62% to 89%), and surface disinfection (50% to 78%). Three-month follow-up data showed that although 75% of physicians were retained, crucial components still required extra training refresher sessions. **Conclusion:** Notwithstanding its research limitations, such as a single-region examination and dependent reporting of information, the study shows that structured SP training has immediate effects on healthcare practices. Regular simulation-based standardized patient education should be made mandatory by health institutions to close compliance deficits within high-risk zones, specifically in areas with minimal resources.

Keywords

Standard Precautions, Infection Prevention, IPC, High-risk Patient Care

1. Introduction

Standard precautions (SP) serve as the foundation for infection prevention by establishing basic infection control practices that stop diseases from spreading through blood, body fluids, and non-intact skin, along with mucous membranes [1]. It minimizes blood-borne and other pathogens from recognized and unrecognized sources and safeguards healthcare providers and patients by minimizing transmission

risks of identified and unidentified microbial agents [2]. A 2024 meta-analysis reveals that the rate of maintaining standard precautions in the Low and Middle Income Countries (LMICs) is 53% only [3]. A South Indian study justified the result of non-compliance with the emergency patient care management and the busy schedule of physicians [4]. In Bangladesh, only 44% of SP elements are available in the

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Received: 13 May 2025; **Accepted:** 26 May 2025; **Published:** 10 June 2025



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healthcare settings [5]. The major factor affecting healthcare workers' (HCW) behavior not to follow SP is the lack of training and knowledge [6]. Regular training of Infection Prevention sessions at the university level can demonstrate a compliance rate of 60.1% in healthcare workers, with the highest adherence in wearing masks to cover the mouth and nose [7]. A Chinese study evaluated the before-and-after impact of Infection Prevention and Control (IPC) training and found the accuracy rate of standard precautions was 69.87% before training and 77.11% after training [8]. High-Risk-Patient-Care zones like Intensive Care Units (ICU) are some areas where the SPs are necessary, but sometimes the staffs serves the patient there with a piece of poor knowledge [9]. In Bangladesh, a study showcases that physicians with less than 5 years of clinical experience and no ICU experience serve their duties significantly poorly in the high-risk patient care units [10]. There a very few studies that evaluate the effectiveness of training on standard precautions of physicians in the high-risk patient care. This study solely aims to justify the evaluation of training effectiveness on physicians' behavior toward standard precautions in high-risk patient care in the circumstances of Bangladesh.

2. Methodology

The study design followed a quasi-experimental pre- and post-intervention model in which physicians received 2 hours of training sessions on the guidelines of Standard Precautions. This multicenter study took place at the Rajshahi Medical College Hospital in Rajshahi and the M Abdur Rahim Medical College and Hospital in Dinajpur from January 2020 to December 2020. Training was open to all physicians, but data collection for the study was conducted with only those phy-

sicians who met the specific inclusion and exclusion criteria.

2.1. Inclusion Criteria

- 1)Active medical practitioners work in high-risk patient Care, including the ICU, emergency section, and infectious disease wards at the study hospital.
- 2)Willingness to provide informed consent.

2.2. Exclusion Criteria

- 1)Physicians on long-term leave or expected to be unavailable during the follow-up period.
- 2)Part-time or visiting consultants are not regularly involved in patient care in the selected units.
- 3)Refusal to provide informed consent for participation.
- 4)Administrative or supervisory physicians are not directly involved in bedside care.

An individual case report form (CRF) was generated for each subject, and data collection focused on hand hygiene (before and after patient care), PPE use, and handling of sharp instruments. All data were prepared for analysis after collection was completed. MS Excel and SPSS version 26.0 served as the primary tools for data analysis in this study. A p-value < 0.05 was considered significant at the 96% confidence interval.

3. Result

A total of 120 physicians participated in the study, including the ICU, the emergency department, surgery, and infectious disease sections like COVID-19, dengue, TB, and other high-risk patient care management.

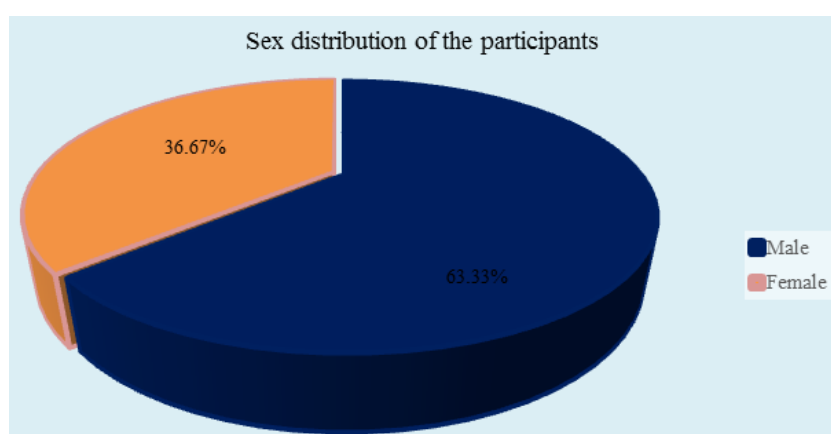


Figure 1. Pie chart showed demographic distribution of participants, sex (N=120).

Figure 1 shows the demographic characteristics, where the majority of the physicians who participated in the study were male. The male-female ratio for the study was 1.73:1.

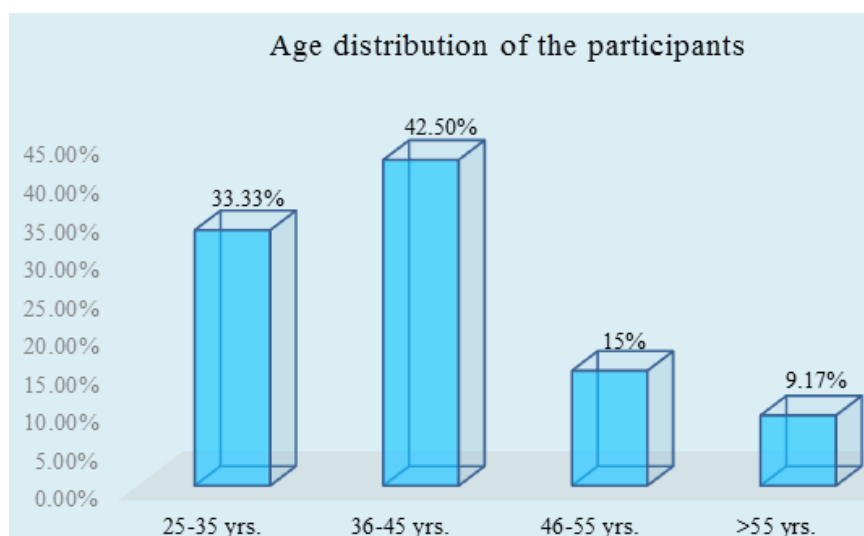


Figure 2. Column chart showed demographic distribution of participants, age (N=120).

Figure 2 shows that the majority of participants belong to the 36-45 age group, followed by the 25-35 age group, indicating that the study is dominated by young doctors with

limited experience. The mean age of the participants was calculated at 40.3 ± 9.3 years.

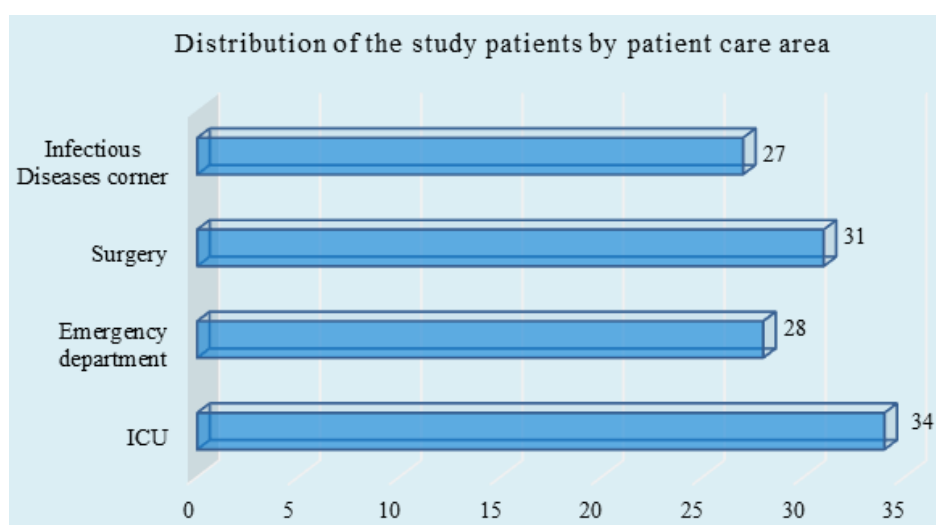


Figure 3. Column chart showed demographic distribution of participants (duty area).

Figure 3 shows that the maximum of physicians participated to the study were ICU doctors (28.33%), followed by Surgeons (25.83%), emergency department doctors (23.33%) and infectious disease corner physicians (22.5%).

Table 1. Baseline Characteristics of Study Participants (N = 120).

Characteristic	Category	Frequency (n)	Percentage (%)
Years of Experience	<5 years	50	41.7%

Characteristic	Category	Frequency (n)	Percentage (%)
Prior SP Training	5–10 years	42	35.0%
	>10 years	28	23.3%
	Yes	65	54.2%
	No	55	45.8%

Table 1 shows the baseline characteristics of the physicians, where majorities of the physicians shows <5 years of work

experience, and 45.8% of participants are practicing in the high-risk patient care areas without Standard Precautions (SP) training.

Table 2. Pre vs. Post-Training Compliance with Standard Precautions.

Behavior	Pre-Training Compliance (%)	Post-Training Compliance (%)	Mean Difference (%)	p-value
Hand hygiene	58%	82%	+24%	<0.001
PPE use	45%	75%	+30%	<0.001
Sharps safety	62%	89%	+27%	<0.001
Surface disinfection	50%	78%	+28%	<0.001
Overall compliance	55%	82%	+27%	<0.001

Table 2 reveals that training resulted in substantial enhancements of SP compliance at +30% in PPE use alongside increases in other domains listed. Hand hygiene performance increased to 82% after training, which brought it close to the World Health Organization standards, alongside a 27% im-

provement in sharps safety practices. Statistically significant results ($p < 0.001$) show that the training program succeeded in resolving practical PPE barriers, together with knowledge deficits.

Table 3. Retention of Training Effects at 3-Month Follow-Up.

Behavior	Immediately post-training (%)	3-Month Follow-Up (%)	% Decline	p-value (vs. post-training)
Hand hygiene	82%	74%	-8%	0.012
PPE use	75%	68%	-7%	0.023
Sharps safety	89%	83%	-6%	0.018
Overall retention	82%	75%	-7%	0.015

According to Table 4 data, hand hygiene and PPE use showed an 8% and a 7% decline, respectively, while total compliance dropped 7% from the 3-month follow-up. $P < 0.05$

shows a significant retention of implementing training learnings.

Table 4. Multivariate Analysis of Factors Influencing Compliance Improvement.

Factor	Category	Adjusted Odds Ratio (aOR)	95% CI	p-value	Specialty-Specific Effects
Prior SP Training	Yes vs. No	1.45	1.12–1.88	0.004	Strongest in ICU (aOR=1.62)
Department	ICU (Ref)	1.00	-	-	-
	Surgery	1.18	0.91–1.53	0.210	-
	Emergency	1.05	0.80–1.38	0.720	-
	Infectious Disease	1.32	0.99–1.76	0.058	-
Training Attendance	Full vs. Partial	2.10	1.64–2.69	<0.001	Consistent across specialties
Years of Experience	>10 vs. <5	0.92	0.75–1.13	0.420	NS in all groups

Factor	Category	Adjusted Odds Ratio (aOR)	95% CI	p-value	Specialty-Specific Effects
Hospital Role	Resident vs. Attending	1.12	0.85–1.47	0.420	-

Table 4 indicates that attending the complete training program (aOR=2.10), together with established knowledge of the Subjects and Procedures (aOR=1.45) demonstrated the most significant impact on compliance improvement. The largest improvement rate occurred among ICU physicians who received training before (aOR=1.62), thus suggesting specialized follow-up programs could boost results further. The effectiveness rates of this training remained unchanged by the level of clinical experience and the healthcare specialty area of participants. Specialists who treat infectious diseases possibly showed better improvements because they already know about infection protocols (p=0.058).

4. Discussion

The quasi-experimental pre- and post-intervention study was conducted with 120 physicians from the high-risk patient care of two tertiary care centers in northern Bangladesh. With a 1.73:1 male-female ratio, most of the participants belong to the 36-45 years age group (42.50%), followed by the 25-35 years age group (33.33%). The least amount of physicians participated from the >55 years of age group (9.17%), followed by 46-55 years of age (15%). The maximum physicians who participated in this study served their duty in the ICU (28.33%), next in the surgery departments (25.83%), followed by emergency (23.33%) and the infectious diseases corner (22.5%). Some researchers explained the emergency department (ED) as the most high-risk patient care department in clinical settings [11, 12]. Most physician lacks clinical experience; 23.3% of physicians are noted with more than 10 years of experience by this study. P. C. Colet *et al.*, 2017 published that young doctors are more tend to follow standard precautions [13]. 54.2% of study physicians are prior trained with SP, and surprisingly, 45.8% of physicians are practicing in the high-risk patient care without SP training. T. Sharmin *et al.*, 2023 reported that 94.4% of physicians in Bangladesh didn't know the component of standard precaution, and the majority of them are not aware of the sequence of wearing and removing the different components of PPEs [14]. The current study observed a drastic change in the compliance with SP before and after training sessions. $P < 0.001$ in hand hygiene, PPE use, sharps safety, and surface disinfection parameters demonstrates a significant effectiveness of the training sessions. A similar study in Brazil shows a 10% increase in knowledge and significant positive changes in healthcare professionals after SP training [15]. Zhang X. *et al.*, 2025 differentiate between two methods of standard precaution training, where they found the accuracy rate in the simulation

group (79.08%) was higher than that in the theoretical teaching group (76.60%) [16]. However, overall 82% compliance shows a significance of SP training, but the simulation training method can be taken into consideration for better output. In 3 3-month follow-up, overall retention of training effectiveness declined to 75% from 82%. Although overall retentions show a significance (p=0.015). Passos IPBD *et al.*, 2022 showed significant effectiveness of post-standard precaution training (P=0.05), which decreased 6 months after training to non-significant (P=0.08) [17]. Uchendu O. C. *et al.*, 2020 recommended periodic SP training sessions for healthcare workers to avoid the risk of non-compliance after a certain period of training [18]. The multivariate analysis also indicates that repetitive training programs have a strong impact on the physician's behavior towards standard precautions (aOR=1.62). Another study disagrees with the interpretation, where they evaluate no significant long-term gain in knowledge about infection control two years following the educational intervention with medical students [19]. The physician's behavior could differ when they received a practical training session during their practice.

5. Limitation

The study has evaluated the effectiveness of standard precaution training, yet it has several limitations. The results obtained from 120 physicians at two northern Bangladesh facilities lack universal application since they cannot be generalized to other health service environments outside this region. The study data were based on doctors' self-reporting of their standard precautions adherence, which might be influenced. Without a randomized controlled group, the study cannot rule out alternative factors beyond the training methods that might have impacted results. The study did not test the training method against alternative educational approaches like hands-on physical simulations, which might have given better results.

6. Conclusion

The results of the study demonstrate that doctors who operate in high-risk medical environments have better SP compliance when they participate in particular training programs. The implemented intervention led in significant gains in hand hygiene practices, PPE utilization, safe sharps practices, and surface disinfection procedures, resulting in a total compliance rise from 55% to 82%. Due to a slight decline in com-

pliance rates over the 3-month follow-up period, more frequent refresher training is necessary. Implementing regular simulation-based training programs for healthcare personnel would maximize their compliance with Standard Precautions and reduce the incidence of infections in medical environments. Protecting patients and medical personnel is still crucial, particularly in places with limited resources like Bangladesh.

Abbreviation

SP	Standard Precaution
IPC	Infection Prevention and Control
PPE	Personal Protective Equipments
ICU	Intensive Care Unit
ED	Emergency Department
WHO	World Health Organization
LMIC	Low and Middle-income Countries

Author Contributions

Tohura Sharmin is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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