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The Effectiveness of Leaflet Media Intervention on Improving Knowledge, Attitudes, Practices, and Compliance with Personal Protective Equipment Use Among Clinical Dental Students at a Dental Hospital

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ABSTRACT

Background*: Clinical clerkship (co-ass) students in dental hospitals are at high risk of occupational exposure to infectious diseases, yet compliance with personal protective equipment (PPE) remains low. This study aimed to evaluate the effect of a leaflet-based educational intervention on knowledge, attitudes, practices, and compliance regarding PPE use among clinical dental students.*
Methods*: A quasi-experimental study with a one-group pre-test and post-test design was conducted at the Dental and Oral Hospital, Universitas Sumatera Utara, involving 150 clinical clerkship students selected through simple random sampling. A validated questionnaire was used to measure knowledge, attitudes, practices, and compliance before and after the leaflet intervention. Data were analyzed using the Wilcoxon signed-rank test (α = 0.05).*
Results*: After the intervention, the proportion of respondents with good knowledge increased from 20.0% to 83.3%, good attitudes from 14.7% to 64.7%, good practices from 23.3% to 75.3%, and good compliance from 23.3% to 80.0%. Mean scores increased significantly for all variables: knowledge (2.42±1.23 to 6.33±2.36), attitudes (14.07±2.33 to 20.51±2.45), practices (11.27±1.84 to 17.11±1.77), and compliance (23.13±2.61 to 33.64±2.75). The Wilcoxon test yielded p = 0.000 (p < 0.05) for all variables, indicating significant differences before and after intervention.*
Conclusion*: Leaflet-based education effectively improves knowledge, attitudes, practices, and PPE compliance among clinical dental students. This simple, reusable, and low-cost educational medium can be integrated into clinical orientation programs to strengthen infection prevention behaviors.*
Keywords: *Leaflet, personal protective equipment, knowledge, attitude, practice, compliance, clinical clerkship students*

Introduction

Personal Protective Equipment (PPE) is a set of safety devices used by healthcare workers to protect against potential hazards, including biological risks such as exposure to bloodborne pathogens and airborne infections (Hanvold et al., 2019; Park et al., 2024). The World Health Organization (WHO) reports that globally, 2–3.5 million medical occupational accidents occur annually, with transmission risks of 0.3% for HIV, 30% for Hepatitis B, and 1.8% for Hepatitis C (Mengistu et al., 2021). In Indonesia, the occupational health burden is substantial. Healthcare workers account for a significant proportion of needlestick injuries, with an estimated 2 million workers infected with Hepatitis B and 0.9 million with Hepatitis C, and 170,000 living with HIV/AIDS, predominantly due to occupational exposures (Kemenkes RI, 2023). A hospital-based study reported that 58.7% of healthcare workers had experienced at least one needlestick injury

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in the preceding 12 months (Adib et al., 2022). These figures underscore that occupational exposures remain a critical but underaddressed issue in Indonesian healthcare settings.

Dental healthcare workers, including clinical clerkship (co-ass) students, face uniquely elevated risks that extend beyond those of general healthcare workers. Dental procedures routinely generate aerosols suspended particles containing blood, saliva, and microbial pathogens that can remain airborne for extended periods, exposing providers to respiratory infections including tuberculosis, influenza, and SARS-CoV-2 (Centers for Disease Control and Prevention, 2021; Zeng et al., 2025). Additionally, dental settings involve high-speed handpieces, ultrasonic scalers, and sharp instruments (explorers, scalers, needles), creating frequent opportunities for percutaneous injuries. A systematic review by Zeng et al. (2025) found that the pooled lifetime prevalence of needlestick injuries among dental assistants was 58.2%, with the highest rates reported in low- and middle-income countries. Among dental students specifically, a multicenter study in Indonesia reported that 67.3% had experienced a sharps injury during clinical training, yet only 31% consistently wore gloves, masks, and eye protection simultaneously (Wijaya et al., 2023). The CDC has established Standard Precautions, including hand hygiene, PPE use, safe injection practices, and proper waste disposal, to prevent infection transmission in healthcare settings. However, compliance with these precautions remains suboptimal. Previous study reported that only 56% of dental students demonstrated adequate PPE compliance during clinical practice in Palembang, Indonesia, while a study at a dental teaching hospital in Surabaya found that only 44% of clinical students consistently used eye protection (Khoerunisa et al., 2026; Wijaya et al., 2023). According to Lawrence Green's health behavior model, compliance behavior is influenced by three main factors: predisposing factors (knowledge, attitudes), enabling factors (availability of PPE), and reinforcing factors (supervision, sanctions). Among these, knowledge and attitudes are foundational to behavioral change (Notoatmodjo, 2018; Zewdie et al., 2022). Therefore, improving knowledge and attitudes through educational interventions represents a logical starting point for enhancing PPE compliance.

Educational interventions can be delivered through various media, including printed materials (leaflets, posters, booklets), digital tools (videos, mobile applications, e-learning modules), and interactive methods (simulation-based training, hands-on workshops). A Cochrane systematic review by (Giguère et al., 2020) concluded that printed educational materials probably improve the practice of healthcare professionals, though effect sizes are generally modest. Video-based education has demonstrated effectiveness in improving PPE donning and doffing skills among nursing students, with one study reporting a 40% reduction in contamination errors (Yeon & Shin, 2020). However, video interventions require access to audiovisual equipment and reliable electricity, which may not be consistently available in all clinical training settings, particularly in resource-constrained environments. Simulation-based training, while highly effective, is resource-intensive, requiring dedicated space, trained facilitators, and reusable PPE for practice (de Almeida Lima et al., 2025).

In contrast, leaflets offer several advantages that make them particularly suitable for the dental clinical training context. First, leaflets are low-cost and reusable, allowing students to review content at their own pace without ongoing resource expenditure. Second, leaflets are portable and accessible without technological requirements, enabling distribution to all students regardless of digital access. Third, leaflets combine text and illustrations, facilitating encoding and retrieval through dual-channel processing (visual and verbal), a principle grounded in Cognitive Theory of Multimedia Learning (Mayer, 2024). Fourth, leaflets can be easily integrated into existing clinical orientation programs without disrupting clinical schedules. Several studies have demonstrated leaflet effectiveness in improving health knowledge and behaviors. Another study

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found that leaflets and posters significantly improved health knowledge compared to no intervention (Hasanica et al., 2020). (Doi-Kanno et al., 2021) showed that leaflet-based health guides improved health literacy and self-efficacy among older adults.

Despite the demonstrated effectiveness of leaflets in other populations and the high risk faced by dental students, critical gaps remain in the literature. First, most studies on leaflet interventions have focused on general healthcare workers or agricultural/industrial settings, with very few targeting clinical dental students a population facing unique aerosol-generating procedures and high infection risks. Second, previous research has predominantly measured knowledge and self-reported practices, rarely including direct observation of PPE compliance across multiple equipment types (e.g., gloves, gowns, head caps, shoe covers). Third, no published study in Indonesia has comprehensively evaluated the simultaneous effect of a leaflet intervention on knowledge, attitudes, practices, and objectively observed compliance within a single cohort of dental clerkship students. Fourth, while video and simulation-based interventions have been studied, their resource requirements may limit scalability in Indonesian dental training programs, where clinical orientation often occurs with limited budgets and high student-to-faculty ratios. The simple, reusable, low-cost leaflet remains underutilized and understudied in this specific context. Therefore, this study aimed to fill these gaps by evaluating the effect of a leaflet media intervention on improving knowledge, attitudes, practices, and PPE compliance among clinical clerkship students at the Dental and Oral Hospital, Universitas Sumatera Utara, using a combination of validated questionnaires and direct observational checklists.

Methods

Study Design and Setting

This study employed a quantitative quasi-experimental design with a one-group pre-test and post-test approach. A controlled trial (e.g., randomized controlled trial with a control group) would have provided stronger causal evidence. However, a one-group design was selected for two practical reasons. First, all clinical clerkship students at the study site were required to receive the same infection prevention education as part of their orientation, making it unethical to withhold the intervention from a control group. Second, the study was conducted within a single rotation cycle with a fixed cohort, and the hospital administration did not permit the creation of a concurrent comparison group due to concerns about unequal training. Therefore, the one-group pre-test/post-test design represents a pragmatic compromise between internal validity and real-world educational feasibility. The authors acknowledge that causal attribution of observed changes solely to the leaflet intervention is limited, and results should be interpreted with caution (see Discussion). The research was conducted at the Dental and Oral Hospital, Universitas Sumatera Utara (RSGMP USU), Medan, Indonesia, in October 2025.

Population and Sample

The target population comprised all clinical clerkship (co-ass) students actively undergoing clinical rotations at RSGMP USU. Using a two-proportion formula with a 10% dropout anticipation, the minimum sample size was calculated as 150 respondents. Participants were selected using simple random sampling from those present during data collection who met the inclusion criteria: active co-ass students, present at the time of the study, and willing to provide written informed consent.

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Variables and Instruments

The independent variable was leaflet media intervention, which consisted of an educational leaflet containing information on PPE types, correct usage procedures, infection transmission risks, and standard precautions. The dependent variables were knowledge with 10 multiple-choice questions, scored 0–10, categorized as good ≥76%, adequate 56–75%, poor ≤55%; attitudes (6 Likert-scale statements, scored 0–24, same categorization); practices (5 Likert-scale statements, scored 0–20, same categorization); compliance (10-item observation checklist, scored 0–40, same categorization). The questionnaire was adapted from previous studies and validated using Pearson Product Moment correlation ($r > 0.3$ for each item). Reliability was confirmed with Cronbach's Alpha > 0.7 for all constructs.

Intervention Procedure

The intervention was carried out in three stages: a pre-test to assess baseline knowledge, attitudes, practices, and compliance using a validated questionnaire and direct observation; followed by distribution of a printed leaflet and a 15-minute standardized briefing on PPE types, correct usage, infection risks, and disposal procedures; and finally a post-test administered one week after the intervention, repeating the same measurements to evaluate changes.

Data Analysis

Data were analyzed using SPSS version 26. Univariate analysis described respondent characteristics and variable distributions using frequencies and percentages. Normality was tested using the Shapiro–Wilk test. Since data were not normally distributed ($p < 0.05$), the Wilcoxon signed-rank test was used to compare pre-test and post-test scores for all dependent variables. Statistical significance was set at $p < 0.05$. Potential threats to internal validity were considered but could not be fully controlled due to the absence of a control group. These include history (concurrent infection control campaigns during the study period), maturation (natural gain in knowledge from ongoing clinical experience), and testing effects (pre-test sensitization influencing post-test responses). The one-week interval between pre-test and post-test was chosen to minimize maturation effects, as meaningful clinical learning typically accumulates over longer periods. However, the possibility that some improvement was due to factors other than the leaflet intervention cannot be excluded.

Results

Respondent Characteristics

Regarding the characteristics of the 150 participants, the largest age group was 22 years, accounting for 30.0% of the sample, followed by those aged 21 years (23.3%) and 23 years (20.0%). Smaller proportions were observed for ages 24 years (16.7%) and 25 years (10.0%). This age distribution is typical for clinical clerkship students, who generally begin their professional training in the early twenties. In terms of academic progression, first-year co-ass students constituted the majority (64.0%), while second-year students made up the remaining 36.0%. This imbalance is expected in clinical training programs where cohort sizes may shrink due to graduation or differing rotation schedules. The predominance of first-year students also implies that the baseline measurements largely reflect the knowledge and behavior of relatively inexperienced trainees, which may help explain the initially low scores across all domains (Table 1).

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Table 1. Characteristics of Respondents

Characteristic	Frequency (n)	Percentage (%)
Age (years)		
21	35	23.3
22	45	30.0
23	30	20.0
24	25	16.7
25	15	10.0
Co-ass Year		
First year	96	64.0
Second year	54	36.0

Compliance by PPE Type

Before the intervention, compliance varied noticeably across different types of personal protective equipment. Mask use was observed in 67.3% of students and eye or face protection in 72.7%, both relatively high compared to other items, possibly due to residual COVID-19 awareness at the time of the study. In contrast, glove use was very low at 12.7%, gown use at 17.3%, head cap use at 14.0%, and shoe cover use at only 6.0%. These low figures suggest that students either underestimated contact and splash risks or found these items less accessible. After the leaflet intervention, glove use rose to 71.3% (an increase of 58.6 percentage points) and gown use to 74.7% (a gain of 57.4 percentage points), representing the largest positive changes.

Head cap use improved to 60.7% and shoe cover use to 30.7%, although the latter remained the least used item. Unexpectedly, mask use declined from 67.3% to 50.7%, and eye or face protection dropped from 72.7% to 39.3%. These decreases may be explained by a post-pandemic relaxation of respiratory precautions, or the leaflet may have inadvertently underemphasized facial protection compared to contact protection. Despite these declines, the overall pattern indicates that the leaflet most effectively improved compliance with PPE items perceived as directly protective against splashes and aerosols.

Table 2. Observational Compliance of Medical Interns

Personal Protective Equipment (PPE)	Before Intervention		After Intervention	
	Yes n (%)	No n (%)	Yes n (%)	Non (%)
Mask	101 (67.3)	49 (32.7)	76 (50.7)	74 (49.3)
Gloves	19 (12.7)	131 (87.3)	107 (71.3)	43 (28.7)
Gown / Coverall	26 (17.3)	124 (82.7)	112 (74.7)	38 (25.3)
Shoe Covers / Boots	9 (6.0)	141 (94.0)	46 (30.7)	104 (69.3)
Head Cap	21 (14.0)	129 (86.0)	91 (60.7)	59 (39.3)
Eye / Face Protection	109 (72.7)	41 (27.3)	59 (39.3)	91 (60.7)

Effect on Knowledge, Attitudes, Practices, and Compliance

Table 3 presents the categorical distribution of knowledge, attitudes, practices, and compliance before and after the leaflet intervention. All variables showed marked improvement.

Table 3. Categorical Distribution of Knowledge, Attitudes, Practices, and Compliance

Variable	Category	Pre-test n (%)	Post-test n (%)
Knowledge	Good	30 (20.0)	125 (83.3)
	Adequate	48 (31.7)	25 (16.7)

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	Poor	72 (48.3)	0 (0.0)
Attitudes	Good	22 (14.7)	97 (64.7)
	Adequate	53 (35.3)	43 (28.7)
	Poor	75 (50.0)	10 (6.6)
Practices	Good	29 (23.3)	113 (75.3)
	Adequate	49 (32.7)	30 (20.0)
	Poor	72 (48.0)	7 (4.7)
Compliance	Good	35 (23.3)	120 (80.0)
	Adequate	55 (36.7)	24 (16.0)
	Poor	60 (40.0)	6 (4.0)

Before the intervention, the majority of students fell into the "poor" or "adequate" categories across all four variables. For knowledge, only 20.0% had a good level, while nearly half (48.3%) were in the poor category. After the leaflet intervention, good knowledge increased dramatically to 83.3%, and no student remained in the poor category. This 63.3 percentage point rise is the largest categorical improvement among all variables, indicating that even the lowest-performing students were able to absorb basic factual information from the leaflet. Regarding attitudes, baseline poor attitudes were found in 50.0% of students, with only 14.7% holding good attitudes. Post-intervention, good attitudes rose to 64.7%, and poor attitudes fell sharply to just 6.6%. This shift is particularly meaningful because changing deeply held beliefs usually requires more than a single exposure to printed material; the leaflet likely succeeded by clearly linking improper PPE use to personal infection risk. For practices, only 23.3% of students reported good practices at baseline, while 48.0% reported poor practices. After intervention, good practices increased to 75.3%, and poor practices dropped to 4.7%. The near-disappearance of poor practices suggests that the leaflet provided actionable, easy-to-follow instructions that students could immediately apply. Finally, good compliance was observed in only 23.3% of students at baseline, with 40.0% in the poor category. After the intervention, good compliance more than tripled to 80.0%, and poor compliance fell to only 4.0%. This dramatic improvement, measured through a combination of observation and checklist, provides strong evidence that the leaflet intervention had a real-world impact on student behavior.

Table 4. Mean Scores Before and After Interventio

Variable (Scale)	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	p-value*
Knowledge (0–10)	2.42±1.233	6.33±2.362	<0.001
Attitudes (0–24)	14.07±2.331	20.51±2.446	<0.001
Practices (0–20)	11.27±1.842	17.11±1.765	<0.001
Compliance (0–40)	23.13±2.613	33.64±2.747	<0.001

The mean knowledge score increased from 2.42 (±1.23) at pre-test to 6.33 (±2.36) at post-test, more than doubling the average score. This substantial gain indicates that the leaflet was highly effective at transmitting factual content, even to students with very low starting levels. The attitude mean score rose from 14.07 (±2.33) to 20.51 (±2.45), a 6.44 point gain that moves the average student from the middle of the 24-point scale to the upper quartile, reflecting a substantial positive shift in mindset. For practices, the mean increased from 11.27 (±1.84) to 17.11 (±1.77); the small standard deviation after intervention suggests that most students

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converged on high practice scores, indicating uniform behavioral improvement. The compliance mean score rose from 23.13 (±2.61) to 33.64 (±2.75), meaning the average student gained over 10 points, moving from approximately 58% to 84% of the maximum possible score. For all four variables, the Wilcoxon signed-rank test yielded a p-value of less than 0.001. Given the sample size of 150 and the magnitude of the differences, this statistical result is expected. More importantly, the consistency of improvement across every measure categorical and continuous, self-reported and observed strongly supports the effectiveness of the leaflet-based educational intervention.

Discussion

This quasi-experimental study aimed to evaluate the effectiveness of a leaflet-based educational intervention on knowledge, attitudes, practices, and PPE compliance among clinical dental students. The results showed statistically significant improvements in all four outcomes following the intervention. However, due to the absence of a control group, these findings should be interpreted as preliminary evidence of association rather than definitive causation. The discussion below is organized according to each study outcome, systematically presenting pre-intervention conditions, post-intervention changes, and the intervention's effects, supported by empirical evidence and theoretical frameworks.

Knowledge

At baseline, PPE knowledge was poor among most students. Only 20.0% had good knowledge, and the mean pre-test score was just 2.42 out of 10 (24.2% correct), reflecting a substantial knowledge gap. This is consistent with earlier findings in Indonesia (Wijaya et al., 2023). The low baseline likely reflects limited prior training, the fact that most respondents were first-year clerkship students (64.0%), and the absence of structured PPE instruction in pre-clinical years. After the leaflet intervention, the share of students with good knowledge jumped to 83.3%, and none remained in the poor category. The mean score more than doubled to 6.33 (63.3% correct). This improvement aligns with previous studies on printed educational materials (Dita & Mustafa, 2024; Saati & Alkalash, 2022; Veera et al., 2025). From a cognitive learning perspective (Mayer, 2024), the leaflet likely helped by combining text and images, reducing cognitive load and supporting dual-channel processing. Nevertheless, the post-test mean of 63.3% shows that a single leaflet has limits; some procedural details may still need hands-on demonstration. Moreover, we assessed knowledge only one week after the intervention, so long-term retention remains unknown.

Attitudes

Attitudes toward PPE use were similarly poor at baseline. Only 14.7% of students held good attitudes, while 50.0% were categorized as having poor attitudes. The mean attitude score was 14.07 out of 24 (58.6% of maximum), indicating neutral to negative dispositions toward PPE. This finding is concerning because attitudes are predisposing factors that influence behavioral intentions (Notoatmodjo, 2018). Negative attitudes may stem from perceived inconvenience, discomfort, or a belief that infection risks are low. (Khoerunisa et al., 2026) reported that only 44% of dental students in Surabaya

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consistently used eye protection, attributing low compliance to attitudes that facial protection is unnecessary for "minor" procedures. After the leaflet intervention, good attitudes increased to 64.7%, and poor attitudes fell sharply to just 6.6%. The mean attitude score rose to 20.51 (85.5% of maximum), a gain of 6.44 points. This shift moved the average student from the middle of the scale to the upper quartile, representing a substantial positive change in mindset.

Effect and comparison with empirical evidence: The improvement in attitudes aligns with the Health Belief Model (HBM). According to HBM, health behaviors are influenced by perceived susceptibility, perceived severity, perceived benefits, and perceived barriers (Zewdie et al., 2022). The leaflet intervention likely increased perceived susceptibility by explicitly linking improper PPE use to infection risks (e.g., "without gloves, you have a 30% risk of Hepatitis B transmission after a needlestick"). It also enhanced perceived benefits by emphasizing that correct PPE use reduces infection risk and promotes patient safety. (Sivaraman et al., 2022) used the Health Belief Model to explain PPE use among otorhinolaryngology professionals during COVID-19, demonstrating that perceived threat and benefits significantly influenced protective behaviors. Similarly, (Sangwan et al., 2022) found that training improved attitudes toward PPE among frontline healthcare workers, with knowledge gains translating into more positive dispositions. Beyond HBM, Cognitive Dissonance Theory may also explain the attitude shift. Students who received the leaflet and then reported improved attitudes may have experienced dissonance between their prior behavior (low PPE use) and new knowledge (high infection risk). Resolving this dissonance required adopting more positive attitudes toward PPE. The leaflet's clear, evidence-based messaging likely facilitated this cognitive.

Despite the marked improvement, 10 students (6.6%) remained in the poor attitude category after the intervention. These individuals may have deeply held beliefs or prior negative experiences (e.g., PPE discomfort, heat stress) that a single leaflet cannot overcome. Attitudes are more resistant to change than knowledge, as they involve emotional and evaluative components. The one-week follow-up may also capture transient attitude shifts that could regress over time. Future interventions should incorporate role modeling, peer discussion, or testimonials from infected colleagues to reinforce positive attitudes.

Practices

Self-reported PPE practices were poor at baseline. Only 23.3% of students reported good practices, while 48.0% reported poor practices. The mean practice score was 11.27 out of 20 (56.4% of maximum). This finding is consistent with observational data showing very low use of gloves (12.7%), gowns (17.3%), and head caps (14.0%) before the intervention. The discrepancy between higher mask and face shield use (67.3% and 72.7%) and lower use of other PPE items suggests that students selectively used protective equipment based on perceived risk rather than comprehensive standard precautions. After the leaflet intervention, good practices increased to 75.3%, and poor practices dropped to only 4.7%. The mean practice score rose to 17.11 (85.6% of maximum), with a small standard deviation (1.77) indicating that most students

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converged on high practice scores. The improvement in self-reported practices is consistent with the Theory of Planned Behavior (TPB). TPB posits that behavior is influenced by intention, which is shaped by attitudes, subjective norms, and perceived behavioral control (Asante & Novak, 2024). The leaflet intervention enhanced perceived behavioral control by providing clear, actionable instructions on correct PPE procedures (e.g., how to don gloves without contamination, when to change masks). Previous study found that attitudes, subjective norms, and perceived behavioral controls affected PPE compliance through intention mediation, explaining 65.1% of variance in adherence (Ismurdijahmitra et al., 2022; Sangwan et al., 2022). Our findings support TPB students who received the leaflet reported feeling more confident and capable of using PPE correctly, which translated into improved self-reported practices.

Social Cognitive Theory (Bandura) also offers insight. Observational learning occurs when learners see modeled behaviors (Asante & Novak, 2024). While the leaflet was not interactive, it included illustrated step-by-step demonstrations of correct PPE donning and doffing, which may have served as a vicarious learning experience. Self-efficacy the belief in one's ability to perform a behavior likely increased as students realized that correct PPE use is not technically difficult when procedures are clearly explained. The practice variable relied on self-reported measures, which are subject to social desirability bias. Students may have over-reported good practices to align with researcher expectations. This concern is partially mitigated by the observational compliance data, which also showed substantial improvements for most PPE types (e.g., glove use increased from 12.7% to 71.3%). However, the observation data revealed a concerning decline in mask and face shield use (from 67.3% to 50.7% and 72.7% to 39.3%, respectively), which contrasts with the self-reported practice improvements. This discrepancy suggests that either (a) self-reported practices overestimated true behavior, or (b) the leaflet inadvertently emphasized contact protection (gloves, gowns) over respiratory protection. Future studies should use objective measures (e.g., video recording, electronic monitoring) rather than self-reports.

Compliance

Observed PPE compliance was critically low at baseline. Only 23.3% of students demonstrated good compliance, while 40.0% fell into the poor category. The mean compliance score was 23.13 out of 40 (57.8% of maximum). As shown in Table 2, compliance varied widely by PPE type mask (67.3%) and eye/face protection (72.7%) were relatively high, likely due to residual COVID-19 awareness, while glove use (12.7%), gown use (17.3%), head cap use (14.0%), and shoe cover use (6.0%) were extremely low. This pattern indicates that students perceived respiratory hazards as more threatening than contact or splash hazards, despite evidence that dental procedures generate blood- and saliva-contaminated aerosols that pose both types of risk (Xiao & Watson, 2019) . After the leaflet intervention, good compliance more than tripled to 80.0%, and poor compliance fell to only 4.0%. The mean compliance score increased to 33.64 (84.1% of maximum), a gain of over 10 points. The largest improvements were observed for glove use (+58.6 percentage points) and gown use (+57.4 percentage points), indicating that the leaflet was most effective at changing behaviors perceived as directly protective

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against contact and splash risks. The substantial improvement in observed compliance aligns with findings from Yeon et al. (2020), who reported that reality-based education on PPE use significantly reduced contamination sites (42 vs. 89) and improved doffing performance (Yeon & Shin, 2020). In a Cochrane review, concluded that printed educational materials probably improve professional practice, though effect sizes vary. Our findings extend this evidence to dental students in a low-resource setting(Giguère et al., 2020). Several explanations may account for the unexpected decline in observed mask use (from 67.3% to 50.7%) and eye or face protection (from 72.7% to 39.3%) after the intervention. First, the study was conducted in October 2025, well after the acute phase of the COVID-19 pandemic, so students may have perceived respiratory precautions as less necessary; the leaflet's emphasis on contact protection (gloves, gowns) may have inadvertently reinforced this perception. Second, a Hawthorne effect during the pre-test observation may have temporarily elevated mask and face shield use because students knew they were being watched, and by the post-test observation one week later this reactivity may have diminished, revealing lower baseline usage. Third, the leaflet content may have devoted more space and illustrations to gloves, gowns, head caps, and shoe covers than to masks and face shields, although a formal content analysis would be needed to confirm this imbalance. Fourth, mask and face shield use may be more sensitive than other PPE items to contextual factors such as perceived patient infection status or the type of clinical procedure being performed, and the pre-test and post-test observations may have occurred during different clinical activities. Future interventions should ensure balanced emphasis across all PPE types and incorporate periodic reinforcement to sustain compliance.

Several limitations should be acknowledged. First, the absence of a control group limits causal inference, as improvements cannot be definitively attributed solely to the intervention. Second, the one-week follow-up period captures short-term effects only; long-term retention of knowledge and sustained behavioral change remain unknown. Third, the study was conducted at a single institution, limiting generalizability. Fourth, reliance on self-reported measures for knowledge, attitudes, and practices may introduce social desirability bias, although observation data partially mitigated this.

Conclusion

This study concludes that leaflet-based educational intervention significantly improves knowledge, attitudes, practices, and compliance regarding personal protective equipment use among clinical dental students. The proportion of respondents with good knowledge increased from 20.0% to 83.3%, good attitudes from 14.7% to 64.7%, good practices from 23.3% to 75.3%, and good compliance from 23.3% to 80.0%. Mean scores for all variables increased significantly ($p = 0.000$). Leaflets are effective, low-cost, and reusable educational tools that can be integrated into clinical orientation programs to strengthen infection prevention behaviors. Sustained improvements require complementary strategies including routine supervision, role modeling by clinical instructors, and periodic refresher training.

Ethics approval and consent to participate

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Ethical approval was obtained from the Research Ethics Committee of Universitas Prima Indonesia (037/KEPK/UNPRI/IV/2026). All participants provided written informed consent after receiving a complete explanation of the study. Anonymity and confidentiality of all data were strictly maintained.

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