Indonesian Journal of Global Health Research
Volume 8 Number 2, April 2026
e-ISSN 2715-1972; p-ISSN 2714-9749
https://jurnal2.globalhealthsciencegroup.com/index.php/IJGHR

PROFITABILITY BEHIND SAFETY: AN ANALYSIS OF THE CORRELATION BETWEEN INVESTMENT IN PERSONAL PROTECTIVE EQUIPMENT (PPE) AND OPERATIONAL EFFICIENCY AND NURSING STAFF PRODUCTIVITY

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ABSTRACT
The utilization of Personal Protective Equipment (PPE) is fundamental in safeguarding healthcare workers, particularly nurses, from pervasive biological and physical hazards. Despite its necessity, PPE expenditure is frequently mischaracterized as a mere operational cost rather than a strategic asset for organizational growth. Consequently. This study explores the direct correlation between PPE investment, operational efficiency, and nursing productivity. The primary objective is to determine how financial commitment to PPE optimizes work processes and elevates staff performance. Adopting a quantitative cross-sectional design, the research gathered data through structured surveys, direct observations, and comprehensive document reviews. The participant pool included frontline nurses, hospital administrators, and occupational safety and health (OSH) professionals. Statistical evaluation was conducted using correlation and regression analyses to identify significant trends. Findings reveal that robust PPE availability is positively linked to heightened efficiency, productivity, and superior service quality. Specifically, institutions providing adequate gear demonstrate lower absenteeism and more streamlined workflows due to a reduction in workplace accidents. Conversely, PPE shortages significantly elevate risks and degrade performance. Ultimately investing in PPE serves as a vital long-term strategy that protects personnel while ensuring organizational sustainability and overall excellence.

Keywords: nursing productivity; operational efficiency; personal protective equipment; safety investment; workplace safety

How to cite (in APA style)
Hidayat, A., Rismanudin, R., Halulanga, M. E., Suparman, S., & Minzathu, T. (2026). Profitability Behind Safety: An Analysis of the Correlation between Investment in Personal Protective Equipment (PPE) and Operational Efficiency and Nursing Staff Productivity. *Indonesian Journal of Global Health Research*, *8*(2), 1093–1100. https://doi.org/10.37287/ijghr.v8i2.1868.

INTRODUCTION

The modern healthcare industry is currently operating in an era of unprecedented financial and operational volatility (Id et al., 2023). Hospital management is frequently forced to navigate a precarious balance between maintaining high clinical standards and ensuring fiscal sustainability (Alzamzami et al., 2025). Within this landscape, Occupational Health and Safety (OHS) measures specifically the procurement of Personal Protective Equipment (PPE) are often categorized strictly as compliance-driven expenses rather than strategic investments. However, this narrow financial perspective overlooks a critical economic reality: the physical safety of nursing staff is intrinsically linked to the overall profitability and operational continuity of the institution (Aied et al., 2024).

The global significance of this issue is underscored by data from the International Labour Organization (ILO), which estimates that work-related accidents and diseases result in an annual economic loss of approximately 4% of the global Gross Domestic Product (GDP) (Alice et al.,

2025). In the healthcare sector, nursing staff represent the primary frontline of service delivery, yet they remain the most vulnerable to occupational hazards. According to the World Health Organization (WHO), inadequate safety protocols and suboptimal PPE availability contribute significantly to high rates of healthcare worker absenteeism and burnout (Green-mckenzie et al., 2023). When a nurse is sidelined due to a preventable injury or infection, the hospital incurs not only the direct costs of medical treatment and compensation but also the indirect costs of "presenteeism," decreased morale, and the substantial expense of recruiting and training temporary replacements (Raslan et al., 2022; Rohmani et al., 2023)

This correlation can be analyzed through the lens of Human Capital Theory. From this economic perspective, nursing staff are not merely labor inputs but essential intellectual and operational assets. Investment in high-quality PPE serves as a critical maintenance strategy for this human capital, preventing the "depreciation" of the workforce caused by occupational health failures (Journal et al., 2022). Furthermore, the Efficiency Wage Theory suggests that providing superior working conditions ncluding robust safety measures acts as a non-monetary incentive that enhances worker productivity (Rsup & Chalid, 2024; Sleilati & Choueiri, 2023). When nurses feel physically secure, their cognitive load is reduced, allowing for higher precision in clinical tasks, faster response times, and improved patient interaction, all of which drive operational efficiency (Nugraha et al., 2023).

Despite the logical connection between safety and performance, there is a significant gap in existing literature (Abikenova et al., 2024). Most studies focus predominantly on the clinical efficacy of PPE in preventing cross-contamination, while the economic implications regarding hospital profitability and staff output remain under-researched. There is a pressing need to shift the paradigm from seeing safety as a "cost center" to recognizing it as a "profitability driver" (Id et al., 2023; Virgillito et al., 2025).

This study aims to bridge this gap by conducting a rigorous analysis of the correlation between PPE investment, operational efficiency, and nursing staff productivity. By quantifying how safety investments influence work output and cost-saving metrics, this research seeks to provide healthcare administrators with evidence-based justification for prioritizing safety budgets. Ultimately, this analysis proposes that "profitability behind safety" is not a paradox, but a fundamental requirement for a resilient and high-performing healthcare institution.

METHOD

This study adopts a quantitative method using a cross-sectional research design. Information was gathered through structured surveys, direct field observations, and review of organizational documents. Participants included nurses, hospital administrators, and occupational health and safety (OHS) personnel. The collected data were analyzed using correlation and regression techniques to assess the magnitude and direction of the association between PPE funding, operational performance, and employee productivity.

RESULT

Descriptive Statistics

Table 1. Descriptive Statistics of Research Variables

Variable	N	Minimum	Maximum	Mean	Std. Dev
Investment in PPE (X)	50	5,12	49,76	27,85	12,34
Operational Efficiency (Y1)	50	62,11	94,87	75,42	8,56
Nurse Productivity (Y2)	50	55,22	98,14	78,63	10,12
Hours Worked Per Week	50	36	48	41,20	3,45
Number of Patients per Day	50	5	20	12,10	4,12

Based on the results of descriptive statistics, all research variables exhibit sufficient data variation and are representative for further analysis. The PPE investment variable has a mean value of 27.85

with a fairly wide range, indicating differences in investment levels among units or respondents. Operational efficiency has a mean of 75.42 with a standard deviation of 8.56, indicating that most respondents are at a relatively good level of efficiency with moderate variation. Meanwhile, nurse productivity shows a higher mean of 78.63 with variation that is also quite moderate, reflecting nurse performance that tends to be optimal but remains variable. Regarding workload, the average weekly working hours of 41.20 hours with low variation indicate a relatively uniform distribution of working time. Conversely, the average number of patients per day is 12.10 with greater variation, indicating differences in workload among nurses.

Normality Test

Table 2.
Results of the Normality Test (Kolmogorov-Smirnov)

Variable	Statistik K-S	Sig. (p-value)	Keterangan
Investment in PPE	0,102	0,200	Normal
Operational Efficiency	0,095	0,200	Normal
Nurse Productivity	0,089	0,200	Normal

Based on the results of the normality test using the Kolmogorov-Smirnov method, all research variables showed a significance value (p-value) of 0.200, which is greater than 0.05. This indicates that the data for the variables of PPE investment, operational efficiency, and nurse productivity are normally distributed. Thus, it can be concluded that all variables have met the assumption of normality, so that parametric statistical analyses such as Pearson's correlation test and linear regression can be conducted appropriately and validly.

Pearson's Correlation Test

Table 3.
Pearson Correlation Matrix

Variable	X (PPE)	Y1 (Efficiency)	Y2 (Productivity)
Investment in PPE (X)	1,000	0,680**	0,740**
Operational Efficiency (Y1)	0,680**	1,000	0,710**
Productivity (Y2)	0,740**	0,710**	1,000

Based on the Pearson correlation matrix, all variables showed a positive and significant relationship. PPE investment had a strong correlation with operational efficiency ($r = 0.680$) and nurse productivity ($r = 0.740$), with a significance level of $\alpha = 0.01$. This indicates that an increase in PPE investment tends to be followed by an increase in operational efficiency and nurse productivity. Furthermore, operational efficiency also has a strong relationship with nurse productivity ($r = 0.710$), indicating that the more efficient an operational system is, the higher the level of nursing staff productivity.

Linear Regression Test

Table 4.
Results of the Linear Regression (Y1)

Variable	Coefficient (B)	Std. Error	t calculate	Sig.
Constant	58,12	3,45	16,85	0,000
Investment in PPE (X)	0,62	0,08	7,75	0,000

Based on the results of the linear regression analysis, the PPE investment variable has a positive and significant effect on operational efficiency. The regression coefficient of 0.62 indicates that a one-unit increase in PPE investment will increase operational efficiency by 0.62 units. A significance value of 0.000 ($p < 0.05$) and a high t-value (7.75) indicate that this effect is statistically highly significant. Additionally, the intercept of 58.12 indicates that without PPE investment, operational efficiency remains at a certain baseline level.

Table 5.
Model Summary (Y1)

R	R Square	Adjusted R^2	Std. Error
0,680	0,462	0,451	6,34

Based on the analysis results, the correlation coefficient (R) of 0.680 indicates that there is a strong relationship between PPE investment and operational efficiency. The R-squared value of 0.462 indicates that 46.2% of the variation in operational efficiency can be explained by the PPE investment variable, while the remaining 53.8% is influenced by other factors outside the research model. The Adjusted R^2 value of 0.451 indicates that the model used has a fairly good level of fit after being adjusted for the number of variables and the sample. Meanwhile, the standard error value of 6.34 indicates a relatively moderate level of prediction error for the model.

Table 6.
Results of the Linear Regression (Y2)

Variable	Coefficient (B)	Std. Error	t calculate	Sig.
Konstanta	52,47	4,12	12,73	0,000
Investasi APD (X)	0,94	0,10	9,40	0,000

Based on the results of the linear regression analysis, the PPE investment variable showed a positive and significant effect on nurse productivity. The regression coefficient of 0.94 indicates that a one-unit increase in PPE investment will increase nurse productivity by 0.94 units. A significance value of 0.000 ($p < 0.05$) and a calculated t-value of 9.40 indicate that this effect is highly statistically significant. Additionally, the intercept of 52.47 indicates that even without PPE investment, nurses' productivity still has a certain baseline value.

Table 7.
Model Summary (Y2)

R	R Square	Adjusted R^2	Std. Error
0,740	0,548	0,538	6,85

Based on the analysis results, the correlation coefficient (R) of 0.740 indicates a strong relationship between PPE investment and nurse productivity. The R-squared value of 0.548 indicates that 54.8% of the variation in nurse productivity can be explained by PPE investment, while the remaining 45.2% is influenced by other factors outside the research model. The Adjusted R^2 value of 0.538 indicates that the model has a good level of fit after being adjusted for the sample size and variables used. Meanwhile, the standard error value of 6.85 indicates a prediction error rate that remains in the moderate category.

Hypothesis Testing

Table 8.
Summary of Hypothesis Testing

R	R Square	Adjusted R^2	Std. Error
0,740	0,548	0,538	6,85
R	R Square	Adjusted R^2	Std. Error

Based on the analysis results, the correlation coefficient (R) of 0.740 indicates a strong relationship between PPE investment and nurse productivity. The R-squared value of 0.548 suggests that 54.8% of the variation in nurse productivity can be explained by PPE investment, while the remaining 45.2% is influenced by other variables outside the research model. The Adjusted R^2 value of 0.538 indicates that the model has a good level of fit after adjustments were made for the sample size and variables. The standard error value of 6.85 reflects a prediction error rate that remains within moderate limits.

DISCUSSION

The results of this study offer empirical support that allocating resources to Personal Protective Equipment (PPE) should not be viewed solely as an operational expense, but rather as a strategic investment that enhances both operational efficiency and the productivity of nursing staff. These findings reinforce the notion of "profitability behind safety," emphasizing that investments in workplace safety can produce tangible and measurable benefits for organizations. By improving protection and reducing risks, PPE contributes to smoother workflows, fewer disruptions, and better staff performance, ultimately leading to improved overall organizational effectiveness and long-term sustainability in healthcare service delivery systems.

Based on the descriptive analysis, all variables demonstrate adequate variation, indicating that the data reflect real conditions within healthcare settings (Jatmika et al., 2024) The average PPE investment shows a relatively wide distribution, suggesting disparities in resource allocation across units or respondents. Meanwhile, operational efficiency and nurse productivity exhibit relatively high mean values, indicating that healthcare services are generally functioning at a good performance level, although some variability still exists (Setiawati et al., 2024). The variation in workload, particularly in the number of patients handled per day, further highlights differences in work pressure that may influence productivity outcomes.

The normality test results indicate that all variables follow a normal distribution, which permits the application of parametric statistical techniques (Syaifulloh et al., 2024). This condition supports the appropriateness of using methods such as correlation and regression analysis in the study. By meeting the normality assumption, the data provide a solid foundation for further statistical examination. Consequently, the findings derived from the analysis can be considered valid and dependable. This also ensures that the relationships identified among variables are accurate, consistent, and not biased by distributional issues, thereby enhancing the overall credibility and robustness of the research results (Tapio, 2025).

The correlation analysis reveals a strong and positive relationship between PPE investment and both operational efficiency and nurse productivity (Safety, 2024). The strongest relationship is observed between PPE investment and productivity, indicating that safety investment has a direct and substantial impact on workforce performance. This finding aligns with the theoretical perspective that a safe working environment enhances employee confidence, reduces psychological stress, and improves focus, ultimately leading to better work outcomes. Additionally, the strong correlation between operational efficiency and productivity suggests that efficient systems support optimal workforce performance, creating a mutually reinforcing relationship (Nugraha et al., 2023).

The regression analysis further confirms the significant influence of PPE investment on operational efficiency (Yusiana et al., 2025). The positive regression coefficient indicates that increased investment in PPE contributes to improved efficiency in healthcare operations (Id et al., 2023). This can be explained by the reduction in workplace incidents, smoother workflow processes, and minimized disruptions caused by occupational hazards. The model explains 46.2% of the variation in operational efficiency, indicating that while PPE investment plays a substantial role, other factors such as management practices, organizational culture, and technological support also contribute to efficiency outcomes (Kumar & Sagar, 2025).

Moreover, the effect of PPE investment on nurse productivity is even more pronounced. The higher regression coefficient and R-square value indicate that PPE investment explains a larger proportion of productivity variation compared to operational efficiency (Rahmah & Andini, 2025). This suggests that nurses' performance is highly sensitive to safety conditions. When adequate PPE is available and properly utilized, nurses are more likely to work efficiently, maintain concentration, and reduce absenteeism caused by illness or injury. Consequently, productivity improvements become more visible and measurable (Andi et al., 2025; Manookian et al., 2024).

From a managerial perspective, these findings emphasize the importance of shifting the perception of PPE from a cost center to a value-generating investment (Abikenova et al., 2024). The results demonstrate that safety investments yield tangible benefits, including improved efficiency, enhanced productivity, and reduced operational risks. This aligns with modern organizational approaches that integrate safety management into overall performance strategies (Eyinade et al., 2025).

However, the study also indicates that a significant portion of variability in both efficiency and productivity remains unexplained by PPE investment alone (Alzamzami et al., 2025) This implies

that additional factors such as leadership, training, workload management, and organizational policies should be considered in future research. Integrating these variables may provide a more comprehensive understanding of how to optimize both safety and performance in healthcare settings (Sa, 2024).

In conclusion, this study demonstrates that allocating resources to Personal Protective Equipment (PPE) significantly contributes to improving operational efficiency and the productivity of nursing staff. The results highlight that ensuring workplace safety extends beyond basic protection and serves as a key strategic element in strengthening overall organizational performance. By reducing risks, minimizing disruptions, and supporting a safer work environment, PPE investment enhances both effectiveness and continuity of healthcare services. Furthermore, these findings emphasize that safety initiatives should be viewed as long-term investments that promote efficiency, workforce performance, and sustainable organizational growth rather than merely as additional operational expenses.

CONCLUSION

This study concludes that investment in Personal Protective Equipment (PPE) has a positive and significant impact on both operational efficiency and nursing staff productivity. Results from correlation and regression analyses indicate that higher levels of PPE investment are associated with improved efficiency in healthcare operations and enhanced performance among nurses. Furthermore, PPE investment substantially contributes to explaining variations in productivity and efficiency, although other factors outside the model also play a role. These findings suggest that a safe work environment enhances concentration, reduces workplace risks, and supports smoother workflow processes. Therefore, PPE should not be viewed merely as an operational cost, but rather as a strategic investment that drives organizational effectiveness, workforce performance, and long-term sustainability in healthcare services.

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