Quality Audit Analysis: Implementation of the Five Moments, Six Steps Handwashing Protocol for Hospital Incidences of Phlebitis

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Background: Handwashing by health professionals is often associated with efforts to prevent cross-infection in hospitals. The handwashing compliance of health professionals is still below 40%. This is very risky, causing nosocomial infections in visiting patients. Incidences of phlebitis in infusion is one indicator that must be considered when addressing infection prevention and reaching control targets with indicators below 1.5 per mile. **Methods:** This study uses a quantitative analytical approach, aiming to analyse the relationship between the effectiveness of implementing health professional handwashing training with incidences of phlebitis in hospitals. Compliance with handwashing behaviour of health professionals was observed by auditing the quality of handwashing through the Five Moments and Six Steps protocol, carried out by the Infection Prevention Control Nurse (IPCN), which consisted of doctors (n = 30) and nurses (n = 70). Incidences of phlebitis were measured through daily recordings and monitoring by the Infection Prevention Control Link Nurse (IPCLN) in four rooms. The results were validated by the IPCN and the hospital's control and prevention committee. Data analysis used SEM WarpPLS. **Results:** There is a significant relationship between nurses not handwashing and incidences of phlebitis, with p value: 0.007 (highly significant), obtaining an R-square determinant or $R^2 = 0.19$, meaning that 19% of nurses, who are ineffectively handwashing, are at risk of causing

phlebitis. There is no relationship between doctors' handwashing with incidences of phlebitis, with the p value: 0.416 (not significant). **Conclusion:** There is a significant relationship between the implementation of the Five Moments, Six Steps protocol for nurses and incidences of phlebitis.

Key words: *Health professionals, Five Moments, Six Steps, phlebitis.*

Introduction

In the last two decades handwashing has been critically discussed in related to the problem of infection, with efforts to reduce antimicrobial resistance (Pires and Pittet, 2017). Implementation of the Five Moments, Six Steps protocol is a standard procedure for every hospital health professional, ensuring that infection is controlled properly and correctly. Some studies show that the average level of compliance for health workers when washing their hands in a hospital setting is still below 50% (Lal, 2015; Pittet, 2001; Shojaei et al., 2006). The average complication of infection is 8-10% in all hospitals, often occurring in the intensive care unit (Gross, 1948). Handwashing has proven benefits, namely preventing the transmission of infection, yet compliance with consistent handwashing protocols, especially in intensive care units, ranges between 28% and 74% (Gross, 1948).

Poor handwashing, when preparing food, contributes to outbreaks of Staphylooccus aureus and gram-negative Bacilli, which can lead to health problems. The presence of microorganisms is also found in patients with phlebitis, namely E. coli, Staphylococcus and Bacillus (Rusmawati et al., 2018). Exposure to phlebitis is treated between three days and 17 days (Jannah et al., 2016). Studies report the incidence of infiltration among cannulae to up to 31.5%, and the majority of cannulae in the study had developed Grade II (72%) infiltration. Phlebitis developed in 29.8% of cannulae. Nearly 45% of cannulae were infiltrated with Grade II and Grade III phlebitis. Post-infusion phlebitis at 48 hours was diagnosed in 59 (1.8%) patients. Fifteen (25.4%) of these patients had phlebitis at the time of cannula removal (Rusmawati et al., 2018). The low compliance in handwashing clearly has the potential to cause infections (phlebitis).

Methods
Study Design

This study's design analyses the relationship between the health professional handwashing effectiveness with incidences of phlebitis. The study was conducted at the Military Hospital, taking four rooms – namely the ICU, Hemodialysis Room, Emergency Unit and Inpatient Room. The data collection process was carried out by observing and auditing health

professionals, and the quality of their handwashing compliance when washing their hands via the Five Moments, Six Steps protocol, a standard World Health Organization (WHO) protocol (World Health Organization, 2016). The study used a sample of 100 participants, consisting of 30 doctors and 70 nurses.

The audit was carried out by the Infection Prevention Control Nurse (IPCN) Hospital Infection Prevention and Control Committee. Observation was assessed by analysing each step of the Five Moments, Six Steps protocol, including Moment 1: handwashing before contact with patients; Moment 2: handwashing before aseptic procedures; Moment 3: handwashing after any contact with body secretions; Moment 4: handwashing after contact with patients; and Moment 5: handwashing after contact with the surrounding environment. Observations were made in 2018, once every three months. Phlebitis event data was always observed by an Infection Prevention Control Link Nurse (IPCLN) officer by conducting an assessment and validating.

Data Analysis

The data analysis used in this study employed a Structural Equation Model (SEM) analysis of WarPLS, analysing the relationship between the handwashing of doctors and nurses, complying with the Five Moments, Six Steps protocol, to incidences of phlebitis. Factor loading was used at each of the five moments of the protocol, the highest factor indicating the most important moment during handwashing.

Conditions are accepted when a significant hypothesis reaches a p-value of <0.05. The coefficient of determination is used to see the effect on the independent variable. Model fit is used to assess whether the model is appropriate or not with an APR and ARS value of >0.05.

Results

This auditing of the implementation quality of Five Moments, Six Steps – of 100 doctors and nurses – was carried out over one year, divided into four stages, with monitoring carried out every three months. The average compliance rate of health professionals washing their hands was 81%, still below the WHO standard of 100%.

Nurse handwashing data, in all five handwashing moments, had an outer loading factor averaging 0.783 and a p-value of 0.001, thus fulfilling a significant convergent validity at a level of 10%. This proved that the five moments of handwashing effectively described the variable implementation of nurses' handwashing (X1). There is a factor load – the highest in the implementation of nurses' handwashing – occuring at moment four, of 0.854, meaning nurses always wash their hands after interacting with patients ($X_{1.4}$).

Measurement of variable implementation of doctors' handwashing activities during all moments obtained an outer loading factor average of 0.76 and a p-value of 0.001. This fulfils a significant convergent validity at a level of 10%, so the indicator clearly describes the variable implementation of doctors' handwashing (X2). The most important factor load – an indicator of doctors' handwashing – is during moment five, of 0.893, meaning the doctor always washed their hands after being exposed to a patient's environment. (Table 1)

Table 1: Health professionals' handwashing with the Five Moments, Six Steps protocol

Type	Moment 1	Moment 2	Moment 3	Moment 4	Moment 5	p-value	Information
Nurses	0.600	0.807	0.783	0.854	0.811	0.001	Significant
Doctors	0.437	0.752	0.860	0.841	0.893	0.001	Significant

The WarpPLS analysis – using the t-test – found that there were significantly high effects of nurse handwashing through the Five Moments, Six Steps process (X1), with the with p-value 0.007. The R-square determinant above, with the value of $R^2 = 0.19$ (Figure 2), shows the effect of nurse's handwashing (X1) contributed to incidences of phlebitis (Y1) by 19%. Analysis of the effect of handwashing of doctors found no effect (not significant) on incidences of phlebitis (Table 2).

Table 2: Hypothesis Test Results

Type	Relationship between variables		Coefficient of path	p-value	Information
Nurses	X1	Y1	0.442	0.007	Highly significant
Doctors	X2	Y1	-0.044	0.416	Not significant

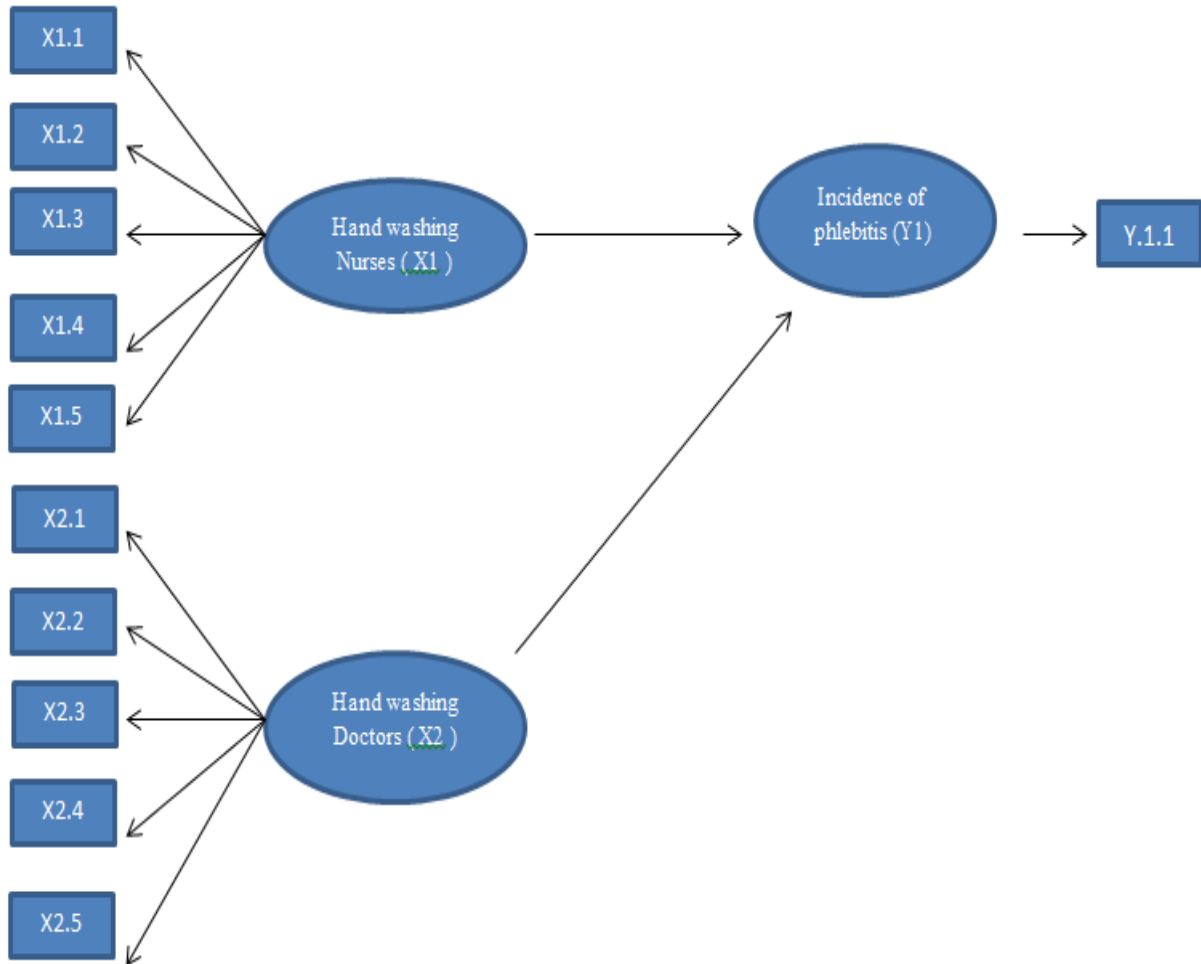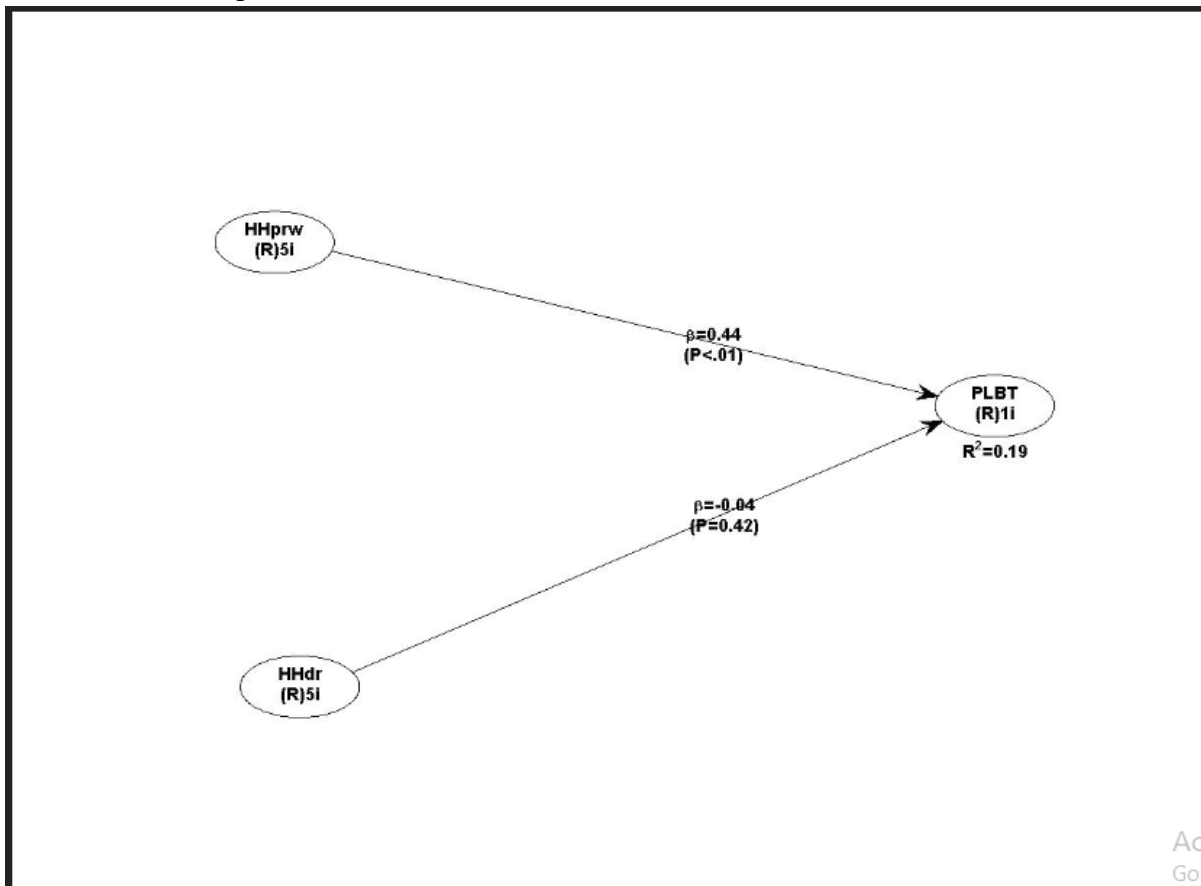**Figure 1.** Model of relationship between handwashing of health professionals and incidences of phlebitis

Table 3: Table 3 Model Results of Goodness of Fit

Model fit and quality indices	Analysis Results	Fit Criteria	Information
Average path coefficient (APC)	APC = 0.243 p = 0.051	Signifikan jika p < 0,05	Not significant
Average R-squared (ARS)	ARS = 0.193 p = 0.081	Signifikan jika p < 0,05	Not significant
Average adjusted R-squared (AARS)	AARS = 0.108 p = 0.149	Signifikan jika p < 0,05	Not significant

Average block VIF	AVIF = 1.717	Acceptable if AVIF ≤ 5 Ideal if AVIF ≤ 3	Ideal
Average full collinary VIF	AFVIF = 2.301	acceptable if AFVIF ≤ 5 ideal if AFVIF ≤ 3	Ideal
Tenenhaus GoF	GoF = 0.376	Less than if GoF ≥ 0,1 medium if GoF ≥0,25 more than if ≥ 0,36	Great
Sympson's paradox ratio	SPR = 0.500	acceptable if SPR ≥0,7 Ideal if SPR = 1	*Acceptable*
R-square contribution ratio	RSCR = 0.934	acceptable if RSCR ≥0,9 Ideal if RSCR = 1	*Acceptable*
Statistical suppression ratio	SSR =1.000	acceptable if SSR≥0,7	*Acceptable*
Nonlinear Bivariate causality direction ratio (NLBCDR)	(NLBCDR) =1.000	acceptable if (NLBCDR) ≥0,7	*Acceptable*

Figure 1 and Table 3 show the results of the Average Path Coefficient, APC = 0.243 and p = 0.051, and average R-squared, ARS = 0.193, with the p = 0.081 (no smaller than 0.05). This proves it is not significant, so the variable relationship model is not appropriate and can be ignored, as the research objective is to test the hypothesis.

Figure 2. Goodness of fit model of relationship between handwashing of health professionals and incidences of phlebitis.

Based on the figure above, the results testing the model of the relationship between handwashing of nurses (X1) and doctors (X2) with incidences of phlebitis (Y1) shows there is a direct influence between the implementation the Five Moments, Six Steps protocol with nurses, with a path coefficient of 0.44. (p <0.01), and with the R-square determinant above, with the value of $R^2 = 0.19$. This shows the effect of nurses' handwashing (X1) contributed to incidences of phlebitis (Y1) by 19%.

Discussion

This study identifies the biggest factor load on nurse handwashing occurred at the fourth moment (0.854), where nurses washed their hands after making contact with patients. Importantly, nurses prioritise and are more concerned with, their own safety against infection, compared to their efforts to prevent infections to patients. This is shown with the loading factors of compliance with handwashing moment one, with a loading factor of 0600 nurses washing their hands before contact with patients. This has the potential to transmit germs from

one patient to another. In the identification of doctors' handwashing, the biggest factor was at moment five (0.893), where doctors wash their hands after being exposed to a patient's environment. Self-protection against germs or infections is still seemingly more important than the implementation of handwashing to protect infections for patients with the lowest loading factor (0.437) in moment one.

This state of affairs is in accordance with results of wider research on the risk of transmission of infection from ineffective handwashing, and is dependent on how individual components are integrated into the handwashing protocol; how it is integrated into the hospital environment; and correct construction, use (education), cleaning and maintenance (Weinbren, 2018). Efforts to improve compliance with staff handwashing must be done to prevent the risk of transmitting germs, given education and training of staff is frequently cited as essential to the development and maintenance of hand hygiene compliance. This is often quoted as the single most effective measure to prevent hospital acquired infection (Cole, 2006). The need to increase compliance with handwashing must be done through continuous education and training – the most commonly followed approach to increase awareness and improve compliance (Laskar et al., 2018). Monitoring and evaluation, by conducting audits, should be carried out by hospitals' control and prevention committees on an ongoing basis.

Based on the results of hypothesis testing, there is a significant relationship between the implementation of the Five Moments, Six Steps protocol with incidences of phlebitis. This clarifies previous research indicating that handwashing plays a role in the transmission of infections in the health service, food industry and society (Jumaa, 2005). When doctors implemented the handwashing protocol, there was no relationship with incidences of phlebitis, as nurses had 24-hours more direct contact with patients, compared with their doctors, so the risk of contributing was higher. The result of the R-square determinant above, with the value of $R^2 = 0.19$, shows the effect of the implementation of nurses' handwashing, (X1) contributing to the incidence of phlebitis (Y1) by 19%. This is also supported by research on the presence of germs on nurses before and after handwashing (Widodo et al., 2017) and due to the lack of nurses' attention to infusion care for patients (Rosa and Kep; Saini, 2011). The need for compliance with handwashing needs to be approached through strategies and efforts to increase compliance in hospitals through education, training, motivation and the hospital's health service system (Cole, 2006; Jemal, 2018; Laskar, 2018; Mathur, 2011).

In testing the equation model, testing the relationship between the implementation of Five Moments, Six Steps, health workers with phlebitis incidents do not fit the expected model, so it cannot be used as a model reference. The main purpose of research is to identify the relationship of variables, so that the model can be ignored.

Conclusion

There is a significantly high effect on the implementation of nurses handwashing through the Five Moments, Six Steps protocol (X1) with the incidence of phlebitis, with p value 0.007, and the R-square determinant above with the value $R^2 = 0.19$. Future research needs to identify factors that influence compliance of handwashing and the opportunity to wash hands through the Five Moments, Six Steps protocol.

Acknowledgments

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