

# Knowledge and Perceived Self-Efficacy Regarding Personal Protective Equipment for Coronavirus Disease 2019 Prevention: A Cross-Sectional Study among Thai Nursing Students at Suan Sunandha Rajabhat University

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## ABSTRACT

**Introduction:** Personal protective equipment plays a crucial role in preventing the transmission of Coronavirus Disease 2019 among healthcare workers as well as nursing students in clinical settings. The study aimed to investigate the level and relationship between knowledge and perceived self-efficacy regarding personal protective equipment for COVID-19 prevention among nursing students at Suan Sunandha Rajabhat University, Thailand.

**Methods:** An analytical cross-sectional study was conducted involving 144 undergraduate nursing students at a single faculty of nursing in Thailand between August and September 2022. An online questionnaire was administered to collect data on participants' general characteristics, knowledge, and perceived self-efficacy regarding the use of personal protective equipment. Data were analyzed using descriptive statistics, the Chi-Square test, and Spearman's rank correlation coefficient.

**Results:** Among 144 participants, a majority demonstrated high knowledge regarding the use of personal protective equipment (45.8%) while reporting moderate perceived self-efficacy regarding the use of personal protective equipment (45.1%). No statistically significant differences in the proportions of knowledge were found based on the participants' study year ( $p$ -value = 0.499). However, there was a statistically significant difference in the proportions of perceived self-efficacy according to the participants' study year ( $p$ -value = 0.013). Furthermore, knowledge was significantly positively correlated with perceived self-efficacy regarding the use of personal protective equipment ( $r$  = 0.24;  $p$ -value = 0.002).

**Conclusion:** The findings suggest a need for developing teaching and learning strategies to enhance nursing students' proficiency in using personal protective equipment in alignment with current requirements.

**Keywords:** Personal protective equipment; Knowledge; Perceived self-efficacy; Nursing student

## Introduction

The Coronavirus Disease 2019 (COVID-19) outbreak, caused by the Severe Acute Respiratory Syndrome 2 (SARS-CoV-2) virus [1], poses significant public health challenges globally. As of January 2024, over 774 million cases and 7 million deaths have been reported worldwide [2]. Transmission occurs through respiratory droplets, direct or indirect contact with infected individuals, and potentially through airborne particles generated during certain medical procedures

[1, 3]. Healthcare workers are particularly vulnerable due to close patient contact, with studies indicating high infection rates among frontline personnel [4, 5]. Preventive and control measures are crucial in combating the spread of the COVID-19 virus [6], with personal protective equipment (PPE) being especially important. PPE, including eye protection, masks, gowns, and gloves, plays a critical role in preventing the transmission of infection [7].

Given the pivotal role of nursing students in patient care [8], especially during health crises like the ongoing pandemic [9], their preparedness to use PPE is paramount. At Suan Sunandha Rajabhat University's College of Nursing and Health, third- and fourth-year nursing students undergo comprehensive training, including theoretical and practical nursing aspects, covering PPE usage [10]. Additionally, adequate knowledge about PPE is essential, as it serves as the foundation for correct usage [11]. Bandura's theory of self-efficacy suggests that individuals' confidence in their abilities influences their actions [12]. Therefore, nursing students' awareness of their capacity to use PPE correctly is crucial.

However, the existing literature presents mixed findings regarding healthcare personnel's knowledge of and practices related to PPE. While some studies report high levels of knowledge, positive attitudes, and good practices [13], others indicate significant gaps, particularly in understanding proper PPE application [14]. Importantly, knowledge correlates with self-efficacy in using PPE effectively. Therefore, understanding nursing students' knowledge and self-efficacy regarding using PPE to prevent COVID-19 is essential for enhancing their preparedness and ensuring their safety and effectiveness in patient care.

This study aims to investigate the level and relationship between knowledge and perceived self-efficacy regarding personal protective equipment for COVID-19 prevention among nursing students at Suan Sunandha Rajabhat University, Thailand. The findings will provide valuable insights for curriculum development, training strategies, and healthcare protocols, ultimately enhancing students' competency and readiness to support healthcare teams in managing COVID-19 patients. Additionally, the results can inform broader initiatives aimed at improving PPE usage among healthcare workers, thereby contributing to overall infection control efforts and public health outcomes.

## Methods

### *Study design and setting*

This study employed an analytical cross-sectional study and was conducted at a single faculty of nursing in Thailand between August and September 2022. The undergraduate nursing curriculum stands as the key program of the university, attracting an annual enrollment of approximately 120 students.

### *Study sample and sample size calculation*

The inclusion criteria were third- and fourth-year undergraduate nursing students who had completed both the classroom lectures and practical components of the fundamentals of nursing courses. The sample size was calculated using G\*power software version 3.1.2, with parameters set at  $\alpha = 0.05$ , effect size derived from a previous study = 0.231 [15], and power = 0.80,

resulting in a required sample size of 144 nursing students. Participants were selected using simple random sampling, with 72 students from each third- and fourth-year nursing cohort.

### **Data collection**

Data were collected through an online questionnaire sent to individual university students' email addresses after Institutional Review Board (IRB) approval, including four parts. The first part provided information about the study, including confidentiality, the right to refuse or withdraw from the study, and informed consent. Participants were required to provide consent before proceeding to the next part. The second part is the participants' general characteristics, including gender, age, study year, GPA, and sources of information on COVID-19 and the use of PPE.

The third part of the questionnaire assesses knowledge regarding the use of PPE, which was developed based on the guidance of the World Health Organization (WHO) on the use of PPE in COVID-19 [16]. It includes components such as types and properties, putting on, taking off, and discarding PPE. This tool consists of 19 questions presented in four multiple-choice options. The knowledge scores are categorized according to Bloom's cut-off points [11]: 15-19 scores (80-100%), 11-14 scores (60-79%), and <11 scores (<60%) indicate high, moderate, and low knowledge regarding the use of PPE, respectively. The tool underwent evaluation by three experts, resulting in a CVI of 1, and its reliability was assessed by a pilot study with 30 nursing students in another nursing faculty, with the Cronbach's alpha coefficient being found at 0.76.

The fourth part of the questionnaire evaluates perceived self-efficacy regarding the use of PPE, which was developed based on Bandura's self-efficacy concept [12]. The components include confidence regarding putting on, taking off, and discarding PPE. This tool consists of a total of 15 questions on a Likert scale from "strongest confident (5 scores)" to "lowest confident (1 score)". The perceived self-efficacy scores are categorized according to Bloom's cut-off points [11]: 60-75 scores (80-100%), 45-59 scores (60-79%), and <45 scores (<60%) indicate high, moderate, and low perceived self-efficacy regarding the use of PPE, respectively. The tool underwent evaluation by three experts, resulting in a CVI of 1, and its reliability was assessed by a pilot study with 30 nursing students in another nursing faculty, with the Cronbach's alpha coefficient being found at 0.98.

### **Data analysis**

After collecting the online questionnaire, data were entered and processed on SPSS version 25.0 for Windows (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to describe the participants' general characteristics, level of knowledge, and perceived self-

efficacy regarding the use of PPE. As the knowledge and perceived self-efficacy scores of third and fourth-year nursing students did not exhibit a normal distribution ( $Z = 0.169, 0.147, 0.156$ , and  $0.146$ ;  $p$ -value  $< 0.050$ , respectively), the Chi-Square test was used to compare knowledge and perceived self-efficacy between third and fourth-years nursing student at a significant level of .05. Additionally, the knowledge and perceived self-efficacy scores of all participants also did not demonstrate a normal distribution ( $Z = 0.138$ , and  $0.127$ ;  $p$ -value  $< 0.050$ , respectively). Therefore, by converting the data from continuous to ordinal scale, Spearman's Rank Correlation Coefficient was used to examine the relationship between knowledge and perceived self-efficacy at a significant level of 0.050.

### Ethics consideration

This study and its protocols were approved for conducting research in human subjects by the Suan Sunandha Rajabhat University Ethics Committee on July 29, 2021, with certification number COA.1-073/2021. All participants were clearly informed about the study, including confidentiality and the right to refuse or withdraw from the study before obtaining the informed consent.

## Results

### General characteristics of the participants

Among the 144 undergraduate nursing students who participated in this study, the majority (88.9%) were female, with an average age of  $21.7 \pm 1.68$  years. The average cumulative GPA was 2.99 out of a full score of 4, with 42% falling into the good level. Regarding the average academic performance, the fundamental of the nursing course was  $2.69 \pm 0.54$ , while the fundamental of the nursing practicum course was  $3.24 \pm 0.48$ . Nearly half (47.9%) of the participants achieved a very good level of performance in the fundamental nursing course, and more than half (54.9%) achieved it in the fundamental nursing practicum course. Social media was the most common source of information on COVID-19 and the use of PPE, with 93.8% and 69.4% of participants, respectively, while classroom learning was reported by only 2.1% and 23.5% of participants, respectively. There were no statistically significant differences in the proportions of general characteristics between the two groups (Table 1).

**Table 1** General characteristics of the participants and differences in the study years (n=144)

Characteristic	3 <sup>rd</sup> year n (%)	4 <sup>th</sup> year n (%)	Total n (%)	$\chi^2$	p-value
<b>Age</b> ( <i>Mean = 21.7, SD = 1.68</i> )					
<b>Gender</b>					
Female	65 (90.3)	63 (87.5)	128 (88.9)	0.070 <sup>F</sup>	0.791
Male	7 (9.7)	9 (12.5)	16 (11.1)		
<b>Cumulative GPA</b> ( <i>Min = 2.07, Max = 3.84, Mean = 2.99, SD = 0.32</i> )					
Very good ( $\geq 3.5$ )	7 (9.7)	6 (8.3)	13 (9.0)	0.151 <sup>P</sup>	0.985
Good (3-3.49)	30 (41.7)	31 (43.1)	61 (42.4)		
Fairly good (2.75-2.99)	19 (26.4)	18 (25.0)	37 (25.7)		
Average ( $< 2.75$ )	16 (22.2)	17 (23.6)	33 (22.9)		
<b>Academic performance in fundamental of nursing course</b> ( <i>Min = 2, Max = 4, Mean = 2.69, SD = 0.54</i> )					
Very good ( $\geq 3.5$ )	11 (15.3)	12 (16.7)	23 (16.0)	0.48 <sup>P</sup>	0.922
Good (3-3.49)	13 (18.1)	10 (13.9)	23 (16.0)		
Fairly good (2.75-2.99)	14 (19.4)	15 (20.8)	29 (20.1)		
Average ( $< 2.75$ )	34 (47.2)	35 (48.6)	69 (47.9)		
<b>Academic performance in fundamental of nursing practicum course</b> ( <i>Min = 2, Max = 4, Mean = 3.24, SD = 0.48</i> )					
Very good ( $\geq 3.5$ )	39 (54.2)	40 (55.6)	79 (54.9)	3.97 <sup>P</sup>	0.057
Good (3-3.49)	16 (22.2)	24 (33.3)	40 (27.8)		
Fairly good (2.75-2.99)	4 (5.6)	5 (6.9)	9 (6.3)		
Average ( $< 2.75$ )	13 (18.1)	3 (4.2)	16 (11.1)		
<b>Sources of information on COVID-19</b>					
Social media	67 (93.1)	68 (94.4)	135 (93.8)	1.34 <sup>P</sup>	0.719
Television Broadcasting	3 (4.2)	1 (1.4)	4 (2.8)		
Classroom learning	1 (1.4)	2 (2.8)	3 (2.1)		
Health care worker	1 (1.4)	1 (1.4)	2 (1.4)		
<b>Sources of information on the use of PPE</b>					
Social media	49 (68.1)	51 (70.8)	100 (69.4)	0.44 <sup>P</sup>	0.803
Classroom learning	17 (23.6)	17 (23.6)	34 (23.5)		
Health care worker	6 (8.3)	4 (5.6)	10 (6.9)		

*F = Fisher's Exact Test; P = Pearson Chi-Square*

### Knowledge and perceived self-efficacy regarding the use of PPE

Participants' knowledge scores regarding the use of PPE ranged from 6 to 19, with an overall mean of  $13.84 \pm 2.48$ . The majority of the participants (45.8%) exhibited high knowledge, followed by moderate (43.8%) and low (10.4%) levels. Perceived self-efficacy scores regarding the use of PPE ranged from 15 to 75, with an overall mean of  $52.66 \pm 14.11$ . The majority of the participants reported moderate perceived self-efficacy (45.1%), followed by high (38.2%) and low (16.7) levels (Table 2).

**Table 2** Knowledge and perceived self-efficacy regarding the use of PPE of the participants (n=144)

Variables	n	%
<b>Knowledge regarding the use of PPE</b> ( <i>Mean = 13.84, SD = 2.48</i> )		
High (15-19 scores)	66	45.8
Moderate (11-14 scores)	63	43.8
Low (< 11 scores)	15	10.4
<b>Perceived self-efficacy regarding the use of PPE</b> ( <i>Mean = 52.66, SD = 14.11</i> )		
High (60-75 scores)	55	38.2
Moderate (45-59 scores)	65	45.1
Low (< 45 scores)	24	16.7

### Comparison of Knowledge and perceived self-efficacy regarding the use of PPE based on the study year

Differences in proportion in knowledge and perceived self-efficacy regarding the use of PPE based on the study year of the participants were analyzed. No statistically significant differences in the proportions of knowledge regarding the use of PPE were found based on the participants' study year ( $\chi^2 = 1.39$ , p-value > 0.050). However, there was a statistically significant difference in the proportions of perceived self-efficacy regarding the use of PPE according to the participants' study year at the 0.050 significance level ( $\chi^2 = 8.70$ , p-value < 0.050) (Table 3).

**Table 3** Differences in the study variables between third-year and fourth-year nursing students (n=144)

Variables	3 <sup>rd</sup> year n (%)	4 <sup>th</sup> year n (%)	$\chi^2$	p-value
<b>Knowledge regarding the use of PPE</b>				
High	36 (54.5)	30 (45.5)	1.39	0.499
Moderate	28 (44.4)	35 (55.6)		
Low	8 (53.3)	7 (46.7)		
<b>Perceived self-efficacy regarding the use of PPE</b>				
High	20 (36.4)	35 (63.6)	8.70	0.013
Moderate	41 (63.1)	24 (36.9)		
Low	11 (45.8)	13 (54.2)		

Knowledge regarding the use of PPE was significantly positively correlated with perceived self-efficacy regarding the use of PPE at the 0.010 significance level ( $r = 0.243$ , p-value < 0.010).

### Discussion

This study revealed that the majority of participants exhibited a high level of knowledge regarding the use of PPE, with 45.8% reporting high knowledge, 43.8% moderate knowledge, and 10.4% low knowledge, aligning with the findings of Simak and Kristamuliana [14]. They reported that 76% of nurses demonstrated good knowledge of PPE usage. This could be attributed to the comprehensive education on PPE received by nursing students through their coursework in fundamental nursing courses, encompassing both classroom learning and practical training in clinical settings [10]. Interestingly, 23.5% of participants

identified classroom teaching as a source of knowledge about PPE, while social media emerged as the most prevalent source of information on PPE, as reported by 69.4% of participants. This underscores the significance of social media as an easily accessible platform for knowledge dissemination in contemporary times [17]. The majority of participants exhibited a moderate level of self-efficacy regarding the use of PPE, with 45.1% reporting moderate self-efficacy, 38.2% high self-efficacy, and 16.7% low self-efficacy. This could be attributed to the relatively limited experience of nursing students in using certain types of PPE, such as N95 mask, which require practice and successful experiences to develop confidence effectively. Indeed, creating

appropriate practice scenarios is recognized as the most effective method for enhancing an individual's self-efficacy [12]. Interestingly, the study identified that participants reported the lowest confidence levels in correctly using face shields, removing face shields, and removing N95 masks, with percentages of 15.3%, 14.6%, and 14.6%, respectively.

The proportion of knowledge scores regarding the use of PPE among participants between the third and fourth years did not show a significant difference, potentially attributed to the widespread use of technology, particularly social media, which plays a significant role in students' learning in the 21st century [17]. Social media serves as a crucial source for students to acquire additional knowledge outside the classroom, with past studies indicating that 63.83% of nursing students spend more than 5 hours per day on online social networks, and 68.83% access them 3-5 times per day [17]. The current study found that participants from both year levels received knowledge about the use of PPE from social media in similar proportions. Additionally, students in both years follow the same curriculum [10]. Therefore, it was concluded that there was no significant difference in knowledge scores regarding the use of PPE between third and fourth-year nursing students.

The proportion of self-efficacy scores regarding the use of PPE significantly differed between third and fourth-year nursing students. The majority of third-year nursing students (63.1%) were at the moderate level, whereas for fourth-year nursing students, the majority (63.6%) were at the high level. This discrepancy may be attributed to the greater nursing practice experience of fourth-year students compared to third-year students, providing them with more opportunities to utilize PPE. Skills training, which involves creating appropriate experiences and achieving success, is the most effective method for enhancing self-efficacy [12]. Therefore, fourth-year students with more experience using PPE exhibited higher levels of self-efficacy than third-year students, who had less exposure to using such equipment.

Knowledge regarding the use of PPE was positively correlated with self-efficacy regarding its use, with statistical significance at the 0.010 level ( $r = 0.243$ ,  $p\text{-value} < 0.010$ ), consistent with the predetermined assumptions and in line with the findings of Simak & Kristamuliana [14]. This relationship mirrors the results of a study on Pakistani nurses, where knowledge about PPE use correlated with self-efficacy in preventing COVID-19. Knowledge is foundational in driving practical application, which, in turn, contributes to an individual's experience and, ultimately, their self-efficacy [12, 18]. Therefore, nursing students with sufficient or high levels of knowledge about PPE are more likely to recognize their ability to use it correctly, leading to its effective utilization.

The findings suggest that fourth-year nursing students are more likely to possess the capacity to

support and assist the healthcare team in caring for COVID-19 patients compared to third-year nursing students. Furthermore, upon analyzing the study results within sub-themes, it was identified that nursing students still exhibit gaps in knowledge and confidence regarding certain aspects. Hence, these research findings should inform the development of teaching and learning strategies aimed at enhancing students' proficiency in using PPE in alignment with current requirements. Additionally, future research should explore other factors that may influence or correlate with knowledge and self-efficacy in PPE usage. Moreover, there is a need to design programs aimed at augmenting knowledge and self-efficacy in PPE usage and conduct experimental studies to assess their effectiveness.

Some limitations were considered in the study. Since this study was conducted using a cross-sectional design in only one faculty of nursing in Thailand, the generalization of the findings should be considered with caution.

## Conclusions

Most nursing students exhibit knowledge and self-efficacy regarding using PPE to prevent COVID-19. Both third and fourth-year students demonstrated similar levels of knowledge concerning PPE utilization. However, disparities were observed in self-efficacy regarding its use. Furthermore, there was a positive correlation between knowledge of PPE usage and self-efficacy in its application.

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## Conflict of Interest Statement

The authors declare that there is no conflict of interest associated with this study.

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