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The Relationship between Health Literacy, Prevention Behaviors, and COVID-19 Infection among Industrial Workers in Chachoengsao Province, Thailand

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Abstract

This study was a cross-sectional correlational study to examine the relationship between health literacy, prevention behaviors, and COVID-19 infection among industrial workers in Chachoengsao province, Thailand. Between January and February 2022, purposive sampling was carried out to recruit 92 industrial workers as inclusion and exclusion criteria from Chachoengsao province, Thailand. Data collection was based on an HL questionnaire. The HL is comprised of six domains. There is an assessment of information and services, knowledge and understanding of health, communication with professionals, making appropriate health decisions on good practices, managing health information, and getting media and information literacy. The prevention behavior questionnaire was based on COVID-19 infections. The measurement reliability was reported as Cronbach alpha = 0.895 to 0.919, respectively. The data was analyzed using descriptive statistics, including frequency, percentage, mean, standard deviation, and range. Moreover, to analyze the relationships between study variables using the correlational coefficient and Chi-square statistic, the p-value of .05 was considered statistically significant. Results showed that industrial workers had a high level of health literacy and COVID-19 prevention behavior. Health literacy was significantly positively correlated with prevention

behavior (r_s = 0.508, p = 0.000). In addition, there was no significant positive correlation between COVID-19 infection and health literacy (χ^2 = 3.420, p = 0.230), but it was significantly related to prevention behaviors (χ^2 = 92.000, p = 0.000). The results of the study demonstrated that promoting health literacy is an important strategy for improving prevention behaviors among industrial workers. The roles of occupational nurses are critical to promoting and providing appropriate responses and could effectively control the spread of COVID-19.

Keywords: Health Literacy, Prevention Behaviors, COVID-19 Infection, Industrial Workers

What was Known

- Healthy people had a high level of health literacy and prevention behaviors related to COVID-19.
- Health literacy is highly correlated with COVID-19 prevention behaviors in healthy populations.
- Lack of evidence to investigate the relationship between SARS-COV-2 RAPID ANTIGEN TEST results and health knowledge with prevention behaviors, particularly in industrial workers.

What's New and Next

- The SARS-COV-2 RAPID ANTIGEN TEST result had a non-significant positive correlation with health literacy, but it had a significant relationship with prevention behaviors.
- Further research is required to address other related factors and examine other objective assessments that reflect actual health behaviors to better understand the relationship between health knowledge, prevention behaviors, and COVID-19 infection.

Introduction

Coronavirus Disease 2019 (COVID-19) is an infectious disease caused by Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2) and leads to physical and psychosocial burdens in infected people and healthcare providers (HCPs)[1]. Moreover, it affects stakeholders operating in the manufacturing and industrial sectors, particularly in Thailand. Therefore, Industrial Workers have to access related information and follow measures to prevent infection

and the spread of COVID-19[2]. It is therefore imperative that industrial workers are knowledgeable about health surveillance and adhere to COVID-19 prevention policies and practices when working in the industrial sector[2-3]. According to the Federation of Thai Industries, there was a COVID-19 outbreak in over 881 factories in 62 provinces and 61,919 people. These people were infected with COVID-19 in industrial plants. The food industry is also contributing to the spread of COVID-19. According to the province with the highest rate of spread, the first three outbreaks of COVID-19 occurred in Phetchaburi province. Consequently, many food manufacturing plants in Chachoengsao Province and Saraburi Province have inevitably ceased operations[2-3].

Health literacy (HL) is a current health promotion and prevention concept and represents the cognitive and social competencies necessary to maintain good health[2-3]. Three types of HL consist of six domains including functional literacy, interactive literacy, and critical literacy. These include assessment of information and services, knowledge and understanding of health, communication with professionals, good health practices, health information management, and media and information literacy[3].

Among healthy people, HL is vital to promoting better health outcomes. Such as increasing an individual's ability to take control and manage his or her health and greater cost savings for the health system[4]. During the COVID-19 pandemic, HL is an important skill for preventing the spread of COVID-19. Based on previous research, HL is statistically related to behaviors aimed at preventing COVID-19 and changing health behaviors[5], the decision-making, accessibility, and evaluation of health information[6]. The researchers highlighted the importance of exploring the relationship between health and literacy. The Thai industrial is informed by COVID-19 preventive behaviors and the rate of COVID-19 infection among food industry staff. This study will gather information and research to design and develop guidelines for advancing health literacy. It also encourages self-care behaviours that prevent COVID-19 infection and prevent the spread of the disease in the food industry, family, and community appropriately.

For COVID-19 and industrial sectors in Thailand, the Federation of Thai Industries has policies and measures in place to prevent and control infection. Since the COVID-19 pandemic, the number of people infected with COVID-19 is still higher and increasing rapidly, particularly in Chachoengsao province[7]. This has led to the inevitable closure of industrial plants, especially small and low-tech companies that have suffered the most from the crisis and extended

lockdowns. In addition, COVID-19 directly impacts demand reduction, input shortages, more than 8.4 million people out of work, and 1.5 million people in the manufacturing sector[7].

Occupational nurses' roles in the workplace are crucial to preventing COVID-19 in the workplace. They also provide community education, screening, and screening, and reducing and controlling COVID-19 infection[8]. While there are numerous types of HL research studies and prevention behaviors in various populations. However, the lack of studies focused on HL prevention behaviors and COVID-19 infection, especially among industrial workers, and in Thailand[2]. As a result, the researchers had to conduct a study on HL, which looks at the relationship between HL prevention behaviorsand COVID-19 infection among industrial workers in Chachoengsao province. It had a higher COVID-19 infection when the COVID-19 outbreak began in Thailand[2,9].

Materials and Methods

Ethical approval

The research was approved by the Research Ethics Office of Rangsit University, with the approval number COA. No. RSUERB2021-101. All information was confidential and anonymized. The confidentiality and freedom to withdraw from the study at any time were assured, and the participants were assured that their decisions would not affect their work.

Study area

This study was conducted in a large factory according to the Factory Act B.E. 2535 (1992) in Chachoengsao province, Thailand.

Study design and sample size

This research was a cross-sectional correlational study to examine the relationship between HL prevention behaviors and COVID-19 infection among industrial workers in Chachoengsao Province, Thailand. The HL of Nutbeam[4] (2000) was used as the conceptual framework of the study **(Figure 1).**

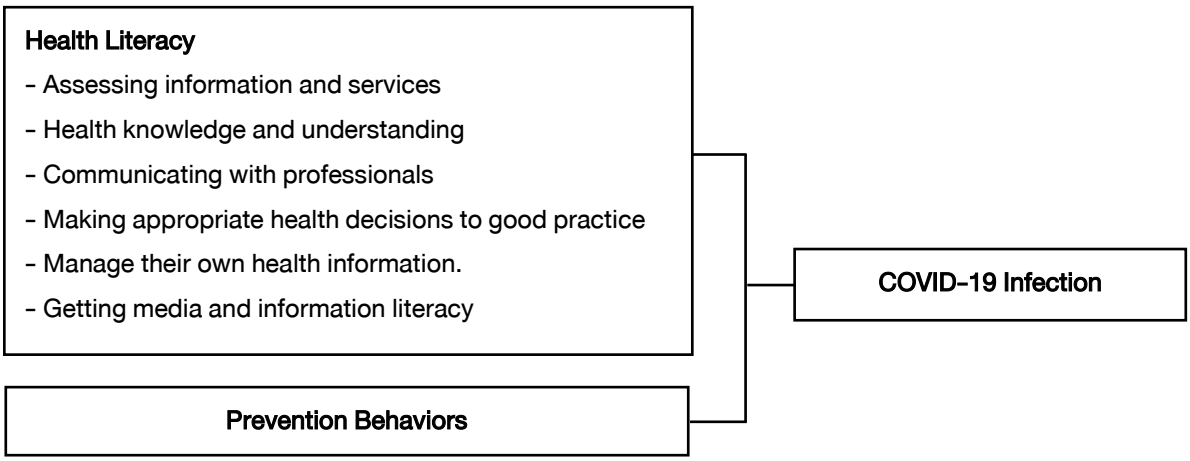

Figure 1, The conceptual framework of the study

Sampling method

The study participants were selected and included in the study using purposive sampling. Inclusion criteria were 1) An operational industrial worker who worked in the factory for more than three months; 2) 18-60 years of age; 3) literate and able to speak and understand the Thai language, and 4) willing to participate in this study. The exclusion criteria were 1) participants who had a history of COVID-19 infection within 14 days; and 2) participants who had an acute and critical disease while participating in the study.

For calculating the sample size needed by power G, given α as 0.05, 80% of the power. The HL effect size in related studies was 0.30[5], with a two-tailed hypothesis considered. Thus, the sample size can be at least 86 participants, with an extra 20% attrition[10]. Finally, the sample size for the study was about 100 participants, which was found to be adequate.

Data collection and instruments

Data was collected in January 2022. Following approval of the study by the Research Ethics Office of Rangsit University. The researchers contacted and explained the objectives of the study to the Chairman of C.C. AUTOPART Co., Ltd., Chachoengsao Province, Thailand. The study participants were recruited through purposive sampling. All results and tests were confidential and anonymized. Research instruments in this study are comprised of three data collection instruments as follows: The Personal Data Sheet form includes demographics and HL Questionnaires, health information developed by researchers and used to collect demographic

and health information on industrial workers, and the HL Questionnaire about ways of accessing health information.

1) The COVID-19 questionnaire and prevention behaviors have been authorized and developed by Choojai R., Boonsiri C., and Patcheep K[9]. The instruments were a 45-item questionnaire in which all questionnaires were positive questions. The questions were answered through a five-point Likert scale. They were used to assess COVID-19 and prevention behaviors such as Never = 1, Rarely = 2, Sometimes = 3, Often = 4, and Always = 5. Questionnaires identified 20 items of preventive behaviour related to COVID-19 in Table 4.The questionnaires related to six domains that included assessing information and services (5 items), health knowledge and understanding (15 items), communicating with professionals (5 items), making appropriate health decisions for good practice (5 items), managing their health information (10 items), and getting media and information literacy (5 items). The measurement reliability has been reported as Cronbach alpha was 0.80 in a previous study[9] and 0.895 in the current study.
2) The COVID-19 Prevention Behaviors Questionnaire is a self-reported questionnaire that reflects the COVID-19 prevention behaviors of study participants. All questionnaires were positive, comprising 20 items. A five-point Likert scale was used as Never = 1, Rarely = 2, Sometime = 3, Often = 4, and Always = 5. A higher mean score indicates a higher level of infection prevention behavior, with the HL score divided into three groups: high -moderate -and low. The reliability of the measurement was reported, CVI was 0.88, and Cronbach alpha was 0.86 in a previous study[9] and .919 in the current study.
3) For the COVID-19 infection, an objective assessment was assessed using the Antigen Test Kit *(SRAS-COV-2 RAPID ANTIGEN TEST). The* SARS-CoV-2 Antigen Detection Kit Colloidal Gold Method, Xiamen Jiqing Biomedical Technology Co., Ltd., has been considerately used for assessing the COVID-19 infection of study participants. The accuracy was 98.76% (95% CI:87.75%-95.52%), clinical sensitivity was 93.64% (95% CI: 87.10%-98.11%), and clinical specificity was 100% (95% CI: 96.97%-100.00%)[9].

Subsequently, we conducted the instrument testing process with 30 employees from a large factory in Chachoengsao province. This study classifies a factory and a large factory (200

workers). We were tested for face validity, content validity, and reliability by three nursing instructors. They were accepted with a CVI equal to 1 on both questionnaires, with Cronbach's alpha on the COVID-19 HL and Prevention Behaviors questionnaire, 0.895 to 0.919 respectively.

Data analysis

Demographic data and health information were analyzed using descriptive statistics, including frequency and percent. HL and prevention behaviors were analyzed and reported by range, mean, and standard deviation. In addition, we analyze the relationship between HL and prevention behavior by using the Pearson Product Moment Correlation Coefficient. The magnitude of the correlation coefficient was stratified and applied to the associated study[11]. Additionally, we analyze the relationships between HL prevention behaviors and COVID-19 infection (SARS-CoV-2 rapid antigen results) using chi-square statistics.

Results

Demographic characteristics of the study participants

A total of 100 potential participants were recruited and eight participants were not able to complete the questionnaire completely. consequently, 92 participants participated in this study. For the demographics of the study participants, more than half of the participants were male (53.30%) and the average age of the participants was 36.34 years (SD = 12.40). Most of the participants (56.40%) were married, 42.00% of the participants graduated from high school, and half of them had a number of salaries ranging from 5,000 to 10,000 baht per month **(Table 1).**

Table 1, Demographic characteristics of the study participants (n=92)

Characteristics		n (%)
Gender	Male	49 (53.30)
	Female	43 (46.70)
Age (years)	18-40 years old	54 (58.70)
	40-60 years old	37 (40.20)
	> 60 years old	1 (1.10)
	Married	49 (56.40)

Table 1, Demographic characteristics of the study participants (n=92)

Characteristics		n (%)
	Divorced/Separated	3 (3.40)
Educational attainment	Primary school	23 (28.40)
	Secondary School	34 (42.00)
	Bachelor's degree	15 (18.50)
	Master's degree and higher	9 (11.10)
Salary (baht)	< 5,000	4 (4.50)
	5,000-10,000	44 (50.00)
	10,001-20,000	33 (37.50)
	> 20,000	7 (8.00)

Health information of the study participants

More than one-third (77.20%) of the participants had no underlying disease, and 19.60% had common health problems such as hypertension, chronic lung disease, and diabetes mellitus. Only 3.30% had complex chronic health problems. Nine out of ten participants (91.30) received a COVID-19 vaccine greater than or equal to two shots of the vaccine. Most participants had no history of previous infection (91.30%), and a few participants were closely contacted with family members (3.30%) and colleagues (3.30%). Most participants accessed health information by watching television and following the factory announcement. This announcement is from November 1, 2021, to April 30, 2022, and prior to data collection for this study. As regards the COVID-19 infection (SRAS-CoV-2 Rapid Antigen Test results), almost all participants had a negative result (98.9%), and only one (1.1%) had a positive result with double confirmation **(Table 2).**

Table 2, The health information and COVID-19 infection of the study participants (n=92)

Characteristics		n (%)
Comorbidity	No underlying disease	71 (77.20)
	Common health problem	18 (19.60)
	Complex chronic health problems	3 (3.20)
		2 (2.20)
History receiving COVID-19 vaccines	None	
	1 shot of the COVID-19 vaccine	6 (6.50)
	2 shots of the COVID-19 vaccine	49 (53.30)
	3 shots of the COVID-19 vaccine	35 (38.00)
History of COVID-19 infection (more than 14 days before participation)	No history of infection and closed contact	84 (91.30)
	Previous infection	2 (2.10)
	Closed contact with a family member	3 (3.30)
	Closed contact with a colleague	3 (3.30)
Ways to access health information (Participants might access more than one resource)	Factory announcement	47 (51.10)
	Television	59 (64.10)
	Radio	18 (19.60)
	Facebook application	38 (41.30)
	LINE application	17 (18.50)
	Ministry of Public Health website	11 (12.00)
COVID-19 infection		**n (%)**
(ATK results)	Negative	91 (98.9)
	Positive	1 (1.1)

Health literacy of the study participants

Health literacy in six domains of study participants, the overall HL of participants was high (M = 97.41, SD = 10.88). In considering the HL subscale, participants had high HL levels. These included assessing information and services, health knowledge and understanding, health information management, media, and information literacy, and making appropriate health

decisions based on good practices. The only communication with occupational skills shows that the mean score is 16.60 (SD = 4.09) with a moderate HL level **(Table 3).**

Table 3, Health literacy of the study participants (n=92)

Health literacy	Range	Mean(SD)	Interpretation
Overall health literacy	65-122	97.41(10.88)	high
1. Assessing information and services	8-25	19.59(3.59)	high
2. Health knowledge and understanding	3-15	12.55(1.81)	high
3. Communicating with professionals	6-25	16.60(4.09)	moderate
4. Making appropriate health decisions to good practice	2-10	7.68(1.31)	high
5. Managing their health information	14-25	21.27(3.37)	high
6. Getting media and information literacy	11-25	19.72(3.08)	high

The COVID-19 prevention behaviors of the study participants

Regarding the COVID-19 prevention behaviors of participants, overall prevention behavior showed a high level of COVID-19 prevention behavior (M=85.79, SD=12.08). Moreover, almost all subscale of the COVID-19 prevention behavior was high level, only item one "avoiding eating half-cooked meat and food" was moderate (M=4.46, SD=1.17) **(Table 4).**

Table 4, The COVID-19 prevention behaviors of the study participants (n=92)

COVID-19 prevention behaviors	Range	Mean(SD)	Interpretation
Overall prevention behaviors	44-100	85.79(12.08)	high
1. Avoid eating half-cooked meat and food	1-5	3.53(1.17)	moderate
2. Usually apply 70% alcohol gel or hand washing after greeting and doing activities with others	1-5	4.46(0.94)	high
3. Wear a face mask correctly.	1-5	4.83(0.57)	high
4. Close the lid when you flush the toilet and wash your hands vigorously after using the restroom.	1-5	4.37(0.91)	high
5. Avoid touching your eyes, nose, or mouth with an unwashed hand.	1-5	4.49(0.85)	high
6. open doors and windows to create airflow across	1-5	4.66(0.70)	high

COVID-19 prevention behaviors	Range	Mean(SD)	Interpretation
the room.			
7. Eat a healthy diet and beverage	1-5	4.46(0.87)	high
8. Do regular physical activity and exercise	1-5	4.24(1.10)	high
9. Avoid greeting friends outside such as in café, a restaurant, and a market	1-5	4.28(0.94)	high
10. Avoid going outside and communities such as a park, a department store, and a festival	1-5	4.25(0.93)	high
11. Avoid going outside and crowded areas such as a hospital, and a clinic	1-5	4.18(0.95)	high
12. Avoid going outside and provincial areas which had a high rate of COVID-19 infection	1-5	4.09(1.24)	high
13. Take clean and shower after going and doing activities outside	1-5	4.46(0.93)	high
14. separate your clothes after going and doing activities outside	1-5	3.74(1.12)	high
15. keep and separate any infected waste	1-5	4.39(0.86)	high
16. Cover your mouth and nose with tissue when you cough or sneeze	1-5	4.15(1.14)	high
17. keep physical distancing when staying with your family members	1-5	4.14(1.02)	high
18. If you expose a potentially infected person, you will notify health care providers	1-5	4.14(1.20)	high
19. Clean your house, especially your bedroom, restroom, and cooking room with a disinfectant solution	2-5	4.39(0.89)	high
20. Always watch and follow health information from various channel	3-5	4.67(0.61)	high

Correlation between health literacy prevention behaviors and COVID-19 infection

In the statistical analyses of the study variables, all study variables including HL, sub-scale, HL, prevention behavior, and COVID-19 infection were examined and did not be passed the general statistical assumptions of Pearson's correlation coefficient. Therefore, the relationships between HL and prevention behaviors were used Spearman rank-order correlation

coefficient. Moreover, to examine the relationship between HL with prevention behavior and COVID-19 infection, a Chi-square statistic was used.

The findings showed that Health literacy had a significant positive correlation with prevention behavior (r_s = 0.508, p = 0.000). Furthermore, the COVID-19 infection had a non-significant positive correlation with health literacy (X^2 = 3.420, p = 0.230), but it had a significant relation to prevention behavior (X^2 = 92.000, p = 0.000). In examining the relationship between subscale HL and prevention behaviors. We found that overall prevention was moderately positively correlated significantly with appropriate health decision-making. Participants were good decision-making practices in health, including management of their health information, and media and information literacy **(Table 5).**

Table 5, The correlation between health literacy prevention behaviors and the COVID-19 infection rate (n=92)

Study variables	Overall COVID-19 prevention behaviors		
	Spearman's rank	Sig (2-tailed)	Level of correlation
Overall health literacy	0.508	0.000	moderate
1. Assessing information and services	0.198	0.058	no correlation
2. Health knowledge and understanding	0.060	0.571	no correlation
3. Communicating with professionals	0.088	0.406	no correlation
4. Making appropriate health decisions to good practice	0.312	0.003	moderate
5. Managing their health information	0.511	0.000	moderate
6. Getting media and information literacy	0.511	0.000	moderate

Discussion

We found that there was no correlation between COVID-19 infection and HL Since most samples (92%) were normal and only a few patients (1%) belonged to the homogeneous group, there was no difference between the groups. However, participants had a high level of HL and a high level on the HL subscale, except for communication with professionals with a moderate

level of HL. These results were consistent with the related study, in which most participants had a moderate to high level of HL and 56% had an adequate level of HL[2,12].

In support of the study's findings, it was found that most study participants were well-educated, married, and had sufficient income that could be related to better support. Health information about COVID-19 is adequately accessible. These results were related to the last study that found that higher educational attainment, adequate income, and good family support positions were associated with higher HL[12,13]. The COVID-19 pandemic has also been spreading for more than two years. Much of the health and prevention information has already been developed and publicized through various channels on social media and in the industrial factory.

The results of this study showed that HL had a significant positive correlation with prevention behaviors (r_s = 0.508, p = 0.000). It was consistent with the results of a previous study that found that COVID-19 prevention behaviors in adults were strongly correlated with health knowledge (r = 0.23, p < .001). A higher HL is necessary for COVID-19 prevention behavior and an important skill in assessing a wide range of information and making appropriate decisions[6].

Surprisingly, the COVID-19 infection had a non-significant positive correlation with HL (χ^2 = 3.420, p = 0.230), but it had a significant relationship with prevention behaviors (χ^2 = 92.000, p = 0.000). Possible reasons to explain the outcome, even LH is an important skill to take care of people's health and manage it based on COVID-19 prevention behaviors. However, these are insufficient to assess and reflect the actual behaviors because the instruments were self-assessed, and participants might have a socially desirable bias in questioning the questionnaires[14-15]. Moreover, the relationship between HL prevention behaviors and COVID-19 infection may be linked to other social determinants of health[15-18]. As a result, further research is required to examine the factors influencing the relationship among these study variables.

The promotion of health literacy among staff at the operational level in industrial facilities is important. The Staff is demonstrating more effective COVID-19 prevention behaviours. It will help researchers use research evidence and findings in the design and development of guidelines to promote health literacy. And promote self-care behaviours to prevent COVID-19 infection and prevent the spread of the disease in the food industry, family, and community appropriately. The industry can use the results of the research to take advantage of them. The impact of this study on nursing practice, the results of the study confirmed the importance of HL in the care and management of COVID-19. Occupational health nurses are at the forefront of the fight against COVID-19 in all situations and in all sectors. Therefore, the findings of the study

could help nurses and health professionals better understand HL prevention behaviors and COVID-19 infection. This leads to the delivery of appropriate strategies and interventions to promote and sustain HL over the long term until the COVID-19 situation is alleviated.

Conclusion

In conclusion, occupational health nurses must play a key role in providing care to industrial workers during the COVID-19 pandemic. Occupational health nurses should promote HL knowledge among industrial workers, while, in combination with prevention behaviors, health competencies, and prevention behaviors do not guarantee low COVID-19 infection rates.

In addition, health policies and programs associated with infection control are fundamental to industrial safety for workers. The main point of this study should be the improvement of the six domains of HL of the group of workers, whose skills should support communication with professionals. As a result, further research is required to examine other related factors and other objective evaluations that reflect actual health behaviors to better understand the relationship between HL prevention behaviors and COVID-19 infection.

Ethical Approval Statement

The research was submitted to and approved by the Research Ethics Office of Rangsit University, with the approval number COA. No. RSUERB2021-101.

Author Contributions

SS contributed to the study conception and design, manuscript writing, and data collection, carried out reliability testing, and initial statistical analysis of data, data analysis, and interpretation. SP contributed to study conception and design, and critical revisions for important intellectual content and language editing. All authors read and approved the manuscript prior to submission for publication.

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Conflict of Interest

There was no conflict of interest in this study.

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