

HEALTH STATUS AND FACTORS INFLUENCING ACCESS TO HEALTHCARE SERVICES BY WORKERS IN PETROL STATIONS IN RAYONG PROVINCE, THAILAND

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ABSTRACT

Background. Petrol station (PS) workers are categorized as “unskilled labor”, which leads to low wages, economic instability, and a lack of adequate access to healthcare services (HCS) despite exposure to dangerous chemicals. A lack of information on the HCS access of PS workers is concerning.

Objective. This study was undertaken to elucidate factors that influenced access to health care for fuel station workers in gas stations in Rayong province, Thailand.

Material and methods. Two-hundred PS workers (100 serving at fuel dispensers and 100 working at other locations) were interviewed to evaluate their health conditions and factors affecting HCS access. The study cohort comprised 137 (68.5%) women and 63 (31.5%) men. The mean age was 30.29±10.97 years and the average monthly salary was 341.16 ± 124.72 USD.

Results. The average distance between a respondent’s residence and government hospital was 10.49 ± 8.571 km. Most respondents (63.5%) were in good physical health, and 79.5% reported having “positive mental health”. However, 73% reported neurological disorders and 57% reported respiratory symptoms. During the previous 12 months, 44.5% of respondents had HCS access; 80.9% of participants reported that they had accessed HCS to obtain treatment for an illness, and 18% went for a health checkup. Government centers were rated as “satisfactory” by 78.8% of PS workers, and 75.5% received medical coverage under a social-security scheme. Moreover, 38.5% obtained HC information from their colleagues. HCS access was attributed to the cost of receiving HCS as well as the sex, marital status, illness severity of PS workers.

Conclusions. Workers should have access to comprehensive HCS. Policy frameworks and systems for HCS should take account of employees’ sex, marital status, and the type and severity of their illnesses.

Key words: *health status, health services, gas stations, Eastern Economic Corridor, Thailand*

INTRODUCTION

Because they fuel ever-increasing numbers of vehicles of various types, petrol attendants in petrol stations (PS) contribute to the economy of Thailand [1]. However, categorization of this occupational group as “unskilled labor” leads to low wages, economic instability, and inadequate social welfare, as well as reduced access to healthcare services (HCS) [2]. Access to primary HC is one of the most pressing issues confronting developing countries, including Thailand [3]. Although individual PS have been reported to employ an average of ~7 people, their skills have not been utilized appropriately [4]. Timely

access to HCS has been found to reduce morbidity and mortality due to preventable diseases [3].

HCS access is particularly important for PS workers because they are exposed to a wide array of hazards [3, 5], including physical, chemical, and biological hazards, as well as stress [6, 7, 8, 9, 10]. Only 14.6% of PS employees experience safe conditions while working [11]. Chemical hazards to which these workers may be exposed to regularly include substances containing benzene, toluene, ethylbenzene, and xylene (BTEX). Inadequate protective gear and very close proximity to the fuel head can have adverse acute and chronic effects upon health, including neurological effects [8, 12]. BTEX can cause headaches and dizziness [11,12],

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respiratory symptoms (e.g., coughing and throat irritation), and irritation to the eyes and skin (e.g., itching) [13]. BTEX compounds are likely responsible for long-term chronic health effects, including blood-related diseases (e.g., myeloid leukemia and aplastic anemia), potentially irreversible damage to the kidneys, cardiovascular disorders, or nervous-system disruptions. Benzene is especially dangerous, being classified as carcinogenic to humans (IARC group 1) [14]. The World Health Organization (WHO) has reported that exposure to benzene ($1.7 \mu\text{g}/\text{m}^3$) may be associated with an excess lifetime risk of leukemia of 10 people per million [15]. Thus, there is an urgent need for the provision of adequate HCS access for PS workers, but this is a complex concept.

The importance of service distribution is reflected in measurement of the performance of HCS access [16, 17]. After passing of the National Health Security Act B.E. 2002, progress has been made in the protection of human rights in public health in Thailand. Almost all Thai citizens are entitled to receive medical care based on their rights in one of three systems: the welfare of civil servants, the social security system, and universal health insurance system. They also have the right to receive services in case of accidents or emergencies without having to reserve money in advance (Universal Coverage for Emergency Patient Project) [18].

The conformity of HCS into geographic, economic, or social dimensions permits operational measurements of HCS access [16]. Economic development in Rayong Province (RP) may be one of the factors influencing HCS access. The cost of medical services is quite high, which may affect people on a low income [16]. The HC utilization is conceptual and aims to demonstrate the factors that lead to HCS use. The first factor is population characteristics. This factor can be broken down into predisposing factors (sex, age, education), social structure (e.g., education, occupation, beliefs), resource factors (e.g., income, health insurance, the ability to pay various expenses, distance from residence to the healthcare establishment, channels for receiving healthcare information) [19], and healthcare needs (e.g., severity of existing disease). The second major factor is environmental (i.e., the social, economic, and political) factors affecting HCS access. The third major factor is health behavior (e.g., exercise, smoking, and initial self-treatment) affecting HCS access [20, 21, 22]. Moreover, the degree of coordination, efficiency, and quality of care are key factors influencing the satisfaction of patients relating to HCS access [17].

Previously, scholars have focused only at HCS access by migrant workers [23, 24, 25]. However, information on the health status and factors affecting HCS access among PS workers is lacking. Insights

emerging from such studies can aid development of HCS targeting this specific class of workers. Acknowledging this knowledge gap, we investigated the health conditions and factors influencing HCS access among PS workers in RP.

MATERIALS AND METHODS

Ethical approval of the study protocol

The study protocol was approved by the Human Research Committee of Burapha University (Chonburi, Thailand). Protecting the rights of study participants was an important concern of our study. The research objectives were explained to all PS workers, who were free to choose whether to participate in this study. Coercion was not applied, and PS workers were free to withdraw from the trial at any time. Inclusion criteria People were included in our study if they: (i) were aged 18–60 years; (ii) could read, understand conversations, and write in Thai; (iii) had never been diagnosed with a blood disease.

Study design

This cross-sectional study was carried out in RP (located 179 km from Bangkok) from October 2020 to May 2021. The study cohort was 200 people who worked in PS in RP. According to our survey, we found that the PS in RP had similar tasks: fuel services, cashier-based work, as well as working in offices, coffee shops, restaurants, and convenience stores. Therefore, the workers in each PS were homogeneous. We employed a cluster random sampling method according to the inclusion criteria stated above. If the required number of individuals was not obtained, then data were collected from all of the workers who volunteered at that PS. Then, the next PS was chosen and the process continued until the projected sample size was obtained.

Determination of the sample size

The sample size was determined using a formula applied to populations in previous surveys conducted in Thailand [4]. Each PS had an average of seven employees. The level of confidence was determined to be 1.96 at 95%, with a 5% margin of error for each of the 100 PSs. Moreover, 76.4% of Asian laborers have been reported to have HCS access ($p=0.764$) [28]. The calculated sample size was 198.70. Two-hundred PS employees were selected: 100 who worked at fuel dispensers and 100 who served outside fuel dispensers.

Research instruments and methods of data collection

The research instrument used to collect data in this study was a questionnaire consisting of four sections.

Part one was based on demographic characteristics and health behavior (seven questions). It focused on

sociodemographic characteristics: age, sex, marital status (single/married/widowed, other), highest education level attained (below secondary school/above secondary school or the equivalent), individual income, smoking habits, and alcohol consumption. The responses to these questions entailed scoring options and filling in words in the questionnaire.

Part two was based on health status and needs (15 questions). It focused on physical and mental health conditions in the past few years. Respondents selected scoring options for physical illness, mental illness, and their severity (healthy/minor illness/severe illness) and filled-in words. Questions related to: sources of HCS access; whether workers could continue working in the previous 12 months if they were slightly ill; the location at which they were most likely to receive HCS if they were seriously ill or unable to continue working in the previous 12 months; HCS access during the 12 months; treatments received for illnesses.

Part three was based on enabling factors (eight questions with multiple sub-questions). This covered: monthly income (in USD); the cost of receiving HCS each time (in USD); inability to pay (payments in installments/pay what you can/contact social services/borrow from employers or others); distance from residence to HC establishment where services are received regularly (in km); channels for receiving information on HC and ratings of welfare rights relating to HCS access; satisfaction levels regarding a government facility where treatment was provided.

Part four was based on HCS access (two questions). The focus was on whether PS employees had HCS access in a medical facility at least once in year (yes/no).

Data collection

Data were collected between October and November 2020. At the onset, a memorandum was sent to PS managers, and they were asked for permission to collect data at each PS. After receiving permission to collect the data, research assistants were trained to provide them greater understanding of the questions. The managers and coordinators at each PS were asked subsequently to collect the data. Finally, each respondent was interviewed, with each interview in the office area of each PS lasting 15 min.

Statistical analyses

After checking the accuracy of the data, the data were coded and saved on a personal computer. Statistical analyses were undertaken using SPSS 20 (IBM, Armonk, NY, USA). The statistical analysis consisted of two parts. The first part contained descriptive statistics (frequencies, percentages, means, standard deviations, medians, minimum values, and maximum values) presented in tabular form. The

second part comprised inferential statistics obtained by univariate logistic regression analysis to determine the correlation between each variable and HCS access. Factors that were significant upon univariate analysis were entered into a multivariate logistic regression model. Independent variables that were associated with HCS access (including sex, age, marital status, levels of minor and severe illnesses, cost of HCS access, distance from residence to HC establishment) were analyzed as adjusted odds ratios (ORs) and 95% confidence intervals (CIs). $p < 0.05$ was considered significant.

Critique of research findings

After the report had been written, a meeting was held with experts to hear their opinions and make corrections before writing the final report. The researcher presented the study results to 15 experts (physicians, occupational-health experts, safety engineers, epidemiologists, statisticians, researchers, toxicologists, occupational-health nurses, personnel from the Ministry of Health, and information-technology personnel). Everyone was provided an opportunity to make suggestions. Each session took ~120 min. Subsequently, the report was amended based on the advice of these experts.

RESULTS

The results relating to the sociodemographic characteristics and health behavior of PS workers (Table 1) showed that they were more female workers (68.5%) than male workers, and that the mean age (\pm SD) was 30.29 ± 10.97 years. Most employees were younger than 30 years, with 57% having an educational status of high school or above. Most respondents were non-smokers (66%) and 54.5% consumed alcohol (Table 1). Our assessment focusing on health conditions revealed that 63.5% and 79.5% of respondents were physically and mentally healthy, respectively. Among the 65% of respondents who had had a mild illness, 43.1% sought treatment at a government hospital and 19.2% at a private hospital. Also, 32.0% of respondents had experienced a serious illness. However, of respondents who had experienced a serious illness, most (57.8%) received HCS at a government hospital. If respondents received HCS in a hospital, 79.5% did not have to pay, and 20.5% had to pay in full. If a PS worker received HCS in a hospital, the cost of receiving this service on each visit was 15.85 ± 17.52 USD.

Of the respondents who received obtained access to health care service on each occasion with an average distance \pm SD. 10.49 ± 8.571 kilometers from accommodation to health care facilities, receiving the most information, 38.5 percent of colleagues, followed by family, 32 percent, with welfare rights in

Table 1. Demographic characteristics and health behavior indicating numbers and percentages of workers in gas stations in Rayong Province, Thailand

Demographic characteristics and health behavior factors of respondents	Workers dispensing fuel (n = 100)		Workers not dispensing fuel (n = 100)		Total	
	n	%	n	%	N	%
Demographic factor						
Population						
Sex						
Female	56	56.0	81	81.0	137	68.5
Male	44	44.0	19	19.0	63	31.5
Age (years)						
≥30	35	35.0	51	51.0	86	43
< 30	65	65.0	49	49.0	114	57
Mean ± SD	27.81±9.56		32.77±11.75		30.29±10.97	
Min–Max	18-58		18-66		18-66	
Marital status						
Married/widowed, other	38	38.0	57	57.0	95	47.5
Single	62	62.0	43	43.0	105	52.5
Educational background						
Less than secondary school	39	39.0	25	25.0	64	32
Higher than secondary school (or equivalent)	61	61.0	75	75.0	136	68
Health behavior						
Smoking habit						
Yes	44	44.0	24	24.0	68	34
No	56	56.0	76	76.0	136	66
Alcohol consumption						
Yes	49	49.0	42	42.0	91	45.5
No	51	51.0	58	58.0	109	54.5

Table 2. Needs factor, and enabling factor during the past year within the group handling the fuel dispenser and the group working outside the dispenser area

	Workers dispensing fuel (n = 100)		Workers not dispensing fuel (n = 100)		Total	
	n	%	n	%	n	%
Needs factor						
Physical health						
Good physical health	66	66.0	61	61.0	127	63.5
Slight illness	33	33.0	39	39.0	72	36.0
Serious illness	1	1.0	0	0.0	1	0.5
Mental health						
Good mental health	85	85.0	74	74.0	159	79.5
Slight illness	14	14.0	25	25.0	39	19.5
Serious illness	1	1.0	1	1.0	2	1
Illness within 12 months						
No	67	67.0	60	60.0	127	63.5
Yes	33	33.0	40	40.0	73	36.5
Severity of the illness						
Continued working	19	57.6	30	75.0	49	67.1

	Workers dispensing fuel (n = 100)		Workers not dispensing fuel (n = 100)		Total	
	n	%	n	%	n	%
Time of work for treatment, not require hospitalization	13	39.4	8	20.0	21	28.8
Required hospitalization	1	3.0	2	5.0	3	4.1
Slightly ill but able to continue working in the last 12 months						
No	43	43.0	27	27.0	70	35
Yes	57	57.0	73	73.0	130	65
Places to get treatment when slightly ill (select more than one item)						
Private hospitals	6	10.5	19	26.0	25	19.2
Public hospitals	29	50.9	27	37.0	56	43.1
Clinics	11	19.3	11	15.1	22	16.9
Local <i>tambol</i> health hospitals	1	1.8	3	4.1	4	3.1
Drugstores	10	17.5	13	17.8	23	17.7
Severe illness or unable to continue working during the past 12 months						
No	72	72.0	64	64.0	136	68
Yes	28	28.0	36	36.0	64	32
Places visited for treatment when seriously ill (select more than one item)						
Private hospital	4	14.3	11	30.6	15	23.4
Government hospital	19	67.9	18	50.0	37	57.8
Clinic	3	10.7	5	13.9	8	12.5
District health- promotion hospital	2	7.1	0	0.0	2	3.1
Drug store	0	0.0	2	5.6	2	3.1
Enabling factor						
Monthly income (in USD)						
<283	47	47.0	40	40.0	87	43.5
≥283	53	53.0	60	60.0	113	56.5
Mean ± SD	318.24±28.699		364.36± 154.05		341.16± 124.72	
Min–Max	226.44–849.14		141.52–1,132.18		141.52–1,132.18	
Distance from residence to medical care service (in km)	9.91 ± 7.956		11.01 ± 9.114		10.49 ± 8.571	
Non-treatment-related expenses during each visit						
Free of charge	73	73.0	63	63	136	68
Full payment	27	27.0	37	37.0	64	32
Mean ± SD	320.77 ± 488.524		531.62 ± 1613.165		444.60 ± 1272.083	
Channels for receiving information on health care						
Family	33	33.0	31	31.0	64	32
Co-workers	47	47.0	30	30.0	77	38.5
Health officials	11	11.0	23	23.0	34	17
Others	26	26.0	25	25.0	22	25.5
Cost of receiving health services on each visit (in USD)						
Free of charge	83	83.0	76	76.0	159	79.5
Full payment	17	17.0	24	24.0	4	20.5
Mean ± SD	12.93± 17.85		17.83± 17.41		15.85 ± 17.52	
Inability to pay						
No	90	90.0	88	88.0	178	95.7
Yes	3	3.0	5	5.0	8	4.3

	Workers dispensing fuel (n = 100)		Workers not dispensing fuel (n = 100)		Total	
	n	%	n	%	n	%
Not specified	7	7.0	7	7.0	14	
Solution for those unable to pay medical expenses						
Payment by installments	1	33.3	3	60.0	4	56
Borrowing from employers	0	0.0	2	40.0	2	25
Others	2	66.7	0	0.0	2	25
Welfare rights relating to health care						
Life insurance	2	2.0	2	2.0	4	2
Social Security Scheme	81	81.0	70	70.0	151	75.5
Health insurance	2	2.0	5	5.0	7	3.5
Employer	1	1.0	1	1.0	2	1.0
Personal funds	12	12.0	15	15.0	27	13.5
Other	2	2.0	7	7.0	9	4.5
Satisfaction with the services provided at public medical care establishment						
Very satisfied	7	19.4	11	20.8	18	20.2
Satisfied	29	80.6	41	77.3	70	78.7
Unsatisfied	0	0.0	1	1.9	1	1.1

Table 3. Numbers and percentages of workers with a current history of illness, classified according to systemic symptoms

	Workers dispensing fuel (n = 100)		Workers not dispensing fuel (n = 100)		Total	
	n	%	n	%	n	%
Eye disorders						
- No	70	70.0	58	58.0	128	64
- Yes	30	30.0	42	42.0	72	36
Ear disorders						
- No	85	85.0	79	79.0	164	82
- Yes	15	15.0	21	21.0	36	18
Respiratory disorders						
- No	40	40.0	45	45.0	85	42.5
- Yes	60	60.0	55	55.0	115	57.5
Skin disorders						
- No	83	83.0	81	81.0	164	82
- Yes	17	17.0	19	19.0	36	18
Neurological symptoms						
- No	25	25.0	29	29.0	54	27
- Yes	75	75.0	71	71.0	146	73
Mental and emotional disorders						
- No	51	51.0	49	49.0	100	50
- Yes	49	49.0	51	51.0	100	50
Hepatobiliary disorders						
- No	81	81.0	82	82.0	163	81.5
- Yes	19	19.0	18	18.0	37	18.5
Urinary bladder disorders						
- No	48	48.0	47	47.0	95	47.5
- Yes	52	52.0	53	53.0	105	52.5

	Workers dispensing fuel (n = 100)		Workers not dispensing fuel (n = 100)		Total	
	n	%	n	%	n	%
Anemia symptoms						
- No	91	91.0	93	93.0	184	92
- Yes	9	9.0	7	7.0	16	8
Chronic diseases (DM/thyroid/heart disease/hypertension)						
- No	97	97.0	93	93.0	190	95
- Yes	3	3.0	7	7.0	10	5

Health care from social security the most 75.5 %. The monthly income reported by 68% of respondents was ≥ 283 USD, and 56.5% had a mean income of 341.16 ± 124.72 USD (Table 2). Specific information on various systemic symptoms (e.g., neurological, psychological, respiratory) is detailed fully in Table 3.

Of these PS workers, 40.3% had an annual health check at a government hospital, and 29.2% at a private hospital. A total of 44.5% of respondents received a hospital visit, of which 80.9% were a medical visit,

18% were a medical examination, and 7.9% were associated with drug disbursement. A total of 36% of PS workers had an annual health check-up (Table 4). Multiple logistic regression analyses of independent variables and their effect on HCS access are shown in Table 5. For instance, the effect of being female on HCS access carried an OR of 2.348 (95%CI 1.067–5.165), yet it was 2.128 (95%CI 1.054–4.296) if the respondent was married/widowed/other.

Table 4. Numbers (percentages) of gas station workers with access to health care services

Access to health care services	Workers operating at the fuel dispensers (n = 100)		Workers operating outside the fuel dispensers (n = 100)		Total	
	n	%	n	%	n	%
Access to health care services in a health facility over the past 12 months						
No	64	64.0	47	47.0	111	55.5
Yes	36	36.0	53	53.0	89	44.5
Treatment of illnesses	29	80.6	43	81.1	72	80.9
Vaccination against disease	2	5.6	2	3.8	4	4.5
Attending a lecture on health knowledge	1	2.8	2	3.8	3	3.4
Health check-up	4	11.1	12	22.6	16	18
Contraception	2	5.6	1	1.9	3	3.4
Receiving medicine	2	5.6	5	9.4	7	7.9
Chest x-rays	1	2.8	3	5.7	4	4.5
Annual health check-up						
No	70	70.0	58	58.0	128	64
Yes	30	30.0	42	42.0	72	36
Sources of health services						
Private hospitals	6	20.0	15	35.7	21	29.2
Public hospitals	13	43.3	16	38.1	29	40.3
Clinics	6	20.0	5	11.9	11	15.3
Local <i>tambol</i> health-promotion hospitals	3	10.0	0	0.0	3	4.2
Drugstore	2	6.7	6	14.3	8	11.1

Table 5. Factors affecting gas station workers' access to health services

Factor	Health services		Crude		p-value	OR	Adjusted		Coefficient (β)
	No n = 111 (55.5%)	Yes n = 89 (44.5%)	OR				Lower	Upper	
Sex									
Female	66 (48.2)	71 (51.8)	2.689 (1.416,5.106)		0.002	2.348	1.067	5.165	0.854
Male	45 (71.4)	18 (28.6)	Ref		Ref	Ref	Ref	Ref	Ref
Marital status									
Married/widowed/other	40 (42.1)	55 (57.9)	2.871 (1.612,5.113)		0.000	2.128	1.054	4.296	0.755
Single	71 (67.6)	34 (32.4)	Ref		Ref	Ref	Ref	Ref	Ref
Slightly ill but working in the last 12 months									
No	62 (88.6)	8 (11.4)	Ref		Ref	Ref	Ref	Ref	Ref
Yes	49 (37.7)	81 (62.3)	12.811 (5.66,29.00)		0.000	7.978	3.264	19.499	2.077
Seriously ill									
No	93 (68.4)	43 (31.6)	Ref		Ref	Ref	Ref	Ref	Ref
Yes	18 (28.1)	46 (71.9)	5.527 (2.87,10.629)		0.000	3.394	1.581	7.286	1.222
Cost of receiving health services each time (baht)									
No	96 (60.4)	63 (39.6)	Ref		Ref	Ref	Ref	Ref	Ref
Yes	15 (36.6)	26 (63.4)	2.641 (1.298,5.375)		0.007	2.439	1.03	5.775	0.892
Distance from residence to the medical care establishment where they regular receive services (in km)									
≤ 5	69 (63.9)	39 (36.1)	Ref		Ref	Ref	Ref	Ref	Ref
>5	42 (45.7)	50 (54.3)	2.106 (1.194,3.716)		0.010	1.82	0.898	3.678	0.597
Other expenses , not spending money									
No	84 (61.8)	52 (38.2)	Ref		Ref	-	-	-	-
Yes	27 (42.2)	37 (57.8)	2.214 (1.209, 4.053)		0.010	-	-	-	-
Age (years)									
≥30	41 (47.7)	45 (52.3)	1.746 (991,3.078)		0.054				
< 30	70 (61.4)	44 (38.6)	Ref		Ref	-	-	-	-

Factor	Health services		Crude		p-value	OR	Adjusted		Coefficient (β)
	No n = 111 (55.5%)	Yes n = 89 (44.5%)	OR	95% CI			Lower	Upper	
Educational background									
Less than secondary school	36 (56.2)	28 (43.8)	0.956 (0.526,1.740)		0.884	-	-	-	-
Higher school (or equivalent)	75 (55.1)	61 (44.9)	Ref		Ref	-	-	-	-
Income (baht/month)									
< 10,000	51 (58.6)	36 (41.4)	Ref		Ref	-	-	-	-
≥10,000	60 (53.1)	53 (46.9)	1.251 (0.712, 2.200)		0.436	-	-	-	-
Physical health									
Good health	77 (60.6)	50 (39.4)	Ref		Ref	-	-	-	-
Slight illness	34 (46.6)	39 (53.4)	0.055 (0.99,3.16)		0.055	-	-	-	-
Mental health									
Good health	110 (55.6)	88 (44.4)	Ref		Ref	-	-	-	-
Slight illness	1 (50.0)	1 (50.0)	1.250 (0.077, 20.69)		0.875	-	-	-	-
Satisfaction with public medical care services									
Very satisfied	-	18 (100.0)	-		-	-	-	-	-
Moderately satisfied	-	70 (100.0)	-		-	-	-	-	-
Not satisfied	-	1 (100.0)	Ref		Ref	-	-	-	-
Social benefits relating to health care									
Employer/at own expense/ other	22 (57.9)	16 (42.1)	0.887 (0.434,1.812)		0.711	-	-	-	-
Life insurance/social security/ health insurance	89 (54.9)	73 (45.1)	Ref		Ref	-	-	-	-
Sources of health information (can select more than one response)									
No	74 (54.4)	62 (45.6)	Ref		Ref	-	-	-	-
Yes (Family, coworkers, health officials)	37 (57.8)	27 (42.2)	0.871 (0.478,1.587)		0.652	-	-	-	-

Cox & Snell R Square 0.339, Nagelkerke R Square 0.453

DISCUSSION

The percentage of people accessing HCS is <50% even though a universal health insurance system is in operation in Thailand [18]. In our cross-sectional study, we looked at the population characteristics, environmental factors, and health behavior of PS workers in RP. Multiple logistic regression analysis revealed that the patterns of HCS access were similar to those described previously. Scholars have documented a significant relationship between HCS access and some sociodemographic characteristics, enabling factors, and healthcare needs: sex, marital status, illness severity, the cost of receiving HCS in each visit, and distance from residence to the HC establishment where services are received regularly [29, 30]. Women had HCS access that was 2.348-times greater than that of men. This observation reveals the challenge of ensuring HCS access which meets the requirements of different sexes as well as socioeconomically disadvantaged and vulnerable populations. This is an important challenge because different groups may judge appropriateness and quality differently [16]. However, our data are not in accordance with the results of a study by *Sangkhamkul* et al. [31] who investigated social networks. They reported that the level of disability and being female could predict HCS access. However, their study group differed in relation to demographic factors (e.g., age, occupation) compared with our study cohort.

HCS access of respondents with a status of married/divorced/widowed was 2.128-times greater than that of unmarried respondents, data which are consistent with the findings of a study by *Pandey* and colleagues [13]. They analyzed the relationship between marital status and HCS access. In a cohort comprising 12,929 people, 6,473 (50.3%) were married, of whom 58% (compared with a population of unmarried people of 36%) had greater HCS access provided at hospital outpatient departments. Thus, social factors influence HCS access. Our findings can help to explain the relationship between marital status and HCS access, in addition to providing evidence that can contribute to HC development.

Illness severity

We found that illness severity affected HCS access. Those with a minor illness and severe illness were, respectively, 7.978-times and 3.394-times more likely to access HCS than those who were not ill. The reasons why workers wanted HCS access was (i) to obtain treatment for illness (80.9%) and (ii) to have a health checkup (18%). Respondents with a mild illness or a severe illness were more likely to receive HCS than those who were not ill. However, this finding is not consistent with that of *Lee* and colleagues [25]. They

found that workers who had a mild illness did not themselves avail HCS. However, the design and cohort of our study differed from those of *Lee* and colleagues because the participants in the latter were migrant workers working in Singapore. Several studies have found that workers who are not sick rarely avail themselves of HCS in hospitals or other HC centers. We discovered that 40.3% had an annual health check at a government hospital, and 29.2% at a private hospital. Different from the findings of the study by *Lee* et al. [25] on migrant workers, other studies have found that if workers become ill, most go to a private clinic, and fewer go to a government clinic [25, 32].

Health status and medical history

Most of our respondents were in good physical and mental health. This observation may have been because of their age: most were aged <30 (range, 18–60) years. Hence, the chance of having an underlying disease was low. *Chaiklieng* et al. [33] found that the age range of PS employees was 19–58 years, which is lower than that of PS employees working in Brazil (20–70 years) [34]. Hence, workers should be urged to seek HCS regularly. However, we also found that 73% of respondents reported previously identified neurological symptoms, 57% reported respiratory symptoms, and 50% reported mental and emotional problems. These data are consistent with results in several studies showing that 47.0% of PS workers experienced headache and 22.0% experienced fatigue [35, 36, 37]. Of the 57% of PS workers who developed respiratory symptoms, their symptoms may have been caused (at least in part) by smoking (34% of PS workers smoked tobacco). This prevalence of smoking is higher than that in the general population in Thailand (19.1%) [38]. Health promotion by changing workers' behavior to stop smoking can reduce the risk factors for respiratory diseases. A comprehensive approach raises awareness of the huge impact of chronic respiratory diseases, and highlights the risk factors as well as ways to prevent and treat these diseases [39]. In addition, health surveillance by prevention and control of chronic disease from BTEX exposure as well as good Occupational, Social and Health and Safety practices should be used by employers and employees to control risk, minimize exposure, and protect the health of all people at risk of exposure working in PS [40].

Data for respondents with liver abnormalities were consistent with behavioral-health data: 45.5% of PS workers consumed alcohol. Alcohol consumption can lead to various liver abnormalities, including inflammation and related disorders [41]. PS owners and public-health officials should participate in campaigns urging these workers to stop consuming alcohol, enhancing good liver health, as well as reducing the cost of receiving HCS in hospital.

Cost of receiving HCS

This study revealed that the payment of health care service was associated with 2.439 time more accessing health services than without having to pay for health care. We observed that PS workers who paid for HCS had greater access to HCS than those who did not pay for HCS. Our results appeared to reverse the causality between the cost of receiving HCS and access to HCS because it was a cross-sectional study in which participants accessed HCS before we collected their data. In addition, 75.9% of respondents were found to be eligible for health insurance through social security, with the average cost of one-time access to HCS being not very high (12.58 ± 36.01 USD). Therefore, such costs should not be a major barrier to HCS access by PS workers. In our study, the cost of HCS increased with illness severity, but we did not examine this relationship. Also, we did not assess the type of expense for each time healthcare was accessed. *Langton et al.* [42] found that HCS access with regard to hospitalization in two study cohorts increased, with the greatest increase seen in the last 2 months of life (67% increase in the cohort who died from cancer and 80% increase in the comparison cohort). Also, the percentage of dispensed medicines per month increased by 36% in the cohort who died from cancer and 19% in the comparison cohort.

Distance from the respondents' residence to the HC establishment in which services are received regularly

The average distance between a respondent's residence and government hospital was 10.49 ± 8.571 km, so HCS access was convenient for PS workers. A distance from the respondent's residence to the establishment where he/she received HCS >5 km was associated with HCS access that was 1.817-times higher than if the distance from the respondent's residence to the establishment where he/she receives HCS was ≤ 5 km. We found that respondents had a short distance to travel to access HCS in RP. Our results are in accordance with those of *Jordan et al.* [43]. They found the maximum distance to a hospital to be 9.4 km (travel time = 13.7 min). In the UK, a threshold distance to a specialist hospital is 24–50 miles [44], and is 10 miles to screening services, 4 miles to family-planning clinics, and 2.5 miles to primary care, all of which have been described as "poor access".

Our study data are not in accordance with results from other studies indicating that distance affects HCS access [45]. RP is economically developed, which makes travel to HCS very convenient. Also, the public-transport system in Thailand has improved and become more convenient and comfortable, so distance is no longer an obstacle to HCS access [6,

46]. However, we concentrated purely on urban areas, so we likely underestimated the extent of geographic barriers to HCS access. Our study is similar to many studies that found the distance from the participant's residence to a hospital to be correlated with HCS access. Distance has been found to be a significant driver for HC use and feeds into aspects of HCS access [47, 48]. Moreover, the distance from a "hub" location is a proxy for factors which affect the affordability of good access to HCS. Practices which are further away from their nearest hub have a much lower prevalence of use of the service [49].

Income and welfare rights relating to HC

The average monthly income of PS workers was 341.16 ± 124.72 USD, with most workers having a monthly salary >283 USD. This figure is close to the minimum daily wage of 9.48 USD and 9.51 USD in RP and Chonburi Province, respectively [50]. Although low income has been associated with a wide range of problems related to HCS access [51], we found that income did not influence HC behaviors. RP is a highly developed economic area, so the high cost of living may hinder HCS access. However, we found that income was not related to HCS access. This may have been because PS workers receive social security and government welfare for HC. In 2005, member countries of the WHO (including Thailand) committed to developing health-financing systems such that all people have HCS access known as "universal coverage". Health inequalities are observed in many countries [52, 53].

Our findings, however, differed from those of a long-term study in China which found that income influenced HCS access [54]. Although salaries were found to be associated significantly with visits to a physician within 3 days of illness onset ($p = 0.002$) [26], that study did not evaluate individuals in the same occupational group, and their educational status differed. The lack of association between income and HCS access in our study may have been because 75.5% of respondents had social-security cards.

Channels for receiving HC information

Access to primary HC is key to improving health outcomes [55]. In our study, respondents reported receiving the most support for HC information from their coworkers (38.5%), followed by receiving information from their family (32%), and health officials (17%). If a PS worker has good information related to HCS as well as social support, he/she will have better HCS access that will improve his/her health. More channels of communication are required to ensure that workers receive HC-related information and have better access to providers and outreach services for HC. We are focusing on a lack

of communication related to HC information that influences a person's ability to access HCS [16, 55]. There should be more channels to provide information about HC through colleagues and family. Also, HC workers should be more accessible to PS workers to encourage them to enhance their understanding of the value of having HCS access and achieving positive health outcomes [56].

Satisfaction with HCS

Satisfaction with HCS influences the well-being of a population. Quantifying satisfaction is one way of rating the quality of HCS [57]. A total of 78.8% of respondents were satisfied with the access to HCS provided by hospitals and other sources. However, we did not study causality in detail to assess satisfaction. A study in an elderly population revealed satisfaction with service quality to have a significant relationship with HCS access [31], but our study cohort was much younger.

Limitations and strengths of our study

Our study had two main limitations. First, the interview form for PS workers with systemic disorders did not involve passing a physical examination by a physician. There may have been a discrepancy with regard to documenting abnormal symptoms. Nevertheless, the interview form has been validated by physicians, and is intended for screening for abnormal symptoms only. Second, data were collected during the coronavirus disease 2019 (COVID-19) outbreak in Thailand. Most people avoided leaving their homes/workplace to a hospital because they were afraid of contracting COVID-19. Therefore, some workers may not have been able to access HCS. Studies are needed to monitor employees' access to HCS services under normal working conditions.

Our study had three main strengths. First, information about health conditions as a whole and risk behaviors in PS workers can lead to greater access to HCS and promotion of health among this group of workers. Second, the face-to-face interviews with individual PS workers allowed abnormal symptoms to be assessed appropriately. Third, the *critique* of study results by 15 experts provided recommendations for future, more comprehensive research. As a result, the credibility and knowledge gained from this research can be utilized to encourage employees to seek HCS.

CONCLUSIONS

HCS access was attributed to the cost of receiving HCS as well as the sex, marital status, illness severity of PS workers: these factors should be considered as part of the framework for public-health policy. PS workers should be encouraged to access HCS by

undergoing annual health checkups (and not waiting until they become ill). Providing all workers with equal and comprehensive HCS access can enhance their long-term health. Qualitative and quantitative studies are needed to investigate the social and cultural factors associated with increased access to HCS.

Acknowledgments

We would like to thank the staff at Memorial Hospital Sirindhorn for their assistance with data collection in the study area, and the owners and station managers for their cooperation. We would also like to express our appreciation to all of the volunteers who assisted in this study.

Funding

This research was funded by the Health Systems Research Institute at Burapha University, Thailand (grant number 63-070).

Conflicts of interest

The authors declare that they have no competing interests in this work.

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Received: 30.03.2022

Accepted: 20.06.2022

Published online first: 10.07.2022