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Factors Associated with Incidence of Long-Term COVID-19 Symptoms Among Adults in Nakhon Si Thammarat Province, Thailand†

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Abstract

Introduction: Long-term COVID has recovered in patients from the infected Coronavirus 2019, but there are still symptoms of problems that can occur four weeks to 3 months after infection in adults more than children.

Research objective: To study the incidence of Long-term COVID-19, the situation of symptoms and problems caused by long-term COVID-19, and factors associated with the incidence of long-term COVID-19 symptoms after Coronavirus 2019 infection among adults in Nakhon Si Thammarat Province.

Methodology: This research is a retrospective study. The sample of people aged 20 - 59 with RT-CPR or ATK positive was 260. The researchers collected data by using a questionnaire about personal data, health status, vaccination, history of infection with Coronavirus 2019, quarantine place, and symptoms of problems after infection with Coronavirus 2019. Statistical analysis included descriptive statistics, Chi-square tests, and binary logistic regression.

Results: The study revealed that the incidence of long-term COVID-19 symptoms was 30.8 %. The most prevalent clinical symptoms were cough (82.5 %), weakness/fatigue (67.5 %), headache/dizziness (53.8 %), hair loss (36.3 %), and myalgia/bone pain (31.3 %). The factors associated with the incidence of long-term COVID-19 symptoms after the Coronavirus 2019 infection were sex, age, underlying diseases, BMI, vaccination, and quarantine place, significant ($p < 0.05$).

Conclusions: According to the study results, patients with long COVID-19 symptoms after Coronavirus 2019 in males aged > 35 years old, with underlying diseases and obesity, received the vaccine 1 - 2 times and in-home quarantine. Therefore, healthcare providers should provide surveillance, screening, and monitoring of symptoms and advise on observing these patients' symptoms after the coronavirus 2019.
Keywords: Long-term COVID-19 symptoms, Factors, Incidence, Adults

Introduction

Coronavirus disease (COVID-19) has been a pandemic disease with a global impact since late 2019. COVID-19 caused a total of 770 million infected individuals worldwide, with a mortality of 6.9 million. World Health Organization (2023), Thailand was ranked 29th among countries with the highest mortality, with nearly 5 million infection cases, 32,771 deaths, and 4.62 million recoveries. Department of Disease Control, Ministry of Public Health Daily (2022), Specifically, Nakhon Si Thammarat Province had the highest number of infections among the top 5 provinces in the country. Most infected COVID-19 cases were adults with an average age of 39 years. Nakhon Si Thammarat Provincial Public Health Office (2022), COVID-19 infection not only affected individuals during infection but also had long-term effects on various organ systems such as respiratory, cardiovascular, gastrointestinal, dermatological, ocular, otolaryngological, musculoskeletal, neurological, psychiatric, and immune systems. Department of Medical Services (2021).

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Post-COVID-19 conditions lead to persistent symptoms, known as long COVID-19, which typically manifest within three months after getting the COVID-19 infection. and can last for at least two months. Common long-term COVID-19 symptoms include fatigue, difficulty breathing, exhaustion, cough, insomnia, headache, dizziness, hair loss, anxiety, stress, short-term memory loss, chest pain, and muscle pain. World Health Organization (2023), The particular cause and pathophysiology of COVID-19 are not yet fully understood. Still, they may result from viral persistence, leading to persistent inflammation and chronic immune system stimulation, causing abnormal immune responses. Castanares et al. (2021) This has significant implications for daily life and quality of life, especially for adults who rely on work for income, resulting in financial strain on families (Aiyegbusi et al., 2021; Kirdmanee et al., 2020).

Long-term COVID-19 symptoms among individuals who have recovered from COVID-19 in adults aged 35 to 69 years were more likely to develop long-term COVID-19 symptoms (Huang et al., 2021; Jones et al., 2021). Since adults have overwhelming responsibilities, including family burdens, work duties, and their physical health and that of family members, they tend to prioritize self-care and medical visits less (Kasemsuk & Boonbunjob, 2018). When adult individuals get sick, they are more likely to self-medicate, and subsequent post-COVID-19 symptoms. Guo et al. (2020) that individuals with underlying health conditions are more susceptible to post-COVID-19 symptoms. Vimercati et al. (2021); Tleyjeh et al. (202); Collantes et al. (2021); Rashedi et al. (2020). Meanwhile, individuals with a BMI over and equal to 25 kg/m^2 are at a higher risk of developing severe symptoms during infection, with up to a 30.8 % chance of experiencing post-COVID-19 conditions. Tancharoensukjit (2023); Burgban (2022). On the contrary, individuals who take antiviral medications alongside symptomatic treatment are less likely to develop post-COVID-19 symptoms. Tancharoensukjit (2023), Those who receive two doses of the COVID-19 vaccine reduce the likelihood of experiencing long-term COVID-19 symptoms and the severity of COVID-19 infection. Li and Ma (2020) The likelihood of having long-term COVID-19 symptoms increases in individuals undergoing home quarantine because they may engage in inappropriate self-care behaviors after infection, which can lead to continuous stimulation of the immune system within the body (Hamsomboon et al., 2022; Wang et al., 2020).

Nakhon Si Thammarat Province had the highest number of COVID-19 infections among the top 5 provinces in Thailand, with infected cases of individuals at an average age of 39 years. Nakhon Si Thammarat Provincial Public Health Office, studying post-COVID-19 conditions in this demographic will provide valuable insights. Nakhon Si Thammarat Provincial Public Health Office (2022) Moreover, most existing studies have focused on long-term COVID-19 symptoms among severely infected cases treated in hospitals rather than examining the incidence and factors related to long-term COVID-19 symptoms among adults in community settings. This gap of knowledge aligns with the current reality where individuals infected with COVID-19 are often managed on an outpatient basis and are required to self-manage at home following medical evaluation. As community healthcare practitioners responsible for safeguarding and addressing health issues across all age groups, it is imperative to investigate the incidence of long-term COVID-19 symptoms and their associated factors among adults in Nakhon Si Thammarat Province. This research aimed to study the incidence and factors associated with developing long-term COVID-19 symptoms among adults in Nakhon Si Thammarat Province, Thailand.

Methodology

Research design and setting

This research was a retrospective study aimed to investigate the incidence of long-term COVID-19 symptoms and factors associated with this incidence among adults in Nakhon Si Thammarat Province.

Population

Population: The study population consisted of 120,293 adults who tested positive for COVID-19 with RT-PCR and/or antigen test kit (ATK) from January to December 2022 and lived in Nakhon Si Thammarat Province.

Samples size: Participants were adults who had tested positive for COVID-19 with RT-PCR and/or ATK and lived in Nakhon Si Thammarat Province. The sample size was calculated using G Power 3.1 software for multiple regression analysis, with a significance level (α) set at 0.05, a power of test (Power)

of 0.8, and a medium effect size of 0.3. The minimum sample size was 217 individuals. The researchers added 20 % of the required sample size to ensure data comprehensiveness, resulting in 260 participants.

The proposed participants were selected using the inclusion criteria, which included individuals aged 20 - 59 years, diagnosed with COVID-19 for at least 3 - 6 months, having total mental capacity, able to communicate effectively and comprehend the Thai language, and willing to participate in the research. On the contrary, individuals were excluded from the sample group if they exhibited severe illness or could not provide information for the study.

A multi-stage sampling method was utilized to recruit participants. Firstly, Nakhon Si Thammarat Province was divided into six zones. One district was randomly selected from each zone, resulting in a total of 6 districts. Then, a second round of simple random sampling was conducted at the district level to select one subdistrict health-promoting hospital per district. Afterward, the sample size for each subdistrict health-promoting hospital was calculated based on proportions. 260 participants were selected from the six subdistricts' health-promoting hospitals.

Data collection

The researchers collected data by handing the questionnaire to all participants at their homes in the community, with a detailed description of each question. Adults were selected by simple random sampling as per the qualification of having positive for COVID-19 by RT-PCR and/or ATK for at least 3 - 6 months until the number of adults reached the determined criteria. The participants had 30 - 45 min to complete the questionnaire. The researchers asked permission to wait until all questionnaires were completed, which would be regarded as the end of the questionnaire.

The research instruments consisted of 4 parts. The researchers developed the first part based on a literature review. The second, third, and fourth parts were adapted from the Department of Medical Services (Department of Medical Services, 2021).

The first part focused on demographic data. The second part consisted of 4 open-ended medical history questions. The third section covered the history of COVID-19 vaccination and infection, COVID-19 detection methods, quarantine locations, duration of quarantine, disease severity, and medication received during illness. The last part comprised questions on long-term COVID-19 conditions; the evaluation will consider the presence of persistent or newly occurring symptoms that appear in weeks 5 - 12 after being diagnosed with COVID-19 and continue for at least two months covering general symptoms, respiratory system, and cardiovascular system, nervous system, psychiatric symptoms, gastrointestinal system, skin, eyes, ears, nose, throat, musculoskeletal system, and immune system.

Five experts validated the questionnaire's content, resulting in a validity score of 0.96 to 1.00. Reliability testing was conducted with 30 adults who met the study's criteria. The quality of the instrument was evaluated using the Kuder-Richardson 20 (KR-20) formula, resulting in a reliability coefficient of 0.91, indicating high reliability.

Ethical consideration

To protect the rights of the participants, the research plan was reviewed by the Human Research Ethics Committee of Walailak University for approval. This was given under document number WUEC-23-097-01 on April 10, 2023. After approval, the researchers received permission from the directors of 6 health-promoting hospitals to collect data from the participants. The participants were given detailed information about the research, including the research team, study procedures, and their rights as participants. They were assured that their decision to participate or leave the research would not affect their medical care and that all information provided would be kept confidential. Throughout the research, the participants were told they could express any discomfort or tiredness and ask for changes to the study schedule or withdraw from the study at any time. Once participants understood and agreed to these terms, they willingly agreed to participate in the research by signing the informed consent form provided by the researchers.

Data analysis

The data were subjected to statistical analysis with a significance level set at 0.05. Descriptive statistics, including frequencies, percentages, mean values, and standard deviations, were utilized to examine demographics, medical history, COVID-19 vaccination records, COVID-19 infection records, and post-infection long-term COVID-19 symptoms. The relationships between factors related to long-term COVID-19 symptoms among adults in Nakhon Si Thammarat Province were investigated using chi-squared statistics.

Results

Demographic data

The participants were female and aged 20 - 35 years (n = 137, 52.7 %). The mean age was 34.22 years (SD = 9.58). Nearly two-thirds of the sample had a BMI of less than 25 kg/m^2. Moreover, most participants reported no comorbidity (n = 209, 80.4 %). The findings revealed that only two samples did not receive the COVID-19 vaccine. Three-fourths of the participants received 3 or 4 doses of the COVID-19 vaccine (n = 190, 73.1 %). More than half of the samples reported having non-mild COVID-19 symptoms. Most participants were quarantined in a field hospital (n = 129, 49.6 %) or at home (n = 92, 35.4 %). Most participants received medication based on symptoms (n = 208, 80.0 %), as shown in **Table 1**.

Incidence and long-term COVID-19 symptoms

The sample reported experiencing long-term COVID-19 symptoms (n = 80, 30.8 %), where the top 10 most common long-term COVID-19 symptoms from 80 participants (in each person may be more than one symptom) were cough (82.5 %), fatigue (67.5 %), headache/dizziness (53.8 %), hair loss (36.3 %), muscle/joint pain (31.3 %), fever (26.3 %), amnesia (26.3 %), movement disorders (23.8 %), dysphagia (22.5 %), and palpitation (18.8 %), as shown in **Table 2**.

Factors associated with the incidence of long-term COVID-19

The findings revealed significant associations between particular variables and the incidence of long-term COVID-19 symptoms. Gender, age, and body mass index (BMI) were found to have statistically significant correlations ($p < 0.05$). Similarly, factors such as quarantine location, treatment facility, and underlying medical conditions demonstrated significant associations with long-term COVID-19 symptoms ($p < 0.01$). Moreover, the frequency of vaccine doses received also showed a significant correlation with long-term COVID-19 symptom occurrence ($p < 0.001$). However, variables relating to illness severity and the type of medication received, whether symptom-based or combined with antiviral drugs, did not show statistically significant associations with the development of long-term COVID-19 symptoms, as shown in **Table 3**.

Table 1 Number and percentage of the samples' demographic data and health (n = 260).

Data	n	%
Gender		
Male	123	47.3
Female	137	52.7
Age groups (Min = 20, Max = 59, Mean = 34.22, SD = 9.58)		
20 - 35 years	137	52.7
> 35 - 59 years	123	47.3
Nutritional status (BMI)		
< 25 kg/m^2	170	65.4
≥ 25 kg/m^2	90	34.6

Data	n	%
Comorbidity		
Not present	209	80.4
Present	51	19.6
COVID-19 vaccine received		
No	2	0.8
Yes	258	99.2
COVID-19 vaccine doses		
0 - 2 times	70	26.9
3 - 4 times	190	73.1
Degree of COVID-19 infection severity		
Non-mild symptoms (green-yellow)	163	62.69
Moderate-severe symptoms (orange-red)	97	37.31
Place of quarantine or treatment		
Hospital	36	13.8
Field hospital	129	49.6
Home isolation	92	35.4
Treatment		
Received medication for symptoms	208	80.0
Received medication for symptoms and antiviral medication	52	20.0

Table 2 Number and percentage of incidence and long-term COVID-19 symptoms (n=260).

Data	n	%
Presence of long-COVID-19 symptoms (n = 260)		
Yes	80	30.8
No	180	69.2
Presence of symptoms (n = 80)		
Cough	66	82.5
Fatigue	54	67.5
Headache/Dizziness	43	53.8
Hair loss	29	36.3
Dyspnea	27	33.8
Muscle/Joint pain	25	31.3
Fever	21	26.3
Amnesia	21	26.3
Movement disorders	19	23.8
Dysphagia	18	22.5
Palpitation	15	18.8
Chills	13	16.3
Allergy	13	16.3
Diarrhea	12	15.0
Abdominal pain	12	15.0

Data	n	%
Itching rash	12	15.0
Anosmia	11	13.8
Nausea and vomiting	11	13.8
Blurred vision	11	13.8
Depression	10	12.5
Anxiety/Stress	6	7.5
Insomnia	6	7.5

Table 3 Factors associated with the incidence of Long-term COVID-*19* (n = 260).

Variables	n (%)	Long-Term Covid-19		x^2	*p-value*
		No (%)	Yes (%)		
Gender				4.816	0.032*
Male	123 (47.3)	77 (62.2)	46 (37.4)		
Female	137 (52.7)	103 (75.2)	34 (24.8)		
Age				6.581	0.011*
20 - 35 years	137 (52.7)	103 (75.2)	34 (24.8)		
> 35 - 59 years	123 (47.3)	77 (62.2)	48 (37.4)		
Comorbidity				7.903	0.007**
Not present	209 (80.4)	153 (73.2)	56 (26.8)		
Present	51 (19.6)	27 (52.9)	24 (47.1)		
BMI				6.922	0.031*
< 25 kg/m^2	170 (65.4)	127 (74.7)	43 (25.3)		
≥ 25 kg/m^2	90 (34.6)	53 (58.8)	37 (41.2)		
Degree of COVID-19 infection severity				0.768	0.406
Non-mild symptoms	163 (62.69)	116 (71.2)	47 (28.8)		
Moderate-severe symptoms	97 (37.31)	64 (66.0)	33 (34.0)		
COVID-19 vaccine doses				21.94	0.000***
1 - 2 times	70 (26.9)	33 (47.1)	37 (52.9)		
3 - 4 times	190 (73.1)	147 (77.4)	43 (22.6)		
Treatment				0.113	0.615
Received medication for symptoms	208 (80.0)	142 (68.3)	66 (31.7)		
Received medication for symptoms and antiviral	52 (20.0)	38 (73.1)	14 (26.9)		
Place of quarantine or treatment				9.031	0.003**
Hospital	165 (63.4)	125 (75.8)	40 (24.2)		
Home/community isolation	95 (36.6)	55 (57.9)	40 (42.1)		

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Discussion

The study on long-term COVID-19 symptoms among 260 adult individuals in Nakhon Si Thammarat Province found that 80 individuals (30.8 %) experienced long-term COVID-19 symptoms. This incidence rate is higher than the World Health Organization's report, which indicates that 20 % of individuals infected with COVID-19 experience long-term COVID-19 symptoms. World Health Organization (2023), The long-term COVID-19 symptoms identified in this study included cough, fatigue/weakness, headache/dizziness, hair loss, and muscle/joint pain. Since long-term COVID-19 symptoms likely result from organ damage due to the acute-phase infection, specific mechanisms following the initial illness can contribute to the symptoms affecting multiple organs. Castanares et al. (2021) and Tantipasawasin (2022). These findings align with previous research indicating residual symptoms of COVID-19 such as fatigue, muscle/joint pain, and chest tightness. Carfì et al. (2020), Leon et al. (2021), and Wangchalabovorn et al. (2022) found that the samples' most common long-term COVID-19 symptoms were fatigue, difficulty breathing, weakness, headache, and hair loss. Similarly, a national survey by the Department of Medical Services involving 1,300 respondents reported that the top long-term symptoms included fatigue, difficulty breathing, cough, insomnia, headache, hair loss, dizziness, anxiety, stress, memory loss, and chest pain (Department of Medical Services, 2021).

Factors associated with long-term COVID-19 symptoms included gender, age, underlying diseases, BMI, vaccination records, and quarantine arrangements. Adult males experienced longer-term COVID-19 symptoms than females, possibly attributed to genetic factors. Yong (2021) explained that females have 2 X chromosomes, which may enhance immune function and disease resilience, particularly in the functioning of T-cells, compared to males. Since the female immune system is stronger than the male, the likelihood of having long COVID-19 may be lower.

In terms of age, adults aged > 35 - 59 years had higher long-term COVID-19 symptoms than those aged 20 - 35 years, consistent with previous findings associating older age with long-term COVID-19 symptoms. Geddes (2022), Whitaker et al. (2022), Moreover Jones et al. (2021) found that individuals aged 40 years or older admitted with sudden-onset dyspnea had a significant association with long-term COVID-19 symptoms after hospital discharge. Patients with comorbidity had a higher likelihood of experiencing residual or new-onset symptoms after COVID-19 infection compared to those without comorbidity. This was attributed to the multi-organ dysfunction caused by COVID-19, affecting various systems in the body, including the respiratory, cardiovascular, urinary, and endocrine systems, leading to tissue inflammation and damage. Individuals with underlying diseases were more susceptible to systemic failure, increasing the likelihood of long-term COVID-19 symptoms due to a weakened immune system. Vimercati et al. (2021) and Channarong (2022) Moreover, adults with a BMI greater than 25 had higher probabilities of experiencing long-term COVID-19 compared to those with a BMI less than 25. This aligned with a prior study that found a significant association between obesity and long-term COVID-19 symptoms in COVID-19 patients. Geddes (2022) and Whitaker et al. (2022) stated that severe pneumonia in adults with a BMI greater than 25 was higher than that of those with normal weight (Burgban, 2022).

Regarding COVID-19 vaccination, patients who received only 1 - 2 vaccine doses had a higher likelihood of long-term COVID-19 symptoms than those who received 3 - 4. The finding was consistent with previous studies indicating a reduction in long COVID-19 incidence positively related to the number of COVID-19 vaccination shots. Similarly, Antonelli et al. (2022) revealed that individuals who received two or more vaccine doses had nearly a 50 % reduction in the risk of COVID-19 compared to unvaccinated individuals. Moreover, Wongsermsin et al. (2022) found that receiving two or more COVID-19 vaccine doses significantly decreased the risk of long-term COVID-19. In contrast, individuals who received only one vaccine dose or did not receive any COVID-19 vaccines were at a higher risk for long-term COVID-19.

In terms of environmental factors, it was found that home/community quarantine was associated with the incidence of long-term COVID-19 symptoms. Adults who underwent home/ community quarantine were more likely to experience long-term COVID-19 symptoms compared to those who received treatment in hospitals or field hospitals. Hamsomboon et al. (2022) and Khotchanam and Susawad (2023) also found that COVID-19 patients who quarantined at home had a greater likelihood of developing

long-term COVID-19 than those who received hospital treatment, irrespective of symptom severity. This could be attributed to COVID-19-infected individuals practicing home quarantine, who may lack essential knowledge to recover or prevent long COVID-19. Additionally, individuals in home quarantine may not have eaten medication, possibly increasing their susceptibility to developing long-term COVID-19 symptoms (Hamsomboon et al., 2022; Wang et al., 2020).

However, in this study, the severity of COVID-19 illness and the use of symptom-based treatment or antiviral medication were not associated with the incidence of long-term COVID-19 symptoms. Patients with symptoms who practiced good self-care habits, such as adequate rest, hydration, nutritious food, and avoiding overexertion during illness, were more likely to recover from the disease faster, reducing the likelihood of developing long-term COVID-19 symptoms. Cheng et al. (2020) Furthermore, patients with moderate to severe symptoms who received antiviral medications such as Favipiravir, Lopinavir, Ritonavir, and symptom-based treatment were less likely to experience severe COVID-19 symptoms and reduced the occurrence of long COVID-19 (Tancharoensukjit, 2023)**.**

Conclusions

The most common long-term COVID-19 symptoms affect the quality of life in adults. Factors associated with long-term COVID-19 symptoms included age, comorbidities, body mass index, number of COVID-19 vaccine doses received, and quarantine location. Therefore, healthcare providers should prioritize surveillance, screening, symptom monitoring, and advice on observing symptoms for adults who are at high risk of developing long-term COVID-19, such as adults over 35 years old with obesity and underlying medical conditions.

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