การพัฒนาและตรวจสอบคุณภาพเชิงจิตวิทยาของแบบสอบถามความรู้และทัศนคติที่มีต่อภาวะลองโควิด

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บทคัดย่อ

ปัจจุบันผลกระทบของภาวะลองโควิดเพิ่มขึ้นทั่วโลก อาการของลองโควิดมีความหลากหลายและกลไกทางพยาธิสรีรวิทยายังไม่เป็นที่เข้าใจดีนัก ดังนั้นการประเมินความรู้ และทัศนคติของบุคคลที่มีต่อภาวะลองโควิดจึงเป็นสิ่งสำคัญ จุดมุ่งหมายของงานวิจัยนี้คือการสร้างและตรวจสอบแบบสอบถามประเมินความรู้ และทัศนคติที่มีต่อภาวะลองโควิด ประกอบด้วย ส่วนความรู้ 14 ข้อ และทัศนคติ 6 ข้อ ซึ่งได้รับการตรวจสอบความตรงเชิงเนื้อหาของแบบสอบถามโดยผู้เชี่ยวชาญ จากนั้นคัดเลือกผู้เข้าร่วมวิจัยที่มีสุขภาพดี อายุระหว่าง 18-60 ปี จำนวน 30 คน เพื่อประเมินความสอดคล้องภายใน และความเที่ยงภายในผู้ประเมิน ผลการวิจัยพบว่าดัชนีความตรงเชิงเนื้อหารายข้อ (I-CVI) และดัชนีความตรงเชิงเนื้อหาทั้งฉบับ (S-CVI) เป็นที่ยอมรับ (≥ 0.8 และ 0.91 ตามลำดับ) ความสอดคล้องภายในส่วนทัศนคติของแบบสอบถามอยู่ในระดับดี (Cronbach's alpha = 0.82) และความเที่ยงภายในผู้ประเมินส่วนความรู้อยู่ในเกณฑ์ยอมรับได้ (percent agreement ≥ 66.7) เช่นเดียวกับส่วนทัศนคติที่แสดงด้วยสัมประสิทธิ์สหสัมพันธ์ซึ่งมีนัยสำคัญทางสถิติ ($p < 0.05$) โดยสรุปแล้วแบบประเมินความรู้ และทัศนคติที่มีต่อภาวะลองโควิดเป็นเครื่องมือที่มีความเป็นมาตรฐาน ซึ่งจะสามารถนำไปใช้เป็นแนวทางแก่บุคลากรทางการแพทย์ นักเทคนิคการแพทย์ชุมชน ในการประเมินความรอบรู้ด้านสุขภาพ รวมถึงใช้เป็นแนวทางสำหรับส่งเสริมสุขภาพในชุมชน

คำสำคัญ: ลองโควิด แบบสอบถาม ความรอบรู้ด้านสุขภาพ นักเทคนิคการแพทย์ชุมชน

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#52-3-66 .indd 8698 7/12/2566 BE 12:31

Development and Psychometric Validation of the Knowledge and Attitudes Questionnaire toward Long COVID (KA-long COVID)

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Abstract

The impact of long COVID has been increasing globally, however, the symptoms and pathophysiological mechanisms are still not well understood. Therefore, evaluating individuals knowledge and attitudes (KA) towards long COVID is crucial. This study aimed to create and validate the KA-long COVID questionnaire, which consists of 14 items for knowledge and 6 items for attitude. The questionnaire's content validity was established through expert agreement, and its internal consistency and intra-rater reliability were assessed using 30 healthy participants, aged 18-60 years old. Results showed acceptable item level-content validity index (I-CVI) and scale level-content validity index (S-CVI) (≥ 0.8 and 0.91, respectively). The attitude section's internal consistency was reliable (Cronbach's alpha = 0.82). The knowledge section's intra-rater reliability was acceptable (percent agreement ≥ 66.7), and the attitude section's Spearman rank correlation coefficient was significant ($p < 0.05$). In conclusion, the KA-long COVID questionnaire is a reliable and valid instrument for measuring knowledge and attitudes toward long COVID. This questionnaire could guide healthcare professionals, including community medical technologists, in measuring health literacy and improving health outcomes.

Keywords: Long COVID, Questionnaire, Health literacy, Community medical technologists

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Received: 10 May 2023 Revised: 19 July 2023 Accepted: 3 August 2023

#52-3-66 .indd 8699 7/12/2566 BE 12:31

Introduction

The coronavirus disease 2019 (COVID-19) is an emerging disease caused by the coronavirus (SARS-CoV-2). The first case was detected in December 2019 in Wuhan and spread rapidly due to its dense population.[1] Consequently, China had to announce the country's lockdown in order to control the situation. Approximately 80 percent of patients recovered without hospitalization, whereas 20 percent of those infected showed symptoms and were admitted to the hospital. Five percent of patients had severe symptoms and high mortality rate.[2] These patients with underlying diseases or elderly tended to have more severe illnesses than ordinary people. In the current global epidemic situation, many countries have been able to control the epidemic and prevent new infections. In contrast, new infections in many countries, including Thailand, are still high.

Recently, new virus mutations confer higher infectivity and low virulence. Most infected people, especially with vaccination, show mild symptoms and recover within a few days. However, some people still face prolonged symptoms after recovering from the illness. The condition is known as "Long COVID" which usually occurs with pathological sequelae.[3] The cause of long COVID remains unclear. It has been hypothesized that the antibodies produced during the infection to eliminate the virus can also affect the cells in the body. Another reason is that the body is unable to eliminate the infection completely,[4] resulting in inflammation and other pathologies.[5-7] The condition has a variety of names, including Long COVID-19, Post-COVID conditions, Long-haul COVID, post-acute COVID-19, post-COVID-19 syndrome or chronic COVID, etc. Symptoms of long COVID exhibit substantial heterogeneity, encompassing more than 200 symptoms including fatigue, shortness of breath, brain fog, musculoskeletal pain, chest pain, headaches, loss of taste and smell, sleep disturbances, heart-related symptoms, gastrointestinal illnesses and mental health issues.[8, 9] The prevalence of long COVID is still being studied, and estimates vary. Recent research indicates that approximately 45% of individuals who have survived COVID-19 have been observed to exhibit a variety of unresolved symptoms after approximately four months.[10] Patients suffering from long COVID have documented persisting and protracted symptoms affecting multiple physiological systems, resulting in substantial reductions in quality of life, occupational capabilities, and considerable disability.[11, 12] The symptoms can be debilitating and cause difficulties in daily activities, work, and social interactions. In addition, the experience of long COVID can lead to psychological distress as patients contend with persistent symptoms and the uncertainty surrounding their recovery.

The condition can occur in people with severe or mild symptoms after the infection is not detected in the patients. There is currently no definitive determination of the diagnostic criteria and the principles of diagnosis are constantly being improved and developed. In this case, the knowledge of long COVID is an inevitable component for healthcare professionals in order to assess, treat and monitor an infected patient. Therefore, long COVID awareness and understanding, along with guidelines for post-infection self-care, are essential for the general population to maintain good quality of life. In addition, measuring knowledge and attitudes toward long COVID is essential for developing targeted interventions. By addressing knowledge gaps and shaping positive attitudes, interventions can be tailored to meet the specific needs of individuals with long COVID, ultimately leading to improved patient outcomes and better overall management of the condition.

Medical technologists play an important role in the healthcare team by performing a variety of laboratory tests and procedures to help diagnose and monitor medical conditions. They have to communicate with patients, physicians, and other healthcare professionals to provide information about laboratory testing and results. In addition, health promotion is a crucial responsibility of medical technologists, particularly those in community settings, due to their advantageous position in reaching individuals compared to hospital settings. However, prior to initiating any health promotion activities, it is imperative to assess an individual's personal health literacy. Therefore, questionnaires can be an effective tool for health promotion because they can help individuals to identify their health-related behaviors and attitudes, and provide them with tailored feedback and recommendations for improvement.

Currently, COVID-19-related health literacy can be widely accessed from various kinds of media. Many studies demonstrated a relationship between health literacy and COVID-19-related beliefs and behaviors.[13-16] They focused on strategies for increasing awareness and prevention behaviors. Nevertheless, a number of people infected with COVID-19 still suffer from long COVID. Moreover, it is a complex issue and the information may be diverse and inconstant. In this sense, health literacy on long COVID is critical during the COVID-19 pandemic in order to take care of themselves, make informed decisions, and access appropriate healthcare services.[17] To assess this, the conceptual model by Nutbeam was used in this study. It identified three levels of health literacy: functional, interactive and critical health literacy.[18] Given the ongoing uncertainty surrounding long COVID, we focused on accessing functional health literacy with regard to public awareness of health conditions. This study aimed to evaluate the validity and reliability of the questionnaire on

knowledge and attitudes towards long COVID (KA-long COVID). The accurate assessment can be used to develop a guideline for patients at risk of long COVID to increase their understanding and participation in self-care and clinical treatment.

Methodology

The development and validation of the knowledge and attitudes questionnaire involve a systematic process to ensure its reliability and validity as a research instrument. The process typically begins with an extensive review of existing literature on long COVID. Then, a pool of potential questionnaire items is generated. A group of healthcare professionals specialized in COVID-19 management evaluate the initial items as a panel of experts in the field. The questionnaire is then administered to a small sample of individuals who are representative of the target population. Lastly, psychometric evaluation techniques are used to assess its reliability and validity. This includes assessing internal consistency and intra-rater reliability.

Item generation

In this phase, the researchers identified the key questions related to knowledge and attitudes towards long COVID by gathering data from various databases such as PubMed, Scopus and TCI. The search keywords used included Long COVID, Post-COVID condition, Long-haul COVID, Post-acute COVID-19, Post-COVID-19 syndrome or chronic COVID. Furthermore, guidelines from local and national health organizations, including the WHO, CDC and Ministry of Public Health (Thailand), were complied to develop the questionnaire.

To ensure the accuracy of the initial questionnaire's content, content validity indices (CVIs) were calculated for both individual items (I-CVI) and the overall scale (S-CVI). The first draft was provided to five experts who were carefully selected based on their expertise in academia and healthcare. The expert panel consisted of two medical doctors, one medical technologist, one pharmacist, and one occupational therapist. One medical doctor was an active epidemiological investigator, who had experiences in proactive screening of COVID-19 patients, and the other was specialized in cognitive neurology. The medical technologist was specialized in virology and had expertise on biosafety requirement for SARS-CoV-2 while the pharmacist was working full-time at drugstore and had a research background in herbal medicine and the occupational therapist was specialized in physical, mental and cognitive impairment. These experts were asked to evaluate each question's clarity and alignment with the questionnaire's objectives. They rated each item on a four-point Likert scale, with scores ranging from 1 (not relevant) to 4 (highly relevant). Experts were also encouraged to provide feedback and suggest revisions to

improve the wording and phrasing. The I-CVI value for each item and the S-CVI value for the overall scale were assessed. It was necessary for the I-CVI and the S-CVI to be equal to or greater than 0.78 and 0.9, respectively. Any question with a low CVI value was revised based on the feedback provided by the experts.[19, 20] To gather feedback from the target population, a pilot test was conducted to assess the face validity. Participants who met the inclusion criteria were invited to respond to all items in order to evaluate comprehension, question clarity, and scoring criteria. Additionally, any ambiguous words or phrases were also identified and revised based on the participant's feedback.

Psychometric properties study

The psychometric properties of the tool were assessed, including internal consistency and intra-rater reliability. A total of thirty participants were included in the study, following specific inclusion criteria: (a) being a healthy individual residing in Bangkok and surrounding areas (b) aged between 18-60 years (c) having good proficiency in the Thai language for effective communication, and (d) never get COVID-19 or recovered from COVID-19 more than 3 months. The exclusion criteria involved individuals who were diagnosed with COVID-19 during the intra-rater reliability process. All participants were provided with detailed information about the research study in accordance with ethical principles, and their consent to participate was obtained. This study received ethical approval from the Mahidol University Central Institutional Review Board (COA No. MU-CIRB 2022/224.1608).

Measurement

The authors collected data using an online survey titled "Questionnaire on Knowledge and Attitude towards long COVID (KA-long COVID)". The questionnaire comprised two parts with a total of 12 questions. In the knowledge section, participants were required to select their response from "Agree", "Disagree" or "Not sure". In the attitudes section, participants rated their agreement on a scale of 0 to 3, where 0 indicated disagreement and 3 indicated strong agreement. To assess intra-rater reliability, participants were asked to complete the survey twice, with a one-week interval between responses. For internal consistency analysis, the authors used the participant's first response for calculation.

Statistical Analysis

All statistical analyses in this study were performed using SPSS for Windows (Version 18.0; SPSS Inc., Chicago, IL). Descriptive statistics were used to calculate the demographic characteristics. The internal consistency of the attitude section, which was scored using a Likert scale, was assessed using Cronbach alpha coefficient. For the knowledge

section, intra-rater reliability was determined using percent agreement, while Spearman's rank correlation was used for the attitude section.

Result

In the preliminary phase of the study, relevant literature and guidelines were reviewed to extract questions, which were then organized into two sections with sub-domains. The first draft of KA-long COVID consisted of 21 items (15 on knowledge and 6 on attitudes), but after removing repetitive items and receiving feedback from an expert panel, one item with an I-CVI value of 0.60 was excluded, leaving 20 items for construct validation (Table 1). The S-CVI/Ave was 0.91, indicating acceptable content validity. Only minor issues were reported regarding the wording of the questionnaire during the pilot study. The participants suggested adding more explanation about patient group 608, which was included in the footnote.

The final version of the 20-item KA-long COVID questionnaire was distributed to 30 participants in the main study to test its psychometric properties. The characteristics of the participants are presented in Table 2, which shows that the sample group consisted of 30 participants, including 14 males (46.7%) and 16 females (53.3%). The mean age of the participants was 33.07 (SD = 12.95, range = 18-59). Most of the participants held a Bachelor's degree (66.7%), and 43.3% of them were university students.

Table 1 Content validity index (CVI) rating of the individual KA-long COVID items.

Item		I-CVI
Knowledge section		
K0	Symptoms that persist after recovering from COVID-19 within the first month are not considered as long COVID.	0.6
K1	Long COVID can be prevented once infected with the virus.	1
K2	Long COVID symptoms may be the same or different in each person.	1
K3	Long COVID symptoms can last from a few months to years.	1
K4	Patients in group 608 who are ≥ 60 years old, or have any of the 7 underlying diseases including chronic respiratory disease, cardiovascular disease, chronic renal failure, stroke, obesity, cancer and diabetes or being pregnant, have a higher chance of developing long COVID than other groups.	1

Table 1 Content validity index (CVI) rating of the individual KA-long COVID items. (Cont.)

Item		I-CVI
Knowledge section		
K5	Long COVID infection can occur in healthy infected people or have mild symptoms or never had any underlying diseases before.	1
K6	Following long COVID symptoms can be found in infected people more often than in those who have never been infected:	
K6.1	Fatigue, muscle weakness	1
K6.2	Shortness of breath	1
K6.3	Joint pain, muscle pain	0.8
K6.4	Brain fatigue, short memory	0.8
K6.5	Hair loss	1
K6.6	Headache, dizziness	0.8
K6.7	Stress, anxiety, insomnia, depression	0.8
K6.8	Coronary artery blockage, myocardial infarction	0.8
K6.9	Indigestion, diarrhea, Gerd	0.8
Attitude section		
A1	A person who is infected with COVID-19 and received antiviral drugs such as Favipiravir, Molnupiravir, Remdesivir and Paxlovid is less likely to develop long COVID-19 condition compared to those who do not receive such drugs.	0.8
A2	*Andrographis paniculata* or Andrographolide can prevent long COVID.	1
A3	Full-dose vaccination and a booster can prevent long COVID.	1
A4	People who exercise regularly and have adequate rest are less likely to develop a long COVID condition compared to those who rarely exercise and rest	1
A5	Consumption of foods with high vitamins, minerals and fiber helps promote faster recovery and reduces the incidence of long COVID.	0.8
A6	Consumption of probiotics such as yogurt and fermented milk helps the body to recover faster and reduces the incidence of long COVID.	0.8

Table 2 Demographic characteristics of study participants (N = 30).

Characteristics		Participants	Percentage
Sex	Male	14	46.7
	Female	16	53.3
Occupation	University student	13	43.3
	Freelance	4	13.3
	Civil servant	8	26.7
	Business	4	13.3
	State enterprise	1	3.3
Education	Bachelor's Degree	20	66.7
	Master's Degree	7	23.3
	Ph.D.	3	10.0
		Mean (SD)	Range
Age (years)		33.07 (12.95)	18-59

Internal consistency and intra-rater reliability

The attitude section of the KA-long COVID questionnaire showed high and acceptable internal consistency (Cronbach's alpha = 0.82). In terms of intra-rater reliability, the results were consistently good, as shown in Table 3. The knowledge section demonstrated satisfactory reliability with percent agreement ranging from 66.7 to 93.3. The attitude section exhibited moderate to strong correlations according to Spearman's rank correlation coefficient (0.43-0.70).[21, 22] The item with the strongest correlation was A3 (r_s = 0.70, $p < 0.003$), while other items showed moderate correlation.

Table 3 Intra-rater reliability of KA-long COVID (N = 30).

Knowledge section	**% Agreement**	
K1	70.0	
K2	93.3	
K3	66.7	
K4	80.0	
K5	70.0	
K6.1	66.7	
K6.2	86.7	
K6.3	73.3	
K6.4	66.7	
K6.5	83.3	
K6.6	76.7	
K6.7	80.0	
K6.8	70.0	
K6.9	76.7	
Attitude section	Spearman rank correlation coefficient (r_s)	*p*
A1	0.67	0.000
A2	0.61	0.000
A3	0.70	0.003
A4	0.62	0.000
A5	0.62	0.000
A6	0.43	0.018

Knowledge and Attitude results

Opinion on KA-long COVID items in knowledge section are presented in Table 4. The highest percent agreement was shown in item K2 (Long COVID symptoms may be the same or different in each person) with 96.7% agreement whereas, the lowest percent agreement was observed in item K6.8 (Coronary artery blockage, myocardial infarction), with only 33.3% agreement among participants. In the attitude section, the highest agreement score was 2.4 out of 3.0 for item A4 (people who exercise regularly and have adequate rest are less likely to develop a long COVID compared to those who rarely exercise and rest) and item A5 (consumption of foods with high vitamins, minerals and fiber helps promote faster recovery and reduce the incidence of long COVID), as shown in Table 5. However, the agreement scores for other questions were low, indicating contradictions regarding anti-viral drugs, the use of *Andrographis paniculate* extract, vaccination, and probiotics.

Table 4 Opinion on KA-long COVID items in knowledge section (N = 30).

Answers (%) / Items	Agree	Disagree	Not sure
K1	16 (53.3)	6 (20.0)	8 (26.7)
K2	29 (96.7)	0	1 (3.3)
K3	18 (60.0)	3 (10.0)	9 (30.0)
K4	22 (73.3)	2 (6.7)	6 (20.0)
K5	23 (76.7)	3 (10.0)	4 (13.3)
K6.1	18 (60.0)	2 (6.7)	10 (33.3)
K6.2	23 (76.7)	2 (6.7)	5 (16.7)
K6.3	17 (56.7)	4 (13.3)	9 (30.0)
K6.4	16 (53.3)	2 (6.7)	12 (40.0)
K6.5	16 (53.3)	5 (16.7)	9 (30.0)
K6.6	20 (66.7)	2 (6.7)	8 (26.7)
K6.7	14 (46.7)	5 (16.7)	11 (36.7)
K6.8	10 (33.3)	6 (20.0)	14 (46.7)
K6.9	13 (43.3)	8 (26.7)	9 (30.0)

Table 5 Participant's score in attitude section of KA-long COVID (N = 30).

Attitude section	Mean	SD
A1	1.60	1.037
A2	1.33	0.844
A3	1.73	0.980
A4	2.40	0.770
A5	2.40	0.814
A6	1.93	0.907

Discussion

In this study, we developed a tool using literature review and expert suggestions and showed that it has good psychometric properties. We followed guidelines from reputable organizations to create the questionnaire. However, the prevalence and definition of long COVID are still uncertain and controversial, and more evidence is needed.

From our preliminary result, we found that almost all participants understood that long COVID symptoms might be the same or different in each person, in accordance with the current media reports. However, there was a diversity in other areas of knowledge. More than half of the participants did not know about the consequence of long COVID in terms of phycological and digestive problems. Only one-third of participants were aware that long COVID could cause blood vessel blockage and heart issues despite several studies suggesting a strong association.[23, 24] In term of attitudes, most believed that regular exercise, adequate rest and a healthy diet could reduce their chances of developing long COVID, which has been suggested as an effective multisystemic therapy for long COVID.[25] Conversely, some believed that vaccines, commercial drugs, herbal medicine (such as *Andrographis paniculata*), and probiotics could not prevent the long COVID. The evidence supporting this belief is not concrete; thus, it may be useful to trace the roots of these beliefs through qualitative processes.

Medical technologists have played a crucial role in identifying and monitoring COVID-19 cases during the pandemic. They could continue to utilize their expertise to promote health, prevent disease, and educate the public on health-related issues. By doing so, they could assist healthcare providers in implementing effective preventative measures and developing strategies to improve public health outcomes. Research enables healthcare providers to tailor their approach to care, ensuring that patients receive personalized, high-quality care. A proactive approach to healthcare can have significant benefits,

including improved patient outcomes, reduced healthcare costs, increased patient satisfaction, improved population health, and more efficient use of healthcare resources.

There are some limitations of this study. Firstly, it was based on a small sample size, and given that a large proportion of the participants were university students, it may not be representative of the entire population. Therefore, further studies are recommended to verify the stability of KA-long COVID in a larger population. Secondly, the study included participants both with and without previous COVID-19 infection, which might have affected the results due to differences in their experiences.

Conclusion

The KA-long COVID tool was found to be valid for assessing the knowledge and attitude towards long COVID. The study showed good results in terms of content validity, internal consistency, and intra-rater reliability. Although there are some limitations to the tool, the findings from a large population can guide health educators, professionals, researchers, and policymakers in developing suitable management plans for long COVID treatment and education.

Acknowledgements

This research project was supported by Faculty of Medical Technology, Mahidol University. The authors would like to express our gratitude to the research participants and experts who were involved in this study for their valuable participation and contribution. Additionally, the authors extend our thanks to Prof. Virapong Prachayasittikul and Asst. Prof. Likit Preeyanon from the Faculty of Medical Technology, Mahidol University for their kind advice and proofreading assistance.

Conflicts of interest

The authors declare no conflicts of interest.

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