



Peri-pandemic Physical Activity in Southeast Asia: A Narrative Review

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ABSTRACT

To stifle widespread transmission of the COVID-19 virus, Southeast Asian governments initiated lockdowns and quarantines that severely limited human mobility and people's engagement in healthful and sufficient physical activity (PA). What was the state of PA in Southeast Asia during the pandemic? This narrative review answered this major question by reviewing relevant studies identified through a keyword search in online research databases, the results of which were then filtered according inclusion criteria and topic relevance before the final set of articles were summarized and synthesized. The findings of 13 studies, covering only five Southeast Asian nations, make up the bulk of this narrative review. Some of the studies reported associations between PA and mental health (especially anxiety and depression), health literacy, Health-Related Quality of Life, and sleep. Other studies discussed the use of technology for PA, problems related to physical activity, and the importance of PA to the elderly during the pandemic. More studies need to be done about peri-pandemic PA, particularly about the factors, systems, and technologies affecting PA levels and sedentary behavior from pre- to peri-pandemic periods so that stakeholders can improve maintenance-level PA, preserve increased PA levels, increase PA levels where such have decreased, and keep sedentary behavior low all throughout. Peri-pandemic sedentary behavior also needs more attention, since physical inactivity and sedentary behavior, although distinct from each other, usually accompany each other, are correlated, and have significant impact on human health.

Keywords: physical activity, sedentary behavior, COVID-19, pandemic, Southeast Asia

INTRODUCTION

Every human being needs to maintain a certain level of physical activeness to reap the health benefits of physical movement (U.S. Centers for Disease Control and Prevention, 2021). Living an active life contributes much to physical and mental health, promotes overall well-being, and improves one's quality of life (Nowak et al., 2019; Velten et al., 2018). Physical activity, for example, is associated with lower risks of depression, anxiety, and other mental illnesses (Hu et al., 2020). It is also said to provide short- and long-term benefits for mood and sleep (Chan et al., 2019; Wang & Boros, 2021).

Unfortunately, the COVID-19 pandemic has thrown the whole world into disarray and has greatly affected many people's normal ways of living. Attempts to contain the virus and prevent further widespread transmission compelled many Southeast Asian countries to restrict human mobility by enforcing curfews, quarantines, and lockdowns (AseanTodayTV, 2020). Such restrictions also had the real potential to severely limit people's usual pre-pandemic physical activities.

The World Health Organization provides a very simple definition of physical activity — "any bodily movement produced by skeletal muscles that requires energy expenditure" (2020, para. 2). How much health-maintaining physical activity to engage in per day or per week depends on one's age and health or physical

conditions (e.g., pregnancy and postpartum period, chronic conditions, and disabilities). The recommended amount or level ideally combines both moderate- and vigorous-intensity physical activities. One is considered physically active if she or he meets at least the minimum recommended amount of physical activity for one's age and/or condition.

Even during a stressful and restrictive period such as the COVID-19 pandemic, people should still strive to reach at least the minimum levels of physical activity for their population grouping, or else they might not receive the health benefits that sufficient physical activity can bring and that they will need to navigate successfully through the stresses of the pandemic.

How have the COVID-19 pandemic and the community responses to it (e.g., lockdowns) affected Southeast Asians' engagement in physical activity and exercise? Were they able to maintain their levels of physical activity as before the pandemic, or did the standstill provide them more time to be physically active? What adaptations did people make to their usual physical activities just to achieve the recommended amount? How did their levels

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of peri-pandemic physical activity affect other aspects of their health? What factors or variables made Southeast Asians increase, decrease, or maintain their engagement in sufficient physical activities? These kinds of questions prompted me to carry out this narrative review. In a nutshell, I wanted to find out what the current literature at that time said about the general state of physical activity, especially people's performance of it, among Southeast Asians during the COVID-19 pandemic.

METHODOLOGY

This study is a non-systematic review, better known as a narrative review, the purposes of which are to objectively identify and summarize current knowledge of a topic based on what has already been published about it and to determine aspects of the topic that existing research has not addressed (Ferrari, 2015; Green et al., 2006). Consequently, readers will find in such a review a comprehensive and contextualized overview of the topic. The Methods or Methodology section is optional for narrative reviews, but its presence in the narrative review can clarify the key messages of the review article (Ferrari, 2015). Further, since bias is more prone to manifest in the

literature search process (i.e., the "Methods") of a non-systematic review might use – is recommended (Ferrari, 2015). My narrative review employed such a structured approach.

Although no standardized or acknowledged guidelines have been established for narrative reviews, I tried to increase the study's objectivity and lessen the possibility of bias by incorporating some of the features from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses, better known as the PRISMA (Page et al., 2021), as a general guide and framework. The PRISMA flow of information consists of several phases: identification of sources, screening of records, retrieval of reports, assessing eligibility of reports, and inclusion of reports. My study's process followed a similar path, as shown in Figure 1.

The first step identified potential sources from the research databases ERIC, PubMed, ProQuest, and Scopus. The key concepts of the study's topic became primary keywords for the search; other topic-relevant keywords synonymous with the primary ones were also used. Every search session used a combination of the concept or

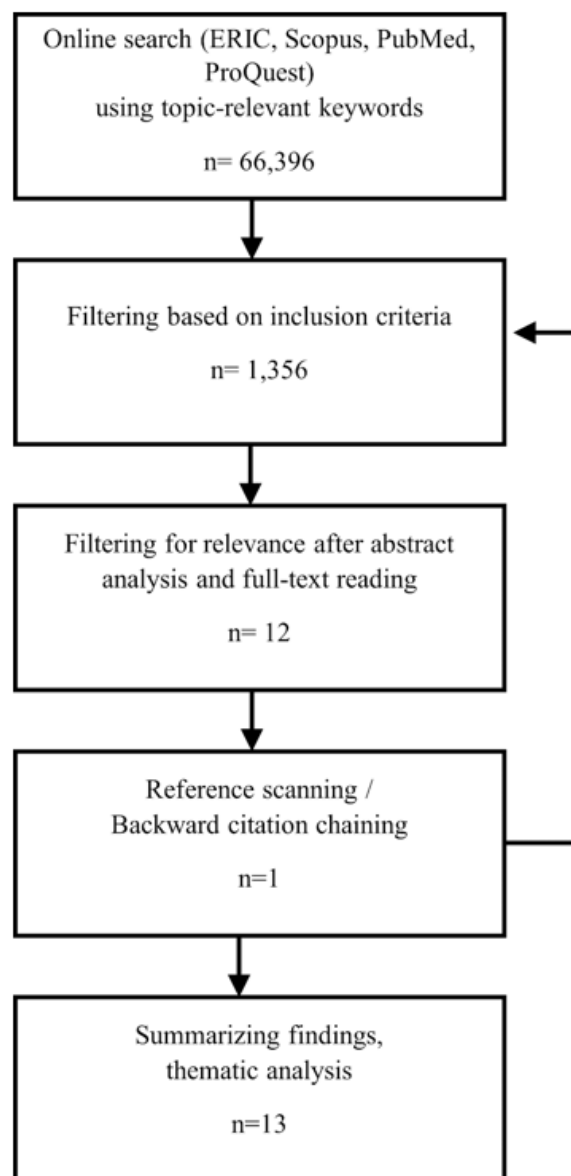


Figure 1 Studies selection and filtering process in the narrative review.

topic-relevant keywords and the names of the Association of Southeast Asian Nations members: "physical activity," "exercise," "pandemic," "COVID," "Southeast Asia," "Brunei," "Myanmar," "Cambodia," "Timor-Leste," "Indonesia," "Laos," "Malaysia," "Philippines," "Singapore," "Thailand," and "Vietnam." The same keyword combinations were used for each of the databases accessed.

This study originally intended to limit its scope to only the Philippines, but after the initial search was done, not one article fit the study's selection criteria. So the net had to be cast wider, resulting in the expansion of the study's coverage to the whole of Southeast Asia. The expanded database search produced 68 results from ERIC, 20 results from PubMed, 70 results from Scopus, and 66,238 results from ProQuest - a total of 66,396 hits.

The second step narrowed down the initial set of sources according to several selection criteria. Abstracts only (without accessible full text), previews, preprints, letters to the editor, and the like were excluded. Only full-text peer-reviewed journal articles published online in English from 2020 (i.e., the start of the pandemic) to May 12, 2021 (last day of searching) were selected for relevance screening in the third step. Because they did not meet the inclusion criteria, 65,025 items were discarded, leaving a total of 1,373 candidates for possible inclusion. Although the review and publication process made it impossible to extend the last day of searching, the narrative review of the articles published within the limited period can sufficiently provide a snapshot of the general state of physical activity in Southeast Asia, albeit only during the limited period.

In the third step, an assistant evaluator and I screened out any source that did not explicitly include or discuss physical activity as a study factor or variable, or was not directly or exclusively about it. In other words, we screened the sources for relevance and pertinence to the topic of this narrative review. We did this by first assessing whether the article title showed relevance. If so, we then checked the abstract, and if it also showed relevance, we finally examined the whole article. If the full article was found relevant, it was considered eligible for inclusion. This was the only step in the process where an extra hand was used.

After assessing 1,373 candidates, only 12 were found relevant and pertinent to the study topic, and, thus, suitable for inclusion. The references of these sources were also mined for other additional sources that fit the inclusion criteria for this study. One more source was found in the citation chaining process, thus bringing this study's total number of sources to 13.

In the fourth and last step of the process, the findings from the final set of sources were then summarized and synthesized. The discussion is organized according to topics that recurred across several sources. The next section presents the results of the summarization and synthesis.

RESULTS AND DISCUSSIONS

Table 1 lists the 10 member states of the Association of Southeast Asian Nations (ASEAN) and the authors of studies related to peri-pandemic physical activity in those countries.

Peri-pandemic State of Physical Activity in Southeast Asia

The studies reviewed in this paper presented non-uniform findings about the changes to pre-pandemic and peri-pandemic physical activity engagement among Southeast Asians. Some authors reported an observed increase in physical activity levels during the pandemic; others reported a decline. Yet, some others reported sustained levels of physical activity. No sources were found for Brunei, Cambodia, Laos, Myanmar, and the Philippines under the search parameters used in this study.

Indonesia.

Thahir et al. (2020) found that only 43.9% of their study's participants (undergraduate and postgraduate students) performed moderate to vigorous physical activities during the pandemic, while the rest of the 56.1% engaged in little to no physical activities during the pandemic. Of those who did moderate to vigorous physical activities, 21.8% did exercise only, 39.3% did house cleaning only, and 38.9% did both exercise and house cleaning. On average they exercised for 4.03 (± 2.12) days for 31.39

Table 1 Study authors on peri-pandemic physical activity in ASEAN states

Country (n=10)	Studies Found (n=13)	Authors
Brunei	0	
Cambodia	0	
Indonesia	2	Anggraini, 2020; Thahir et al., 2020
Laos	0	
Malaysia	3	Ibrahim et al., 2021; Jailani et al., 2020; Murukesu et al., 2021
Myanmar	0	
Philippines	0	
Singapore	1	Lim et al., 2021
Thailand	3	Katewongsa, Potharin, et al., 2021; Katewongsa, Widyastari, et al., 2021; Topothai et al., 2020;
Vietnam	4	Do, Nguyen, et al., 2020; Do, Tran, et al., 2020; Nguyen et al., 2020; Tran et al., 2020;

(±33.04) minutes each time. These figures from the study do not indicate whether the physical activity levels of Indonesians during the pandemic increased, decreased, or remained the same. Neither do they indicate whether the amount of physical activity performed was sufficient (i.e., reached the recommended daily or weekly minimum amount).

Malaysia.

Murukesu et al. (2021) studied the physical activity patterns, psychosocial well-being, and coping strategies of 42 community-dwelling elderly individuals ≥60 years old with cognitive frailty during the lockdown period (a.k.a. Movement Control Order period) in Malaysia during the COVID-19 outbreak. The study's respondents were also participants of the randomized control for the WE-RISE intervention, which consisted of multi-component physical exercises, cognitive training, nutritional counseling, and psychosocial support all intended to reverse cognitive frailty among the elderly (Murukesu et al., 2020).

Participants in the intervention group spent significantly higher MET-minutes per week (metabolic equivalent task scored in minutes per week) in walking activities and performed more moderate physical activities (e.g., cycling, lifting light weights, gardening, and other moderate exercises) during the lockdown than those in the control group (Murukesu et al., 2021). The three-month home-based component of the WE-RISE program may have facilitated the development of independent exercise habits among the participants (Murukesu et al., 2021). The participants' exposure to WE-RISE may have increased their knowledge of the importance of an active lifestyle, and this increased awareness could have motivated them to engage in some form of physical activity at home during the lockdown (Murukesu et al., 2021).

In contrast, the control group spent more time per week in passive activities (e.g., sitting or lying down) than the intervention group did during the lockdown; that is, the control group exhibited engaged in more sedentary behavior than did the intervention group. Moreover, about 9.5% of those in the control group reported the onset of back pain, which they did not have before the lockdown. Studies have shown that mobility restrictions tended to increase the elderly's likelihood to engage in sedentary behavior, which has been associated with chronic back pain among the elderly.

Even before the COVID-19 pandemic, the elderly have usually been the least physically active members of the population and could hardly meet physical activity guidelines tailored for them. So, there is little reason to expect them to increase their physical activity during the pandemic. The decrease in physical activity and the increase in sedentary behavior among the elderly during the lockdown in Malaysia, particularly in the study's control group, could be attributed to the mobility restrictions imposed by the Malaysian government in response to the COVID-19 pandemic (Murukesu et al., 2021), potentially hampering the management of these elderly people's cognitive frailty, further degrading their functionality, or causing further disability over time if allowed to persist

continuously.

Singapore.

The cross-sectional survey by Lim et al. (2021) found that Singaporean school children's time spent on physical activity decreased from an average of 1.13 hours pre-lockdown to 0.91 hours during the lockdown. The reduction was similar across schools and at all school levels. The decline in physical exercise apparently also proved detrimental to Singaporean children's sleeping duration during the lockdown, as shall be discussed in a subsequent section.

Thailand.

Another study that reported a decrease in physical activity during the pandemic was that by Katewongsa, Widyastari, et al. (2021), who analyzed datasets from Thailand's Surveillance on Physical Activity for the years 2019 and 2020. Their study determined a decline in the prevalence of physical activity sufficiency in Thailand — fewer people (57.0%) performed sufficient moderate to vigorous physical activity in 2020 (i.e., during the pandemic) than the 74.6% who did so in 2019 (i.e., before the pandemic). Sufficient physical activity refers to the World Health Organization's recommendation of either 75 minutes of vigorous physical activity per week or a combination of moderate and vigorous physical activities totaling 150 minutes per week.

The cumulative duration of moderate to vigorous physical activity also decreased from 580 minutes pre-pandemic to 420 minutes peri-pandemic, with the lowest observed average duration of 414.1 minutes occurring at the height of the lockdown in Thailand from March 29 to May 2 (Katewongsa, Widyastari, et al., 2021). Even after the lockdown was eased somewhat from May 2 onwards, the average duration of moderate to vigorous physical activity among adult Thais hovered just somewhere around 425.36 minutes. The cumulative duration of work-, transport-, and recreation-related physical activities also declined during the pandemic period.

Further, the study's multivariate analysis also found that sufficiency of moderate to vigorous physical activity had statistically significant associations with gender, age, occupation, chronic disease, area of residence, and exposure to the Fit from Home campaign (a government-initiated intervention for sedentary behavior). Thai males did more physical activities in both pre- and peri-pandemic periods and were 1.3 times more likely to have sufficient moderate to vigorous physical activity than females during the pandemic. More middle-aged adults (40 to 64 years old) than young adults (18 to 39 years old) had sufficient moderate to vigorous physical activity in both pre- and peri-pandemic periods and middle-aged adults were 1.2 times more likely to have sufficient physical activity than young adults.

Urban residents were 13% less likely to get sufficient moderate to vigorous physical activity than non-urban residents. Those with chronic diseases were 27% less likely to meet the recommended physical activity level

during the pandemic. Compared to those working in agriculture, the unemployed were 27% less likely to have sufficient physical activity.

Finding similar trends for physical activity in Thailand, the study by Katewongsa, Potharin, et al. (2021) focused on sedentary behavior among the Thai population. The study found that 69.2% of the Thai population accumulated >13 hours of sedentary behavior per day in 2020; this was an increase from 65.9% in 2019. Likewise, the average duration of non-sleeping sedentary state increased to 875 minutes per day in 2020 from 824 minutes per day in 2019 (Katewongsa, Potharin, et al., 2021). The highest sedentary behavior was observed during the maximum curfew period (i.e., between March 29 and May 2, 2020), but it decreased slightly when the curfew was relaxed. High degrees of sedentary behavior are usually accompanied by insufficient moderate to vigorous physical activity, as was the case in the 2019 sample, but in the 2020 data, the prevalence of high sedentary behavior was nearly equal between those with sufficient and insufficient physical activity (Katewongsa, Potharin, et al., 2021). Also, the study determined that sedentary behavior did not correlate with either sufficiency of physical activity or the government-initiated intervention for sedentary behavior.

Topothai et al. (2020) analyzed the magnitude of daily step counts of the 186,653 individuals (18 to 80 years old) who participated in the first season of the Thailand National Steps Challenge, which encouraged participants to walk or run for ≥ 60 km within 60 days and to report their performance data back to organizers via a smartphone application. Analysis of the data captured between February 21, 2020, and March 31, 2020, revealed an average daily step count of 1,301 steps, which was way below the recommended minimum physical activity level of 7,000 steps a day (Topothai et al., 2020, p. 9). The highest overall average daily step count of 1,674 was recorded in the period between February 21 to 27 (Period 1), but this drastically dropped to 633 by Period 5 (March 23 to 31). Katewongsa, Widyastari, et al. (2021) also similarly observed a 55% decline in physical activity levels in Thailand from March 2020 to May 2020.

Topothai's team offered no explanation about why all the study's participants did not or could not reach the recommended daily step count of 7,000. However, they provided several explanations for the steady drop of the average daily step count from Period 1 to Period 5. One reason was underreporting, since some participants might not have been carrying their smartphones throughout the day, or they might have only reported the extra steps on top of their baseline. The second possible reason was the participants' behavioral decay caused by the overemphasis of competition rather than positive reinforcement in the step challenge's design. The third possible reason was the disruption in domestic physical activity because of the COVID-19 pandemic. The World Health Organization officially declared the COVID-19 global pandemic on March 11, 2020, which fell right in the middle of the study's Period 3 (March 9 to 15).

Surprisingly, health care workers recorded a lower overall average daily step count than the average

of those from the general population. This is a worrying outcome because those in the health care field ought to be exemplars of physical activeness and fitness. The research team explained that selection bias may have been a possible reason for this outcome: the health care workers might have had weaker motivation to do the step challenge than those from the general population who self-selected themselves into the program.

Another unexpected outcome was the lower overall average daily step count of the younger crowd (18 to 45 years old) compared with the average of those in the older age group (46 to 80 years old). The researchers supposed that technology such as pedometers and smartphones may have exerted a motivational influence upon the older adults, causing them to have moderate to high engagement with the initiative, as earlier studies have similarly demonstrated.

The women, obese participants, and rural residents also registered lower overall average daily step count than their respective counterparts.

In terms of percentage decrease between Period 1 and Period 5, the following populations showed a larger percentage decrease in their average daily step count than their respective counterparts' percentage decrease: health care workers (64% vs. 57%), females (64% vs 55%), younger participants between 18 and 45 years old (71% vs 55%), obese participants (65% vs 60%), and rural residents (63% vs 60%).

Vietnam.

In Vietnam, 61.6% of the 7,124 health care workers who participated in the study by Tran et al., (2020) reported maintaining at least their pre-pandemic physical activity levels during the pandemic, with some participants indicating an increase in their physical activity levels. Do, Tran, et al. (2020) found a comparable percentage (68.2% of 5,209 respondents) in their study on the relationship between health literacy and the eHealth Literacy Scale (eHEALS) and adherence to lifestyle changes (i.e., smoking, drinking, physical activity, and eating).

Effects on Anxiety, Depression, and Mental Health

This narrative review's reference reports that also investigated the effects of physical activity—especially sufficient or increased physical activity—on mental health uniformly reported positive benefits, especially regarding the likelihood of anxiety and/or depression.

Tran et al., (2020) determined that physical activity was a protective factor for the mental health of the health care workers involved in the COVID-19 response (i.e., the frontliners) in Vietnam. Those with unchanged or increased levels of physical activity succumbed less to anxiety and depression. Among those with zero, ceased, or decreased physical activity levels during the pandemic, the frontliners were 5.26 times more likely to become anxious and 4.42 times more likely to become depressed than non-frontliners with the same physical activity levels. In contrast, those who maintained or increased their physical

activity levels showed less likelihood for anxiety (50% lower likelihood for frontliners and 65% for non-frontliners) and depression (60% lower likelihood for frontliners and 46% for non-frontliners).

The evaluation by Nguyen et al. (2020) of the physical activity level of 3,947 Vietnamese outpatients of ages 18 to 85 years old found that those who had at least 748.5 MET-min/week (metabolic equivalent task scored in minutes per week) of physical activity — i.e., those considered to have had “more physical activity” — showed significantly lower odds of depression (odds ratio of 0.56 - 0.59).

The participants of the study by Thahir et al. (2020) who did not engage in moderate to vigorous physical activities, 34.1% were found to be possibly depressed, and 65.9% were found to be probably not depressed, while among those who did engage in such activities, only 27.1% were found to be possibly depressed and 72.9% were found to be probably not depressed. Thahir et al. (2020) did not find any relation between the duration of the physical activity and the depression status of the students, but they did observe a difference in the proportion of depression between those who performed moderate to vigorous physical activities during the pandemic and those who did not. The prevalence of possible depression was lower (by seven percentage points) and the prevalence of probable absence of depression was higher (also by seven percentage points) among those who engaged in moderate to vigorous physical activities. Although, among those who did not perform moderate to vigorous activities, almost two-thirds (65.9%) were found to be probably not depressed — still outnumbering those who were possibly depressed.

The study by Ibrahim et al. (2021) examined the feasibility of using virtual technology for delivering a group exercise intervention to community-dwelling elderly Malaysians. The anxiety scores and depression scores of those who had fewer than 14 sessions of the intervention were higher than the scores of those who had ≥ 14 sessions. Their post-intervention scores for anxiety and depression decreased from their pre-intervention scores but remained higher than their baseline scores (except for those with < 14 sessions, whose post-intervention score for depression was lower than their baseline score).

Effects on Health-Related Quality of Life Score

Two studies explored the associations between physical activity and Health-Related Quality of Life (HRQoL), a measure for evaluating the impact of illnesses, disorders, and disabilities on several domains of health, particularly the physical, mental, social, and environmental aspects (Arab-Zozani et al., 2020; Choi et al., 2021). HRQoL also pertains to how a person perceives his or her health and is associated with increased chances of negative outcomes due to illness, such as the inability to work and mortality (Choi et al., 2021).

Tran et al., (2020) found a strong positive association between physical activity and the HRQoL of the health care workers involved in the COVID-19 response (i.e., frontliners)

in Vietnam. Those who sustained or increased their levels of physical activity during the pandemic had significantly higher HRQoL scores than those who didn't, as was shown in the higher HRQoL scores (2.08 for frontliners and 6.29 for non-frontliners) of those who maintained or increased their physical activity levels. In contrast, frontliners who had zero, ceased, or decreased physical activity levels had 3.31 lower HRQoL scores than non-frontliners reporting similar physical activity levels.

The study by Nguyen et al. (2020) reported similar findings. Those who had more physical activity — i.e., those who spent at least 748.5 MET-min/week (metabolic equivalent task scored in minutes per week) of physical activity — showed significantly higher HRQoL scores of between 70.7 and 72.7 points, which is a high score, considering that 100 is the maximum.

The foregoing two studies provide evidence of the link between HRQoL and physical activity. In general, these studies showed that higher levels of physical activity correlated with higher HRQoL during the pandemic.

Effects on Sleep

Lim et al. (2021) found that the correlation between exercise duration and sleep duration among Singaporean school children before and during the lockdown was, respectively, $r^2 = 0.03$ ($p = 0.47$) and $r^2 = 0.13$ ($p < 0.01$), a correlation that they attributed to the increased number of children ($n=114$) who did not exercise during the lockdown and the overall reduction of exercise during the lockdown, such that a slight change in exercise amount could exert a significant influence on sleep duration during the lockdown. The authors also noted an increase in screen time and a corresponding decrease in exercise, both of which could be explained by the lockdown restrictions imposed during the pandemic and the consequent increase in time and presence at home.

Health Literacy and Physical Activity

Two studies in this review found positive associations between health literacy (HL) scores (or similar constructs) and physical activity.

In Vietnam, health care workers with higher HL scores and higher eHealth Literacy Scale (eHEALS) scores showed a greater likelihood for engaging in sustained or increased physical activity during the lockdown (Do, Tran, et al., 2020). Among health care workers, significantly higher HL and eHEALS scores occurred more among male doctors with better ability to pay for medication and who had epidemic containment experience. Do, Tran, et al. (2020) suggested integrative and multidisciplinary approaches to improve both scores, which would consequently improve healthy behaviors, including physical activity, among health care workers.

Do, Nguyen, et al. (2020) found similar results in their study. The elderly (60 to 85 years old) with suspected COVID-19 symptoms who had higher HL scores not only reported more physical activity but also ate healthier diets and had a lower likelihood for depression. The

authors observed this significant association between HL and physical activity only in the said subpopulation of participants. According to the authors, such a population faces a higher risk of severe COVID-19, so they “arguably have the most to gain from practicing healthy lifestyles (e.g., healthy dietary intake and more physical activity) to protect and improve their health-related quality of life” (Do, Nguyen, et al., 2020, p. 7).

Technology for Physical Activity

Two studies focused on leveraging technology to help Southeast Asians improve their physical activity levels both peri- and post-pandemic.

The first one by Anggraini et al. (2020) proposed an exercise and performance learning assistant system (EPLAS) for people in Indonesia, Japan, and Taiwan who needed to practice exercises or learn performances by themselves at home during the COVID-19 pandemic. The system presents the user with a video guide of an instructor demonstrating the proper execution of some exercise or performance such as yoga, tai chi, or dance. The user is expected to follow along and mimic the correct execution. Afterwards, using the opensource software known as OpenPose, the system rates how well the user accurately imitated the movements, positions, or postures demonstrated in the video. This rating system is supposed to be the feedback mechanism of EPLAS. To evaluate the EPLAS, Anggraini’s team ran tests for five static yoga poses among 41 individuals (between 13 and 78 years old) from Indonesia, Japan, and Taiwan. OpenPose was used to objectively evaluate every user’s pose by comparing it with the instructor pose as a reference. The yoga instructor and 19 users also conducted subjective evaluation of the 41 volunteer users. The subjective results were compared with the system results. Anggraini’s team found a strong positive correlation (0.746) between the average thresholds reported by the OpenPose software and the average subjective rating results, thus leading the team to consider the proposed EPLAS valid and effective.

The second study by Ibrahim et al. (2021) investigated the feasibility of using virtual technology to deliver a four-week group exercise intervention to community-dwelling elderly Malaysians to help them stay in shape during, and even long after, the COVID-19 pandemic. The 43 individuals, ≥ 60 years old and recruited through social media messaging, needed to attend a 30-minute virtual group exercise class every day for four weeks during which they were guided to perform muscle-strengthening exercises tailored for the elderly, or else perform the exercises privately with the help of an exercise booklet and video. The participants tracked their exercise through a diary.

Among those who attended at least 14 sessions, the mean attendance was 16.43 sessions. Among those who attended less than 14 sessions, mean attendance was 4.36 sessions. Mean overall attendance was 10.26 sessions. Only 60.5% ($n=26$) of the total participants returned their exercise logs or diaries. The research team found a significant difference in mean attendance between participants in both groups who returned and did not

return the diary.

The study by Ibrahim et al. (2021) demonstrated the possibility of recruiting elderly Malaysians via social media messaging for such events or activities as virtual group exercise classes. However, the authors noted possible sample selection bias for their study, since those who agreed to participate were tech-savvy elderly Malaysians, whereas most others could hardly install applications without help although they know how to use social media messaging. Although the study recorded a dropout rate of 23%, the authors found this acceptable, considering dropout rates ranged from 7.5% to 31.9% in some face-to-face exercise intervention studies, online studies with population sample ≤ 200 , and one large study with $n=36,373$.

Physical Activity as a Problem

Jailani et al. (2020) surveyed 278 pre-university students to determine their most prevalent self-perceived problems as students of a public research university in Malaysia. Survey results showed an overall low level of self-perceived problems among the participating students, as indicated by the total average score of 150.78 (SD=88.03) out of a maximum score of 220 in the Mooney Problem Checklist. The participants recorded a mean score of 13.23 for the category pertaining to health and physical development, which was ranked the sixth most interfering problem, although the top reported items in this category did not include anything related to physical activity, such as not getting enough exercise or not being as strong and healthy as one should be. The category of problems pertaining to social and recreational activities was ranked the ninth most interfering problems, with participants recording a mean score of 11.89 for this category. The most reported items that can be argued as related to physical activity included the lack of time for fun and leisure, having very few opportunities for pursuing enjoyable activities, and lacking time for sports. Although the two aforementioned problem categories do not rank high on the list, they can still interfere with students’ lives. Jailani et al. (2020) explained that these problems potentially arose from students’ overloaded schedules, which the researchers feared could deprive the students of enough rest and consequently cause health issues.

Physical Activity and the Elderly

Murukesu et al. (2021) noted that physical activity is inversely associated with immunosenescence (i.e., the decline of immune functions as one ages). So, increased and regular physical activity among the elderly could strengthen their immune system, consequently reducing, suppressing, and/or delaying their risks for chronic diseases, frailty, mortality, reduced efficacy of vaccines, and cognitive decline. Further, the authors also recommended immunity-boosting in physical activity among elderly Malaysians to mitigate the potential adverse outcomes, some of which can be lethal, of the COVID-19 vaccine. Lastly, the authors considered physical activity along with the preservation of psychosocial well-being among the Malaysian elderly, especially during trying times such as the COVID-19 pandemic, to be crucial in increasing their

resilience, extending functional independence, delaying deterioration of physical and cognitive reserves, and preparation for immunization.

CONCLUSION

The Association of Southeast Asian Nations has 10 member states, yet only 13 studies on physical activity during the COVID-19 pandemic were done in and for them. Some countries even did not yield any study on this same topic at all. Apparently, only a few scholars were interested in studying peri-pandemic physical activity despite the clear need to maintain sufficient levels of it with or without an ongoing pandemic. Even those who did bother to delve into this topic focused more elsewhere and somehow skirted any inquiry into the prevalence of sufficient physical activity per age group or special population.

None of this study's sources also studied or explained the factors or causes of any observed increase, decrease, or maintenance of pre- and peri-pandemic physical activity levels. Studying which factors or variables enabled individuals or populations to at least maintain minimum healthy levels of physical activity even under extreme circumstances such as pandemic-instigated quarantines and lockdowns would have allowed one to pinpoint those variables, situations, conditions, and/or practices that need to be retained or maintained when another pandemic or a similar disruption occurs to large populations of people. Similarly, identifying those factors or variables that cause the decline of participation in healthful levels of physical activity can assist policy makers and other persons in authority to mitigate or eliminate those same hindrances the next time a disturbance such as a pandemic occurs.

Of the 13 studies included in this narrative review, only one explored peri-pandemic sedentary behavior. More studies ought to be done about peri-pandemic sedentary behavior, not only on account of its distinction from physical inactivity or insufficiency of physical activity but also on account of the gravity of the negative impact upon multiple aspects of human health, an impact that the stresses of a pandemic can exacerbate. Novel systems and technologies that can impact PA and sedentary behavior in Southeast Asia also ought to be explored and developed, and existing ones ought to be reviewed so that they can be improved.

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