



Observational Study

# Self-management of osteoarthritis while waiting for total knee arthroplasty during the COVID-19 pandemic among older Malaysians

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## Abstract

### BACKGROUND

The study sought to understand the self-management strategies used by patients during the postponement of their total knee arthroplasty (TKA) procedure, as well as the associations between the length of waiting time, pain, and physical frailty and function. The study focused on individuals aged 50 years and above, as they are known to be more vulnerable to the negative impacts of delayed elective surgery and rehabilitation. This study hypothesizes that delayed TKR due to coronavirus disease 2019 (COVID-19) will bear negative effect in self-management, pain, and physical frailty and function in older adults.

### AIM

To investigate the effects of COVID-19 pandemic on self-management, pain, and physical function in older adults awaiting TKA in Malaysia.

### METHODS

This cross-sectional study has the data of participants, who matched the criteria and scheduled for TKA for the first time, extracted from the TKA registry in the Department of Orthopaedics and Traumatology, Hospital Canselor Tuanku Mukhriz. Data on pain status, and self-management, physical frailty, and instru-

mental activities daily living were also collected. Multiple linear regression analysis with a significant level of 0.05 was used to identify the association between waiting time and pain on physical frailty and functional performance.

## RESULTS

Out of 180 had deferred TKA, 50% of them aged 50 years old and above, 80% were women with ethnic distribution Malay (66%), Chinese (22%), Indian (10%), and others (2%) respectively. Ninety-two percent of the participants took medication to manage their pain during the waiting time, while 10% used herbs and traditional supplements, and 68% did exercises as part of their osteoarthritis (OA) self-management. Thirty-six participants were found to have physical frailty (strength, assistance with walking, rising from a chair, climbing stairs, and falls questionnaire score > 4) which accounted for 72%. Increased pain was associated with physical frailty with odds ratio, odds ratio (95% confidence interval): 1.46 (1.04-2.05). This association remained significant even after the adjustment according to age and self-management.

## CONCLUSION

While deferring TKA during a pandemic is unavoidable, patient monitoring for OA treatment during the waiting period is important in reducing physical frailty, ensuring the older patients' independence.

**Key Words:** Osteoarthritis; Total knee arthroplasty; Aged; COVID-19; Pain; Functional performance

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**Core Tip:** Prevalence of osteoarthritis (OA) increases with age and contributes to pain, physical inactivity, and mental distress, eventually resulting in high disease burden and low quality of life. As the last resort for late knee OA, total knee arthroplasty (TKA) aims to relieve knee pain by replacing knee joints' articular surfaces. The emergence of the coronavirus disease 2019 pandemic had interrupted elective surgery and rehabilitation, including TKA for OA patients. The self-management strategies and impacts of delayed TKA may bring interesting insight. This study aimed to determine the associations of TKA waiting time and pain status with physical frailty and function among older patients.

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## INTRODUCTION

Late December 2019, a viral infection, novel coronavirus which is known as coronavirus disease 2019 (COVID-19) was detected with cases emerging from Wuhan, China[1]. According to the World Health Organization, as of 20<sup>th</sup> October 2021, there had been more than 241 million confirmed cases around the world, with more than 4 million deaths reported. The first reported COVID-19 case in Malaysia was on 25<sup>th</sup> January 2020 with a history of close contact with an infected person in Singapore[2]. Due to the emergence of the pandemic, elective surgery and rehabilitation were interrupted. Hospitals were converted into COVID hospitals, and procedures and outpatients' appointments were postponed or cancelled. Individuals with chronic conditions such as osteoarthritis (OA) may have been impacted by these circumstances.

The prevalence of OA increases with age, making it one of the most common joint complaints among older adults. OA is characterized with articular cartilage deterioration and persistent pain, the debilitating symptoms may cause reduce physical function, disability, poor quality of life and depression in long run[3]. As a disease of whole joint, there are multiple structural factors associated with OA. Nevertheless, pain generally becomes more intense and frequent as OA worsens[4]. With a global incidence of 203 cases per 10000 and 654.1 million knee OA cases reported worldwide in 2020, it's an important issue to address[5]. For those with severe knee OA, who have not responded well to non-operative treatments, total knee arthroplasty (TKA) may be the only option available. However, during the COVID-19 pandemic, TKA operations have been postponed and delayed globally, with data from low-middle income countries such as Malaysia not yet well studied[6]. In the United States, 30000 primary and 3000 revision total joint arthroplasty procedures were cancelled weekly and around 92.6% of primary total joint arthroplasty procedures were cancelled in Europe[7].

Our goal is to explore how the COVID-19 pandemic has affected patients in need of TKA by examining the self-management practices they have adopted, as well as how these practices have influenced the relationship between waiting time, pain, physical frailty, and function in individuals over the age of 50 seeking TKA at the Hospital Canselor Tuanku Mukhriz (HCTM), which is a tertiary urban hospital in Kuala Lumpur.

## MATERIALS AND METHODS

### Study participants

This study used a cross-sectional survey design to examine the effects of surgical deferment on patient health status and self-management during the COVID-19 pandemic, using data from a TKA registry. Data was collected anonymously on patients who were waiting for elective TKA between January 2021 and May 2022, obtained from the Department of Orthopaedic at the HCTM in Malaysia which cater approximately 500000 Malaysian citizens who lived in the areas of Cheras, Ampang, Hulu Langat, Semenyih and Bangi. Patients with upcoming appointments for TKR surgery revision or had done TKR were excluded.

### Data collection

This study collected data on-site at the Department of Orthopaedic at the HCTM. The research had two phases: The first phase involved extracting data from the TKA registry, and the second phase involved conducting a survey on patients' health status and self-management. Demographic information was also collected. Participants were contacted and provided with a consent form, and the survey questionnaires were distributed according to their preferences (*e.g.*, online or paper-based). Ethical approval for this study was obtained from the UKM ethics committee (reference number: JEP-2022-105).

**Number of deferrals and Waiting time pre and post COVID:** The number of surgery deferrals and waiting times was obtained from the Department of Orthopaedic at the HCTM during pre- and post-COVID. Participants' names and contact numbers in post covid were collected.

**Demographic data and medical condition:** Participants' demographic data consisted of age, gender, ethnicity, marital status, living arrangement, education level, occupation, and duration of OA. Participants were asked about underlying medical conditions during the waiting time for TKA surgery.

**Pain status:** Pain intensity was assessed using the visual analog scale (VAS), which is a common tool in clinical settings, and is a Likert-scale that measures the intensity of pain felt by participants during the waiting period. On the VAS scale, 0 represents no pain, 5 represents moderate pain, and 10 represents the worst possible pain. In addition to VAS, Knee Injury and Osteoarthritis Outcome Score (KOOS) which is a knee-specific instrument developed to assess patients' perceptions of their knee problems and conditions have also been used[8,9].

**Physical frailty and physical function:** The strength, assistance in walking, rising from a chair, climbing stairs, and falls (SARC-F) questionnaires were used to identify physical frailty associated with sarcopenia based on the cardinal signs of sarcopenia. The SARC-F questionnaires assesses strength, ability to walk independently, ability to rise from a chair, ability to climb stairs and history of falls, which are known indicators of sarcopenia[10]. To evaluate physical function, the Lawton instrumental activity of daily living (IADL) Scale was used. The IADL Scale is a useful tool for measuring a person's current level of functioning and identifying any changes over time. The scale measures eight domains of function, including, but not limited to, self-care and household management, communication, mobility, recreation and leisure, and household maintenance and management. The IADL Scale provides a comprehensive view of patients' physical function and activities of daily living, useful for evaluating the impact of physical frailty or sarcopenia on patients' quality of life[11].

**Self-management:** Self-management included the types of medication taken by participants and the exercise prescription, either through physiotherapy sessions (such as house call physiotherapy or online telehealth) or through self-directed exercises found on websites. Additionally, the study also examined the use of traditional medication by participants during the waiting period. Overall, the self-management data was collected to identify how patients were coping with their pain and physical limitations while they waited for their TKA.

### Statistical analysis

Results from the survey questionnaire were analysed using the Statistical Products and Service Solution (SPSS) IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp. Descriptive analysis (means and percentages) was used to analyse the total number of surgery deferrals and the changes in waiting time of TKA, and to evaluate participants' current underlying medical condition, development a medical condition, self-management (exercise and medication), and pain intensity felt during the waiting period. Multiple linear regression analysis was used to identify the association between waiting time and pain on physical frailty and functional performance among older patients waiting for TKA. The significance level was set at a *P* value of < 0.05. The statistical methods of this study were reviewed by Dr. Sumaiyah Mat from Universiti Kebangsaan Malaysia, who is a holder of Master of Applied statistics.

## RESULTS

Out of the 180 patients who had deferred TKA, 50% were aged 50 years and older (Figure 1). Of the 50 participants successfully contacted, the mean age was 68.7 (SD 6.97). Half of the participants were waiting for TKA surgery for 12 mo or more. The highest waiting period among participants was 14 mo, with the lowest waiting times being four, seven, nine, and 12 mo (Figure 1).

Most of the included participants were female, with a total of 40 (80%) and belonged to the Malay ethnicity (66%), Chinese (22%), Indian (10%), and others (2%) respectively. Participants were mostly married, with 86% of them living with their spouses. 30 participants had pursued their studies at the tertiary level (30%) while 44% had finished secondary school, 20% at the primary school level, and 6% had not received any formal education. Most participants were retired, with 86% of them, while 8% were still working. The most common medical conditions presented among the participants were hypertension (70%), followed by hypercholesterolemia (44%), and diabetes (40%). The percentage of the duration of OA was the same for durations below one year and within one to three years, with 42%, while participants who had been diagnosed with OA for more than three years were 16% (Table 1).

**Table 1** Participants' characteristic (*n* = 50)

Characteristics	<i>n</i> (%)
Age, yr, mean $\pm$ SD	68.7 $\pm$ 6.97
Gender	
Male	10 (20)
Female	40 (80)
Ethnicity	
Malay	33 (66)
Chinese	11 (22)
Indian	5 (10)
Others	1 (2)
Marital status	
Single	1 (2)
Married	43 (86)
Divorce	6 (12)
Living arrangement	
Alone	2 (4)
With husband/wife	47 (94)
Others	1 (2)
Education level	
Unschooling	3 (6)
Primary school	10 (20)
Secondary school	22 (44)
College/university	15 (30)
Occupation	
Unemployed	3 (6)
Retired	43 (86)
Retired but still working	2 (4)
Working	2 (4)
Comorbidities	
Diabetes	20 (40)
Hypertension	35 (70)
Heart disease	6 (12)
High cholesterol	22 (44)
Parkinsonism	1 (2)
Stroke	1 (2)

Visual problem	1 (2)
Asthma	3 (6)
Thyroid	3 (6)
Rheumatoid arthritis	4 (8)
Spine problem	3 (6)
Gastritis	1 (2)
Vertigo	2 (4)
Skin problem	1 (2)
Cancer	1 (2)
Duration of OA	
Less than 1 yr	21 (42)
Between 1-2 yr	21 (42)
More than 3 yr	8 (16)

OA: Osteoarthritis.

Data on self-management showed that 92% of the participants took medication and only a handful of them took alternative medicine such as ointment and herbs (10%). More than half of the participants (68%) did exercise on a daily basis. According to pain severity using VAS as a measurement tool, the median (range) for pain intensity was 7 (6.0-8.0). For the subtype of KOOS, the median (range) for KOOS pain was 14 (9.75-19.25), KOOS symptoms 11 (9-12), KOOS function 19.5 (14-30), and KOOS quality of life 9 (8-10.25) respectively. In activity of daily living, shopping appeared to be the most challenging task with 68% unable to perform, followed by food preparation (38%) and laundry (22%) respectively. In physical frailty, by using SARC-F as a measuring tool, 86% of participants were unable to climb stairs, and 20% of participants were able to walk without assistance or walking aids. Among 50 participants, 72% of them were found to have physical frailty with a SARC-F score of more than 4 (Table 2).

Our study found that among patients who had their TKA surgery deferred during the COVID-19 pandemic, there was a significant association between pain intensity and physical frailty, as measured by the odds ratio of 1.46 (95% confidence interval: 1.04-2.05). This association remained significant even after adjusting for factors such as age and self-management practices. However, we did not find a significant association between waiting time for TKA surgery and poor physical function or frailty (Table 3).

## DISCUSSION

The current study found that, in our setting, the procedure of TKA was delayed due to the pandemic, and our patients undertook self-management to cope with the conditions such as exercise and medication. Despite efforts to manage pain through self-care measures, there was a strong correlation between pain intensity and poor functional status. This suggests that a lack of proper pain management during the waiting period for surgery greatly impacted these patients' overall function.

Our results align with those of previous studies conducted in developed countries, which have shown that delaying elective surgery during the COVID-19 pandemic can have a detrimental effect on patients' quality of life, overall health, and independence[12-14]. Specifically, our study observed that the functional status of patients who were waiting for TKA to be rescheduled was poor. This could be due to chronic conditions of OA related symptoms which can greatly affect their daily activities[15]. However, the length of TKR waiting time does not reflect pain intensity, which is in line with previous systematic review[16]. The severity of OA required to be referred to TKR was argued due to underuse of nonoperative treatments beforehand. This might influence the pain intensity reports arose from varied disease progression[17].

Despite the widespread postponing of elective surgeries during the COVID-19 pandemic, a limited number of studies suggest that such surgeries may be safely carried out with appropriate precautions in place. For example, a retrospective study found that elective surgeries could be resumed with additional precautions taken[18]. Furthermore, some research has indicated that elective surgeries can proceed as scheduled if the patient tests if the patient priorly tested positive for COVID-19, with a certain period of time having passed, such as seven weeks or more. In the United Kingdom specifically, one study found that the 30-d mortality rate after elective surgery was lower among patients who had surgery at seven weeks or more post-positive COVID-19 test results compared to those who underwent surgery within six weeks of a positive test result, with a 3.5 to 4 times higher risk of death[19]. Another study supports that waiting seven weeks or more after a COVID-19 infection to undergo surgery may be optimal[20]. Despite the spike in COVID-19 cases, older patients with severe OA may still opt to undergo surgery depending on their level of pain[21].

**Table 2 Self-management, comorbidities, pain severity, physical function, and physical frailty**

	<i>n</i> (%)
Self-management	
Takes medication for osteoarthritis pain control	46 (92)
Takes traditional supplement	5 (10)
Ointment	4 (8)
Herbs ( <i>Nigella Sativa</i> sp)	1 (2)
Exercise	34 (68)
Exercise duration	
10 min/d	1 (2)
15 min/d	1 (2)
20 min/d	7 (14)
30 min/d	25 (40)
Osteoarthritis severity	
VAS, median (range)	7 (6.0-8.0)
KOOS pain, median (range)	14 (9.75-19.25)
KOOS symptoms, median (range)	11 (9-12)
KOOS function, median (range)	19.5 (14-30)
KOOS quality of life, median (range)	9 (8-10.25)
Physical function, components of LAWTON	
Ability use phone	50 (100)
Shopping	16 (32)
Transport	41 (82)
Medication	46 (92)
Handling finances	42 (84)
Food prep	31 (62)
Laundry	39 (78)
Housekeeping	44 (88)
Physical frailty, components of SARC-F	
Strength	15 (30)
Assist in walking	10 (20)
Rise from chair	12 (24)
Climb stair	2 (4)
Falls	40 (80)
Physically frail (SARC-F > 4)	36 (72)

VAS: Visual analog scale; KOOS: Knee Injury and Osteoarthritis Outcome Score; SARC-F: Strength, assistance with walking, rising from a chair, climbing stairs, and falls questionnaire.

Exercise, by improving neuromuscular control, joint range of motion and strengthening muscle, helps in managing pain, improving functional status and quality of life of people with knee OA, especially elderlies with multitude of comorbidities[22,23]. Although exercise is the most recommended therapy for TKA postponement during COVID-19, a study suggests that proper nutrition, and the use of corrective and assistive orthotics as additional equipment may help in reducing OA pain[24]. Remote telecommunication consultation to serve patient education was also suggested[25]. There was also a study that found patients who experienced an unexpected surgical delay during the COVID-19 pan-demic improved physical function and prevented a decline in patient-reported outcome measures using a psychological intervention delivered *via* a text messaging robot[26].

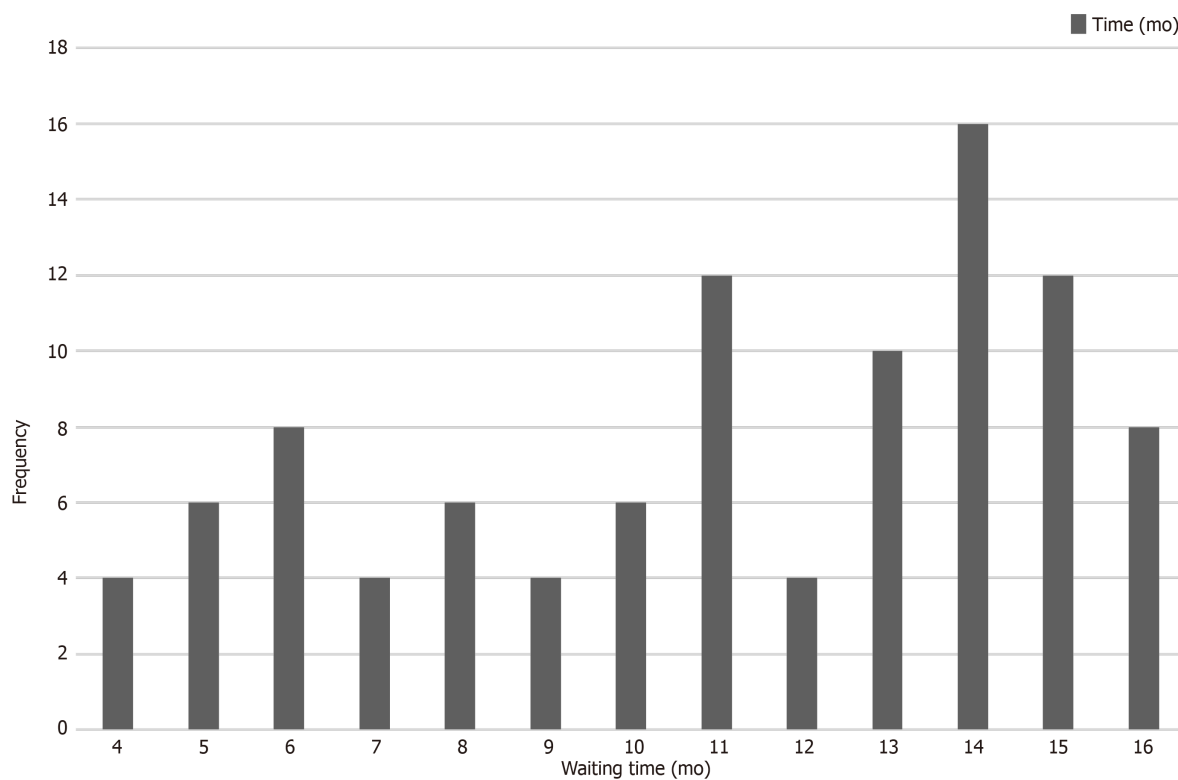


**Table 3 Associations between waiting time and pain with physical function and frailty**

	Physical function, poor IADL (Lawton < 6)	Physical frailty (SARC-F > 4)
Waiting time		
Unadjusted OR (95%CI)	0.96 (0.81-1.13)	1.09 (0.92-1.28)
Adjusted model 1 OR (95%CI)	0.96 (0.81-1.13)	1.09 (0.92-1.30)
Adjusted model 2 OR (95%CI)	0.98 (0.82-1.17)	1.07 (0.89-1.28)
Adjusted model 3 OR (95%CI)	0.96 (0.81-1.13)	1.09 (0.92-1.30)
Pain severity		
Unadjusted OR (95%CI)	1.14 (0.83-1.57)	1.46 (1.04-2.05) <sup>a</sup>
Adjusted model 1 OR (95%CI)	1.14 (0.82-1.57)	1.45 (1.04-2.03) <sup>a</sup>
Adjusted model 2 OR (95%CI)	1.20 (0.86-1.66)	1.43 (1.00-2.03) <sup>a</sup>
Adjusted model 3 OR (95%CI)	1.15 (0.83-1.60)	1.45 (1.03-2.05) <sup>a</sup>

<sup>a</sup>*P* < 0.05.

Adjusted model 1: Adjusted for age. Adjusted model 2: Adjusted for management (medication). Adjusted model 3: Adjusted for management (exercise). OR: Odds ratio; CI: Confidence interval; IADL: Instrumental activities of daily living; SARC-F: Strength, assistance with walking, rising from a chair, climbing stairs, and falls questionnaire.



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**Figure 1** Number of patients according to their waiting time for total knee arthroplasty.

### Limitation

This study has several limitations that should be acknowledged. Firstly, the sample size of this study was relatively small, as we employed a purposive sampling method and the average number of TKA cases at the institution was only 100 per year. While this may not represent the entire population of Malaysia, the study institution caters to almost 500000 residents living in the surrounding areas of Selangor, thus the results can be considered representative of this population. Secondly, due to limited data access and participants' availability, the amount of data collected was restricted. Additionally, some participants were lost to follow-up due to the restrictions on movement during the pandemic. The study utilized both phone and online questionnaires to increase participation, but this could have introduced bias as the questionnaires were filled in by participants with the assistance of the researcher. Despite these limitations, it is important

to note that this is the first study of its kind conducted in a low-middle-income country setting and provides valuable insight into the impact of delayed TKA on older patients during the COVID-19 pandemic.

## CONCLUSION

This study did not find significant association between waiting time for TKA surgery and poor physical function or frailty, suggesting the postponement was not the main factor that bore negative effect on self-management, pain, and physical function in older patients aged 50 and above. Nevertheless, the significant association between pain and physical frailty highlights the importance of closely monitoring these patients for OA pain management during the waiting period to prevent declines in physical function and frailty, and to maintain their independence. Additionally, this research may aid healthcare providers in creating emergency protocols for future pandemics that may cause further postponements of elective surgeries. Such protocols should prioritize older patients for TKA procedures and emphasize thorough monitoring of OA pain management.

## ARTICLE HIGHLIGHTS

### Research background

Total knee arthroplasty (TKA) served as the last resort for individuals with severe knee osteoarthritis (OA), reducing burdens from pain and symptoms which interfere with activities of daily living. Upon happening of coronavirus disease 2019 (COVID-19), health care setting was overloaded with critical medical condition patients, rendering scheduled surgeries postponed. The consequences of delayed TKA remain unknown. As the capital of Malaysia, Kuala Lumpur has hospitals that served during COVID-19, hence is suitable to be appointed as the location for sample recruitment.

### Research motivation

OA is a high prevalence degenerative joint disease, in Malaysia, patients with late-stage OA are usually appointed for TKA as last resort of treatment. Due to COVID-19, their TKA had to be rescheduled, the impact this adjustment should be aware as movement restriction during the pandemic left the patients with self-management to deal with knee pain and symptoms, their physical function and quality of life may worsen if misguided practice was done. The significance of understanding how length of TKR waiting time affects pain, physical frailty and overall health may provide input for physician to plan future guidelines in TKR.

### Research objectives

The research objective of this study is to investigate the effects of COVID-19 pandemic on self-management, pain, and physical function in older adults awaiting TKA in Malaysia. By examining the length of TKR waiting time and the self-management, pain, and physical function of older adults with knee OA, we may provide input for healthcare providers in creating emergency protocols for future pandemics that may cause further postponements of elective surgeries.

### Research methods

Using information from a TKA registry, this study employed a cross-sectional survey approach to assess the impact of surgical postponement on patient health status and self-management during the COVID-19 pandemic. Data were anonymously gathered from the Department of Orthopaedic at the Hospital Canselor Tuanku Mukhriz (HCTM) in Malaysia on patients who were in the waiting period for elective TKA between January 2021 and May 2022. The HCTM caters approximately 500000 Malaysian citizens who lived in the areas of Cheras, Ampang, Hulu Langat, Semenyih and Bangi. Patients who had undergone TKR surgery or had an appointment for a revision were not included. Data for this study was gathered on-site. The study was divided into two stages: The first stage included data extraction from the TKA registry, and the second stage comprised performing a survey on patients' health state and self-management. The survey questionnaires were disseminated after contacting them and obtaining their agreement.

### Research results

Based on sample size of 50 older adults, the study found a significant association between pain intensity and physical frailty even after adjustment for age and self-management practices, however, not between length of TKR waiting time and poor physical function or frailty. The chronic comorbidities may be one of the factors. Over half of the participants exercise on daily basis, and yet 72% of the participants were found to have physical frailty. This suggests exercise alone is not enough, psychological intervention, patient education, and monitoring, for example, remote telecommunication consultation may aid in the management.

### Research conclusions

This study did not find significant association between waiting time for TKA surgery and poor physical function or frailty, suggesting the postponement was not the main factor that bore negative effect on self-management, pain, and physical function in emphasized that older patients aged 50 and above were disproportionately impacted by the postponement of TKA procedures due to the COVID-19 pandemic. Nevertheless, the significant association between pain



and physical frailty. It highlights the importance of closely monitoring these patients for OA pain management treatment during the waiting period to prevent declines in physical function and frailty, and to maintain their independence.

### Research perspectives

Future research may focus on creating emergency protocols for future pandemics that may cause further postponements of elective surgeries. The management should include and investigate the synergy effect of psychological intervention, patient education and monitoring with exercise.

## FOOTNOTES

**Author contributions:** Mat S, Abdul Rani R, Mohamad Yahaya NH, and Che Hasan MK designed and coordinated the study; Mahdzir ANK, Abdul Rani R, Mohamad Yahaya NH, and Che Hasan MK performed the experiments, acquired, and analyzed data; Mahdzir ANK and Mat S interpreted the data; Mahdzir ANK and Seow SR wrote the manuscript; and all authors approved the final version of the article.

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