ORIGINAL ARTICLE

Effect of smartphone applications on reducing the pain of office syndrome among staff at Sakon Nakhon Rajabhat University: a quasi-experimental design

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ABSTRACT

Office syndrome is a term used to describe musculoskeletal disorders (MSDs) occurring in the workplace. The persistent problem of office syndrome means that constant efforts are required to find a solution. This study was a quasi-experimental investigation. The aim was to examine the impact of a smartphone application on reducing the pain associated with office syndrome in a group of participants. The purposive selection technique was employed to obtain a certain sample group from the staff of Sakon Nakhon Rajabhat University who spend 6–8 hours per day working on computers and experience pain in their muscles in eight areas, namely the neck, shoulders, back, wrists, waist, hips, legs, and calves. The sample size was 30. The data analysis requires the use of both descriptive and inferential statistics, specifically generalised estimating equations (GEE). The study found that the group of 30 staff at Sakon Nakhon Rajabhat University had an average overall pain score of 3.31 (SD = 0.40) at the baseline, which decreased to 2.17 (SD = 0.17) in week 4, and 1.47 (SD = 0.21) at week 8. The comparative analysis of the baseline, week 4, and week 8 revealed a significantly higher average pain level before smartphone application use (baseline) than after weeks 4–8, at the statistical significance level of 0.05. Therefore, the institution should promote the usage of the NotifyOfficeSyndrome application among staff who regularly use computer screens to improve their overall health and eliminate the discomfort associated with office syndrome.

Key words:
office syndrome; smartphone application; musculoskeletal disorders; workplace.

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INTRODUCTION

Office syndrome is a term used to describe musculoskeletal disorders (MSDs) occurring in the workplace. Office syndrome refers to the common symptoms experienced by individuals of working age who are required to engage in sedentary office work for extended periods. Lack of physical activity and an unsuitable work environment exert a substantial adverse influence on daily functions and work capacity.[1–2] Office syndrome is highly prevalent in many countries,[3-5] and Thailand is no exception.[6-7] Office syndrome remains an ongoing problem that requires resolution.

University staff have work characteristics that are risk factors for office syndrome. According to a previous study, the prevalence of office syndrome among university staff was between 54.3% and 86.4%.[6, 8–10] Furthermore, work practices have undergone transformation following the COVID-19 pandemic. The prevalence of online work has increased significantly, particularly in the realm of virtual meetings. University staff are required to use a computer, tablet, or mobile phone for several hours each day. As a result, individuals have symptoms such as pain in the neck and shoulder, disorientation, and wrist pain. The symptoms not only adversely affect bodily well-being but also harm mental health and can hinder an individual's ability to carry out their professional activities.

Sakon Nakhon Rajabhat University consists of two distinct categories of staff: academic and support. When evaluating work responsibilities and characteristics, these two groups have been found to be at significant risk of office syndrome. Moreover, a study on the prevalence of muscle pain among staff at Sakon Nakhon Rajabhat University in 2022 revealed that up to 90% of individuals were affected.[11] Hence, it is important to give priority to resolving the problem of muscle pain in this population, because it directly impacts the overall quality of work life.

To address the problem of pain caused by office syndrome, there are various methods available, including medication[12] and corticosteroid injections.[13] These techniques can alleviate pain caused by office syndrome, but they may have adverse consequences such as nausea, vomiting, and the development of stomach ulcers. Furthermore, prolonged use of steroids can result in the onset of osteoporosis, enlarged adrenal glands, and facial swelling.[14] These effects are distinct from the benefits of behavior change, which include improved mobility, proper functioning, and muscle flexibility. These procedures are non-invasive and can be self-administered. Previous studies show that stretching and physical activity during work hours may successfully reduce pain.[15-16] Furthermore, a study conducted on office workers revealed that establishing a daily routine for physical activity interventions at work may help people spend less time sitting down and engage in more physical activity each day.[17] Thus, engaging in muscular stretching exercises and establishing a daily routine for physical activity interventions at work might be considered as alternative approaches to alleviate pain caused by office syndrome.

The combination of smartphone technology and its software applications, along with the widespread use of mobile technologies, has resulted in smartphones now being seen as tools to assist patients and support the future healthcare system. This is mostly centred on the concept of patients managing their own home exercise programmes. Smartphones are user-friendly, affordable, and widely available.[18] Systematic reviews investigating the effects of digital interventions, including mobile phone apps, websites, and web-based software, have demonstrated that these interventions can lead to a decrease in office syndrome incidence.[19] Although the

literature review revealed a study on smartphone applications and their impact on office syndrome, the sample was limited, and there was a lack of notification systems and suitable physical protocols for navigating within the workplace.[20–22] This study aims to investigate the effect of smartphone applications on reducing office syndrome pain and promoting the overall well-being and productivity of individuals who are required to work at a computer for extended periods of time.

METHODS

Research design

This quasi-experimental study uses a one-group pretest-posttest design to determine the effect of mobile applications on reducing the pain caused by office syndrome. The data were collected during the period from March to May 2023.

Population and sample

The participants of this study consist of staff from Sakon Nakhon Rajabhat University who spend 6–8 hours per day working on computers and experience pain in their muscles in eight areas: the neck, shoulders, back, wrists, waist, hips, legs, and calves. The purposive sampling technique was used for participant selection under the following inclusion criteria: they have no underlying disease that limits their physical mobility and currently possess an Android smartphone. The following exclusion criteria were applied: they are currently receiving physical therapy or using medicine for physical pain. The sample size calculation used a formula for comparing the means of dependent groups[23], based on the mean difference pain score findings in the study conducted by Tunwattanapong et al.[24], with a significance level of 0.05 and a power of 80%. A minimum sample size of 26 staff was required with the loss to follow-up rate calculated as 15%. A total sample size of 30 staff was selected for this study.

Instrument

The research instrument was a self-administered questionnaire created by Google Forms, by which participants could answer via the smartphone application. The questionnaire was divided into two parts.

Part 1 included questions on the participants' characteristics: gender, age, marital status, faculty/academic unit, underlying disease, number of years of work experience, number of days per week spent working in front of a computer screen, and number of hours per day spent working in front of a computer screen.

Part 2 used the pain score numerical rating scale (NRS)[25] to determine the level of pain caused by office syndrome through self-assessment. The pain score ranged from 0–10, with extreme pain scoring 10 and no pain score 0.

Smartphone application development and implementation

Step 1: The development of a smartphone application suitable for health promotion in the workplace by reducing the pain caused by office syndrome involved the following activities:

1.1 A review of the literature on office syndrome and smartphone applications.

1.2 A smartphone application assessment by three experts: a lecturer in computer science, a lecturer in sports science, and an orthopaedic doctor.

1.3 Revision of the smartphone application form according to recommendations from the experts.

After Step 1, a smartphone application was developed for Android to allow individuals to provide notification of their exercise frequency in the workplace following the video guidelines of six times

per day (Table 1) (Figure 2). The video guidance was based on a recommendation from the Ministry of Public Health for exercises to prevent office syndrome [26]. The application was called "NotifyOffice Syndrome" (Figure 1).

Table 1. The "NotifyOfficeSyndrome" exercise application

Number of Times	Notification Time	Text
1	09.30	It's time to exercise your body
2	10.30	It's time to exercise your body
3	11.30	It's time to exercise your body before lunch
4	14.00	It's time to exercise your body
5	15.00	It's time to exercise your body
6	16.00	It's time to exercise your body before you go home

Figure 1. Home and menu display on the Android smartphone

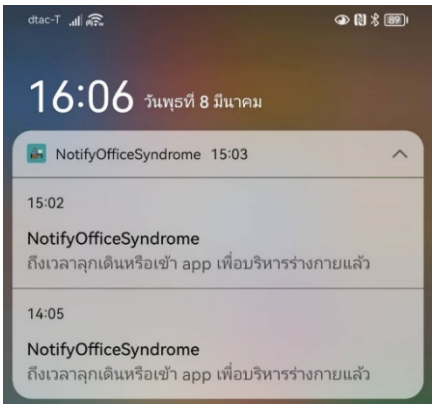

Figure 2. Notifications displayed on the Android smartphone

Step 2: Implementation of the smartphone application

2.1 Prior to implementation, the researchers notified the staff at Sakon Nakhon Rajabhat University about the scope of the study and invited them to participate.

2.2 The smartphone application was implemented over an eight-week period, with 30 members of staff participating:

Week 1: The researchers administered a baseline test to the participants and subsequently explained the use of the smartphone application and demonstrated its functionality until they were able to practice the tasks themselves (Figure 3).

Weeks 2–7: The participants used the smartphone application. The researchers waited for feedback and were prepared to assist participants who were experiencing problems. A Line group was established to facilitate communication and interaction between the researchers and participants. During week 4, the participants' pain levels were measured for the second time.

Week 8: The researchers conducted a review of previous actions and measured the participants' pain levels for the third time.

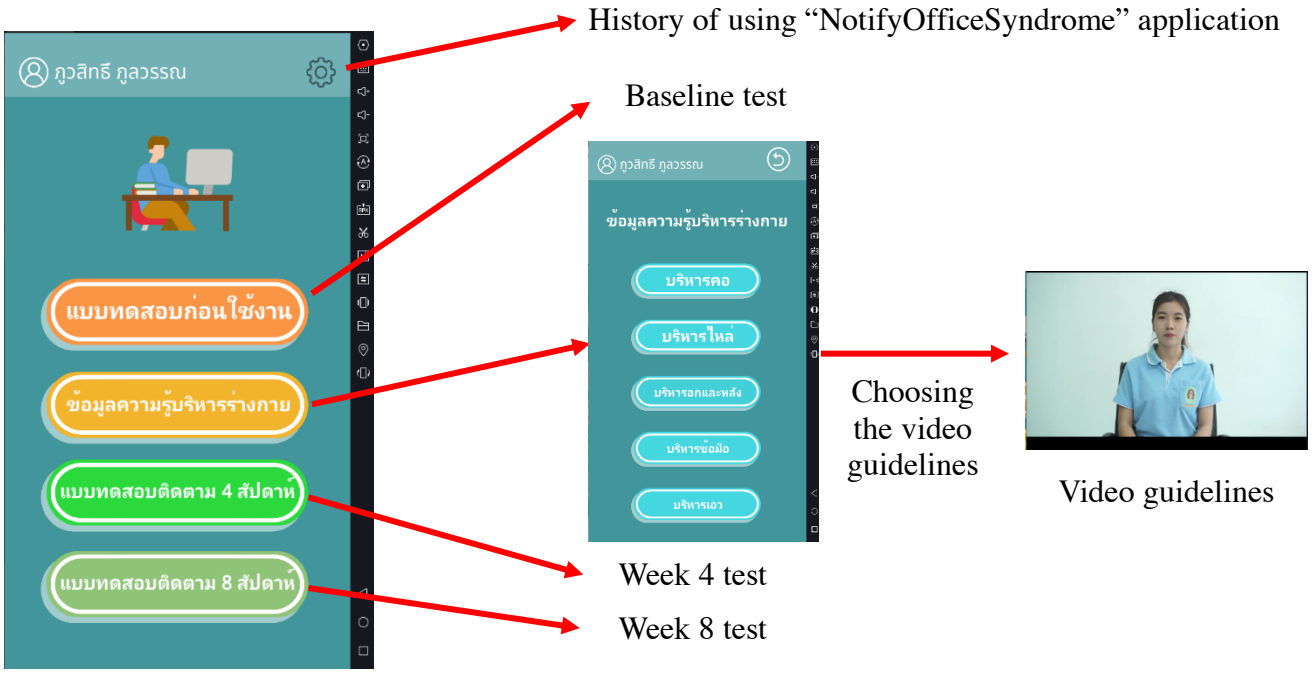

Figure 3. Tutorial of the "NotifyOfficeSyndrome" application

Statistical analysis

The characteristics of participants were presented as frequency, percentage, mean, standard deviation, median, interquartile range, minimum, and maximum. Generalised estimating equations (GEE) were used to compare the means of the three related groups (baseline, week 4, week 8). A p-value of less than 0.05 was considered statistically significant.

Ethics approval

The research protocol was approved by the Sakon Nakhon Rajabhat University Ethics Committee for Human Research. Project number: HE 65-078.

RESULTS

Participant characteristics

The majority of participants were female (66.7%). The mean age was 33.8 years (SD = 5.5), and 56.7% were married. More than half (60%) work in the faculty of science and technology. The majority (86.7%) had no underlying diseases. The mean work experience level was 11.9 years (SD = 7.1). The number of days spent working in front of a computer screen equated to a median of five days per week (Q1 = 5.0, Q3 = 6.0), while the number of hours spent working in front of a computer screen was a median of six hours per day (Q1 = 6.0, Q3 = 7.0) (Table 2).

Table 2. Characteristics of participants

Variable	Number	%
Gender		
Male	10	33.3
Female	20	66.7
Age (years)		
< 40	17	56.7
≥ 40	13	43.3
Mean = 38.3, SD = 5.5, Min = 25, Max = 49		
Marital status		
Single	13	43.3
Marriage	17	56.7
Faculty/Academic units		
Faculty of science and technology	18	60.0
Faculty of Education	2	6.7
Faculty of Humanities and Social Sciences	1	3.3
Faculty of Agricultural Technology	1	3.3
Faculty of Management Sciences	1	3.3
Office of Academic Promotion and Registration	3	10.0
Office of Student Affairs	3	10.0
Office of Academic Resource and Information Technology	1	3.3
Underlying disease		
Yes	4	13.3
No	26	86.7
Work experience (years)		
< 10	12	40.0
≥ 10	18	60.0
Mean = 11.9, SD = 7.1, Min = 2, Max = 30		
Number of days spent working in front of a computer screen per week		
5	18	60.0
6	7	23.3
7	5	16.7
Median = 5.0, Q1 = 5.0, Q3 = 6.0, Min = 5, Max = 7		
Number of hours spent working in front of a computer screen per day		
6	21	70.0
7	2	6.7
8	5	16.7

Variable	Number	%
9	1	3.3
10	1	3.3
Median = 6.0, Q1 = 6.0, Q3 = 7.2 Min = 5 Max = 7		

Effect of the NotifyOfficeSyndrome application

In this study, the pain score before using the NotifyOfficeSyndrome application (baseline) and after using the NotifyOfficeSyndrome application (week 4 and week 8) were compared to show the effect of the NotifyOfficeSyndrome application. When adjusting for the characteristics of participants variable (Table 2), the mean difference in pain score and 95% CI after four weeks, separated by body part, show the following statistically significant reductions: neck 1.60 (95% CI = 0.76–2.43), shoulder 1.40 (95% CI = 0.57–2.23), back 1.30 (95% CI = 0.41–2.19), wrist 1.13 (95% CI = 0.36–1.91), hip 1.30 (95% CI = 0.31–2.28), leg 1.00 (95% CI = 0.21–1.79), and overall 1.14 (95% CI = 0.49–1.77). The mean difference in score and 95% CI after eight weeks, separated by body part show the following statistically significant reductions: neck 2.40 (95% CI = 1.53–3.26), shoulder 2.53 (95% CI = 1.62–3.44), back 2.47 (95% CI = 1.54–3.39), wrist 2.00 (95% CI = 1.28–2.71), waist 1.60 (95% CI = 0.62–2.57), hip 1.26 (95% CI = 0.29–2.23), calf 1.10 (95% CI = 0.28–1.92), leg 1.37 (95% CI = 0.49–2.23), and overall 1.84 (95% CI = 1.17-2.51) (Table 3).

Table 3. Pain score comparison between the baseline, week 4, and week 8

Body Part	Baseline Mean±SD	Week 4 Mean±SD	Week 8 Mean±SD	Mean Diffrence[1†] (95%CI)	Mean Difference[2†] (95%CI)
Neck	4.07±0.52	2.47±0.25	1.67±0.23	-1.60* (-2.43, -0.76)	-2.40* (-3.26, -1.53)
Shoulder	4.47±0.52	3.07±0.30	1.93±0.26	-1.40* (-2.23, -0.57)	-2.53* (-3.44, -1.62)
Back	4.30±0.55	3.00±0.31	1.83±0.25	-1.30* (-2.19, -0.41)	-2.47* (-3.39, -1.54)
Wrist	2.83±0.42	1.70±0.20	0.83±0.17	-1.13* (-1.91, -0.36)	-2.00* (-2.71, -1.28)
Waist	3.33±0.58	2.53±0.27	1.73±0.37	-0.80 (-1.72, 0.12)	-1.60* (-2.57, -0.62)
Hip	2.57±0.57	1.27±0.21	1.30±0.32	-1.30* (-2.28, -0.31)	-1.26* (-2.23, -0.29)
Calf	2.23±0.52	1.67±0.27	1.13±0.24	-0.57 (-1.35, 0.21)	-1.10* (-1.92, -0.28)
Leg	2.67±0.54	1.67±0.27	1.30±0.28	-1.00* (-1.79, -0.21)	-1.37* (-2.23, -0.49)
Overall	3.31±0.40	2.17±0.17	1.47±0.21	-1.14* (-1.77, -0.49)	-1.84* (-2.51, -1.17)

[1]mean difference between week 4 and the baseline
[2]mean difference between week 8 and the baseline
[†]adjusted by the characteristics of participants variable (Table 2)
*p-value <0.05

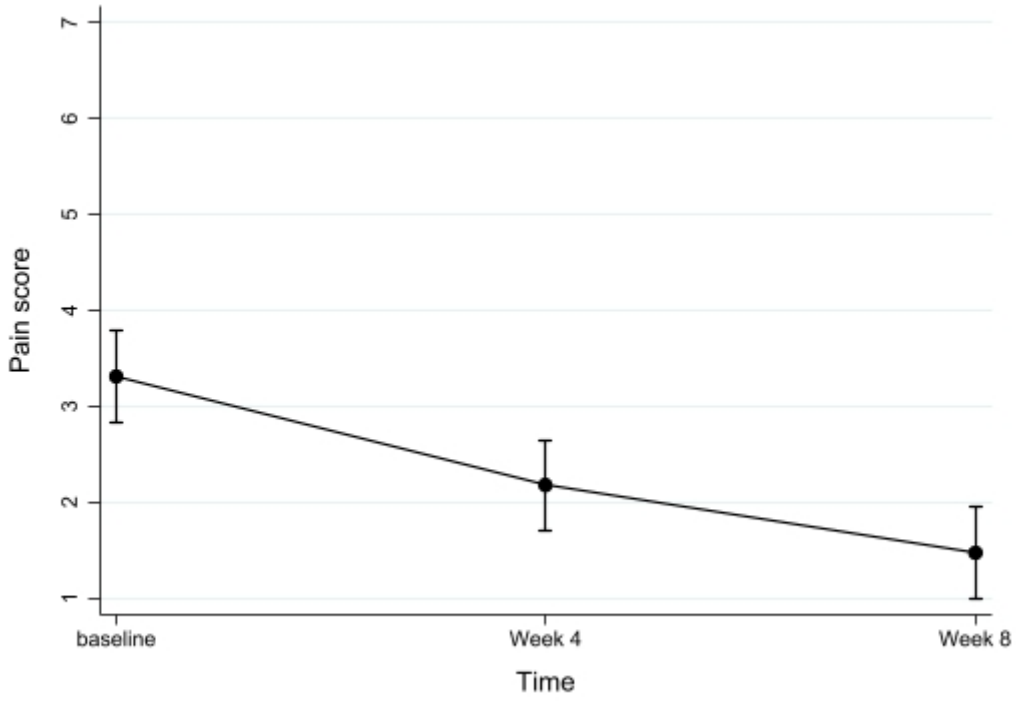

Figure 4. Average overall pain score at the baseline, weeks 4, and 8

DISCUSSION

This study employed a smartphone application named NotifyOfficeSyndrome. It is a platform that offers knowledge on physical exercise during work by demonstrating muscle stretches through short video clips. This can be implemented by individuals in the workplace. Additionally, there is a notice system in place to remind users to engage in physical activity while at work. The aim of this study was to examine the impact of this smartphone application on reducing the pain symptoms associated with office syndrome.

The results of the study found that after use of the NotifyOfficeSyndrome application, there was a statistically significant reduction in the average overall pain score. In week 8, the score decreased to 1.84 (1.17–2.51) and in week 4, it reduced to 1.14 (0.49–1.77) compared to the baseline with a significance level of 0.05. This finding corresponds to previous studies that examined a group of individuals employed in workplaces who experienced chronic neck pain. Research revealed that utilizing a smartphone application as a means of delivering information on adhering to the recommended program for a duration of 8 weeks has the potential to reduce pain[20] consistently among employees experiencing back pain. After a 4-month period of utilizing the Mobile-Web App, it was discovered that the control group had a 1.7 times higher chance of experiencing back discomfort compared to the group using the Mobile-Web App[27]. The use of a smartphone application can serve as motivation for following the intervention program. Smartphones facilitate the transmission of notifications and can become ingrained in daily routines. Furthermore, this study devised a mechanism for notifying individuals about the optimal timing for performing muscular stretching exercises and established specific intervals for taking pauses to

engage in these activities. The previous study demonstrated that implementing a time schedule for exercise in the office can effectively reduce sedentary behavior and increase daily physical activity levels each day[17].

The study used muscular stretching exercises for the research due to their ability to enhance muscle strength through resistance-based training. This type of physical activity promotes muscular relaxation, enhances muscle strength and size, and aids in the prevention of muscle, ligament, and joint injuries[28]. A study was conducted to investigate the impact of stretching exercises on work-related musculoskeletal disorders in the neck, shoulders, and upper back of 72 computer professionals. The participants were instructed to perform stretching exercises during their work breaks. After 4 weeks, it was discovered that all samples exhibited a reduction in symptoms related to work-related musculoskeletal disorders[29]. These findings align with the results of the study, which demonstrated that using the NotifyOfficeSyndrome application for 8 weeks led to a statistically significant reduction in pain in all 8 areas. The reduction in pain score in this study can be explained by the smartphone application encouraging those working at a computer to increase their physical activity by providing notifications and suggestions for exercising while at work. Engaging in appropriate exercise not only enhances muscular flexibility but also generates pressure through muscular contraction, thereby improving the flow of blood and air while reducing muscular pain and stiffness[30]. Furthermore, reducing screen time can enhance mental health and alleviate work-related stress. Smartphone notification was employed in this study to remind participants to undertake physical exercise for 3–5 minutes per hour in accordance with Anthony D Woolf et al.[31,] who explained that extended periods of sitting without intermittent exercise breaks might result in gradual muscle deterioration on a regular basis. Participating in physical activities like standing up, changing posture, or exercising might help reduce discomfort.

Nowadays, digital health interventions utilising smartphones, tablets, and laptops are cost-effective and generally embraced, particularly by younger and middle-aged individuals[19,22]. A previous study demonstrates that digital intervention has a positive impact on health-related results in the workplace[32]. According to this study, smartphones can assist individuals in accessing work-appropriate exercise video clips and provide reminders to ensure adherence to exercise routines. After utilising the application for a duration of eight weeks, the level of discomfort in all eight body parts diminished. Nevertheless, smartphone utilisation is merely a means of facilitating notifications and the retrieval of information in a more convenient manner[33]. In addition, positive health outcomes are contingent upon an individual's ability to practice effective self-management, adhere to instructions, and obtain accurate information.

CONCLUSION

This study shows that after using the NotifyOfficeSyndrome application (weeks 4 and 8), the mean pain score reduced in comparison to before the implementation of the NotifyOfficeSyndrome application (baseline). In addition, after using the NotifyOfficeSyndrome application, muscles in eight areas—the neck, shoulders, back, wrists, waist, hips, legs, and calves—showed a significant reduction in pain from office syndrome. Therefore, the institution should promote the usage of the NotifyOfficeSyndrome application among staff who regularly use computer

screens to improve their overall health and eliminate the discomfort associated with office syndrome.

RECOMMENDATIONS

The current study recommends that the use of the NotifyOfficeSyndrome application be encouraged among staff who frequently use computer screens. However, it is crucial to recognise the inherent constraints of this study. For example, the lack of a control group could affect the ability to accurately assess the true impact of the intervention. Nevertheless, every effort has been made to choose participants not currently undergoing physical treatment or taking medication for physical discomfort in order to accurately demonstrate the impact of the NotifyOfficeSyndrome application. The limited period of the eight-week intervention may not fully reflect the long-term effects of the NotifyOfficeSyndrome application. Future research should involve a randomised control trial and a control group. Moreover, to improve the quality of the smartphone application, subtitles should appear at the bottom of the video and be available on the App Store for iPhone users.

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