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## Mobile Games Among University Students: A symptom and functional severity for Carpal Tunnel Syndrome

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### Abstract

Carpal Tunnel Syndrome (CTS), the chronic trapping of the median nerve on the wrist, is the most common peripheral lesion in the nerve. Patients usually experience nocturnal discomfort, paraesthesia and admiration affecting the innervated digits of the median nerve. A Boston Carpal Syndrome Questionnaire was used in the study. The questionnaires were distributed to 373 undergraduate students, aged between 18 till 25 in one of the public university in Selangor. Findings indicate the respondent have mild symptoms and functional severity of CTS. The majority of the respondents reported that they have mild symptoms of CTS, such as numbness and tingling.

Keywords: Risk; Carpal Tunnel Syndrome; mobile games

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### 1.0 Introduction

Carpal Tunnel Syndrome (CTS) is one of the most common neurological conditions and the upper extremity neuropathic entrapment (Ivanova, 2020). Carpal Tunnel Syndrome is known as a stress-related injury caused by compression of the median nerve in a carpal tunnel due to repetitive movements at the wrist joint (Mohammad, 2019). The incidence of CTS varies widely and is more frequent among working people concerning females than males (Al Shahrani et al., 2019). Patients usually experience nocturnal discomfort, paraesthesia and admiration affecting the median nerve's innervated digits, and these effects are awoken. The pain always radiates up the arm in or past the elbow. Muscle fatigue is a less common complaint. A previous study by Al Shahrani et al. (2019), stated that smartphones were used by 1.85 billion people in 2014. This number was expected to have been 2.87 billion in 2020. The study by Mat Zain et al. (2013) stated that 50% of all respondents had moderately severe symptoms. 42.4% were medically free with no apparent CTS risk factors, and the others had serious symptoms. However, there was no significant association between the patterns of electronic device use and CTS symptoms. The functional status was significantly associated with age, gender, body mass index and occupation.

Woo, White and Lai (2017), found that intensive users had significantly more positive results than non-intensive users. Intensive users also had significantly bigger median nerve cross-sectional areas, flattening ratios, and perimeters and bigger bowing of the transverse carpal ligament, compared with intensive users after both undergoing Phalen's test and Durkan's test. The overuse of electronic devices may adversely affect the median nerve within the carpal tunnel and the transverse carpal ligament, resulting in numbness, tingling, and pain in the hand.

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Based on the study by Mat Zain et al. (2013), the symptom severity of 40% of students had mild numbness, 19.2% had moderate numbness and 5.8% had severe numbness impact by computer video games. While the result from functional severity, more than 70% of CTS cases were mild, 50% had some difficulties with the most affected task of carrying grocery bags and writing.

## 2.0 Literature Review

The use of electronic devices, such as mobile phones and computers, has increased drastically among the young generation, but the risks of CTS on university students have not been comprehensively examined (Lai et al., 2014). The majority of university students are young adults who are relatively more prone to developing musculoskeletal disorders because of the higher usage of smart devices. Thus, the rapid hand movement involved in the prolonged use of mobile phones should raise concerns regarding the incidence of CTS in this population (Woo, 2016).

Smartphone use may cause greater stress on the wrist than a keypad phone use (Kietrys et al., 2015). Lee et al. (2012) stated that additional musculoskeletal symptoms in areas supplied by the median nerve might also be related to higher usage of touchscreen devices. For instance, the median nerve changes reported with touchscreen devices may increase the risk of narrowing the carpal tunnel, increase pressure in the carpal tunnel, and lead to CTS (Ivanova, 2020). According to Lai et al. (2014), the median nerve demonstrated passive longitudinal gliding movement during mobile phones and computers, with the mouse-clicking task generating greater longitudinal excursion than the mobile-phone keying task did.

Mohammad (2019) study indicates that a higher percentage of probable CTS was found in female undergraduates (47.4%). In addition, Hulkkonen (2019) also revealed female gender is commonly considered a risk factor as CTS is more commonly diagnosed in women. Several studies found that obesity and CTS may be explained by either the accumulation of adipose tissue within the carpal tunnel or an increase in hydrostatic pressure through the carpal canal, which affects the compression of the median nerve (Hulkkonen, 2019; Ivanova, 2020; Mohamad, 2019). Ivanova (2020) found that competitive gaming is extremely accessible as a hobby or entertainment medium. At the same time, Lai et al. (2014) have stated that students mainly use computers or mobile phones to search for information or perform various tasks, including word processing and gaming. Although CTS is common among the general population, there is minimal study on the symptom and functional severity for CTS in playing mobile games among university students in Malaysia.

## 3.0 Methodology

This study is a descriptive cross-sectional survey designed to determine the symptom and functional severity for Carpal Tunnel Syndrome in Playing Mobile Games among undergraduate students in one of the public universities in Malaysia.

### 3.1 Research Setting

Data for this study were collected from one of the public universities in Selangor, Malaysia. The population for this study was selected among full-time undergraduate students who stayed in the college residences.

### 3.2 Sample

In this study, the total population of undergraduate students was 11902 (N=11902). The sampling method used in this study was convenience sampling. After calculating the sample size by using the Raosoft calculator, with a 95% confidence level and 5% margin of error, the recommended sample size was 373 (N=373). The respondent includes in this study were young adults between 18 to 25 years old and reside in the college. Students who already had CTS and had systemic diseases were excluded from this study.

### 3.3 The Research Instrument

The instrument that was used in this study was a questionnaire from Mat Zain et al. (2013). This questionnaire consists of two sections. The 25-item questionnaire has been distributed to the respondents. It is divided into two parts: The question was adopted from the previous study, and the researcher gave permission. For part A, demographic Data, the question purposely to get information regarding social demographics consists of gender, educational level, and experience level in mobile phone games, dominant hand, and affected hand. Part B is the Boston Carpal Tunnel Syndrome Questionnaire, an open-access questionnaire (Mat Zain et al., 2013). The questionnaire consists of symptoms severity scale-11 items and a functional severity scale of 8 items. This questionnaire uses a Likert scale, which is brief and easy to administer to the respondent. The instrument was self-administered and written in English and Malay. Respondents are required to answer all the questions. The total score use symptom severity (BCTQ-SS) was categorized into asymptomatic (1-11), mild (12-22), moderate (23-33), severe (34-44), and very severe (45-55). The total score uses functional severity (BCTQ-FS) was categorized into asymptomatic (8), mild (9-16), moderate (17-24), severe (25-32), and very severe (33-40). The questionnaire were given to undergraduate students that meet the inclusion criteria.

### 3.4 Data Collection

Before the data collection, the researchers had conducted a pilot study that included 37 undergraduate students, and later they were excluded from the study. The analysis of Cronbach's alpha for the Boston Carpal Syndrome Questionnaire is  $\alpha = 0.823$ . The research ethics committee has approved the ethics for this study from the university. Data were collected from January 2021 to June 2021. The researcher used a convenience sampling technique, where they approached the respondents at the cafeteria, with the ethical approval letter for the study. The respondents were checked for the criteria fulfilment, undergraduate students who were willing to participate in the

study. Before distributing research instruments, a brief explanation of the research was given, and informed consent was acquired. The respondents were informed that they had the right to refuse to take part in this study. The respondents answered the questionnaires within 10 minutes, and the questionnaire was collected immediately by the researcher.

### 3.5 Data Analysis

The completed questionnaires were coded and subjected to statistical analysis using the IBM Statistical Package for the Social Sciences (SPSS) for Windows, version 22. Estimation of frequency (%), Standard Descriptive Statistical Method was used for objectives 1 and 2, which were 1) to determine the symptoms severity of CTS among students. 2) to determine the functional severity of CTS among students.

### 4.0 Findings

There were a total of 373 respondents in this study. Most of the population survey respondents were male in this study, comprising 213 (57.1%). The other 160 (42.9%) respondents were female. The majority age of respondents was 20-22 (47.4%), followed by 23-25 (46.4) and 18-19 (5.9%). Table 1 shows that the majority of respondents had a moderate (47.5%) experience level in mobile games, followed by experienced (26.5%), very experienced (14.5%), and novice (11.5%). The dominant hand was the right hand with 310 (83.1), followed by the left hand with 63 (16.9).

Table 1. Demographic data of respondents (N=373)

		Frequency	Percentage (%)
Gender	Male	213	57.1
	Female	160	42.9
	18-19	22	5.9
	20-22	178	47.7
	23-25	173	46.4
Level Experience	Very Experience	54	14.5
	Experience	99	26.5
	Moderate	177	47.5
	Novice	43	11.5
Dominant Hand	Right	310	83.1
	Left	63	16.9

The mean scores for each item of symptom severity and the frequency (%) of responses are presented in Table 2. The scale used in the symptom severity was the Likert scale. 1 to 5 means no symptom, mild symptom, moderate symptom, severe symptom, and very severe symptom. Pain length scale from 1 to 5, never, 10 minutes, 10-60 minutes, > 60 minutes, and constant pain. The frequency of awakening scales from 1 to 5, none, once, 2-3 times, 4-5 times, and more than five times. The table shows that most respondents had mild symptom severity. From the results, the most common symptom of CTS that respondents experienced was numbness, with 220 (59.0%) respondents having mild numbness followed by 177 (47.5%) respondents having a mild weakness. The third most common CTS-related symptom experienced was tingling with 162 (43.4%) respondents, followed by daytime pain severity 124 (33.2%) respondents, holding a small object 123 (33%) respondents, and daytime pain length 122 (32.7%) respondents.

Table 2. Mean score of symptom severity and frequency (%) of responses

Symptom Severity	Mean ± SD	No symptom	Mild	Moderate	Severe	Very severe
Night time pain severity	1.41± .61	240 (64.3%)	115 (30.8%)	16 (4.3%)	1 (.3%)	1 (.3%)
Awakening pain	1.47± .71	236 (63.3%)	103 (27.6%)	31 (8.3%)	1 (.3%)	2 (.5%)
Daytime pain severity	1.46± .063	224 (60.1%)	124 (33.2%)	24 (6.4%)	1 (.3%)	0 (0%)
Daytime pain frequency	1.43± .063	233 (62.5%)	119 (31.9%)	18 (4.8%)	3 (.8)	0 (0%)
Daytime pain length	1.45± .66	229 (61.4%)	122 (32.7%)	19 (5.1%)	1 (.3%)	2 (.5%)
Numbness	1.80± .64	114 (30.6%)	220 (59.0%)	37 (9.9%)	1 (.3%)	1 (.3%)
Weakness	1.61± .61	170 (45.6%)	177 (47.5%)	26 (7.0%)	0 (0%)	0 (0%)
Tingling	1.58± .64	185 (49.6%)	162 (43.4%)	23 (6.2%)	3 (.8%)	0 (0%)
Night time numbness or tingling	1.43± .64	239 (64.1%)	108 (29.0%)	24 (6.4%)	2 (.5%)	0 (0%)
Awakening tingling and numbness	1.46± .75	247 (66.2%)	86 (23.1%)	34 (9.1%)	4 (1.1%)	2 (.5%)
Holding a small	1.40± .56	236	123	14	0	0

object	(63.3%)	(33.0%)	(3.8%)	(0%)	(0%)
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The mean scores for each item of functional severity and the frequency (%) of responses were presented in Table 3. The scale used in the functional severity was the Likert scale. 1 to 5 means no difficulty, mild difficulty, moderate difficulty, severe difficulty, and very severe difficulty. The table shows that most respondents had mild functional severity. The results of functional severity show that the most common CTS-related functional severity experienced by respondents was carrying grocery bags with 173 (46.4%) respondents, followed by opening jars with 138 (37.0%) respondents. From the table, it shows that 134 (35.9%) respondents had mild functional severity when doing housekeeping, followed by 103 (27.6%) respondents who had mild functional severity when writing, holding the telephone handle with 102 (27.3%) respondents, buttoning clothes with 91 (24.4%).

Table 3. Mean score of functional severity score and frequency (%) of responses

Functional Severity	Mean $\pm$ SD	No difficulty	Mild	Moderate	Severe	Very severe
Writing	1.32 $\pm$ .52	261 (70.0%)	103 (27.6%)	9 (2.4%)	0 (0%)	0 (0%)
Buttoning clothes	1.26 $\pm$ .47	278 (74.5%)	91 (24.4%)	4 (1.1%)	0 (0%)	0 (0%)
Holding a book while reading	1.24 $\pm$ .46	288 (77.2%)	80 (21.4%)	5 (1.3%)	0 (0%)	0 (0%)
Holding the telephone handle	1.30 $\pm$ .50	265 (71.0%)	102 (27.3%)	6 (1.6%)	0 (0%)	0 (0%)
Opening jars	1.43 $\pm$ .57	223 (59.8%)	138 (37.0%)	11 (2.9%)	1 (.3%)	0 (0%)
Housekeeping	1.52 $\pm$ .67	209 (56.0%)	134 (35.9%)	28 (7.5%)	1 (.3%)	1 (.3%)
Carrying grocery bags	1.65 $\pm$ .67	167 (44.8%)	173 (46.4%)	29 (7.8%)	4 (1.1%)	0 (0%)
Bathing and dressing	1.31 $\pm$ .57	273 (73.2%)	82 (22.0%)	17 (4.6%)	1 (.3%)	0 (0%)

## 5.0 Discussion

The demographic characteristics in this study consist of four items which are gender, age, experience level in mobile games, and dominant hand. A total of 373 people took part in the survey. Male respondents (57.1%) and female respondents (42.9%) participated in this study, indicating that both genders were willing to participate in a study or research. Most students could not continue their education at home due to the Covid-19 outbreak and the government issuing a movement control order (MCO) or lockdown. However, we obtained respondents because some students were granted permission to remain in college to complete lab sessions and practicals. In this study, it was shown that mobile games are also popular among Malaysian students. Respondents were undergraduate students between the ages of 18 and 25. Similarly, a previous study by Mat Zain et al. (2013) showed that approximately 35% of students play games daily. Most students regularly play mobile games individually or in groups, and some even participate in e-sport tournaments. Furthermore, MCO makes it simple to obtain responses throughout the college for various reasons.

This study aimed to determine carpal tunnel syndrome's symptoms and functional severity by playing mobile games among undergraduate students. According to the respondents' recall of experiences, the severity and frequency of the symptoms were determined while playing mobile games. The severity of CTS among the undergraduate students was investigated, with most falling into the mild category. As expected, and in line with other studies' findings. Since the respondents were young adults, the respondents' awareness would be pleased. They were conscious of the unusual sensation in their hands. According to previous research, other studies found similar results, with respondents stating that the sample was drawn from university students because games are among the most popular pastimes among university students (Mat Zain et al., 2013). The assessment was carried out using the BCTQ, which was developed in response to recommendations provided in the literature. Previous research has looked at how patients and workers rate the severity of CTS symptoms (Mohammad, 2019). This study, on the other hand, was limited to university students.

It was discovered that, similar to regular computer use, exposure to a mix of repetitive and intense hand movements while playing computer games might develop symptoms commonly linked with CTS, such as numbness and muscle weakness. This discovery is consistent with the findings of several other investigations (Eleftheriou et al., 2012). Despite this, most cases with CTS-related symptoms in this study fell into the mild group, according to the findings. This study reveals numbness was the symptom with the most outstanding severity score indicated by the subjects, followed by weakness and tingling. When Rozali et al. (2012) looked into the most prevalent symptoms, they discovered that they were numbness or tingling during the daytime. The findings of this study are congruent with a local study conducted among university students by Mat Zain et al. (2013). The majority of those who answered were also in the mild symptom category, with numbness and tingling being the most often reported symptom during the day.

Moreover, the findings of this study are based on the functional severity rating of CTS. The majority of the respondents reported experiencing some level of functional impairment. Carrying grocery bags and housekeeping was shown to be the tasks that were most

adversely affected by the study's findings. A prior study has found evidence to support this conclusion. According to the findings of Mat Zain et al. (2013), the activities that were most adversely affected were carrying grocery bags and writing letters. They assume that the writing task was one of the most affected tasks because the respondents spent a significant amount of time taking notes during the lectures. However, according to the study's findings, respondents devote the majority of their time in their rooms due to MCO and Open and Distance Learning (ODL), making housekeeping one of the most negatively affected chores. As a result, they must clean their rooms more regularly. Moreover, most of them also wash their clothes by hand. Although writing is not one of the most affected jobs, respondents who participate in ODL do not write notes as much as when attending lecture hall. Additionally, the assignment and task are submitted in soft copy format. As a result, they spend more time typing than they do writing. Although, typing is also a repetitive hand movement that can contribute to CTS.

Al Shahrani et al. (2021) conducted a study in Riyadh, Saudi Arabia, finding that 207 respondents had severe symptoms of CTS. The study also found that the intensity of functional symptoms worsened with age, with 207 respondents having severe symptoms of CTS. However, in this study, the results of the respondents only revealed modest severity, with the bulk of the activities posing no problem for the majority of them. This is since our target audience consists solely of undergraduate students and their courses require them to be 18 years old or older with no limited age. Ivanova (2020) also stated that women with CTS rate their impairment and symptoms higher than males. Similar to a study by Hulkkonen (2019), CTS is a common risk factor among women. However, in this study, both genders stay in college and perform their housework. On the other hand, males devote more time to mobile gaming than females. Another study by Mohammad (2019) supported this, which stated that respondents need to spend more time playing mobile games to obtain more experience or become experts. The length of time spent using a device is closely linked to the severity and duration of hand pain (Woo et al., 2017). Therapeutic exercise is one of the treatments for CTS to help in functional performance and reduce the symptom severity (Ivanova, 2020).

## 6.0 Conclusion and Recommendation

This study showed that the majority of respondents had mild symptoms and functional severity. Since the study regarding the symptoms and functional severity of carpal tunnel syndrome among students was limited in Malaysia, this study revealed the importance of being aware of the risk for CTS among young adults, especially university students. This study can help the community implement awareness programs for CTS that are cost-effective and attractive to the public because of the lack of awareness of the symptoms and functional severity of CTS from playing mobile games. As preventive measures, university could provide sufficient information about CTS among students, such as decreasing their time in playing mobile games to reduce repetitive wrist movement.

Though, this is only a descriptive study with convenience sampling. In future interventions, a study can be conducted to determine the risk for CTS on playing mobile games among specific communities since smartphones have been increased due to MCO and ODL, including children, teenagers, and adults. Moreover, future research also needs to focus on the relationship between the dominant hand and CTS because there is still no solid evidence dominant hand leads to CTS. The prospective researcher can conduct the risk for CTS among children to create scientific evidence to support awareness to the community or parents to prevent the development risk of CTS among their children.

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## Paper Contribution to Related Field of Study

The result of this study perhaps could be used to create awareness among university students about the symptom and functional severity for CTS.

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