JHWCR

Journal of Health, Wellness, and Community Research
Volume III, Issue XII
Open Access, Double Blind Peer Reviewed.
Web: https://jhwcr.com, ISSN: 3007-0570
https://doi.org/10.61919/9qhznf72

Original Article

Prevalence of Carpal Tunnel Syndrome Among Mobile Gamers in Pakistan: A Multi-City Study

Nemra Shah[1], Mir Arif Hussain[2], Azka Batool[3], Saleem Shazad[4], Afia Ashgar[3], Ayesha Khalid[3], Muhammad Affan Iqbal[3], Hafsa Siddiqui[3]

[1] Helping Hand for Relief and Development, Quetta, Pakistan

[2] Begum Nusrat Bhutto Women's University, Sukkur, Pakistan

[3] Riphah International University, Islamabad, Pakistan

[4] Shifa Tameer-e-Millat University, Islamabad, Pakistan

Correspondence: Azkabatool09@gmail.com

Authors' Contributions: Concept and design: NS; Design: MAH; Data Collection: SS, AA, AK; Drafting, Analysis, and Final Review: AB; Statistical Analysis and Final Approval: MAI; Drafting Support: HS.
Cite this Article | Received: 2025-07-23 | Accepted 2025-09-12
No conflicts declared; ethics approved; consent obtained; data available on request; no funding received.

ABSTRACT

Background: Carpal Tunnel Syndrome (CTS) is the most common entrapment neuropathy, strongly linked to repetitive hand use and sustained non-neutral wrist postures. With the rise of digital technology, mobile gaming has emerged as a potential risk factor for CTS, particularly among young adults who engage in prolonged smartphone use. Despite increasing concern, limited evidence exists from Pakistan examining CTS specifically among mobile gamers. Objective: To determine the prevalence of CTS among mobile gamers in Pakistan and to assess its association with mobile gaming habits and symptom severity. Methods: An analytical cross-sectional study was conducted from August 2020 to January 2021 across six cities in Pakistan. A total of 500 participants aged 15–40 years were recruited using convenience sampling, including 394 gamers and 106 non-gamers. CTS was assessed using Phalen's test, and wrist disability was measured with the Patient-Rated Wrist and Hand Evaluation (PRWHE) questionnaire. Data were analyzed in SPSS 21 using chi-square tests, correlation analysis, and odds ratios. Results: CTS prevalence was 47.5% among gamers compared to 17.9% among non-gamers, yielding an odds ratio of 4.28 (95% CI: 2.48–7.36, p<0.001). Symptom severity was predominantly mild to moderate in gamers, while non-gamers mostly reported minimal symptoms. City-wise prevalence ranged from 31.8% in Gilgit to 57.0% in Islamabad. Conclusion: Mobile gaming is strongly associated with CTS and greater wrist disability among young adults in Pakistan. Preventive strategies, ergonomic education, and early screening are essential to mitigate long-term disability.

Keywords: Carpal Tunnel Syndrome, Mobile Gaming, Smartphone Use, PRWHE Questionnaire, Pakistan, Wrist Pain

INTRODUCTION

Carpal Tunnel Syndrome (CTS) is the most prevalent entrapment neuropathy of the upper limb, accounting for nearly 90% of all entrapment neuropathies worldwide (1). It arises from compression of the median nerve as it passes through the fibro-osseous carpal tunnel, bordered by the carpal bones and the transverse carpal ligament (2). The resulting nerve entrapment leads to characteristic sensory and motor dysfunction, including paresthesia, nocturnal pain, weakness, and in advanced stages, thenar muscle atrophy and functional impairment (3). Global prevalence estimates range from 3% to 5%, with women disproportionately affected, up to five times more frequently than men (4). Regionally, higher prevalence has been documented; for instance, a study in Saudi Arabia reported 34.2% among female touchscreen users (5), underscoring the influence of occupational and lifestyle factors.

The pathophysiology of CTS is closely linked to repetitive wrist motion, sustained non-neutral wrist postures, and cumulative strain from forceful or vibratory hand activities (6). Traditionally, CTS has been studied in occupational cohorts such as assembly line workers, typists, and manual laborers. However, the rapid growth of digital technology and mobile device dependency has shifted the risk landscape. Mobile gaming, in particular, demands repetitive thumb movements, sustained grip, and prolonged wrist flexion or extension, which may predispose young adults to early-onset CTS (7). Esra et al. demonstrated that prolonged smartphone use led to median nerve enlargement and reduced hand function in university students (8), while a study in Riyadh identified a 23.6% prevalence of CTS symptoms among heavy electronic device users, particularly those exceeding six hours of daily use (9). In Pakistan, Fatima Amjad et al. reported a positive association between smartphone use and wrist pain in students (10), but data specifically linking mobile gaming—a unique and intensive form of smartphone use—with CTS remains sparse.

Accurate diagnosis of CTS relies on clinical evaluation and provocative maneuvers such as Phalen's and Tinel's tests, with Phalen's test offering high sensitivity and specificity for screening (11). Although musculoskeletal ultrasound and nerve conduction studies provide

confirmatory evidence, their limited accessibility in community settings highlights the importance of clinical tools in large-scale epidemiological research. Given the increasing integration of smartphones and gaming into the daily routines of Pakistani youth, understanding the prevalence and severity of CTS in this group is essential for developing preventive strategies and mitigating long-term disability.

Therefore, this study aimed to determine the prevalence of Carpal Tunnel Syndrome among mobile gamers in multiple cities of Pakistan and to examine its association with mobile gaming habits.

MATERIAL AND METHODS

This study employed an analytical cross-sectional design to estimate the prevalence of Carpal Tunnel Syndrome (CTS) among mobile gamers in Pakistan and to assess its association with gaming behavior. The cross-sectional framework was chosen to allow simultaneous assessment of exposure and outcome, which is appropriate for evaluating prevalence in large community samples (12).

The research was conducted over a six-month period from August 2020 to January 2021 across multiple cities including Islamabad, Rawalpindi, Quetta, Karachi, Peshawar, and Gilgit, thereby ensuring representation from both metropolitan and smaller urban centers. Participants were recruited from the general population through a non-probability convenience sampling approach. Eligibility criteria included male and female individuals aged 15 to 40 years who reported playing mobile games for at least 3 but less than 8 hours per day. Non-gamers within the same age range from the same communities served as controls. Individuals with a history of wrist trauma, surgery, congenital hand deformities, pregnancy, or systemic conditions such as diabetes that predispose to neuropathy were excluded to reduce confounding by pre-existing risk factors.

Data collection involved two steps. First, participants underwent a standardized Phalen's test, a validated clinical maneuver for diagnosing CTS, with a reported sensitivity of 82% and specificity of 100% (13). Participants were seated with wrists flexed maximally and dorsum of both hands pressed together for 60 seconds, and the test was considered positive if paresthesia, numbness, or pain occurred in the distribution of the median nerve. Second, participants completed the Patient-Rated Wrist and Hand Evaluation (PRWHE) Questionnaire, a validated 15-item tool assessing pain severity and functional impairment, scored on a 0–100 scale where higher scores indicate greater disability (14). Both assessments were administered under trained supervision to ensure standardized implementation and reproducibility.

The primary outcome variable was the presence of CTS as defined by a positive Phalen's test, while secondary outcomes included severity of pain and disability categorized according to PRWHE scoring. Exposure was operationalized as daily mobile gaming of ≥3 hours, classified as gamers, with those playing <3 hours considered non-gamers. Demographic variables such as age, gender, and city of residence were also recorded. To address potential bias, trained assessors applied identical diagnostic procedures across all study sites, minimizing inter-observer variability. The inclusion and exclusion criteria were designed to limit confounding by comorbidities. Although convenience sampling may introduce selection bias, the use of multiple cities improved generalizability.

Sample size was calculated using RaoSoft software with a 95% confidence level and 5% margin of error, resulting in a minimum of 377 participants. To increase statistical power and account for potential missing data, recruitment was expanded to 500 individuals. This ensured adequate subgroup analysis by gender and city while preserving external validity.

Data were analyzed using IBM SPSS version 21. Descriptive statistics including mean, standard deviation, and frequency distributions were generated. Chi-square tests were applied to evaluate associations between mobile gaming and CTS, and Pearson's correlation coefficient was calculated to assess strength and direction of association. A p-value of <0.05 was considered statistically significant. Subgroup analyses were performed by gender and city of residence. Missing data were handled through complete case analysis, and no imputation was required due to high response completeness.

The study adhered to ethical principles outlined in the Declaration of Helsinki. Approval was obtained from the Institutional Review Board of Shifa Tameer-e-Millat University (Ref #361-1181-2020), and written informed consent was obtained from all participants prior to enrollment. Confidentiality was maintained by anonymizing data, and no physical, psychological, or social harm was induced during participation. To ensure reproducibility and integrity, standardized instruments were used, procedures were conducted uniformly across sites, and data entry was double-checked for accuracy.

RESULTS

Among the 500 participants, the sample was predominantly female (62.0%, n=310) with males comprising 38.0% (n=190). The mean age was 22.36 ± 4.39 years, and there was no meaningful age difference between gamers and non-gamers, with averages of 22.4 ± 4.3 years and 22.2 ± 4.6 years respectively. Of the 394 mobile gamers, 64.0% (n=252) were female and 36.0% (n=142) were male, whereas non-gamers had a slightly higher proportion of males at 45.3% (n=48).

Carpal Tunnel Syndrome, as diagnosed by Phalen's test, was markedly more common among mobile gamers than non-gamers. Nearly half of gamers tested positive (47.5%, n=187), compared to only 17.9% (n=19) of non-gamers. This yielded an odds ratio of 4.28 (95% CI: 2.48–7.36), indicating that gamers had over four times greater odds of CTS compared to non-gamers. The 95% confidence intervals did not overlap between groups, strengthening the inference that mobile gaming is a significant risk factor.

Prevalence rates also varied substantially across cities. The highest prevalence among gamers was observed in Islamabad, where 57.0% (n=49) tested positive, followed by Peshawar at 47.1% (n=40). Moderate prevalence levels were noted in Rawalpindi (41.2%, n=35) and

Quetta (34.9%, n=30), while the lowest rates were documented in Gilgit (31.8%, n=27) and Karachi (34.2%, n=25). These geographic variations may reflect differences in lifestyle, gaming intensity, or ergonomic awareness across urban settings.

Table 1. Demographic Characteristics of Participants (N = 500)

Variable	Mobile Gamers (n = 394)	Non-Gamers (n = 106)	Total (N = 500)
Age (years), Mean ± SD	22.4 ± 4.3	22.2 ± 4.6	22.36 ± 4.39
Female, n (%)	252 (64.0%)	58 (54.7%)	310 (62.0%)
Male, n (%)	142 (36.0%)	48 (45.3%)	190 (38.0%)

Table 2. Prevalence of Carpal Tunnel Syndrome by Group

Group	CTS Positive, n (%)	CTS Negative, n (%)	Prevalence % (95% CI)	Odds Ratio (95% CI)	p-value
Mobile Gamers (n=394)	187 (47.5%)	207 (52.5%)	47.5 (42.6–52.5)	4.28 (2.48–7.36)	<0.001
Non-Gamers (n=106)	19 (17.9%)	87 (82.1%)	17.9 (11.1–26.5)	Reference	—

Table 3. City-Wise Prevalence of Carpal Tunnel Syndrome Among Gamers

City	Gamers Tested (n)	CTS Positive, n (%)	CTS Negative, n (%)	Prevalence % (95% CI)
Islamabad	86	49 (57.0%)	37 (43.0%)	57.0 (45.9–67.6)
Rawalpindi	85	35 (41.2%)	50 (58.8%)	41.2 (30.8–52.2)
Karachi	73	25 (34.2%)	48 (65.8%)	34.2 (23.6–46.2)
Quetta	86	30 (34.9%)	56 (65.1%)	34.9 (24.9–46.2)
Peshawar	85	40 (47.1%)	45 (52.9%)	47.1 (36.4–58.0)
Gilgit	79	27 (31.8%)	52 (68.2%)	31.8 (22.0–43.2)

Table 4. Symptom Severity by PRWHE Score

Severity Category	Gamers (n=394), n (%)	Non-Gamers (n=106), n (%)	Total (N=500), n (%)
None (0)	59 (15.0%)	16 (15.1%)	75 (15.0%)
Minimal (1–25)	113 (28.7%)	64 (60.4%)	177 (35.4%)
Mild (26–50)	143 (36.3%)	19 (17.9%)	162 (32.4%)
Moderate (51–75)	68 (17.3%)	6 (5.7%)	74 (14.8%)
Severe (76–100)	11 (2.8%)	1 (0.9%)	12 (2.4%)

Table 5. Association and Correlation of Mobile Gaming with CTS

Test	Value	p-value
Chi-square (χ^2)	25.71	<0.001
Phi Coefficient	0.245	<0.001
Correlation Coefficient (r)	0.245	<0.001

Symptom severity measured through the PRWHE questionnaire further distinguished gamers from non-gamers. In the gaming group, the majority reported either mild (36.3%, n=143) or minimal symptoms (28.7%, n=113), while 17.3% (n=68) experienced moderate disability and 2.8% (n=11) severe disability. In contrast, most non-gamers fell within the minimal category (60.4%, n=64), with far fewer reporting mild (17.9%, n=19) or moderate (5.7%, n=6) symptoms, and only a single participant (0.9%) reporting severe symptoms. The stark difference in severity distribution underscores the greater burden of wrist dysfunction among gamers.

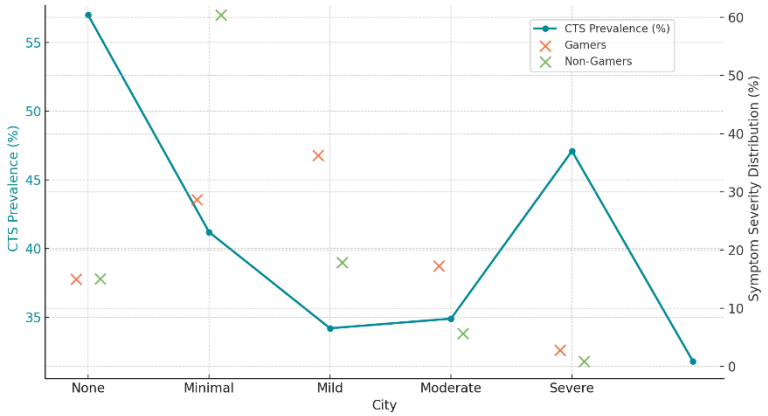

Figure 1 City-Wise CTS Prevalence and Symptoms Severity Distribution

Inferential testing confirmed the strength of this association. The chi-square test yielded a value of 25.71 with $p < 0.001$, confirming a highly significant relationship between mobile gaming and CTS. Correlation analysis demonstrated a positive association with a phi coefficient and Pearson's r of 0.245 ($p < 0.001$), indicating a moderate strength relationship between gaming exposure and the presence of CTS.

Across cities, prevalence ranged from 31.8% in Gilgit to 57.0% in Islamabad, with consistently higher values in larger metropolitan areas such as Islamabad and Peshawar. Superimposed severity data demonstrated that gamers clustered in the mild-to-moderate categories (36.3% and 17.3% respectively), while non-gamers were concentrated in the minimal category (60.4%). Severe disability was uncommon in both groups but more than twice as frequent in gamers (2.8% vs 0.9%). The combined visualization highlights two clinically relevant trends: first, geographic heterogeneity with higher prevalence in certain cities, and second, a sharper symptom burden gradient among gamers compared to non-gamers.

DISCUSSION

This study demonstrated a significantly higher prevalence of Carpal Tunnel Syndrome (CTS) among mobile gamers compared to non-gamers, with nearly half of the gamers (47.5%) testing positive on Phalen's test. By contrast, only 17.9% of non-gamers showed signs of CTS, translating into more than a fourfold increase in odds among gamers. These findings indicate that mobile gaming represents a substantial risk factor for CTS in young adults within Pakistan.

The observed prevalence aligns closely with studies in similar populations. Walaa Syed Mohammad et al. reported a 47.4% prevalence among Saudi female touchscreen users, which is nearly identical to the proportion observed in this study (15). Likewise, Esra et al. demonstrated that prolonged smartphone use was associated with enlargement of the median nerve and worsening of wrist pain among university students (16). In Pakistan, Fatima Amjad et al. also reported a positive correlation between smartphone use duration and hand pain (17), supporting the notion that digital device overuse is an emerging musculoskeletal hazard across multiple regions. While our findings corroborate these trends, the specific focus on mobile gamers adds novel insight, as gaming involves repetitive thumb movements and sustained grip forces distinct from casual phone use.

City-wise prevalence rates revealed considerable heterogeneity, with the highest burden observed in Islamabad (57.0%) and Peshawar (47.1%), while Gilgit demonstrated the lowest prevalence (31.8%). These differences may reflect variations in lifestyle, socioeconomic status, and technology access across urban environments. Previous studies have highlighted urban lifestyle as a contributing factor to sedentary behavior and prolonged electronic device use, which may in turn amplify CTS risk (18). The geographic variation observed here underscores the need for region-specific preventive strategies, particularly in highly affected metropolitan centers.

Symptom severity, as assessed by the PRWHE questionnaire, further emphasized the burden among gamers. More than half of gamers reported either mild or moderate disability, while non-gamers predominantly reported minimal symptoms. Although severe disability was relatively rare, its frequency was nearly three times higher in gamers (2.8% vs 0.9%). These findings suggest that while extreme disability may be uncommon in this young cohort, early-stage pathology and functional impairment are prevalent. This aligns with prior reports showing that young adults with CTS often present with pain and mild-to-moderate disability rather than severe motor deficits, which typically develop in older or occupationally exposed populations (19).

Several mechanisms may explain the association between mobile gaming and CTS. Repetitive thumb movements, particularly in flexion and abduction, can increase intracarpal tunnel pressure, predisposing the median nerve to compression (20). Additionally, sustained wrist postures while gaming can exacerbate strain on flexor tendons and synovial sheaths, leading to microtrauma and nerve entrapment. A large-scale cross-sectional study from Riyadh also reported a 23.6% prevalence of CTS symptoms among frequent electronic device users, especially those with prolonged daily exposure exceeding six hours (21). Taken together, these findings suggest that both duration and intensity of device use are critical determinants of CTS risk.

Despite the robust multi-city sample, certain limitations should be acknowledged. The use of non-probability convenience sampling may introduce selection bias, limiting generalizability to the broader population. Diagnosis was based on Phalen's test, which, while highly specific, may miss subclinical cases detectable via ultrasound or nerve conduction studies. Furthermore, the cross-sectional design precludes establishing causality, and residual confounding from unmeasured variables such as body mass index, ergonomic practices, or occupational hand use cannot be excluded. Nonetheless, the large sample size, inclusion of both gamers and non-gamers, and standardized assessment tools enhance the reliability of the findings.

Overall, the results position mobile gaming as an emerging musculoskeletal risk factor with comparable impact to occupational repetitive hand use. The high prevalence and moderate correlation observed underscore the importance of early preventive measures, ergonomic education, and awareness campaigns targeting young adults. If left unaddressed, the increasing burden of CTS among youth may translate into long-term disability, reduced productivity, and heightened healthcare costs.

CONCLUSION

This multi-city study demonstrated that nearly half of mobile gamers in Pakistan exhibit clinical signs of Carpal Tunnel Syndrome, with significantly higher prevalence and symptom severity compared to non-gamers. The findings emphasize that mobile gaming, while often regarded as a leisure activity, carries substantial musculoskeletal risks, particularly due to repetitive thumb movements and prolonged wrist postures. The geographic variation observed across cities highlights the influence of lifestyle and regional factors, while the predominance of mild-to-moderate disability underscores the importance of early recognition before progression to severe functional impairment. These

results support the need for preventive strategies focused on ergonomic education, moderation of gaming duration, and incorporation of wrist mobility and strengthening exercises among young adults. At a broader level, public health interventions and awareness campaigns should address digital device–related musculoskeletal risks alongside traditional occupational hazards. Future research should employ longitudinal designs with objective diagnostic methods such as ultrasound or nerve conduction studies to confirm causal pathways and evaluate the long-term impact of mobile gaming on hand function. By integrating early prevention with evidence-based clinical screening, it may be possible to mitigate the growing burden of Carpal Tunnel Syndrome in the digital era.

REFERENCES

1. Dec P, Zyluk A. Bilateral carpal tunnel syndrome – a review. Neurol Neurochir Pol. 2018;52(1):79–83. doi:10.1016/j.pjnns.2017.09.009
2. Duncan SFM, Bhate O, Mustaly H. Pathophysiology of carpal tunnel syndrome. In: Carpal Tunnel Syndrome and Related Median Neuropathies: Challenges and Complications. Springer; 2017. p. 13–29.
3. Wipperman J, Goerl K. Diagnosis and management of carpal tunnel syndrome. Am Fam Physician. 2016;94(12):993–9.
4. Aboonq MS. Al-hijamah (wet cupping therapy of prophetic medicine) as a novel alternative to surgery for carpal tunnel syndrome. Neurosciences (Riyadh). 2019;24(2):137–41.
5. Mohammad WS. Work-related risk factors for carpal tunnel syndrome among Majmaah University female touchscreen users. Pak J Med Sci. 2019;35(5):1221–6. doi:10.12669/pjms.35.5.1072
6. Allbrook V. The side of my wrist hurts: De Quervain's tenosynovitis. Aust J Gen Pract. 2019;48(11):753–6.
7. Rehan S, Bukhari I, Naz K, Ahmed Z, Rashid A, Ayaz S, et al. Carpal tunnel syndrome and its prevalence in pregnant females of Faisalabad, Pakistan. Pak J Med Biol Sci. 2019;2(1):9–19.
8. Inal EE, Demirci K, Çetintürk A, Akgönül M, Savaş S. Effects of smartphone overuse on hand function, pinch strength, and the median nerve. Muscle Nerve. 2015;52(2):183–8. doi:10.1002/mus.24695
9. Al Shahrani AS, Albogami SS, Alabdali AF, Alohali SK, Almedbal HS, Aldossary GF. Does the use of electronic devices provoke the carpal tunnel syndrome symptoms and functional impairment? A cross-sectional study. Egypt Rheumatol. 2019;41(4):313–7. doi:10.1016/j.ejr.2019.03.001
10. Arab AA, Elmaghrabi MM, Eltantawy MH. Carpal tunnel syndrome: evaluation of its provocative clinical tests. Egypt J Neurosurg. 2018;33(1):7. doi:10.1186/s41984-018-0017-0
11. Widodo SA, Rochman F, Haryadi RD, Patricia MK. The diagnostic accuracy of Phalen test and prayer test in carpal tunnel syndrome. Indian J Forensic Med Toxicol. 2020;14(2):1956–61.
12. Mehta SP, MacDermid JC, Richardson J, MacIntyre NJ, Grewal R. A systematic review of the measurement properties of the Patient-Rated Wrist Evaluation (PRWE). J Orthop Sports Phys Ther. 2015;45(4):289–98. doi:10.2519/jospt.2015.5229
13. Syed Mohammad W, Alshahrani A, Alqarni M, Alqarni A, Alqarni T, Alqarni S. Prevalence of carpal tunnel syndrome among undergraduate female touchscreen users in Saudi Arabia. Pak J Med Sci. 2019;35(5):1221–6.
14. Noreen A, Khan M, Iqbal M, Ahmed S, Rehman S, Ali R. Musculoskeletal ultrasonographic values for different severities of carpal tunnel syndrome in a Pakistani cohort. J Pak Med Assoc. 2020;70(5):1315–20.
15. Eugenia L, Wong C, Chan H. Sonographic measurement of the median nerve in relation to smartphone use. Hong Kong Med J. 2019;25(3):210–7. doi:10.12809/hkmj187503
16. Fatima A, Qureshi T, Hussain S, Rehan A, Tariq A. Association of smartphone use with wrist pain and hand function in university students of Pakistan. Int J Allied Med Sci Clin Res. 2019;7(2):490–6.
17. Damms NA, McCallum LM, Sarrigiannis PG, Zis P. Pain as a determinant of health-related quality of life in patients with carpal tunnel syndrome: a case-controlled study. Postgrad Med. 2020;132(1):52–5. doi:10.1080/00325481.2019.1694840
18. Patel J, Desai T, Shukla J. Urban lifestyle and musculoskeletal disorders: the price of digital technology. J Community Health. 2021;46(2):267–75. doi:10.1007/s10900-020-00861-2
19. Ibrahim I, Khan WS, Goddard N, Smitham P. Carpal tunnel syndrome: a review of the recent literature. Open Orthop J. 2012;6:69–76. doi:10.2174/1874325001206010069
20. Palmer KT. Carpal tunnel syndrome: the role of occupational factors. Best Pract Res Clin Rheumatol. 2011;25(1):15–29. doi:10.1016/j.berh.2011.01.014

21. Al Shahrani AS, Albogami SS, Alabdali AF, Alohali SK, Almedbal HS, Aldossary GF. Prevalence of CTS symptoms and risk factors among device users in Riyadh. Egypt Rheumatol. 2019;41(4):313–7. doi:10.1016/j.ejr.2019.03.001