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A Cross Sectional Study on Prevalence of Carpal Tunnel Syndrome among Multiparous Mothers in Tertiary Care Teaching Hospitals in Karachi

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ABSTRACT

Carpal Tunnel Syndrome (CTS) is a common condition that occurs when the median nerve is compressed at the carpal tunnel in the wrist. Mothers who have had multiple pregnancies are particularly at risk, as the physical demands of repeated childbirth and childcare can exacerbate strain on the wrist and hand. To determine the prevalence of Carpal Tunnel Syndrome among multiparous mothers in tertiary care teaching hospitals in Karachi.This cross sectional study was conducted at different Tertiary care Teaching Hospitals of Karachi, with a sample size of n=360 multigravida pregnant women aged 20–40 years, selected through convenience sampling. Women currently pregnant or with prior wrist trauma, diabetes, rheumatoid or thyroid dysfunction was excluded. Data was collected using The Boston Carpal Tunnel Questionnaire. Participants was recruited through online and physical survey forms after they have given their consent. The data was interpreted and analyzed in the most updated SPSS version. Phalen's test was positive in 27% of participants and strongly predicted greater symptom severity and functional impairment ($p < 0.001$), despite overall minimal symptoms and preserved hand function on BCTQ scores. This study concludes that multiparous women may develop early clinical signs of carpal tunnel syndrome before significant symptoms or functional impairment appear. Objective assessment, particularly Phalen's test, is essential for early detection, supporting timely preventive strategies to maintain hand function and improve maternal quality of life.

Keywords: *Carpal Tunnel Syndrome, Multiparous mothers, Hospitals, Parity*

INTRODUCTION

Pregnancy brings the gift of life but for many multigravida women, it also brings the silent grip of Carpal Tunnel Syndrome. Carpal tunnel syndrome (CTS) is a form of peripheral neuropathy affecting the upper limb. It occurs when the median nerve is compressed within the carpal tunnel in the wrist[1].

CTS is more common in females as comparison to males and occurs mostly in pregnancy as the hormones are playing part in the development of the baby [2].The prevalence of carpal tunnel syndrome among multigravida women came out to be 41% including mild, moderate, and severe symptoms, as they can vary from person to person [3].The relationship between parity and CTS incidence, with multiparous women demonstrating substantially higher rates of CTS compared to primiparous women. The chances of median

nerve compression increase with the number of pregnancies a woman experiences during her reproductive lifespan. The association between multiparity and CTS is well-established in recent literature [4]. The median nerve arises from the brachial plexus (C6–T1) and progresses down the arm and forearm before entering the hand through the carpal tunnel [5]. As the median nerve gives the motor innervation to the small muscles of the anterior compartment of the forearm except for flexor carpi ulnaris and the ulnar half of flexor digitorum profundus and sensory innervation to the palmar side of the thumb, 2nd and 3rd digit and radial side of 4th digit [6, 7]. The likelihood of developing CTS rises with advancing age. Certain anatomical and physiological characteristics, such as a smaller carpal tunnel, also contribute to this risk. Jobs that involve repetitive hand motions, particularly typing, increase the chances of developing the condition. Women have a higher susceptibility compared to men. Additionally, factors such as pregnancy and specific health issues like obesity, diabetes, arthritis, and metabolic syndrome play a role. A history of wrist trauma or injury can also elevate the risk [8].

The sign and symptoms of CTS includes such as numbness in the fingers or arms in various positions or during consecutive activities constitute the first manifestation of CTS. Nocturnal paresthesia, discomfort, and a feeling of swelling over the hand's median nerve are always present in CTS patients the symptoms may appear with more intensity at night than in the daytime [9]. A key feature of night-time exacerbation of symptoms is that patients often wake up with numbness or have to "shake out" the hand for relief (*"flick sign"*)[10]. The reason for the increase in severity of symptoms appearing more at night is due to the shift in the lymphatic drainage of the upper limb in the supine position, the absence of a muscle pump mechanism that greatly aids in the outflow of interstitial fluid in the carpal tunnel, the bending of the wrist, which increases intra-canalicular pressure, a later-night spike in blood pressure, and a decrease in cortisol hormone these all alone or combine causes the symptoms to intensify during the night time [11]. These symptoms, which include thumb motor weakness and, in more severe cases, wasting of the abductor pollicis brevis (APB) muscle, are associated with substantial deficits in hand use and varied degrees of disability [12].

The carpal tunnel is a slender passage found at the wrist, surrounded by specific anatomical structures that form a rigid conduit for tendons and the median nerve. The base, or dorsal side, is created by the proximal row of carpal bones, and in some accounts, parts of the distal row, which together form the concave bony arch that defines the floor of the tunnel. The roof, or palmar side, is made up of the transverse carpal ligament, also referred to as the flexor retinaculum, which spans from the radial to the ulnar side of the wrist, effectively sealing the tunnel and preserving its structural stability [13]. On the radial (lateral) wall, the boundaries are formed by the scaphoid tubercle and trapezium, while the ulnar (medial) wall is delineated by the pisiform and hook of the hamate .Together, these structures create a rigid osteofibrous canal through which nine flexor tendons and the median nerve pass making it both a vital and vulnerable anatomical space [14].

The contents of Carpal tunnel are median nerve, the nine tendons of the extrinsic flexors of the thumb and fingers, and other connective tissues [15]. The Pathophysiology of CTS is related to a combination of two processes: compression and traction mechanisms, the compression mechanism results from an increase in carpal tunnel pressure. Normally, in a healthy subject, the pressure in the carpal tunnel ranges between 2.5 to 13mmHg. However, the pressure may increase to dangerous levels exceeding 20–30 mmHg in CTS patients.The traction mechanism is due to repetitive traction and wrist movements [16]. CTS involves the interaction between internal factors (anatomical variation, tissue swelling) and external stressors (repetitive use), resulting in increased tunnel pressure that compresses the nerve and impedes normal neural transmission, thus explaining the characteristic numbness, pain, and weakness [17].

During pregnancy, elevated levels of estrogen, progesterone, aldosterone, cortisol, and prolactin cause hormonal and fluid changes that lead to edema and reduced venous return.Rising relaxin levels from the 18th week contribute to ligament relaxation and joint laxity. High relaxin levels can also cause the carpal

ligament to relax, which can then cause the median nerve to become inflamed, flatten, enlarge, and impinge.These combined effects increase pressure within the carpal tunnel, resulting in median nerve inflammation and compression. These changes typically occur during the time period of pregnancy especially in the the trimester and are reversible but in some cases these changes persist post pregnancy and leads to chronic carpal tunnel syndrome in multigravida mothers [18]. Most CTS studies focus on general populations or occupational groups,even many researches have been done on pregnant women during their pregnancy or in their third trimester not specifically on multiparous women.CTS symptoms can persist postpartum and impact daily activities, childcare, and quality of life. That is why this research will provide an insight on multiparous population and it will provide basis for early diagnosis and treatment so that the quality of mother's life postpartum gets better and she can provide optimum care to new life that she birthed.

CTS is diagnosed through history taking, physical examination and supporting examinations. During history taking patients usually complain of tingling, numbness, and pain that exacerbates at night. Weakness, stiffness, and the change in temperature are also frequent. Then upon physical examination mild cases of CTS do not show any findings but to exclude other causes clinicians perform physical examination like they check sensory and motor function of the effected side and then compare it to the other side, the most commonly used tests during physical examination are Phalen's test and Tinel's test, Phalen's test and Durkan's test [6]. The diagnostic yield of Phalen's test (33.1% positive) versus Durkan's compression test (55.4% positive), indicating that Durkan's test may be more sensitive for detecting CTS [19].

Evaluation of the nerve with ultrasound (US) can help with perineural care and detect potential compression neuropathy.Changes in nerve caliber and muscle perfusion can help to diagnose median nerve neuropathies if sufficiently severe [20]. The diagnosis of CTS used to be a clinical one. However, because Electrodiagnostic studies offer objective criteria for prediction and causative evaluation, electrodiagnostic investigations (EDX) are now typically used for diagnosis. Additionally, it helps in CTS diagnosis confirmation and severity grading [6]. Treatment Options for CTS vary from conservative to non-conservative. The conservative treatment is considered the safest option for the treatment of CTS as it has little or no side effects if used properly [1]. For the CTS, there are several conservative therapy options. Neuromobilization is a manual therapy treatment that modifies the physiological characteristics of nerves. Patients with CTS may benefit from its methods, particularly the sliding approach [21]. Fist Flexion Exercise is another carpal ligament gliding exercise recommended to affected CTS individuals this exercise aims to reduce median nerve pressure and improve circulation within the carpal tunnel. This exercise is performed with the wrist kept neutral, the fingers move sequentially through five positions that are: straight, hook fist, straight fist, full fist, and straight hand, promoting ligament stretch, fluid drainage, and nerve mobility to help relieve CTS symptoms [22]. Others includes braces as the American Academy of Orthopedic Surgeons (AAOS) guidelines suggests that immobilizing the wrist has strong beneficial outcome [1]. Nowadays accupuncture is gaining more popularity as many studies has showed that accupuncture has more positive effects than the techniques like night splinting also that accupuncture has showed more effects than the oral NSAIDS, However it cannot be used alone as a treatment option for the CTS but it can be used as an adjunct therapy with the Physiotherapy combined with physiotherapy it can have more faster prognosis as comparison to physiotherapy alone [23]. Non-surgical approaches involve the use of nonsteroidal anti-inflammatory drugs (NSAIDs) or receiving corticosteroid injections in the carpal tunnel to reduce inflammation of the synovial tissue. Additionally, ultrasound has proven to be effective in both diagnosing and treating carpal tunnel syndrome (CTS). While the mechanism is not fully understood, the application of high-frequency waves can have anti-inflammatory effects and improve nerve conduction [1]. The surgical management is the last choice of management for CTS as it is done when conservative managements has failed to produce any outcome. The most commonly used surgical approaches are open carpal tunnel release and endoscopic carpal tunnel release the aim of both of them is to reduce compression on the median nerve at the transverse ligament with in the carpal tunnel [24].

METHODOLOGY

Study Design*:*

The study was a Cross-sectional study.

Sampling Technique*:*

The sampling technique was Non-Probability Convenience Sampling. The sample of the study selected through tertiary care teaching hospitals in Karachi including Abbasi Shaheed Hospital, Jinnah Postgraduate Medical Center JPMC Karachi and Indus Hospital Karachi.

Outcome Measures*:*

During the course of this research, the following parameter, Phalen's test to confirm CTS, symptoms and functional status due to carpal tunnel syndrome was evaluated through the Boston Carpal Tunnel Questionnaire BCTQ.

Data Analysis*:*

Data analysis was performed using SPSS software. Graphic measurements, such as means and standard deviations, were used to account for quantitative factors. To determine any importance association between subjective variables, the Chi-square test was used. (A P-value of 0.05 is considered enormous).

Ethical Considerations:

Ethical approval for this study was obtained from the institutional review board of the respective universities involved. All participants were clearly informed about the purpose, procedures, and voluntary nature of the research before data collection. Participation was completely voluntary, and mothers were given the option to withdraw at any point without any consequences. Written informed consent was obtained from each participant, and anonymity and confidentiality of the data were strictly maintained. The data collected was stored securely and used solely for academic research purposes. The study involved no physical or psychological risk to the participants and did not interfere with their personal activities. There were no conflicts of interest declared by the researchers.

Reliability:

To ensure the reliability of the data collection tools, the internal consistency of the standardized questionnaire Boston Carpal Tunnel Questionnaire was evaluated using Cronbach's alpha through SPSS software. A Cronbach's alpha value between 0.70–0.79 is considered acceptable,0.80–0.89 indicates good internal consistency, and 0.90 or above is regarded as excellent. In this study, the Cronbach's alpha analysis indicates that the Boston Carpal Tunnel Questionnaire (BCTQ) demonstrates excellent internal consistency across both symptom and functional domains. The overall BCTQ scale, combining all 19 items, had a Cronbach's alpha of 0.972, confirming that the questionnaire is highly reliable for measuring both the severity of hand/wrist symptoms and associated functional limitations in this population. These results suggest that the scale items are strongly interrelated and consistently capture the constructs they are intended to measure.

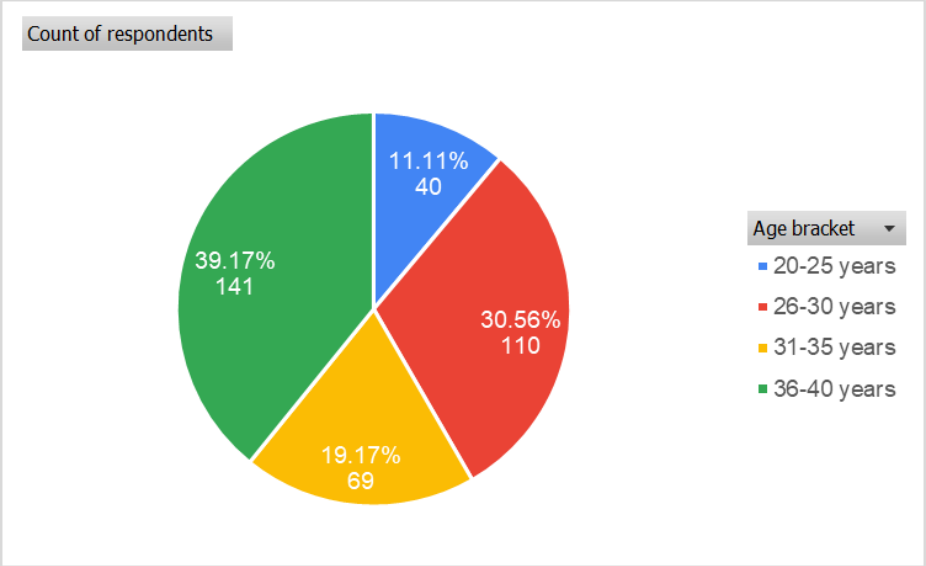
RESULTS AND FINDINGS

Introduction

This chapter presents the results of the cross-sectional study conducted among 360 mothers from various tertiary care teaching hospitals in Karachi. . The data was analyzed using SPSS (Statistical Package for Social Sciences), with descriptive and inferential statistics applied to assess the prevalence of CTS among multiparous mothers and its association with increasing parity.

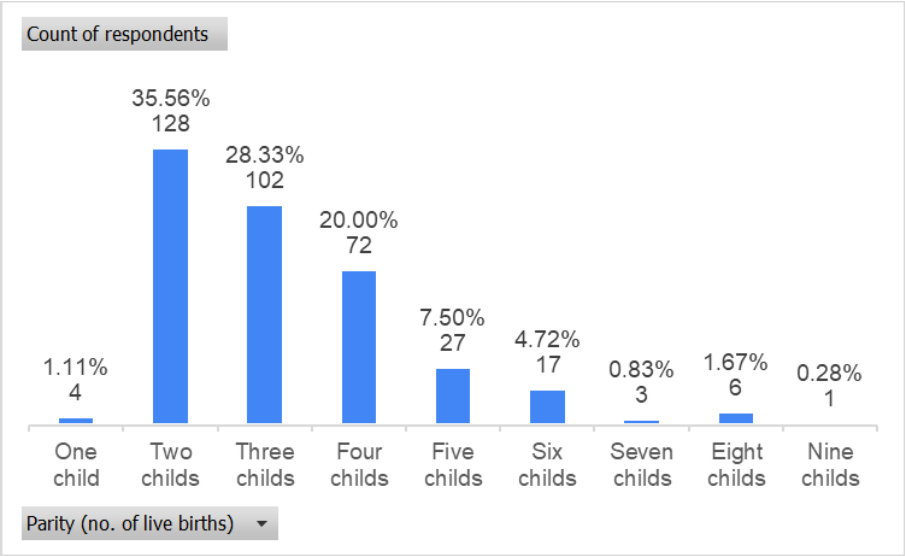
Demographic Characteristics of Respondents:

Chart 1: Age-wise population: Showing break-up of population w.r.t. age of respondents.



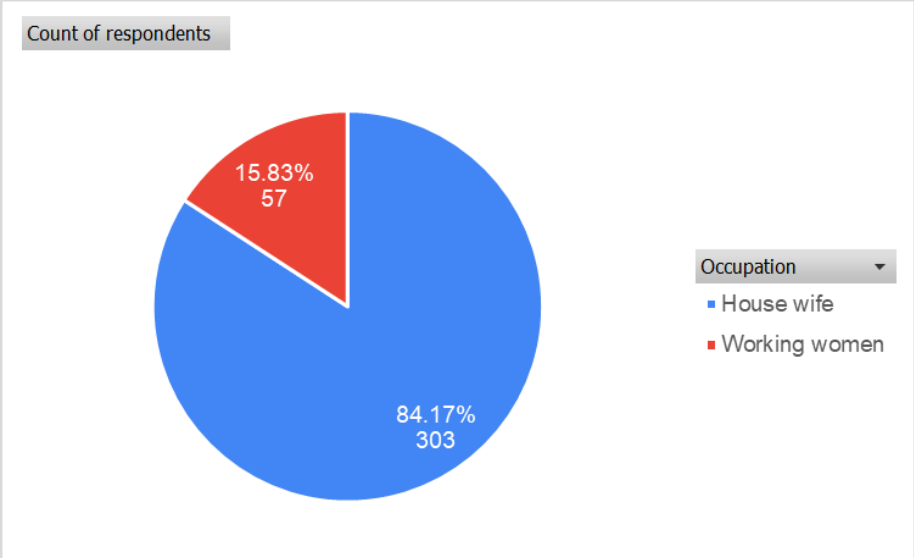
The age-wise distribution of respondents shows a varied representation across different age brackets. Out of a total of 360 respondents, the 36–40 years age group constituted the largest proportion, with 141 individuals (39.2%), indicating that a substantial segment of the study population belonged to a more mature working-age group. This was followed by the 26–30 years age bracket, which included 110 respondents (30.6%), reflecting strong participation from early-career adults. The 31–35 years group comprised 69 respondents (19.2%), representing nearly one-fifth of the sample and suggesting moderate representation of mid-career individuals. In contrast, the 20–25 years age group had the smallest share, with 40 respondents (11.1%), indicating comparatively lower participation from younger adults. Overall, the distribution suggests that the study population was predominantly composed of individuals aged 26–40 years, highlighting greater involvement from participants likely to have longer exposure to occupational or lifestyle-related factors relevant to the study outcomes.

Chart 2: Count of child-wise population: Showing break-up of population w.r.t. count of child of respondents.



The distribution of respondents according to the number of children shows clear variation, with the majority having two to four children. Out of a total of 360 respondents, the largest proportion reported having two children, accounting for 128 respondents (35.6%), followed by those with three children, comprising 102 respondents (28.3%). Respondents with four children represented 72 individuals (20.0%), indicating that a considerable segment of the study population had relatively larger families. Smaller proportions were observed among respondents with five children (27 respondents; 7.5%) and six children (17 respondents; 4.7%). Very few participants reported having seven children (3 respondents; 0.8%), eight children (6 respondents; 1.7%), or nine children (1 respondent; 0.3%). The smallest group consisted of respondents with one child, totaling 4 individuals (1.1%). Overall, the findings indicate that most respondents had two to three children, suggesting a predominance of moderate family size within the study population.

Chart 3: Occupation-wise population: Showing break-up of population w.r.t. occupation of respondents.



The occupational distribution of respondents indicates a predominance of housewives in the study sample. Out of a total of 360 respondents, 303 participants (84.2%) reported being housewives, while 57 respondents (15.8%) were working women. This marked difference suggests that the study population was largely composed of women not engaged in formal employment, which may influence lifestyle patterns, daily physical activity levels, healthcare access, and exposure to occupational stressors. The relatively smaller proportion of working women indicates limited representation of formally employed females, and this imbalance should be considered when interpreting the study findings, particularly in relation to variables that may be affected by occupational status.

Descriptive Statistics

Table 1: Descriptive Analysis of demographics Scale:

Elements	N	Min.	Max.	Mean	SD	Variance
Age	360	1.00	4.00	2.86	1.06	1.13
Parity (No. of live births)	360	1.00	9.00	3.25	1.39	1.92
Occupation	360	1.00	2.00	1.16	0.37	0.13
Phelen test	360	0.00	1.00	0.27	0.44	0.20

The descriptive statistics summarize the key characteristics of the study population. Age, coded into four categories, had a mean value of 2.86 ± 1.06 with a variance of 1.13, indicating that most respondents were concentrated in the higher age brackets, with a moderate spread across categories. Parity (number of live births) ranged from 1 to 9, with a mean of 3.25 ± 1.39 and a variance of 1.92, reflecting that, on average, respondents had three children, while also showing noticeable variability in family size within the sample. Occupation, coded dichotomously, showed a mean of 1.16 ± 0.37 and a low variance (0.13), which is consistent with the predominance of housewives in the study population and limited dispersion between occupational categories. The Phalen's test outcomes, recorded as a binary variable (0 = negative, 1 = positive), had a mean of 0.27 ± 0.44 with a variance of 0.20, indicating that approximately 27% of respondents demonstrated a positive Phalen's test, suggestive of possible median nerve compression or carpal tunnel syndrome. Overall, these statistics indicate a predominantly older, multiparous, non-working female population with a notable proportion exhibiting clinical signs consistent with carpal tunnel involvement.

Table 2: Descriptive Analysis of BCTQ-Symptom severity Scale:

BCTQ-Symptom severity	N	Min.	Max.	Mean	SD	Variance
How severe is the hand or wrist pain that you have at night?	360	1	5	1.41	0.71	0.50
How often did hand or wrist pain wake you up during a typical night in the past 2 weeks?	360	1	5	1.42	0.71	0.50
Do you typically have pain in your hand/wrist during the daytime?	360	1	3	1.41	0.66	0.43
How often do you have hand/wrist pain during daytime?	360	1	4	1.37	0.70	0.48
How long on average does an episode of pain last during the daytime?	360	1	5	1.33	0.61	0.37
Do you have numbness in your hand/wrist?	360	1	5	1.44	0.71	0.50
Do you have weakness in your hand/wrist?	360	1	4	1.44	0.72	0.52
Do you have tingling sensations in your hand?	360	1	4	1.41	0.68	0.46
How severe is numbness (loss of sensation) or tingling at night?	360	1	4	1.44	0.71	0.50
How often did hand weakness or tingling wake you up during a typical night during the past two weeks?	360	1	5	1.42	0.68	0.47
Do you have difficulty with the grasping and use of small objects such as keys or pens?	360	1	4	1.21	0.51	0.26

The Boston Carpal Tunnel Questionnaire (BCTQ) – Symptom Severity Scale results indicate that, overall, respondents experienced low levels of hand and wrist symptoms. Across all items, mean scores ranged from 1.21 to 1.44, which are close to the minimum possible values, suggesting that most participants reported mild or minimal symptoms. Night-time symptoms were relatively infrequent, as reflected by low mean scores for severity of nocturnal hand or wrist pain (1.41 ± 0.71) and frequency of pain waking respondents at night (1.42 ± 0.71). Similarly, daytime pain presence and frequency showed low average scores (1.41 ± 0.66 and 1.37 ± 0.70, respectively), indicating limited daytime discomfort. The average duration of daytime

pain episodes was also minimal (mean = 1.33 ± 0.61), suggesting that when pain occurred, it was typically short-lived. Sensory symptoms, including numbness, tingling, and hand weakness, demonstrated consistently low mean values (approximately 1.41–1.44), with moderate standard deviations, indicating slight variability among respondents but an overall tendency toward mild symptoms. The severity of nocturnal numbness or tingling and the frequency of sleep disturbance due to weakness or tingling were similarly low, reinforcing the finding of minimal night-time functional disruption. Finally, difficulty in grasping and using small objects had the lowest mean score (1.21 ± 0.51), suggesting that most respondents did not experience significant functional impairment in fine motor tasks. Collectively, these findings suggest that while symptoms consistent with carpal tunnel syndrome were present in a subset of participants, the overall symptom burden in the study population was predominantly mild.

Table 3: Descriptive Analysis of BCTQ-Functional limitation Scale:

BCTQ-Functional limitations	N	Min.	Max.	Mean	SD	Variance
Writing	360	1	4	1.14	0.46	0.21
Buttoning of cloths	360	1	4	1.16	0.49	0.24
Holding a book while reading	360	1	5	1.19	0.56	0.31
Gripping a telephone handle	360	1	4	1.21	0.52	0.27
Opening of jars	360	1	5	1.38	0.71	0.51
Household chores	360	1	5	1.49	0.85	0.72
Carrying of grocery basket	360	1	5	1.44	0.79	0.63
Bathing & dressing	360	1	5	1.19	0.57	0.33

The Boston Carpal Tunnel Questionnaire (BCTQ) – Functional Limitations Scale findings indicate that the study population experienced minimal functional impairment in daily activities related to hand and wrist use. Mean scores across all functional items ranged from 1.14 to 1.49, which are close to the minimum scale value, suggesting that most respondents reported no to mild difficulty in performing routine tasks. Activities requiring fine motor skills, such as writing (mean = 1.14 ± 0.46) and buttoning clothes (1.16 ± 0.49), showed the lowest mean scores, indicating that the majority of participants were able to perform these tasks without noticeable difficulty. Similarly, holding a book while reading (1.19 ± 0.56) and gripping a telephone handle (1.21 ± 0.52) were associated with minimal limitations, reflecting preserved hand function in most respondents. Tasks that demand greater grip strength and sustained hand use demonstrated slightly higher mean scores. Opening jars (1.38 ± 0.71), household chores (1.49 ± 0.85), and carrying a grocery basket (1.44 ± 0.79) showed comparatively greater variability, as indicated by higher standard deviations and variances, suggesting that a subset of respondents experienced mild difficulty with these

Table 4: Chi-Square Tests:

Test Element	Pearson Chi-Square	p-value	Result
Age * Symptom severity	3.729	0.713	Null hypothesis accepted (Insignificant relationship)
Age * Functional limitation	12.644	0.179	Null hypothesis accepted (Insignificant relationship)
Age * Combined impact	11.813	0.066	Null hypothesis accepted (Insignificant relationship)
Occupation * Symptom severity	1.541	0.463	Null hypothesis accepted (Insignificant relationship)
Occupation * Functional limitation	1.746	0.627	Null hypothesis accepted (Insignificant relationship)
Occupation * Combined impact	1.045	0.593	Null hypothesis accepted (Insignificant relationship)
Phelen test * Symptom severity	152.099	0.000	Null hypothesis rejected (Significant relationship)
Phelen test * Functional limitation	57.788	0.000	Null hypothesis rejected (Significant relationship)
Phelen test * Combined impact	78.376	0.000	Null hypothesis rejected (Significant relationship)
Parity (No. of live births) * Symptom severity	10.761	0.824	Null hypothesis accepted (Insignificant relationship)
Parity (No. of live births) * Functional limitation	12.240	0.977	Null hypothesis accepted (Insignificant relationship)
Parity (No. of live births) * Combined impact	13.783	0.615	Null hypothesis accepted (Insignificant relationship)

The Chi-square analysis highlights the relationships between demographic and clinical variables and the dependent outcomes—Symptom Severity, Functional Limitation, and Combined Impact. Age, Occupation, and Parity: Across all three outcome measures, there were no significant associations with age, occupation, or number of live births, as indicated by p-values greater than 0.05 (e.g., Age * Symptom Severity: $\chi^2 = 3.729$, $p = 0.713$; Occupation * Functional Limitation: $\chi^2 = 1.746$, $p = 0.627$; Parity * Combined Impact: $\chi^2 = 13.783$, $p = 0.615$). This suggests that these demographic factors do not significantly influence hand/wrist symptom severity, functional limitations, or overall impact in the study population. Phalen's Test: In contrast, the Phalen's test showed highly significant relationships with all three outcomes. Symptom severity ($\chi^2 = 152.099$, $p < 0.001$), functional limitation ($\chi^2 = 57.788$, $p < 0.001$), and combined impact ($\chi^2 = 78.376$, $p < 0.001$) were all significantly associated with a positive Phalen's test. This indicates that median nerve compression, as assessed by the Phalen's test, is strongly linked to both the intensity of symptoms and the degree of functional impairment, and it is a key predictor of overall hand/wrist disability in this population. Overall, these findings emphasize that clinical signs (Phalen's test) are more relevant than demographic characteristics in determining symptom burden and functional limitations related to hand and wrist issues.

Prevalence of Carpal Tunnel Sundrome:

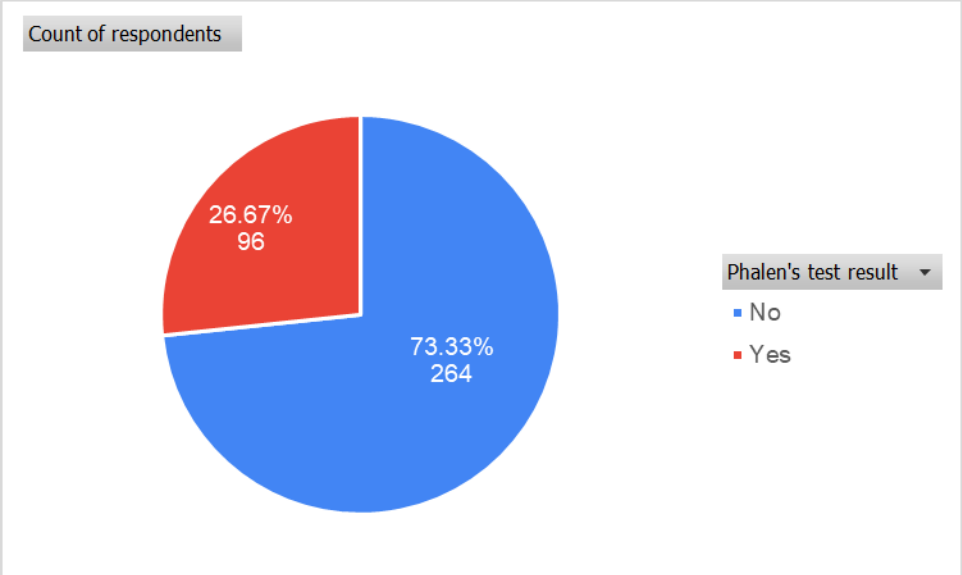


Chart 4: Phalen's test Distribution

The distribution of respondents based on the Phalen's test shows that the majority of the study population tested negative for median nerve compression, while a smaller proportion tested positive. Out of a total of 360 respondents, 264 participants (73.3%) had a negative Phalen test, indicating no clinical signs of carpal tunnel involvement. In contrast, 96 participants (26.7%) had a positive Phalen's test, suggesting the presence of median nerve compression in approximately one-fourth of the sample. This distribution indicates that while most respondents did not exhibit clinical symptoms detectable by the Phalen's maneuver, a notable subset (over a quarter) demonstrated potential nerve compression, which aligns with the symptom and functional limitation patterns observed in the study population. The relatively high prevalence of positive Phalen's test highlights the clinical relevance of median nerve assessment for identifying individuals at risk of hand and wrist dysfunction.

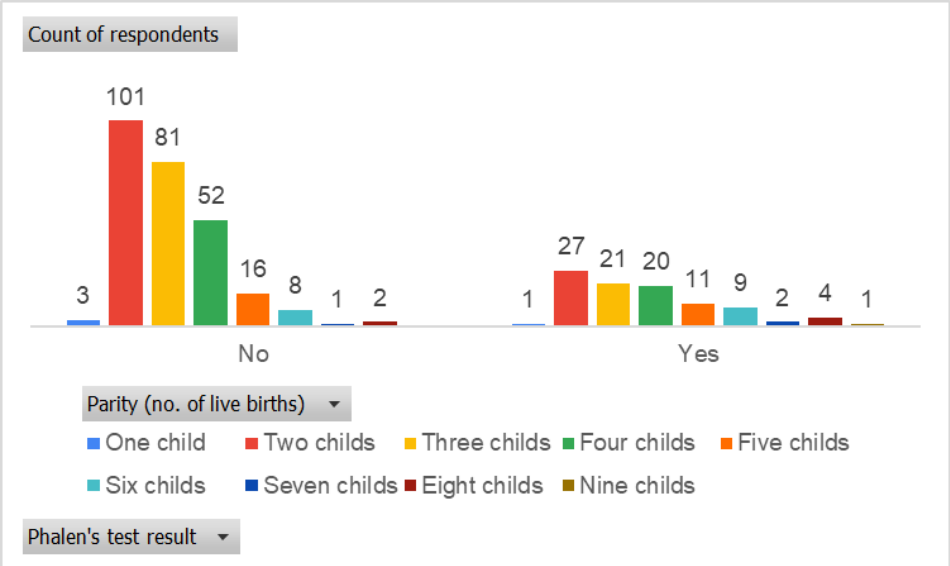


Chart 5: Parity wise Distribution of Phalen's test

The distribution of Phalen's test results according to the number of children shows how median nerve compression varies with parity. Among respondents with one child, 3 (75.0%) tested negative and 1 (25.0%) tested positive. In those with two children, 101 (79.0%) were negative and 27 (21.0%) were positive, while for three children, 81 (79.4%) were negative and 21 (20.6%) were positive. In the four children group, 52 (72.2%) tested negative and 20 (27.8%) positive. Among respondents with five children, 16 (59.3%) were negative and 11 (40.7%) positive, and for six children, 8 (47.1%) were negative and 9 (52.9%) positive. For larger families, seven children showed 1 (33.3%) negative and 2 (66.7%) positive, eight children had 2 (33.3%) negative and 4 (66.7%) positive, and nine children had 0 negative and 1 (100%) positive. These findings indicate that the proportion of positive Phalen's tests increases with higher parity, suggesting that women with more children may be at greater risk of median nerve compression and associated hand/wrist symptoms.

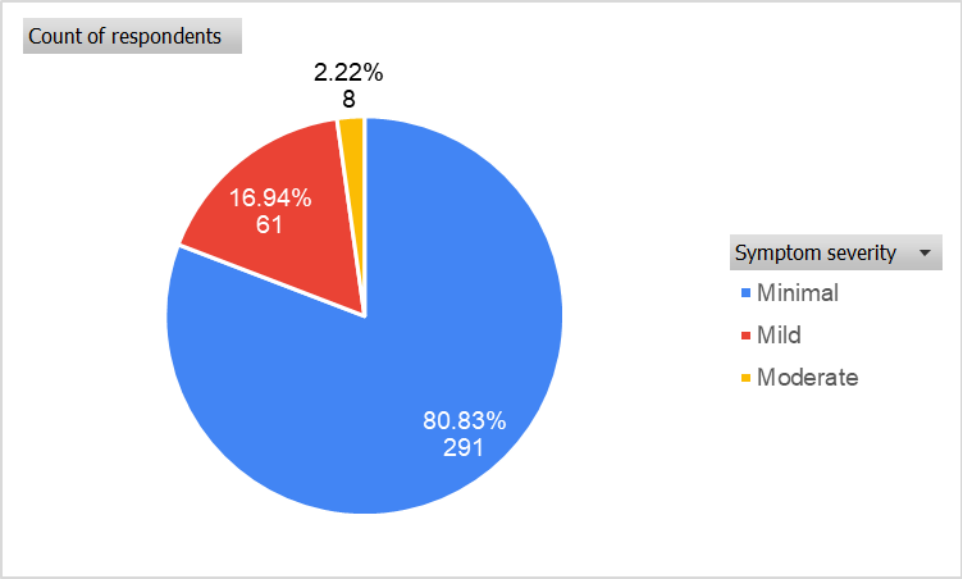


Chart 6: Symptom Severity Distribution

The distribution of symptom severity among respondents indicates that the majority experienced minimal symptoms related to hand and wrist issues. Out of a total of 360 participants, 291 individuals (80.8%) reported minimal symptom severity, 61 respondents (16.9%) experienced mild symptoms, and only 8 participants (2.2%) reported moderate symptoms. This suggests that while hand and wrist discomfort was present in the population, it was predominantly mild or minimal, with very few respondents experiencing more pronounced symptoms. These findings highlight that most participants had low symptom burden, which aligns with the relatively low scores observed in the BCTQ Symptom Severity scale.

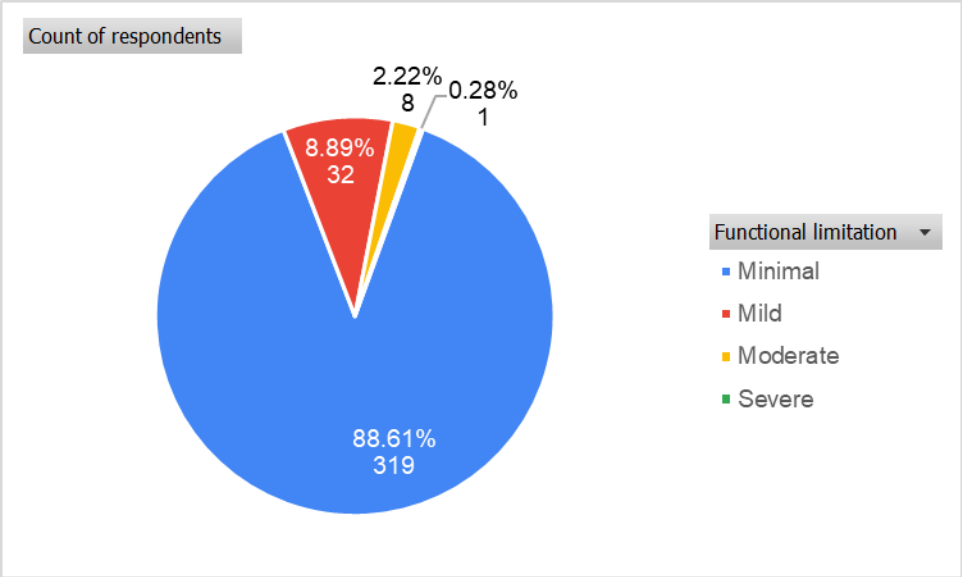


Chart 7: Distribution of functional limitations

The distribution of functional limitations among respondents indicates that the majority experienced minimal difficulties in performing daily activities involving the hand and wrist. Out of 360 participants, 319 individuals (88.6%) reported minimal functional limitations, 32 respondents (8.9%) experienced mild limitations, 8 participants (2.2%) had moderate limitations, and only 1 respondent (0.3%) reported severe functional impairment. These findings suggest that most participants retained good hand function, with only a small proportion experiencing mild to moderate difficulties, and severe functional limitations were rare. Overall, the data indicate a predominantly low functional burden in the study population, consistent with the low symptom severity scores reported.

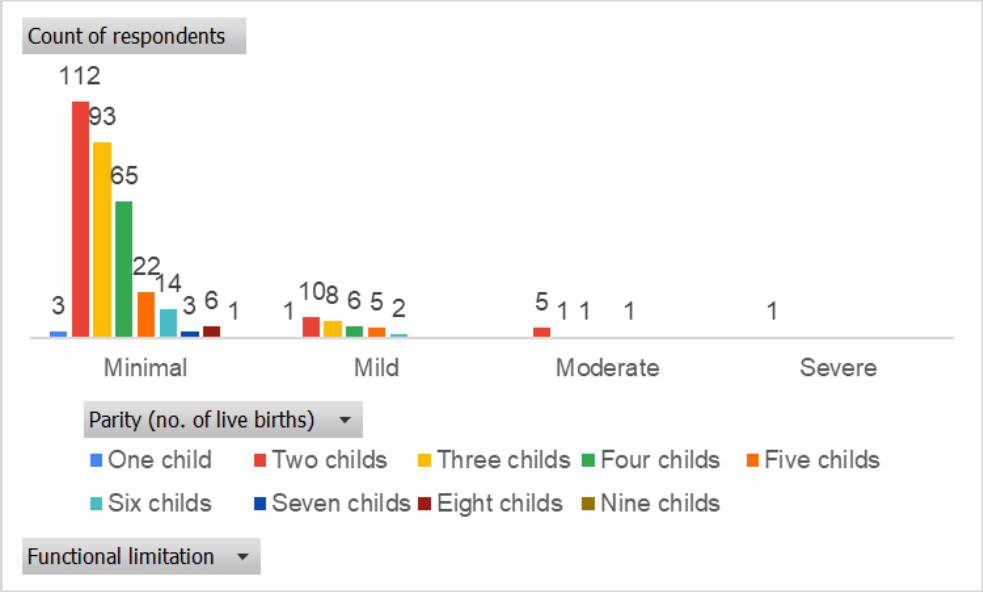


Chart 8: Parity wise distribution of functional limitations

The distribution of functional limitations according to parity shows that the majority of respondents across all parity groups experienced minimal difficulties in performing hand and wrist activities. Among participants with one child, 3 respondents (75.0%) reported minimal limitations and 1 (25.0%) had mild limitations. In the two children group, 112 individuals (86.2%) experienced minimal limitations, 10 (7.7%) mild, 5 (3.8%) moderate, and 1 (0.8%) severe limitation. For those with three children, 93 respondents (81.6%) reported minimal limitations, 8 (7.0%) mild, and 1 (0.9%) moderate. In the four children group, 65 participants (78.3%) had minimal limitations, 6 (7.2%) mild, and 1 (1.2%) moderate limitation. Among participants with five children, 22 (64.7%) experienced minimal limitations and 5 (14.7%) mild limitations. In the six children group, 14 (58.3%) had minimal limitations, 2 (8.3%) mild, and 1 (4.2%) moderate limitation. For seven children, 3 (50.0%) had minimal and 1 (16.7%) mild limitation. In the eight children group, 6 participants (60.0%) reported minimal limitations. The nine children group had 1 participant with minimal limitations. These findings suggest that minimal functional limitations predominate across all parity groups, but the proportion of mild, moderate, and severe limitations tends to increase slightly with higher parity, indicating that women with more children may experience a greater functional burden related to hand and wrist activities.

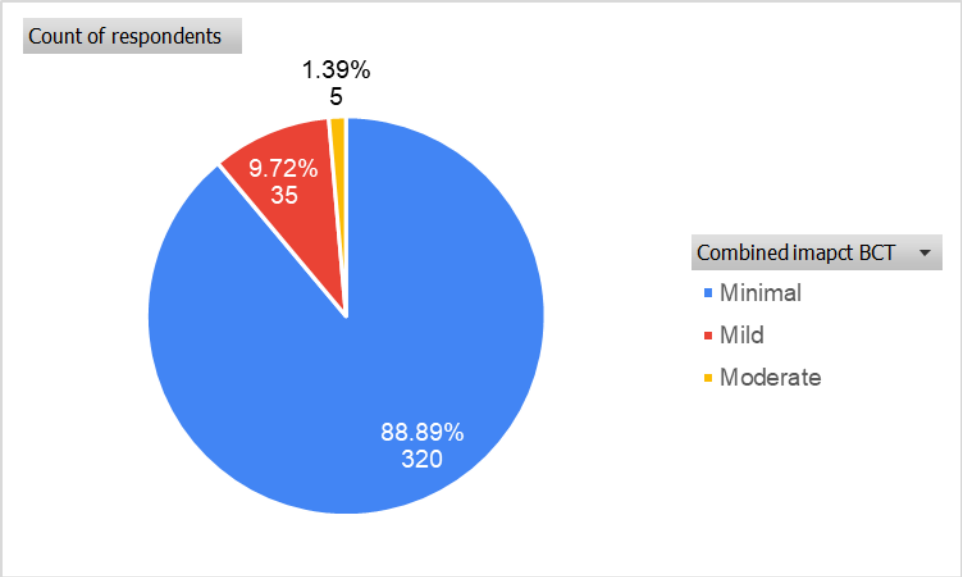


Chart 9: Combined BCTQ impact

The distribution of the combined BCTQ impact indicates that the majority of respondents experienced a minimal overall burden from hand and wrist symptoms and functional limitations. Out of 360 participants, 320 individuals (88.9%) reported minimal combined impact, 35 respondents (9.7%) experienced mild impact, and only 5 participants (1.4%) reported moderate impact. These findings suggest that the overall burden of hand and wrist problems in the study population is predominantly low, with a small proportion of respondents experiencing mild to moderate combined effects on symptoms and functional ability.

STUDY LIMITATIONS

The methodology of this study, while comprehensive, has several limitations that may affect the interpretation and generalizability of the findings. The use of an observational cross-sectional design limits the ability to establish causal relationships between risk factors such as parity, workload, and CTS development, as data are collected at a single point in time. Additionally, the non-probability convenience sampling technique may introduce selection bias, as participants recruited from tertiary care teaching

hospitals may not represent the broader population of multiparous mothers in Karachi. There was uneven distribution of mothers with higher parity which made p value to come higher than 0.05 . The reliance on self-reported data via questionnaires, including the Boston Carpal Tunnel Questionnaire, may be subject to recall bias or subjective reporting.

RECOMMENDATIONS FOR FUTURE RESEARCH

To cope with the limitations of this research model, several strategies can be implemented. Although the cross-sectional design limits causal inference, future studies could adopt longitudinal or cohort designs to track CTS development over time. Sampling bias can be reduced by recruiting participants from community health centers or through home visits and, where possible, using probability sampling to improve generalizability. Next studies should evenly distribute sample with parity. Self-report bias may be minimized by combining questionnaires with objective clinical assessments, such as nerve conduction studies or ultrasound.

CONCLUSION

The study highlights that multiparous mothers, particularly those in the 20–40-year age group, are susceptible to Carpal Tunnel Syndrome (CTS) due to repetitive hand use, hormonal changes, and multiple pregnancies. While CTS is known to be more prevalent in females and during pregnancy, this research specifically examines its occurrence among multiparous women in tertiary care hospitals in Karachi. The findings indicate that 27% of participants tested positive on the Phalen's test, yet overall symptom severity and functional limitations were minimal, suggesting that clinical signs may precede significant disability. Correlation analyses confirmed strong associations between nocturnal pain, numbness, and weakness, while functional tasks remained largely preserved.

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CONFLICT OF INTERST

No financial or commercial ties were existent as to raise the potential for conflict of interest during the research was being conducted.

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