RESEARCH ARTICLE

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Prevalence of Carpal Tunnel Syndrome Among Computer Users Working in Banks of Kolhapur City

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Abstract

Background: The present study investigates the prevalence of Carpal Tunnel Syndrome (CTS) among computer users employed in banks within Kolhapur city. The research utilizes the Boston Carpal Tunnel Syndrome Questionnaire (BCTSQ) and Phalen's test as outcome measures. Prior studies have indicated an increased risk of CTS associated with prolonged computer usage, particularly exceeding four hours per day. The study found that 31.10% of the population tested positive for Phalen's test, indicating a potential presence of CTS. A comparative analysis showed a correlation between years of experience and the likelihood of a positive Phalen test result, with higher rates observed in individuals with longer tenure. The present study underscores the importance of recognizing and addressing the prevalence of CTS among computer users, particularly within the banking sector. It highlights the need for ergonomic interventions and preventive measures to mitigate the risk of CTS development and improve the occupational health and well-being of employees. **Study Design:** Cross-sectional **Methods:** This observational study was conducted on the banks of Kolhapur City. Around 140 subjects were approached and 90 who met the inclusion and exclusion criteria were interviewed in person. Data was collected using the BCTQ. A special test was performed on the subjects. Data was analyzed and prevalence was determined. **Results:** 31.10% of the population showed a positive Phalen's test. On the BCTQ, 61.11% of the population had no symptoms. 13.33% of the population had mild symptoms. 18.88% of the population had moderate symptoms. 6.66% of the population had severe symptoms. **Conclusion:** This study concludes that there is a 31.10% prevalence among computer users working in the banks of Kolhapur city. The prevalence of carpel tunnel syndrome is higher in bank workers due to repetitive loading. Hence it is a need of cause to make the bank workers aware about the same. **Major findings:** 1. This study concludes that there is a 31.10% prevalence among computer users working in the banks of Kolhapur city. 2. On the BCTQ, 61.11% of the population had no symptoms. 13.33% of the population had mild symptoms.

Keywords: Boston Carpal Tunnel Syndrome Questionnaire, Carpal Tunnel Syndrome, Median Nerve Compression, Neuropathy, Phalen's Test

1. Introduction

The carpal tunnel is a small, rigid fibrous-osseous region that serves as the body's closed compartment. At the hand's base (wrist), with the transverse carpal ligament forming the top. Tendons connect these two structures, enabling finger mobility. The thumb, index finger, long finger, and half of the ring finger receive sensation from the median nerve, which passes through the arm and forearm and enters the hand through the carpal tunnel[1].

Carpal Tunnel Syndrome (CTS) is the term for the sensory and motor dysfunction caused by compression of the median nerve in the carpal tunnel[2]. Compression and traction events are combined in entrapment neuropathy. Several variables come together to cause this illness, such as changes in the supporting connective tissue brought on by nerve compression and traction, lesions affecting the myelin sheath and axon, and problems of the intraneural microcirculation. When a peripheral nerve passes through an anatomical compartment that has

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grown too constricted, it can entrap it and cause damage or dysfunction to the nerve both proximally and distally from the site of compression[3].

The most prevalent type of nerve entrapment syndrome is caused by compression (squeezing) of the median nerve in the carpal tunnel. While 47% of instances of CTS are idiopathic (cause unknown), there are other possible causes, including several procedures that reduce carpal tunnel space. Pinching the median nerve within the carpal tunnel is one of the characteristics of CTS. The ten synovia, which envelop the tendons in the carpal tunnel, is expanding, causing this compression. The muscles enlarge because of irritation brought on by the exposures mentioned in the next section. A lubricating substance known as synovium is secreted by the protective sheaths encircling the tendons. The synovium secretion further reduces the space within the carpal tunnel, exacerbating the irritation of the muscle tendons as they brush against one another. Consequently, to lessen the irritation, additional synovium is secreted. The condition known as CTS is the result. There is less space inside the carpal tunnel because of the tendons' current irritation and inflammation and the development of synovium in the protective sheaths. As a result, the median nerve, which passes through the carpal tunnel as well, is impacted. A person experiences tingling and pain because of this impingement[1].

Activities that involve prolonged or repetitive wrist flexion, extension, or clutching can cause carpal tunnel syndrome[2]. Due to the widespread use of computers in office automation over the past few decades, a fast-growing workforce has been interacting with computers for longer lengths of time[4]. It is common knowledge that employees who engage in repetitive work or spend a lot of time in one posture are more susceptible to developing Musculoskeletal Disorders (MSDs) related to their occupations. This relationship emphasizes how crucial it is to address ergonomic issues and support workplace policies that lessen the negative effects of prolonged postures and repetitive motions on worker health. In occupational health research, the link between fixed postures, repeated jobs, and MSDs is well-established. Jobs like typing or assembly line labour that require repetitive motions can cause strain and overuse injuries in the muscles, tendons, and joints. In a similar vein, extended periods spent sitting or standing still without sufficient rest or ergonomic support can aggravate existing neck, shoulder, back, and wrist MSDs. Employers and legislators place a strong emphasis on implementing ergonomic treatments and principles in the workplace to reduce these dangers. This includes setting up ergonomic workstations, recommending frequent stretches and breaks, encouraging good body mechanics and posture, and providing instruction on how to prevent injuries and be conscious of ergonomics. By taking care of these issues, companies can lower the prevalence of musculoskeletal illnesses at work and give workers better, more encouraging work conditions[5].

These repeated motions raise the pressure inside the carpal tunnel, which may decrease blood flow to the median nerve and cause a blockage in the nerve[3]. Reaching and clutching are examples of repetitive actions that might result in commonplace movements that are connected to the onset of CTS. These movements may become hazardous without sufficient rest or recovery time[6,7]. Musculoskeletal issues have been linked to postural stress brought on by inadequate workplace ergonomics, such as where the keyboard, mouse, and monitor are placed. There have been reports of a high frequency of CTS among office workers who operate vibrating devices, especially typists and data entry clerks[4].

Forceful exertion, repeated motions, uncomfortable postures, and localized contact stressors are among the main risk factors. These risk variables can be broadly divided into two categories: personal factors, such as age, gender, anthropometric characteristics, and medical history, and occupational (physical) factors, which include task and environmental circumstances. Research findings indicate that those with repetitive employment had higher rates of pain, paraesthesia, or nocturnal pain in one or both hands compared to non-repetitive workers. People with repetitive work were more likely to have Phalen's Sign than people with non-repetitive jobs[2].

Like many other nations, India has seen impressive growth in its software sector, which has led to a sizeable labour force in computer-related fields. But unlike some other countries, India does not yet have a lot of solid data regarding health risks related to computer use. A cross-sectional study was carried out in Kolhapur to determine the prevalence of Carpal Tunnel Syndrome (CTS) among computer workers, namely those employed in banks, to reduce this discrepancy.

The desire to address the lack of locally relevant data on the health effects of prolonged computer use in India's rapidly growing software and banking sectors drove this study. By shedding light on the prevalence of CTS among

computer professionals in this occupational sector, the study hopes to identify potential dangers to occupational health and provide guidance for prevention and intervention techniques. By concentrating on a particular workforce segment in Kolhapur, the study sought to produce insights that could be more widely applied throughout India's growing computer-related industries, helping to improve occupational health practices and policies catered to the requirements of this workforce.

The primary objectives of the study encompassed two key aims. First and foremost, the study sought to ascertain the prevalence of CTS among computer workers primarily working in this employment setting. Secondly, the research sought to investigate potential associations between certain factors, specifically, the duration of computer work experience, the number of daily hours spent working at a computer and the heightened risk of developing CTS.

The study sought to provide important insights into the occupational health concerns that computer professionals experience, especially about CTS, by following these goals. The prevalence data would provide an understanding of how prevalent CTS is within this specific workforce, shedding light on the extent of this health issue in the context of computer-intensive occupations. Additionally, examining associations with years of experience and daily work hours could reveal critical factors that contribute to the development of CTS, thereby informing potential preventive strategies and workplace interventions aimed at reducing CTS incidence and improving occupational health outcomes among computer workers. One of the most prevalent symptoms of CTS is compression of the median nerve as it passes through the wrist's carpal tunnel. This syndrome is often linked to repetitive hand movements and prolonged periods of computer usage, making it particularly relevant to individuals employed in computer-intensive occupations like banking, where employees frequently engage in keyboard and mouse operations.

The cross-sectional study design allowed researchers to collect data from a specific population at a single point in time, providing valuable insights into the prevalence and potential risk factors associated with CTS among computer workers in banks located in Kolhapur. By examining the duration of computer work experience and daily hours spent using computers, the study aimed to identify any correlations between these variables and the occurrence of CTS.

2. Methods

Study type: observational.
Study design: cross-sectional.
Type of sampling: convenient sampling.
Study population: Computer users working in Banks.
Duration of Study: 6 months.
Study setting: Kolhapur city.
Study sample size: 90.

The sample size is calculated by using prevalence: The prevalence of CTS in India is 13.1%. Margin of error is 7 %.

Inclusion Criteria

Computer users working in banks of Kolhapur city, participants Minimum 5 years of experience, age group 30-45 years, working on the computer for minimum 5 hours, all genders, participant willing to participate.

Exclusion Criteria

Participants with recent trauma of the wrist, congenital or acquired deformities of the hand and wrist, pregnant females, and metabolic disease.

Outcome Measure

Phalen's test: The Phalen's test is a provocative test used in the diagnosis of CTS. The test is performed by having the patient fully flex their wrists by placing the dorsal surfaces of both hands for one minute. A positive test is when symptoms (numbness, tingling, pain) are reproduced.

BCTQ: The BCTQ is a patient-reported questionnaire that examines symptom severity and overall functional status of patients. The Symptom Severity Scale (SSS) scale has 11 questions scored on a 5-point Likert scale of 1-5, and the Functional Severity Scale (FSS) with 8 questions scored from 1-5 as no symptoms/difficulty and 5 as symptoms/cannot perform the activity at all. Carpal Tunnel Questionnaire has excellent test-retest reliability, with correlation coefficients ranging from 0.8 to 0.9 for both scales[8].

Reliability: The questionnaire has excellent test-retest reliability.

Validity: Correlation coefficient ranging from 0.8 to 0.9 for both scales.

3. Procedure

Ethical clearance: Ethical clearance was obtained from the Institutional Ethical Committee to conduct the study, ensuring adherence to ethical guidelines and standards.

Subject selection: Subjects were selected based on specific inclusion and exclusion criteria relevant to the study objectives. Inclusion criteria specified factors like age, health status, or specific conditions being studied, while exclusion criteria included factors such as pre-existing medical conditions that might have confounded the study results.

Informed consent process: The selected subjects were provided with detailed information about the study procedures, potential risks, benefits, and their rights as participants. Written consent was obtained from each subject who agreed to participate, ensuring voluntary participation and understanding of the study.

Phalen's test: The Phalen's test was performed on the subjects who had consented to participate. This test involved assessing symptoms of Carpal Tunnel Syndrome by having the subject hold their wrists in a specific position to provoke symptoms.

Boston Questionnaire explanation: Subjects were briefed on the Boston Carpal Tunnel Questionnaire, explaining its purpose and the types of questions it contained to assess symptoms related to carpal tunnel syndrome.

Questionnaire administration: Subjects were asked to complete the Boston Questionnaire, providing responses to the questions based on their symptoms and experiences related to carpal tunnel syndrome.

Data analysis: Following the completion of the questionnaires, the data was analysed using accepted statistical techniques to ascertain the prevalence of Carpal Tunnel Syndrome in the participants under investigation. This analysis involved summarizing the responses and calculating prevalence rates based on the study criteria. Through these steps, the study aimed to ethically recruit subjects, accurately assess symptoms using standardized tests like Phalen's test and the Boston Questionnaire and derive meaningful prevalence statistics for Carpal Tunnel Syndrome within the selected population.

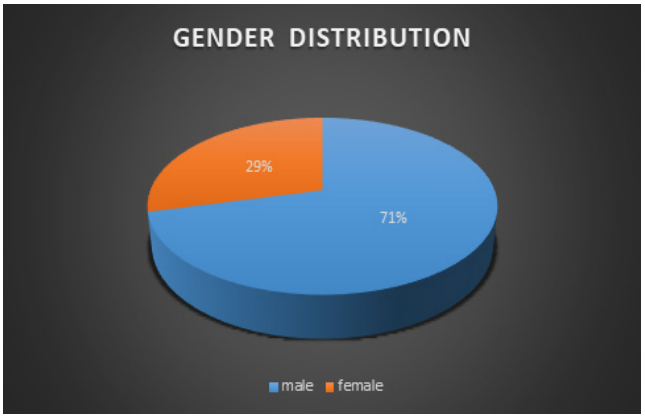
4. Results

Data was collected using a structured proforma and analysed using SPSS version 20. Based on the statistical analysis. The surveyed group consisted of 90 subjects,71% were male and 29% were female. The age of participants was 30 to 45 years with a mean age of 35.48 (±4.24) years.

In our study, we found out the prevalence of Carpal Tunnel Syndrome among computer users working in banks of Kolhapur city is 31.10% (28 participants), remaining 68.80% (62 participants) had negative Phalen's test.

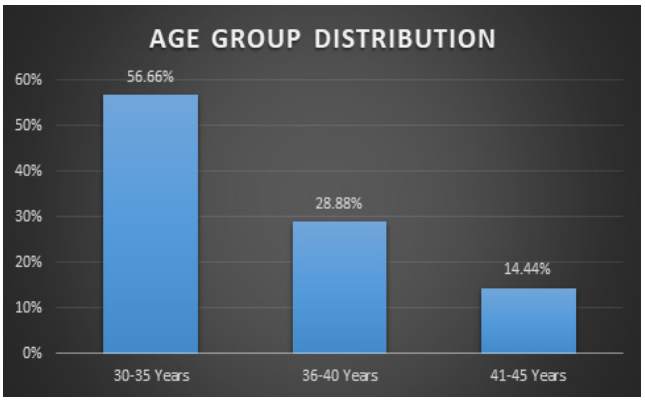
Data was collected by using a structured proforma. Data was then entered into an MS Excel sheet and analysed. Quantitative data was expressed in terms of percentage.

Out of 90 subjects participating in the study, 71% were males and 29% were females.



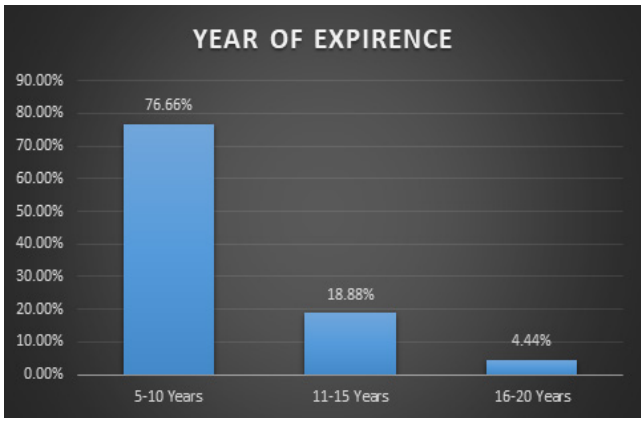
Graph 1. Shows the distribution of gender respectively.

57% of the population was in the age group of 30-35 years, and 29% of the population was in the age group of 36-40 years. 14.44% of the population was in the age group of 41-45 years.

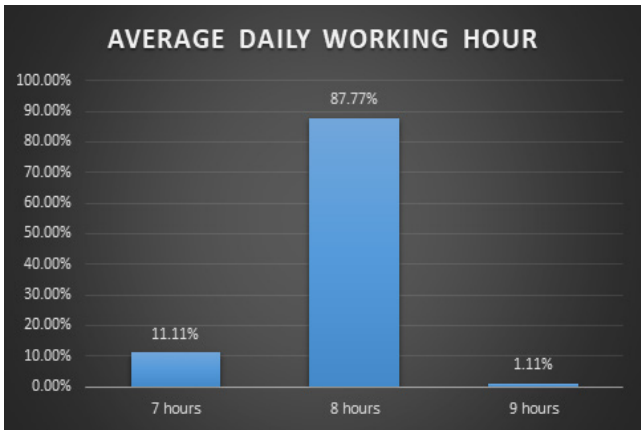


Graph 2. Shows the distribution of age groups respectively.

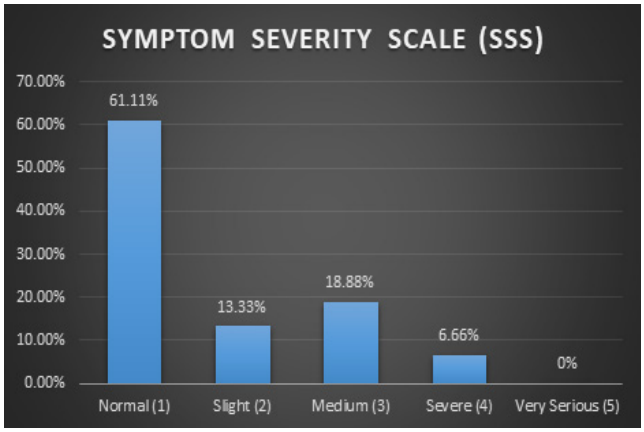
76.66% of the population has an experience of 5-10 years, 18.88% of the population has experience of 11-15 years, and 4.44% of the population has an experience of 16-20 years.



Graph 3. Shows the distribution of years of experience.



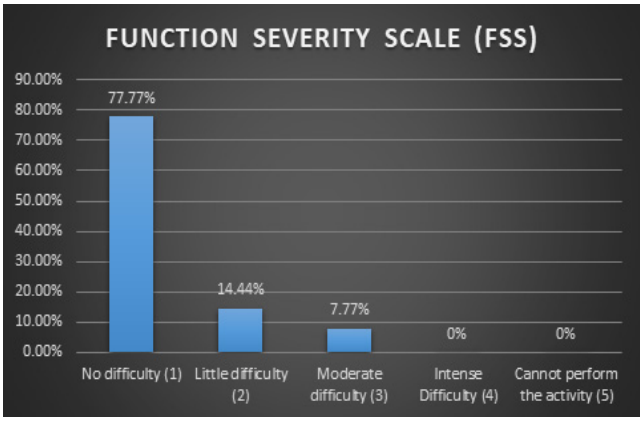
Graph 4. Shows the average daily hours of work per day.



Graph 5. Severity shows the symptoms the subjects felt in the first domain of the Boston carpel tunnel syndrome questionnaire i.e. the Symptom Severity Scale (SSS).

11.11% of the population worked for 7 hours, 87.77% of the population worked for 8 hours, and 1.11 % of the population worked for 9 hours.

61.11% of the population had no symptoms. 13.33% of the population had slight symptoms. 18.88% of the population had medium symptoms. 6.66% of the population had severe symptoms. 0 % of the population had very severe symptoms.

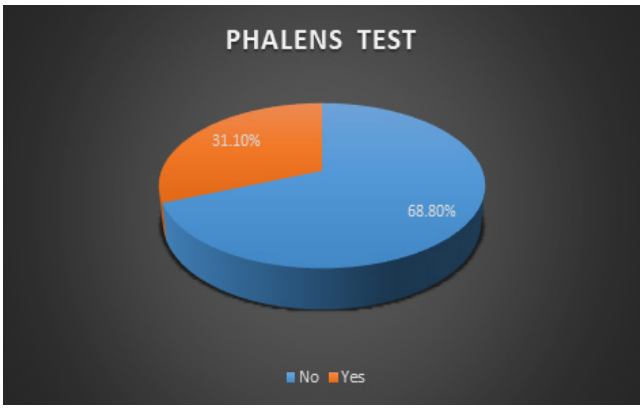


Graph 6. Shows distribution of Function Severity Scale (FSS).

77.77% had a score of 1(no difficulty), 14.44% had a score of 2(little difficulty) 7.77% had a score of 3(moderate difficulty), 0% had a score of 4(intense difficulty), 0% had a score of 5(cannot perform the activity).

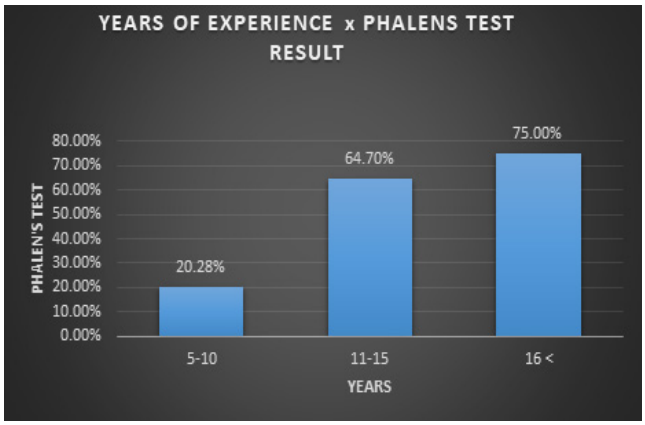
Out of 90 subjects participating in the study, 68.80% population had a negative Phalen's test while 31.10% tested positive for the Phalen's test.

Association between years of experience and prevalence of positive Phalen's test chi-square value test = 16.32, P value = 0.00028 (<0.0001) (statistically significant association).



Graph 7. Shows the distribution of Phalen's test respectively

Out of 90 subjects, 69 had experience ranging from 5 years to 10 years of which 14 were positive, i.e. 20.28%



Graph 8. Association of years of experience with Phalen's test

17 had experience between 11 years to 15 years which 11 were positive i.e. 64.70% 4 had experience of more than 16 years which 3 were positive i.e. 75%.

5. Discussion

This study aims to ascertain the frequency of CTS among computer users working in Kolhapur city's banks. The Boston Carpal Tunnel Syndrome Questionnaire (BCTSQ) and Phalen's test are two outcome measures used in this study to evaluate and diagnose CTS in individuals. Previous research has shown a consistent trend where prolonged computer usage increases the likelihood of developing carpal tunnel syndrome. This study aims to build upon this existing knowledge by specifically examining the prevalence of CTS within the banking sector in Kolhapur city. By utilizing established diagnostic tools such as the BCTSQ and Phalen's test, the researchers aim to provide valuable insights into the prevalence and impact of CTS among this specific occupational group. This information will contribute to a better understanding of occupational health risks associated with computer use, particularly within the banking industry, and may guide the development of targeted prevention and intervention strategies to mitigate these risks. Among computer workers, CTS was very frequent; it would typically show up in those who used computers for more than four hours a day. In the present study, the research population's functional limits and the severity of their symptoms were evaluated using the Boston Carpal Tunnel Syndrome Questionnaire (BCTSQ). Here are the detailed findings from the questionnaire regarding the Symptom Severity Scale (SSS): 61.11% of the population reported no symptoms of carpal tunnel syndrome, 13.33% reported mild symptoms, 18.88% reported moderate symptoms, and 6.66% reported severe symptoms.

These results indicate a range of symptom severity levels within the study population, with a majority experiencing either no or mild symptoms, but a significant proportion reporting moderate to severe symptoms.

According to the Function Severity Scale findings, 77.77% of the population reported no difficulty (score of 1), 14.44% reported little difficulty (score of 2), and 7.77% reported moderate difficulty (score of 3); however, no individuals reported intense difficulty (score of 4) or inability to perform the activity (score of 5)[1,2].

These findings suggest that while most individuals did not experience functional limitations due to carpal tunnel syndrome, a notable minority reported some level of difficulty in performing certain activities, primarily falling within the categories of little to moderate difficulty[3,4].

Phalen's test results revealed that 31.10% of the study population tested positive, while 68.80% tested negative for Phalen's test[5,6].

The positive Phalen's test results indicate a significant portion of the population exhibiting physical signs consistent with carpal tunnel syndrome.

Overall, these results demonstrate how different computer users in the study population display symptoms of Carpal Tunnel Syndrome and functional constraints[7,8]. The frequency and effects of Carpal Tunnel Syndrome in this occupational category can be fully understood by combining physical testing (Phalen's test) with questionnaire-based assessments (SSS and Function Severity Scale)[9,10]. Using the Boston Carpal Tunnel Syndrome Questionnaire, the author Kashan Aslam *et al.* examined the prevalence of Carpal Tunnel Syndrome among computer users employed by the MCB Bank of Faisalabad and discovered that 61% of the population tested positive for the condition[11,12]. He concluded that there is a strong association between computer use and CTS. According to his description, the risk of CTS in computer workers was raised by uncomfortable postures or by misplacing the mouse or keyboard. Repetitive hand motions as well as extreme wrist bending and twisting raise the risk of strain injuries to the hand[13,14]. The study conducted by Amruta Kadam *et al.* aimed to determine the prevalence of Carpal Tunnel Syndrome in auto-rickshaw drivers[15,16]. The findings indicated that the condition affects 23% of these drivers. They employed a self-created survey[17,18]. According to the study, 23% of respondents

reported having wrist or hand pain, whilst 77% reported not having any pain at all when driving. Of the population, 23% experienced tingling, 23% numbness, 16% weakness, 4% movement restriction, and 11% nighttime discomfort. Carpal Tunnel Syndrome can occur because of uneven loading, stagnant muscle activity, and unnatural wrist postures such as working with joints close to their limit of motion[18,20]. They increase the biomechanical stress on the muscles and the tissues around the joints. This causes soreness, uncomfortable tingling, pain or numbness in the distal distribution of the median nerve, as well as a decline in the grip strength and function of the affected hand[21]. Carpal Tunnel Syndrome prevalence in diamond jewellery workers was the subject of a study by Pranita Ganjave. She discovered that about 47% of participants reported having wrist pain, and 37% of study participants tested positive for Phalen. Overall, she demonstrated that workers in the diamond jewellery industry had a high rate of Carpal Tunnel Syndrome symptoms[11]. The tendons in the carpal tunnel may sustain damage and soft tissue microtears, which are tiny tears in the tendons, ligaments, and muscles if force is applied to them repeatedly over an extended length of time. A worker is more vulnerable when they are experiencing weariness and high levels of muscle tension. This occurs because the muscle is weaker and more prone to injury. A unique diagnostic procedure called Phalen's test is utilized to confirm CTS. In the present study, 31.10% of the population tested positive for Phalen's test, indicating a potential presence of CTS. The study also found a strong relationship between the probability of passing the Phalen test and the number of years of professional experience.

Among the 90 subjects included in the study, the prevalence of CTS varied based on years of experience: among subjects with 5 to 10 years of experience, the prevalence of CTS was 20.28%; for those with 11 to 15 years of experience, the prevalence rose substantially to 64.70%; and subjects with over 16 years of experience showed the highest prevalence, with 75% testing positive for CTS.

These findings strongly suggest that there is an escalating probability of developing CTS with increased years of professional experience. This association underscores the importance of considering occupational factors, such as repetitive hand movements or prolonged keyboard use, which may contribute to the development of CTS over time in individuals with longer careers.

6. Conclusion

This study concludes that among computer users working in banks of Kolhapur city, there is a prevalence of Carpal Tunnel Syndrome estimated at 31.10%. This finding underscores the significant impact of occupational factors, such as prolonged computer usage, on the development of Carpal Tunnel Syndrome within this specific population. The identified prevalence rate suggests a noteworthy burden of Carpal Tunnel Syndrome among bank employees who extensively use computers in their daily work. This observation highlights the importance of implementing ergonomic interventions and preventive measures in banking workplaces to mitigate the risk of developing this occupational health concern. Further research and targeted interventions are warranted to explore additional contributing factors and to develop tailored strategies for early detection, management, and prevention of Carpal Tunnel Syndrome among computer users in banking environments. Such initiatives are essential for promoting occupational health and enhancing the overall well-being of individuals working in similar settings.

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