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Impact of Age on CTS (Carpal Tunnel Syndrome) Using Fisher's Exact Test

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Abstract: Age of the workers is split into two groups, namely, 40 years (Group 1) and >40 years (Group 2), and chances of having CTS is also classified into sufferers and non- sufferers CTS. This is done in order to research the impact of age on CTS. When comparing the likelihood of CTS with two levels of age in the current study, Fisher's exact test was employed to determine the relevance of each symptom found in the data that had been collected. Along with age, gender, wrist size, weight, and medical illnesses such diabetes, thyroid issues, connective tissue diseases, acromegaly, and amyloidosis, which is very high risk factor for CTS. In comparison to likelihood of CTS in Groups 1 and 2, it is hypothesised that Group 2 employees are more likely to experience CTS than members of Group 1. Age CTS is more common in older persons than in young adults, with a peak incidence between the ages of 50 and 59. This might be because women's carpal bones are smaller, which results in a smaller carpal tunnel, yet they can still accommodate tendons of a similar diameter. For the Fisher's exact test, notations a, b, c, and d are allocated to the cells, and the sum is represented by notation n. Table 1 is a summary of the findings.

Keywords: Analysis, CTS (Carpal Tunnel Syndrome), Fisher's exact test, Grip, Nerve, Strength, Vibrations

Introduction

It has been observed that CTS is primarily linked to medical or physical conditions, and when such an individual is exposed to workplace factors, risk for CTS can become significantly higher, even though studies on occupational factors responsible for CTS have shown that more than half of the CTS cases are associated with workplace factors. Therefore, a confluence of variables that cause nerve injury is most likely to be the cause of CTS. Evidence also suggests that the higher risk of CTS was developed in forceful work occupations, extreme postures, hand/wrist vibrations, and repetitive hand movements, with the greatest preference for tasks requiring combinations of these risk factors, such as force/repetition or force/position. Psychosocial elements may also be involved, in addition to these mechanical ones. As a result, these risk variables can be broadly divided into two categories: occupational (physical) factors, which include task and environmental circumstances, and personal factors, which include age, gender, anthropometric characteristics, and medical history.

Occupational Risk Factors

Workers at risk are those who use their hands and wrists repeatedly and forcibly, especially if they operate in chilly environments and have health issues or other risk factors. A number of subpopulations are more susceptible to CTS because of the repetitive hand movements required for their jobs, including computer operators, carpenters, shoemakers, farmers, sewers, musicians, handloom weavers etc. The factors linked to occupational risk for CTS are listed below.

Personal Risk Factors

Age

CTS is more common in older people than in young adults, having a peak incidence between the ages of 50 and 59. In kids, it is extremely uncommon. Age is a factor in increased CTS risk; individuals over 50 had a CTS incidence rate that was more than three times higher than that of individuals under 30.

Sex

Compared to men, women are more susceptible to CTS. This might be because women's carpal bones are smaller, which results in a smaller carpal tunnel, yet they can still accommodate tendons of a similar diameter. When examined after accounting for age and body mass index, women have a risk that is 30% higher than that of men and have a CTS incidence rate that is 1.7 times higher.

Physical Characteristics

Increased body mass index (BMI) in obese people can cause carpal tunnel syndrome (CTS) either because there is more fatty tissue inside the tunnel or because the tunnel's hydrostatic pressure is higher. or a lack of physical fitness. Along with age, gender, wrist size, weight, and medical illnesses such diabetes, thyroid disorders, connective tissue diseases, acromegaly, and amyloidosis, it poses a serious danger for CTS.. When applying the conventional criterion of 30 kg/m2, obesity is strongly related with CTS but not BMI as a continuous variable. When considered as a continuous variable, the HR increases roughly linearly with increasing BMI. A BMI greater than or equal to 30 kg/m2 substantially doubles the risk of CTS. Regarding anthropometric variables, it has been proposed that a small wrist or hand size is a risk factor because a tiny wrist exerts more stress per unit surface area on the median nerve during wrist deviations.

Literature survey

Burt et al. (2013) evaluated individual elements such as age, gender, body mass index (BMI), and pre-existing medical conditions when determining the carpal tunnel syndrome (CTS) risk from physical workplace characteristics, particularly hand activity level and violent exertion. On the bases of exposure range compared to hand activity levels and violent exertion, each of the three manufacturing and healthcare workplaces are elected and subjected to inclusion. The study of each participant's work duties are watched, evaluated, and videotaped on the job for later analysis. This analysis included the frequency, duration, and postural deviation of effort. Follow-up actions are taken on individual health assessments included baseline physical exams, questionnaires, electrodiagnostic testing of the median and ulnar nerves for two years. It was discovered that the risk for CTS is influenced by both individual and workplace risk factors. If the employment exposure is high, time spent engaging in strenuous activity may for CTS than obesity. Forceful exertions should be the focus of workplace prevention initiatives.

Carlos et al. (2013) in the study patients were examined how the grip, tip pinch, key (lateral) pinch, and tripod pinch strengths changed after surgery for CTS and thenar atrophy. Surgery was performed on 46 individuals (49 hands) with CTS and thenar atrophy between October 2008 and May 2010. Using a clinical examination, thenar atrophy was evaluated. For assessing the grip strength and the tip, key, and tripod pinch strength, a hydraulic hand dynamometer grip and hydraulic pinch gauge were used respectively. These measurements were taken before the operation as well as 3, and 6 months thereafter. The averages of all forces examined in the afflicted hand before surgery and three months after surgery did not dramatically differ. However, when compared to the measures made prior to surgery and at the three-month mark, substantial variations were discovered for all four strength tests after six months. The findings of this study indicate that by the sixth month following surgical intervention, patients with thenar atrophy have subsequently more grip and pinch strength.

Methodology

Fisher's Exact Test

For the purpose of comparing the likelihood of CTS with two levels of age, body mass index (BMI), and job experience, Fisher's test was employed in the current investigation to determine the relevance of all symptoms found in the data that had been collected. For the Fisher's exact test, notations a, b, c, and d are allotted to the cells, while sum is denoted by n. Table 1 below displays the results.

Table1. Fisher's exact test setup: 2 2 contingency table

Description	Level 1	Level 2	Total
Symptom Present (Test positive)	a	b	a + b
Symptom not Present (Test negative)	c	d	c + d
Total	a + c	b + d	a+b+c+d= n

The hyper geometric distribution calculates the probability value p and gives it the following expression:

$$P = \frac{\binom{a+b}{a}\binom{c+d}{c}}{\binom{n}{a+c}} = \frac{(a+b)!(c+d)!(a+c)!(b+d)!}{a!b!c!d!n!}$$

when there are few observations (sample size 30) that can be used for analysis. If p 0.01 or p 0.05, a parameter is extremely significant, and if p 0.01 or p 0.05, it is not significant.

Analysis using Fisher's Exact Test

Age of the workers is split into two groups, i.e., 40 years (Group 1) and >40 years (Group 2), and the chance of having CTS is also divided into CTS patients and non-CTS sufferers, in order to investigate how CTS is affected by age. A comparison was taken for likelihood of CTS in Groups 1 and 2, it is hypothesised that Group 2 employees are more likely to experience CTS than members of Group 1. As shown in Table 2, all the data has now been operationally categorised in accordance with the Group and chance of having CTS.

Table2. Age and CTS symptom data from surveys

Age	Group 1 (≤ 40 years)	Group 2 (> 40 years)	Total
CTS Sufferers	8	29	37
Non CTS sufferers	30	36	66
Total	38	65	103

Results and discussion

In order to compare the likelihood of CTS in Groups 1 and 2, it is hypothesized that Group 2 employees are more likely to experience CTS than members of Group 1. As shown in Table 2, all the data has now been operationally categorized in accordance with the Group and chance of having CTS.

Conclusion

According to the results of Fisher's exact test, there are 2.12 times as many CTS cases among employees over 40 as there are among those under 40. It is necessary to do research that can identify which factor is more or less predominating in relation to other ones. Utilizing cutting-edge statistical software and techniques makes it possible.

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