



AGING EFFECTS ON CARPAL TUNNEL SYNDROME: SEVERITY AND FUNCTIONAL DECLINE

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ABSTRACT

Carpal tunnel syndrome is a cumulative trauma disorder affecting the forearm and wrist, characterized by loss of sensation, weakness, and tingling in the thumb and the first two fingers. The prevalence of this condition continues to rise each year, with an incidence rate of 276 cases per 100,000 individuals. This study aims to analyze the relationship between age and the severity and functional status of carpal tunnel syndrome in the elderly at the Santo Yosef Nursing Home in Surabaya. The study employed an analytical observational design with a cross-sectional approach. The study population consisted of all 145 elderly residents at the Santo Yosef Senior Care Home in Surabaya, with a sample of 70 respondents selected using purposive sampling. Data were collected through interviews using a questionnaire and analyzed using Spearman's correlation test with the aid of SPSS version 23. The results showed that age group had a significant relationship with SSS ($p=0.017$) and FSS ($p=0.049$). However, the Spearman test results showed r values of 0.284 and 0.236, indicating that the strength of the correlation between age and the severity or functional impact of carpal tunnel syndrome is relatively weak. Thus, there is a significant relationship between age and the severity and functional status of carpal tunnel syndrome, although the strength of this relationship is relatively low.

Keywords: age; carpal tunnel syndrome; elderly; functional status; severity

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INTRODUCTION

Carpal Tunnel Syndrome, or CTS, is categorized as a cumulative trauma disorder that impacts the wrist and forearm regions. It typically manifests through discomfort, a prickling sensation, loss of feeling, and reduced muscle power, especially within the thumb and the first two fingers (Genova et al., 2020; Rotaru-Zavaleanu et al., 2024). This ailment is triggered by the compression of the median nerve, the primary pathway from the upper arm to the wrist. Essentially, when the carpal tunnel experiences swelling or narrowing, the resulting pressure on the nerve hinders sensory and motor performance in the hand. Factors like bone structure irregularities, fascia swelling, or tendon sheath thickening from irritation can escalate pressure on the median nerve, causing this condition (Joshi et al., 2022). Typically, carpal tunnel syndrome progresses in severity over time without intervention, so identifying and treating it early is vital for avoiding permanent injury. Management of early-stage symptoms often involves straightforward approaches like wrist immobilization and the use of splints to promote a neutral posture. By avoiding triggers and allowing the area to rest, these steps work to minimize nerve compression and alleviate inflammation before the damage progresses (Pegoli & Lombardo, 2025; Pradipta et al., 2021).

CTS is the leading median nerve neuropathy, comprising 90 percent of all entrapment diagnoses. While other variations exist, CTS remains the most prevalent, affecting about 3.8 percent of the U.S. population according to NHIS research. Statistics show a steady climb in reported cases, with a higher frequency in females and a tendency for the condition to affect both arms. Approximately one-fifth of individuals experiencing typical nerve pain symptoms are eventually diagnosed with this disorder (Sevy et al., 2023; Mitake et al., 2020). In Indonesia, the prevalence of carpal tunnel

syndrome (CTS) is not yet precisely known due to limitations in diagnosis and case reporting. However, several studies indicate a high incidence of CTS among workers engaged in repetitive activities and working in non-ergonomic positions. A study by Putra et al. (2025) on metalworkers in Bandung found a CTS prevalence of 68%, with age, body mass index, dominant hand, and job type associated with CTS. Meanwhile, Khomairoh and Widajati (2020) reported that 68.8% of batik industry workers in Sumenep experienced CTS symptoms, particularly among workers aged 36–45 years with more than 10 years of service and high-risk work postures. These findings indicate that age and repetitive work activities contribute to an increased risk of CTS.

Multiple elements play a part in CTS development, generally split between medical conditions and personal traits. From a medical standpoint, ailments such as acromegaly, amyloidosis, and diabetes can cause tissue changes that compress the nerve. Meanwhile, general risk factors encompass age, sex, weight, body size, wrist circumference, and the use of oral contraceptives. These factors are related to physical and hormonal characteristics that can affect the narrowness of the carpal tunnel or increase pressure within it..

Law No. 13 of 1998 identifies anyone 60 years or older as part of the elderly population. As the number of seniors continues to climb globally, Indonesia is expected to see even more significant gains. By the turn of the next century, it is projected that Indonesia's elderly demographic will be larger than the average seen worldwide. Higher life expectancy, which grew from 68.6 to 70.8 years, is the primary driver of this demographic shift. Within Indonesia, the elderly population is not spread evenly; Yogyakarta leads with 13.4%, followed by Central and East Java at 11.8% and 11.5% respectively, whereas Papua has the smallest share at 2.8%. Furthermore, women outnumber men among the senior population (Lestari et al., 2022).

Various studies indicate that carpal tunnel syndrome is more common in the elderly than in younger age groups (Cazares-Manríquez et al., 2020; Shields et al., 2025). This condition is associated with degenerative processes resulting from aging, such as decreased tissue elasticity, reduced peripheral nerve regeneration capacity, thenar muscle atrophy, and increased vulnerability of the median nerve to pressure within the carpal tunnel (Żyluk et al., 2021). Additionally, older adults with carpal tunnel syndrome tend to experience more severe sensory disturbances and reduced hand function compared to individuals of working age (Kim et al., 2020).

Nevertheless, research on the relationship between age and the severity of symptoms and functional status of carpal tunnel syndrome in the elderly population in Indonesia remains limited, particularly among the elderly residing in nursing homes. Most previous studies have focused primarily on prevalence and general risk factors without evaluating the impact of age on symptom severity and functional ability. Given this context, this study aims to analyze the relationship between age and the severity of symptoms and functional status of carpal tunnel syndrome in the elderly at Griya Usia Tua Santo Yosef in Surabaya. The results of this study are expected to contribute to the development of scientific knowledge regarding the effects of aging on carpal tunnel syndrome, as well as serve as a basis for efforts toward early detection and more appropriate management in the elderly population.

METHOD

This investigation followed an observational analytical approach with a cross-sectional setup, where researchers observed subjects without interfering in their activities. The team analyzed how different age groups related to carpal tunnel syndrome symptoms to establish whether there is a significant relationship between them. The population in this study comprised all elderly residents at the Santo Yosef Nursing Home in Surabaya, totaling 145 individuals. This entire population served as the basis for determining the study sample size. Based on sample size calculations, the minimum number of respondents required was 52 to ensure the study

was representative of the population and met the requirements for statistical analysis. However, to enhance data representativeness and achieve better research outcomes, this study involved 70 respondents.

The sampling process utilized purposive sampling, a method of intentionally selecting samples based on inclusion criteria established by the researcher. This technique was employed to ensure that the respondents involved truly aligned with the study's objectives and were capable of providing relevant data. The requirements for participating in this study included elderly individuals residing at the Santo Yosef Senior Care Home in Surabaya and aged 60 years or older. Additionally, respondents had to demonstrate consent and willingness to participate in the study and be able to cooperate throughout the questionnaire completion process. These criteria were established to ensure that the data obtained aligns with the study's objectives and accurately reflects the respondents' conditions.

This study was conducted at the Santo Yosef Nursing Home in Surabaya from July to September 2017. The data used were primary data collected directly by the researcher through interviews using a questionnaire administered to the respondents. The research instruments utilized the Symptom Severity Scale (SSS) and Functional Status Scale (FSS) questionnaires, which have been widely used in previous studies to assess the severity of symptoms and functional status in patients with carpal tunnel syndrome. These questionnaires are based on instruments from previous studies that have undergone validity and reliability testing, making them suitable for consistently and accurately measuring the research variables.

Before the interviews were conducted, the respondents first provided written consent, and this study also obtained permission from the management of the Senior Citizens' Home. The interview process lasted approximately 20–30 minutes per respondent. After the data was collected, the researcher checked the data for completeness to ensure no information was missing or invalid. Afterward, the researchers used version 23 of the Statistical Package for the Social Sciences to process and interpret the study data. The analysis employed was the Spearman correlation test, aimed at determining the relationship between variables using an ordinal data scale. In general, this procedure demonstrates that the research was conducted systematically, from structured data collection to appropriate statistical analysis to identify relationships among the variables under study.

RESULT

The classification of participants based on their respective age categories.

Table 1.
Classification of Study Participants According to Age Category

Age Group	f	%
Early Old Age (60-74 years)	19	27.1
Late Old Age (75-90 years)	48	68.6
Very Old Age (90+ years)	3	4.3

Data from table 1 indicates that the 75 to 90 age bracket, known as the late elderly, makes up the majority of the sample at 68.6 percent. The smallest representation comes from the very old age group, which constitutes only 4.3 percent of the participants.

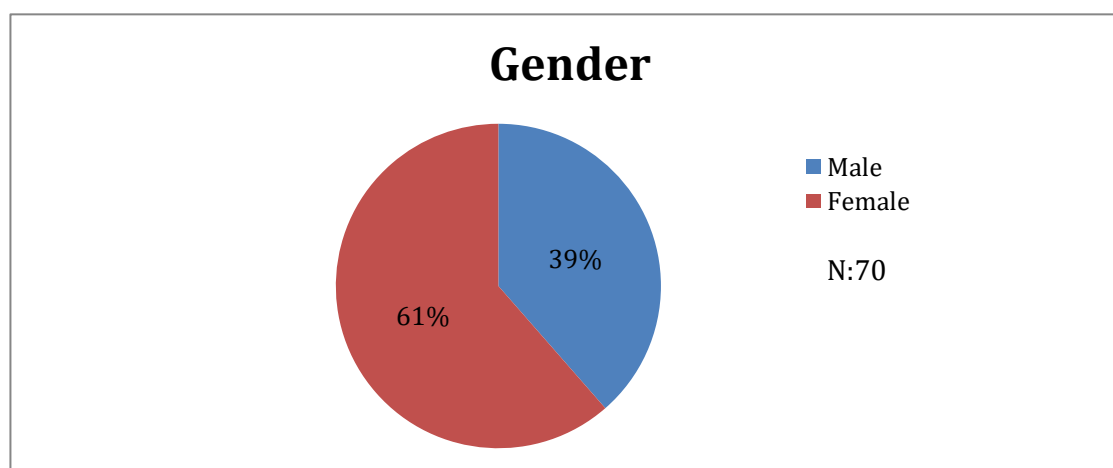


Figure 1. A Profile of The Participants Categorized by Gender Distribution

The study included 70 participants, with 27 men and 43 women, accounting for 39 percent and 61 percent of the total respectively. This indicates that female respondents made up the bulk of the group being studied.

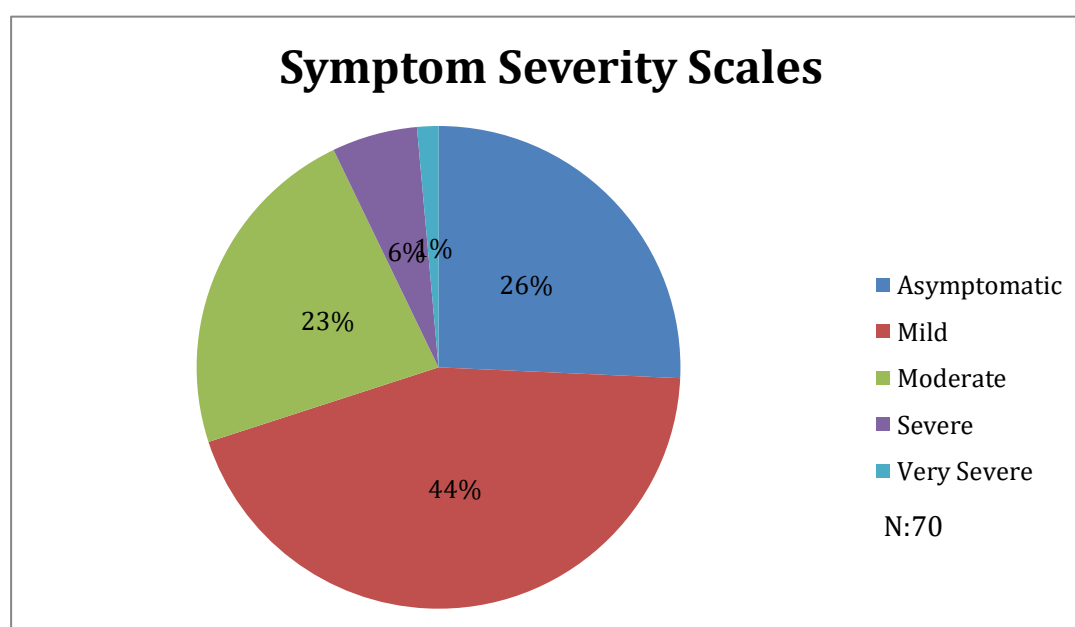


Figure 2. Classification of Participants According To The Intensity of Their Symptoms

Figure 2 illustrates that out of the 70 people surveyed, 18 (26%) displayed no symptoms, whereas 31 (44%) and 16 (23%) fell into the mild and moderate brackets, respectively. Those with more intense symptoms included 4 (6%) classified as severe and 1 (1%) as very severe.

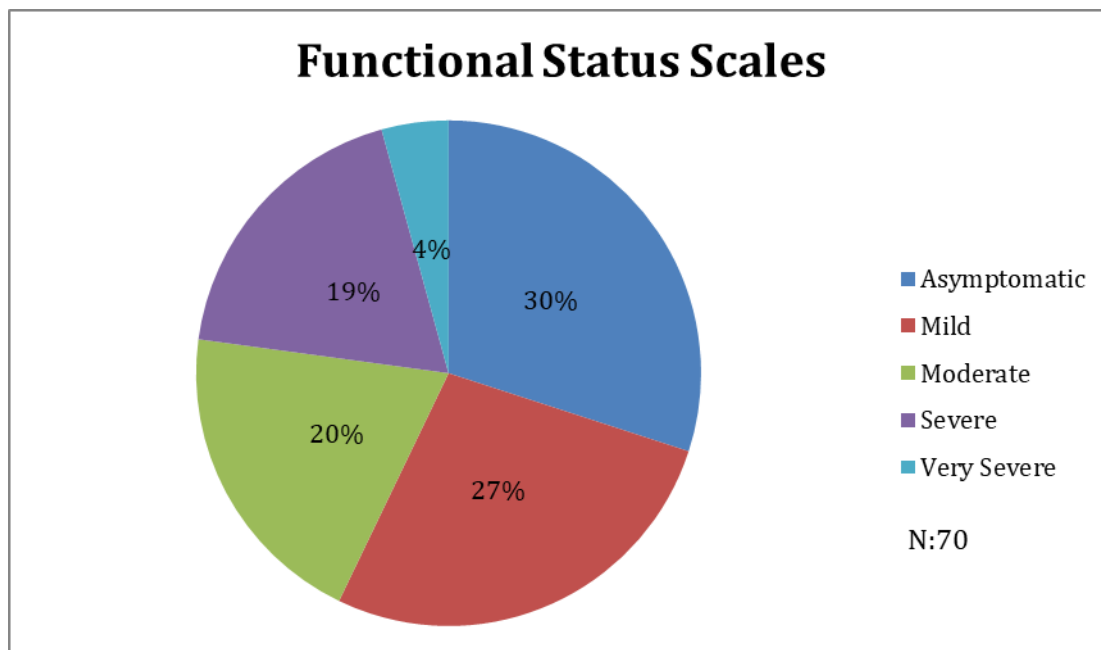


Figure 3. Distribution of Respondents Based on Functional Status Scales

As illustrated in figure 3, among the 70 participants surveyed, 30 percent showed no symptoms, while 27 percent were classified as having mild cases. The remaining distribution included 20 percent in the moderate group, 19 percent in the severe category, and a small minority of 4 percent who experienced very severe symptoms.

The Demographic Distribution of the Group, Showing the Intersection of Age Ranges and Gender

Table 2.
Distribution of Respondents by Age Group and Gender

Age Groups	Gender			
	Male		Female	
	f	%	f	%
Early Old Age (60-74 years)	11	15.7	8	11.4
Late Old Age (75-90 years)	16	22.9	32	45.7
Very Old Age (90+ years)	0	0%	3	4.3

Table 2 reveals that the majority of respondents, regardless of gender, belonged to the late elderly group (75–90 years), with percentages of 22.9% for men and 45.7% for women. The lowest male turnout was in the early elderly group at 15.7%, whereas the lowest female representation occurred in the very elderly group (90+ years) at 4.3%. This indicates that the distribution of respondents in both genders tends to be concentrated in the 75–90 age group, while younger and very old age groups have smaller numbers.

Distribution of Respondents Based on Age Group and Symptom Severity Scale

Table 3.
Distribution of Respondents Based on Age Group and Symptom Severity Scale

SSS degree	Early Old Age (60-74 years)		Late Old Age (75-90 years)		Very Old Age (90+ years)		Total	
	f	%	f	%	f	%	f	%
Asymptomatic	7	10	11	15.7	0	0	18	25.7
Mild	10	14.3	20	28.6	1	1.4	31	44.3
Moderate	1	1.4	14	20	1	1.4	16	22.9
Severe	1	1.4	3	4.3	0	0	4	5.7
Very Severe	0	0	0	0	1	1.4	1	1.4

Data from table 3 shows that for the early old age group (60-74 years), mild cases were most frequent at 15.7 percent, while moderate and severe cases were the least common at 1.4 percent each. Among the late old age group (75-90 years), the mild degree also peaked at 28.6 percent, with the lowest frequency seen in severe cases at 4.3 percent. Finally, the very old age group showed an even distribution of 1.4 percent across the mild, moderate, and very severe categories.

Distribution of Respondents Based on Age Group and Functional Status Scales

Table 4.

Distribution of Respondents Based on Age Group and Functional Status Scales

FSS degree	Early Old Age (60-74 years)		Late Old Age (75- 90 years)		Very Old Age (90+ years)		Total	
	(n)	(%)	(n)	(%)	(n)	(%)	(n)	(%)
Asymptomatic	8	11.4%	13	18.6%	0	0%	21	30%
Mild	4	5.7%	14	20%	1	1.4%	19	27.2%
Moderate	6	8.6%	8	11.4%	0	0	14	20%
Severe	1	1.4%	11	15.7%	1	1.4%	13	18.6%
Very Severe	0	0%	2	2.9%	1	1.4%	3	4.3%
Total	6	8.6%	61	87.1%	3	4.3%	70	100%

As indicated in Table 4, the early elderly bracket (60–74 years) was primarily composed of asymptomatic individuals at 11.4%, with severe cases being the rarest at 1.4%. For the late elderly category (75–90 years), mild symptoms were most frequent at 20%, whereas the very severe category was the least represented at 2.9%. Among the very elderly, mild, severe, and very severe symptoms were found in equal proportions, each representing 1.4% of the total.

Distribution of Respondents Based on Gender and Symptom Severity Scales

Table 5.

Distribution of Respondents Based on Gender and Symptom Severity Scales

SSS Degree	Male		Female		Total	
	(n)	(%)	(n)	(%)	(n)	(%)
Asymptomatic	13	18.6%	5	7.1%	18	25.7%
Mild	8	11.4%	23	32.6%	31	44.3%
Moderate	5	7.1%	11	15.7%	16	22.9%
Severe	1	1.4%	3	4.3%	4	5.7%
Very Severe	0	0%	1	1.4%	1	1.4%
Total	27	38.6%	43	61.4%	70	100%

Distribution of Respondents Based on Gender and Functional Status Scales

Table 6.

Distribution of Respondents Based on Gender and Symptom Severity Scales

FSS Degree	Male		Female		Total	
	(n)	(%)	(n)	(%)	(n)	(%)
Asymptomatic	13	18.6%	8	11.4%	21	30%
Mild	6	8.6%	13	18.6%	19	27.2%
Moderate	3	4.3%	11	15.7%	14	20%
Severe	4	5.7%	9	12.9%	13	18.6%
Very Severe	1	1.4%	2	2.8%	3	4.3%

According to Table 6, among male respondents, asymptomatic cases were the most common, accounting for 18.6%, while the “very severe” severity level was the least common, at 1.4%. Conversely, among female respondents, moderate severity accounted for the highest percentage at 18.6%, while severe severity remained the lowest at 2.8%. This indicates a difference in patterns between men and women, where men tend to be more likely to be asymptomatic, while women are more likely to have moderate severity.

Analysis of the Relationship Between Age Groups and the Degree of SSS

Table 7.

Analysis of the Relationship Between Age Groups and the Degree of SSS

		Age Group	SSS Degree
Spearman's Rho	Age Group	Correlation Coefficient	1.000
		Sig. (2-tailed)	.017
		N	70
	SSS Degree	Correlation Coefficient	.284*
		Sig. (2-tailed)	.017
		N	70

Based on a Spearman's rho test, a p-value of 0.017 was recorded, proving to be lower than the alpha of 0.05. This result shows that the relationship between age and symptom severity is statistically significant. However, the correlation coefficient of 0.284 reveals that the strength of this association is minor. Consequently, although age is a factor in symptom severity, its effect is limited, and additional variables probably influence the outcomes.

Analysis of the Relationship Between Age Groups and FSS Degrees

Table 8.

Spearman's Rho Correlation Analysis Between Age Groups and FSS Degree

		Age Group	FSS Degree
Spearman's Rho	Age Group	Correlation Coefficient	1.000
		Sig. (2-tailed)	.049
		N	70
	FSS Degree	Correlation Coefficient	.236*
		Sig. (2-tailed)	.049
		N	70

Based on a p-value of 0.049 from the Spearman's rho test, which is lower than the alpha threshold of 0.05, the study concludes there is a significant relationship between age and FSS levels. Nevertheless, the correlation coefficient of 0.236 reveals that this association is not particularly strong. This implies that age does play a role in functional status, but its impact is limited and likely influenced by other variables.

DISCUSSION

CTS Symptoms by Gender

Among the 70 participants in this research, women represented the larger group at 61% (43 individuals), compared to men at 39% (27 individuals). This result aligns with earlier research which similarly observed a higher prevalence of women within nursing home environments (Muszalik et al., 2021). This situation is likely influenced by differences in life expectancy, as women in Indonesia tend to have a longer life expectancy than men (Liong et al., 2020; Rukmana & Kartinah, 2025). According to data from the Central Statistics Agency (BPS), life expectancy for women in Indonesia is higher than that for men. As a result, the elderly population particularly in nursing homes tends to be dominated by women, as they have a longer life expectancy and make up a larger proportion of the elderly population (BPS, 2025).

According to the findings, females dominated every symptom level except for the asymptomatic degree in both the SSS and FSS assessments. While men had a higher asymptomatic rate of 18.6 percent versus 7.1 percent for women, the trend reversed for symptomatic degrees. Specifically, women accounted for 32.6 percent of mild cases, 15.7 percent of moderate, 4.3 percent of severe, and 1.4 percent of very severe cases, significantly exceeding the male proportions. Regarding the FSS results, a similar pattern emerged where men were more prevalent in the asymptomatic group

at 18.6 percent compared to 11.4 percent for women. However, women represented a larger share of all other categories, including mild (15.7 percent), moderate (18.6 percent), severe (11.4 percent), and very severe (4.3 percent). These results are in agreement with research, which indicates that women face double the risk of developing carpal tunnel syndrome. This increased vulnerability is often attributed to the physiological changes associated with menopause and hormonal fluctuations (Tang et al., 2022; Manosroi et al., 2023).

CTS Symptoms by Age Group

The research indicates a direct correlation between aging and the probability of developing carpal tunnel symptoms. According to both SSS and FSS assessments, the late elderly group, aged 75 to 90, showed the highest prevalence across most levels of severity. For the SSS, this group accounted for 15.7 percent of asymptomatic cases, 28.6 percent of mild, 20 percent of moderate, and 4.3 percent of severe cases, while the very severe category was exclusively observed in individuals over 90 years old at 1.4 percent.

Findings from the FSS mirrored this trend, showing that the 75 to 90 age group held the highest percentages across all levels, including 18.6 percent asymptomatic, 20 percent mild, 11.4 percent moderate, 15.7 percent severe, and 2.9 percent very severe. These results align with research by Shields et al. (2025), which noted that elderly patients with CTS more frequently experience more severe CTS compared to middle-aged patients. This increase in older populations is likely driven by factors such as declining physical function, thenar muscle atrophy, nerve axon loss, and the cumulative effects of long-term exposure (Omole et al., 2023; Jiménez-del-Barrio et al., 2022; Chen et al., 2024).

Relationship between Age Group and Carpal Tunnel Syndrome Symptoms

Using the two-part Boston Carpal Tunnel Syndrome Questionnaire (BCTSQ) to assess symptoms and function, this study found that complaints related to carpal tunnel syndrome increase alongside age. The scores from the SSS and FSS scales demonstrate that older groups experience greater severity. These observations support the study by (Aghda et al., 2020) who also observed that older age is associated with an increase in CTS clinical findings.

Statistical testing using Spearman's rho revealed a weak correlation between age and symptom severity, with r -values of 0.284 for SSS and 0.236 for FSS. This contrasts with a 2014 study by Ferhan involving 547 patients, which observed that individuals over 65 were over four times more likely to develop carpal tunnel syndrome than those 35 or younger. That study also noted a higher concentration of moderate to severe cases in older participants, citing more significant thenar muscle wasting as a primary factor (Grönfors et al., 2023). Recent research indicates that carpal tunnel syndrome is more common among the elderly and tends to be more severe than in younger age groups. A study by Shields et al. (2025) reported that elderly patients with CTS more frequently experience thenar muscle weakness, atrophy, and sensory disturbances due to increased vulnerability of the median nerve as a result of the aging process. The study also indicates that the risk and severity of CTS increase with age, particularly in individuals over 80 years old.

CONCLUSION

Findings from a study at the Santo Yosef Nursing Home in Surabaya (July 19–27, 2017) show that the 74–90 age group was the most represented, with CTS being more prevalent among female respondents. Most participants were classified as mild in terms of symptom severity (44%) and asymptomatic regarding functional status (30%). A significant association was found between age and the impact of CTS, suggesting that while getting older increases the likelihood of symptoms, the majority of the elderly remain in the mild to asymptomatic range. Consequently, early detection efforts and routine monitoring are needed among the elderly, particularly women and those of

advanced age, to prevent symptoms from worsening and to maintain hand function so that quality of life remains optimal.

REFERENCES

- Aghda, A. K., Asheghan, M., & Amanollahi, A. (2020). Comparisons of electrophysiological and clinical findings between young and elderly patients with Carpal Tunnel Syndrome. *Revue neurologique*, 176(5), 387-392. <https://doi.org/10.1016/j.neurol.2019.11.001>
- Badan Pusat Statistik. (2025). Angka harapan hidup (AHH) menurut provinsi dan jenis kelamin (tahun), 2024. Badan Pusat Statistik. <https://www.bps.go.id/id/statistics-table/2/NTAxIzI%3D/angka-harapan-hidup--ahh--menurut-provinsi-dan-jenis-kelamin?>
- Cazares-Manríquez, M. A., Wilson, C. C., Vardasca, R., García-Alcaraz, J. L., Olguín-Tiznado, J. E., López-Barreras, J. A., & García-Rivera, B. R. (2020). A review of carpal tunnel syndrome and its association with age, body mass index, cardiovascular risk factors, hand dominance, and sex. *Applied Sciences*, 10(10), 3488. <https://doi.org/10.3390/app10103488>
- Chen, X., Zhang, B., & Yuan, Y. (2024). Study of ultrasound and nerve electromyogram in diagnosis of carpal tunnel syndrome and its severity in the elderly. *Biotechnology and Genetic Engineering Reviews*, 40(4), 4495-4511. <https://doi.org/10.1080/02648725.2023.2213079>
- Genova, A., Dix, O., Saefan, A., Thakur, M., Hassan, A., & Arguello, M. T. (2020). Carpal tunnel syndrome: a review of literature. *Cureus*, 12(3). <https://doi.org/10.7759/cureus.7333>
- Grönfors, H., Himanen, S. L., Martikkala, L., Kallio, M., & Mäkelä, K. (2023). Median nerve ultrasound cross sectional area and wrist-to-forearm ratio in relation to carpal tunnel syndrome related axonal damage and patient age. *Clinical Neurophysiology Practice*, 8, 81-87. <https://doi.org/10.1016/j.cnp.2023.02.003>
- Jiménez-del-Barrio, S., Ceballos-Laita, L., Bueno-Gracia, E., Rodríguez-Marco, S., Caudevilla-Polo, S., & Estébanez-de-Miguel, E. (2022). Diacutaneous fibrolysis intervention in patients with mild to moderate carpal tunnel syndrome may avoid severe cases in elderly: a randomized controlled trial. *International Journal of Environmental Research and Public Health*, 19(17), 10983. <https://doi.org/10.3390/ijerph191710983>
- Joshi, A., Patel, K., Mohamed, A., Oak, S., Zhang, M. H., Hsiung, H., ... & Patel, U. K. (2022). Carpal tunnel syndrome: pathophysiology and comprehensive guidelines for clinical evaluation and treatment. *Cureus*, 14(7). <https://doi.org/10.7759/cureus.27053>
- Khomairoh, N., & Widajati, N. (2020). The Relationship of Age, Working Period, and Work Attitude with Complaints of Carpal Tunnel Syndrome on Workers in the Sumenep Batik Industry Indonesia. *Indian Journal of Forensic Medicine & Toxicology*, 14(2). <https://doi.org/10.37506/ijfmt.v14i2.3104>
- Kim, Y. H., Han, E. Y., Kim, J., Seo, K. B., Jeon, Y. T., & Im, S. H. (2020). Associations between hand function and electrophysiological measurements in hand osteoarthritis patients of different ages with or without carpal tunnel syndrome. *Scientific Reports*, 10(1), 19278.
- Lestari, M. D., Stephens, C., & Morison, T. (2022). Constructions of older people's identities in Indonesian regional ageing policies: the impacts on micro and macro experiences of ageing. *Ageing & Society*, 42(9), 2046-2066. <https://doi.org/10.1017/S0144686X20001907>
- Liong, A., Dian, T. A., & Djuari, L. (2020). Age Group with severity scales and functional status carpal tunnel syndrome on elderly at nursing home Santo Yosef Surabaya. *Journal of Widya Medika Junior*, 2(1), 11-22. <https://doi.org/10.33508/jwmj.v2i1.2332>
- Manosroi, W., Atthakomol, P., Phinyo, P., & Danpanichkul, P. (2023). Hormone replacement therapy in women and risk of carpal tunnel syndrome: a systematic review and metaanalysis. *Journal of Orthopaedics and Traumatology*, 24(1), 26.
- Mitake, T., Iwatsuki, K., & Hirata, H. (2020). Differences in characteristics of carpal tunnel syndrome between male and female patients. *Journal of Orthopaedic Science*, 25(5), 843-846. <https://doi.org/10.1016/j.jos.2019.10.017>
- Muszalik, M., Kotarba, A., Borowiak, E., Puto, G., Cybulski, M., & Kędziora-Kornatowska, K. (2021). Socio-demographic, clinical and psychological profile of frailty patients living in the

- home environment and nursing homes: a cross-sectional study. *Frontiers in Psychiatry*, 12, 736804. <https://doi.org/10.3389/fpsy.2021.736804>
- Omole, A. E., Awosika, A., Khan, A., Adabanya, U., Anand, N., Patel, T., ... & Millis, R. M. (2023). An integrated review of carpal tunnel syndrome: new insights to an old problem. *Cureus*, 15(6). <https://doi.org/10.7759/cureus.40145>
- Pegoli, L., & Lombardo, M. D. M. (2025). Comparing the Efficacy of Neurotrophic Medication and Wrist Splint in Early-Stage Carpal Tunnel Syndrome Treatment: A Randomized Clinical Trial. *Res.* 2025;6(3):1-5. <https://doi.org/10.46889/JOSR.2025.6317>
- Pradipta, C. A., Handoyo, R., Julianti, H. P., Zuhdiana, H., & Kusumawati, N. D. (2021). Effects of Additional Radial Shockwave Therapy to Median Nerve Gliding Exercises on Hand Grip Strength in Carpal Tunnel Syndrome Patients. *Indonesian Journal of Physical Medicine and Rehabilitation*, 10(02), 67-74. <https://doi.org/10.36803/ijpmr.v10i02.304>
- Putra, I. G. M., Isbayuputra, M., Wiratman, W., Hidayat, R., & Soemarko, D. S. (2025). Carpal Tunnel Syndrome and Associated Factors Among Workers in Blacksmithing Industry in Java, Indonesia. *The Indonesian Journal of Community and Occupational Medicine*, 5(2), 66-72. <https://doi.org/10.53773/ijcom.v5i2.173.66-72>
- Rukmana, L. A., & Kartinah, K. (2025). Overview of the Use of Leisure Time for the Elderly. *Indonesian Journal of Global Health Research*, 7(3), 689-696. <https://doi.org/10.37287/ijghr.v7i3.6217>
- Rotaru-Zavaleanu, A. D., Lungulescu, C. V., Bunesco, M. G., Vasile, R. C., Gheorman, V., Gresita, A., & Dinescu, V. C. (2024). Occupational Carpal Tunnel Syndrome: a scoping review of causes, mechanisms, diagnosis, and intervention strategies. *Frontiers in Public Health*, 12, 1407302. <https://doi.org/10.3389/fpubh.2024.1407302>
- Sevy, J. O., Sina, R. E., & Varacallo, M. A. (2023). Carpal tunnel syndrome. In *StatPearls* [Internet]. StatPearls Publishing.
- Shields, L. B., Iyer, V. G., Kluthe, T., Zhang, Y. P., & Shields, C. B. (2025). Carpal tunnel syndrome in the very elderly: Clinical, electrodiagnostic, and ultrasound features in a cohort of 187 patients. *Neurology International*, 17(9), 137. <https://doi.org/10.3390/neurolint17090137>
- Tang, H. C., Cheng, Y. Y., & Guo, H. R. (2022). Association between hormone replacement therapy and carpal tunnel syndrome: a nationwide population-based study. *Bmj Open*, 12(1), e055139. <https://doi.org/10.1136/bmjopen-2021-055139>
- Żyluk, A., Żyluk-Gadowska, P., & Fliciński, F. (2021). The effect of age and gender on the improvement of the strength and function of the hand of patients following surgery for carpal tunnel syndrome. *Pomeranian Journal of Life Sciences*, 67(4). <https://doi.org/10.21164/pomjlifesci.794>