



## THE CORRELATION BETWEEN DURATION AND FREQUENCY OF WRITING ACTIVITIES ON SUBJECTIVE COMPLAINTS OF CARPAL TUNNEL SYNDROME

Hana Widyaningtyas<sup>1</sup>, Tanti Ajoe Kesoema<sup>2</sup>, Erna Setiawati<sup>2\*</sup>

<sup>1</sup>Undergraduate Program, Faculty of Medicine, Universitas Diponegoro, Semarang, Indonesia

<sup>2</sup>Department of Physical Medicine and Rehabilitation, Faculty of Medicine, Universitas Diponegoro, Semarang, Indonesia

\* Corresponding Author: E-mail: [roswithaerna@fk.undip.ac.id](mailto:roswithaerna@fk.undip.ac.id)

### ABSTRACT

**Background:** In 2020, lectures were passed online due to the pandemic Covid 19, but now it is offline as before. This method has increased hand duration for writing. Using a hand for long and repetitive duration can affect pathological abnormalities on the nerves that lead to complaints such as soreness, pain, numbness, and weakness. Of these symptoms, 90% refer to a pathological disorder named Carpal Tunnel Syndrome (CTS). **Objective:** To determine the relationship between writing activities and subjective complaints of CTS using research subjects of students of the Department of Medical Science, Faculty of Medicine, Universitas Diponegoro Semarang Indonesia. **Methods:** This study is analytical with a *cross-sectional* method. CTS complaints were measured *Boston Carpal Tunnel Syndrome Questionnaire*(BCTS-Q). *Data analysis was performed using univariate analysis and Spearman correlation bivariate analysis.* **Results:** 99 respondents fit the criteria that experience subjective complaints of CTS based on the BCTS-Q; 69.7% mild, 4% moderate, and 1% very severe. There was no correlation between duration ( $p= 0.852$ ), frequency ( $p = 0.824$ ), and rest time of writing ( $p = 0.285$ ) with subjective complaints of CTS. It could be the cause of high subjectivity in interpreting the severity of CTS without a physical examination and difficulty in recalling the time they needed to write in one week. **Conclusion:** There is no relationship between the duration, frequency, and length of rest time of writing and subjective complaints of CTS.

**Keywords:** CTS, duration, intensity, writing, repetitive motion

### INTRODUCTION

The return of traditional learning and assignment methods just like before COVID-19 has led to an increased duration of manual writing activities. Writing involves repetitive hand movements, which over extended periods can impact the hand and wrist, potentially leading to pathological conditions. Many students report experiencing symptoms such as soreness, pain, numbness, and weakness in their wrists during assignments. These symptoms predominantly stem from compression of the median nerve in the wrist, known as Carpal Tunnel Syndrome (CTS), accounting for approximately 90% of such cases.<sup>1-3</sup> CTS is classified as a type of Repetitive Strain Injury characterized by symptoms ranging from pain and tingling to numbness and electric shock sensations in the wrist area, caused by entrapment neuropathy affecting the median nerve and affecting both structure and function.<sup>4</sup>

In the United States, the annual incidence rate of Carpal Tunnel Syndrome (CTS) ranges from 1 to 3 cases per 1,000 individuals, whereas in developed countries, the prevalence rate is higher at 50 cases per 1,000 people.<sup>1,5</sup> There are six primary factors known to contribute to CTS: repetitive hand movements, forceful tendon contractions, extreme bending of the

wrist, Gripping actions during work, mechanical Pressure on the median nerve, exposure to Vibrations, and inappropriate use of personal protective equipment (PPE).<sup>6</sup>

Previous research has explored the relationship between the intensity and duration of repetitive hand activities and the occurrence of CTS. However, studies examining the independent variables of duration and frequency of writing specifically in subjects are currently lacking in the available literature.

### METHODS

This study is an analytical approach using a cross-sectional method, with the participants of active students from the 2<sup>nd</sup>, 4<sup>th</sup>, and 6<sup>th</sup> semesters of the Medical Study Program, Faculty of Medicine, Diponegoro University, Semarang, Indonesia. The sampling method used is consecutive sampling. The selection of students from these specific semesters was based on varying assignment loads, which are expected to result in differences in both the frequency and duration of writing activities, as well as the outcomes assessed using the BCTS-Q.

Respondents completed the questionnaire via Google Forms, which included questions about



Hana Widyaningtyas, Tanti Ajoy Kesoema, Erna Setiawati

subject characteristics, number of tasks, duration, and frequency of writing, and responses to the Boston Carpal Tunnel Syndrome Questionnaire, focusing on severity and functional status. Participants were selected based on specific research criteria: they were active students in the 2<sup>nd</sup>, 4<sup>th</sup>, and 6<sup>th</sup> semesters of the Department of Medical Science, Faculty of Medicine, Universitas Diponegoro Semarang Indonesia, aged between 18 and 24 years. Exclusion criteria included routine activities involving repetitive and extensive wrist movements such as sewing, embroidery, volleyball, badminton, and bowling, and a history of diabetes mellitus or rheumatoid arthritis.

Of 109 respondents, 99 had inclusion criteria and didn't include the exclusion criteria. Data analysis was performed using univariate analysis and Spearman correlation bivariate analysis.

## RESULTS

From 109 respondents, 10 respondents were included in the exclusion criteria with details of 6 respondents having excess weight (obesity), 1 respondent with rheumatoid arthritis, and 3 respondents had experienced a fracture in the wrist so the 10 respondents were not included in the study. Data was obtained from 99 respondents. From these data, univariate and bivariate analysis was carried out with Spearman's correlation test.

**Table 1.** Characteristics of research subjects

Variable	Frequency	Percentage (%)
<b>Semester</b>		
2 <sup>nd</sup>	31	31,3
4 <sup>th</sup>	33	33,3
6 <sup>th</sup>	35	35,4

Based on the table provided, each batch has a roughly similar number of respondents from the 2<sup>nd</sup>, 4<sup>th</sup>, and 6<sup>th</sup> semesters of the Medical Study Program, Faculty of Medicine, Diponegoro University. However, the number of writing assignments required varies among these batches, potentially influencing the weekly duration and frequency of writing activities for each group of students.

**Table 2.** Univariate analysis related to writing

Variable	2 <sup>nd</sup>		4 <sup>th</sup>		6 <sup>th</sup>	
	n	%	n	%	n	%
<b>Number of Taks in 1 week</b>						
1	0	12,1	1	3	11	31,4
2	1	17,2	3	9,1	13	37,1
3	10	29,3	12	36,4	7	20
4	6	20,2	12	36,4	2	5,7
>4	14	21,2	5	15,2	2	5,7
<b>Duration of Writing in 1 Week</b>						
Very short (≤ 9h)	3	9,7	2	6,1	6	17,1
Short (10-17h)	6	19,4	7	21,2	10	28,6
Medium (18-25h)	8	25,8	13	39,4	13	37,1
Long Enough (26-33h)	11	35,5	8	24,2	4	11,4
Long( 34-40 h)	1	3,2	2	6,1	1	2,9
Very Long (≥ 40 h)	2	6,5	1	3,0	1	2,9
<b>Frequency of Writing in 1 Week</b>						
Low (1-3 day/week)	5	16,1	6	18,2	14	40
Medium( 4-5 day/week)	15	48,4	22	66,7	12	34,3
High (≥ 5 day/week)	11	35,5	5	15,2	9	25,7
<b>Rest time between writing (in minutes)</b>						
0	2	6,5	0	0	3	8,6
30	7	22,6	12	36,4	18	51,4
60	16	51,6	9	27,3	12	34,3
>60	6	19,4	12	36,4	2	5,7

Based on Table 2, significant differences are observed in the number of assignments, duration, and frequency of writing per week across each semester. 2<sup>nd</sup> Semester students typically have more than 4 assignments, 4<sup>th</sup> semester students have between 3 and 4 assignments, and 6<sup>th</sup> semester students have around 2 assignments. This increase in assignment load correlates with higher durations and frequencies of writing activities among the respondents in each respective semester.

**Table 3.** Univariate analysis of subjective complaints CTS

Variable	Interpretation of Subjective Complaints CTS	
Rest Time between writing	<b>p</b>	0,285
	<b>r</b>	0,109



Hana Widyaningtyas, Tanti Ajo Kesoema, Erna Setiawati

From the 19 questions in the Boston Carpal Tunnel Syndrome Questionnaire (BCTS-Q), 11 questions pertain to the severity of symptoms, while 8 questions focus on functional status. Each respondent's total points from these questions are aggregated and interpreted. The interpretation involves comparing the severity and functional status scores, selecting the higher score as the definitive interpretation of the respondent's subjective complaint of Carpal Tunnel Syndrome (CTS). This final interpretation is utilized in the bivariate analysis to assess correlations and relationships with other variables.

**Table 4.** Bivariate analysis of writing duration with subjective complaints of CTS

Variable	Interpretation of Subjective Complaints CTS	
Duration of Writing in 1 Week	p	0,852
	r	0,019

Based on the table, The results of bivariate analysis with Spearman obtained a significance value of 0.852 which exceeds the maximum limit of significance in a correlation test relationship ( $<0.05$ ), thus indicating that the duration of writing has no significant relationship with subjective complaints of CTS.

**Table 5.** Bivariate analysis of writing frequency with subjective complaints of CTS

Variable	Interpretation of Subjective Complaints CTS	
Frequency of Writing in 1 Week	p	0,824
	r	0,023

The results of the bivariate analysis using Spearman's correlation test yielded a significance value of 0.824, which exceeds the conventional threshold for statistical significance (typically set at  $<0.05$ ). This indicates that there was no significant relationship found between writing frequency and subjective complaints of Carpal Tunnel Syndrome (CTS) in this study.

**Table 6.** Bivariate analysis of rest time between writing with subjective complaints of CTS

Variable	2 <sup>nd</sup>		4 <sup>th</sup>		6 <sup>th</sup>	
	n	%	n	%	n	%
<b>Interpretation of Subjective Complaints CTS</b>						
Asymptomatic	5	16,1	10	30,3	10	28,6
Mild	24	77,4	22	66,7	23	65,7
Medium	1	4	1	3	2	5,7
Severe	0	0	0	0	0	0
Very Severe	1	3,2	0	0	0	0

The results of bivariate analysis with Spearman obtained a significance value of 0.285 which exceeds the maximum limit of significance in a correlation test relationship ( $<0.05$ ), indicating that the length of time to rest between writing has no significant relationship with subjective complaints of CTS.

## DISCUSSION

Bivariate analysis using the Spearman test in this study found no significant correlation between writing duration and subjective complaints of Carpal Tunnel Syndrome (CTS). This result is contradictory with previous research, which reported a correlation between prolonged repetitive movements and CTS symptoms.<sup>9</sup> Septiawati et al. also indicate that extended exposure to various risk factors can lead to decreased limb function and increased pain.<sup>10</sup> Megerian et al. underscore that extreme wrist postures and repetitive movements significantly increase pressure on the carpal tunnel, potentially leading to obstruction and compression of the median nerve, thus contributing to CTS symptoms.<sup>11-13</sup> Lazuardi et al. similarly identify extreme wrist motions, including awkward postures in both flexion and extension, as a significant factor in CTS development.<sup>6</sup> The lack of a significant relationship in this study may be partly attributed to the subjective nature of the questionnaire used. By asking respondents to estimate cumulative weekly hours of writing rather than daily hours, the questionnaire format may have made it challenging for participants to recall accurately, potentially leading to confusion and varied responses.



Hana Widyaningtyas, Tanti Ajo Kesoema, Erna Setiawati

The lack of correlation found in this study between the frequency of writing and subjective complaints of Carpal Tunnel Syndrome (CTS) contrasts with findings from Lisa Newington et al. Newington suggests that both the duration and frequency of repetitive movements, particularly those exceeding 20 hours per week or 8 hours per day, are significant risk factors for CTS.<sup>14</sup> Conversely, Shiri et al. also indicate no clear correlation between the frequency of repetitive movements and subjective complaints of CTS.<sup>15</sup> One possible factor contributing to these different findings could be the format of the questionnaire which respondents were asked to estimate cumulative times (hours) on a week rather than specific duration on a day. This approach might be a challenge to recall accuracy time leading to potential discrepancies in reported frequency and perceived impact on CTS symptoms.

## CONCLUSION

In the study conducted among students from the Medical Study Program, Faculty of Medicine, Diponegoro University, it was found that there is no correlation between the duration and frequency of writing and subjective complaints of Carpal Tunnel Syndrome (CTS). Despite this, a notable portion of research subjects reported experiencing subjective CTS symptoms based on the Boston Carpal Tunnel Syndrome Questionnaire (BCTS-Q): specifically, 69.7% reported mild symptoms, 4% reported moderate symptoms, and 1% reported very severe symptoms.

Additionally, the study did not identify any relationship between confounding variables, such as the duration of rest periods between writing sessions, and subjective complaints of CTS. This suggests that factors other than writing habits or rest intervals may be influential in the manifestation of CTS symptoms among the student population studied.

## ETHICAL APPROVAL

The research was conducted after obtaining ethical clearance from the Ethics Committee in Health and Medical Research (KEPK) Faculty of Medicine, Diponegoro University, Semarang, with no. No. 178/EC/KEPK/FK-UNDIP/V/2023.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## FUNDING

No specific funding was provided for this article.

## AUTHOR CONTRIBUTIONS

Conceptualization, Hana; methodology, Hana, Erna, Tanti; data analysis, Hana; data collection, Hana; source of funds, Hana; wrote the original draft, Hana; review and edit, Hana, Erna, Tanti; supervision, Hana, Erna, Tanti.

## ACKNOWLEDGMENTS

This work was supported by the Department of Physical Medicine and Rehabilitation, Faculty of Medicine, Diponegoro University.

## REFERENCES

1. Sevy JO, Varacallo M. Carpal Tunnel Syndrome. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 [cited 2023 Feb 17]. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK448179/>
2. Cazares-Manríquez MA, Wilson CC, Vardasca R, García-Alcaraz JL, Olguín-Tiznado JE, López-Barreras JA, et al. A Review of Carpal Tunnel Syndrome and Its Association with Age, Body Mass Index, Cardiovascular Risk Factors, Hand Dominance, and Sex. *Appl Sci*. 2020 Jan;10(10):3488.
3. Ghasemi-rad M, Nosair E, Vegh A, Mohammadi A, Akkad A, Lesha E, et al. A handy review of carpal tunnel syndrome: From anatomy to diagnosis and treatment. *World J Radiol*. 2014 Jun 28;6(6):284–300.
4. Rambe AS. Sindrom Terowongan Parpal (Carpal Tunnel Syndrome). 2004 Feb 20 [cited 2023 Feb 17]; Available from: <https://dupakdosen.usu.ac.id/handle/123456789/3459>
5. Hegmann KT, Merryweather A, These MS, Kendall R, Garg A, Kapellusch J, et al. Median Nerve Symptoms, Signs, and Electrodiagnostic Abnormalities Among Working Adults. *J Am Acad Orthop Surg*. 2018 Aug 15;26(16):576–84.
6. Lazuardi AI, Ma'rufi I, Hartanti RI. Determinan Gejala Carpal Tunnel Syndrome (CTS) pada Pekerja Pemecah Batu (Studi pada Pekerja





Hana Widyaningtyas, Tanti Ajoy Kesoema, Erna Setiawati

- Pemecah Batu di Kecamatan Sumber Sari dan Sukowono Kabupaten Jember). 2016;
7. Technology C. What is the Boston Carpal Tunnel Questionnaire (BCTQ)? [Internet]. CODE Technology | We Collect Patient Reported Outcomes. 2022 [cited 2023 Apr 3]. Available from: <https://www.codetechnology.com/blog/boston-carpal-tunnel-questionnaire-bctq/>
  8. Leite JC de C, Jerosch-Herold C, Song F. A systematic review of the psychometric properties of the Boston Carpal Tunnel Questionnaire. *BMC Musculoskelet Disord*. 2006 Oct 20;7:78.
  9. Sekarsari D, Pratiwi AD, Amrin Farzan A. Hubungan Lama Kerja, Gerakan Repetitif Dan Postur Janggal Pada Tangan Dengan Keluhan Carpal Tunnel Syndrome (Cts) Pada Pekerja Pemecah Batu Di Kecamatan Moramo Utara Kabupaten Konawe Selatan Tahun 2016. *J Ilm Mhs Kesehat Masy Unsyiah*. 2017;2(6).
  10. Septiawati D, Hasyim H, Najmah. Faktor Risiko Ergonomi saat Mengetik dan Hubungannya dengan Carpal Tunnel Syndrome. *J Ilmu Kesehat Masy* [Internet]. 2013 Nov 1 [cited 2023 Sep 20];4(3). Available from: <https://ejournal.fkm.unsri.ac.id/index.php/jikm/article/view/298>
  11. Megerian JT, Kong X, Gozani SN. Utility of Nerve Conduction Studies for Carpal Tunnel Syndrome by Family Medicine, Primary Care, and Internal Medicine Physicians. *J Am Board Fam Med*. 2007 Jan 1;20(1):60–4.
  12. Genova A, Dix O, Saefan A, Thakur M, Hassan A. Carpal Tunnel Syndrome: A Review of Literature. *Cureus*. 12(3):e7333.
  13. Pramandani NLMS, Wirawan IMA. Faktor Risiko Carpal Tunnel Syndrome pada Siswa Sekolah Menengah Atas Pemain Game Online di Kota Denpasar. *Arch COMMUNITY Health*. 2021 Apr 1;8(1):91–108.
  14. Newington L, Harris EC, Walker-Bone K. Carpal Tunnel Syndrome and Work. *Best Pract Res Clin Rheumatol*. 2015 Jun;29(3):440–53.
  15. Shiri R, Falah-Hassani K. Computer use and carpal tunnel syndrome: A meta-analysis. *J Neurol Sci*. 2015 Feb 15;349(1):15–9.