# Factors Associated with Prehospital Delay in Patients with Acute Stroke

**Ravi Raja[1] , Aroon Kumar [2], Vinesh Kumar[3], Kiran Kumari[4], Simran Kumari [5], Lachhmi Bai[6]**

1. Ravi Raja, General Practitioner, NMC Specialty Hospital, Alain, Abu Dhabi, UAE, drravifulwani@gmail.com
2. Aroon Kumar, MBBS, MD, Chandka Medical College, Larkana, Sindh, Pakistan, aroonkp37@gmail.com
3. Vinesh Kumar, MBBS, MD, Chandka medical College SMBBMU, Larkana, Sindh, Pakistan, drvineshkumar5@gmail.com
4. Kiran Kumari, LUMHS, MBBS,MD, Jamshoro, Sindh, Pakistan drkiranfulwani28@gmail.com(Corresponding author)
5. Simran Kumari, MBBS, MD, Chandka Medical College SMBBMU Larkana, Sindh, Pakistan, Simransawlani.ss@gmail.com
6. Lachhmi Bai, MBBS, Chandka Medical College Larkana, Sindh, Pakistan, drlachhmithakur@gmail.com

## ABSTRACT

**OBJECTIVE:** The study was aimed to evaluate the factors that contribute to a pre-hospital delay in acute stroke patients at the hospital settings.

**BACKGROUND:** Stroke is the leading cause of disability, with rising rates in emerging nations. The majority of strokes are caused by ischemia due to arterial blockage. However, for endovascular treatment and thrombolysis, as well as conservative medicinal care, the period between symptom onset and therapy beginning remains a critical element in functional success. This period is known as prehospital delay.

**STUDY DESIGN:** cross sectional study

**PLACE AND DURATION:** This study was conducted in Liaquat University Hospital, Hyderabad, Sindh, Pakistan from March 2020 to March 2021

**METHODOLOGY:** A total of 177 patients with acute stroke aged more than 18 years were made part of the study, CT scan and MRI brain conducted to confirm the diagnosis. All the male and female patients aged more than 18 years were made part of the study who presented with

non-traumatic ischemic stroke and/or hemorrhagic stroke. The time greater than 4 hours is termed as prehospital Delay (which means that the patients was brought to the hospital after 4 hours of onset of the symptoms). The data was entered and analyzed using SPSS version 26.0

**RESULTS:** Out of the 177 patients who reported with stroke 42(23.73%) presented with hemorrhagic stroke and 135(76.27%) presented with ischemic stroke. Nearly $1/10^{th}$ (11.86%) of the total participants reported recurrent stroke. A total of 116 (65.53%) participants reported prehospital delay as they took more than 4 hours to report at the hospital after the onset of the symptoms of the stroke.

**CONCLUSION:** Though most of factors didn't show statistical significance however, distance from the hospital, education level of the patients, type of residence and occupation of the respondents appeared to have significant association with pre hospital delay.

**KEYWORDS:** Acute Stroke, Prehospital Delay, Risk Factors

**INTRODUCTION**

Stroke is one of the top causes of death and long-term disability globally. It was the second greatest cause of death globally, with ischemic stroke accounting for 62.4% of all incidence strokes [1, 2]. Acute Stroke is the most prevalent kind of stroke, accounting for approximately 80% of all stroke cases. Studies have revealed that the first 4.5 hours following the beginning of symptoms are critical for the patient since this is when Intravenous Thrombolysis (IVT) has been demonstrated to be an effective therapy [3]. As a result, emergency doctors must be attentive of the time of administration of thrombolytic treatment following the onset of symptoms, as it is an essential component for a favorable clinical outcome for patients with acute ischemic stroke [4, 5]. The public health burden of stroke is expected to grow in the future as population demographics shift, particularly in emerging nations [6]. Stroke is the leading cause of disability,

with rising rates in emerging nations. The majority of strokes are caused by ischemia due to arterial blockage [7]. However, for endovascular treatment and thrombolysis [8, 9], as well as conservative medicinal care [10, 11], the period between symptom onset and therapy beginning remains a critical element in functional success [12]. While attempts to minimize door-to-treatment time have yielded substantial results [13], the establishment of prehospital delays in acute stroke remains contentious. Various global investigations found conflicting results regarding prehospital time improvement and variables contributing to delay [14-16]. These delays can also occur after a patient arrives at the hospital, when a health care practitioner fails to recognize the signs of a stroke.

In this study, we sought to evaluate the factors that contribute to a pre-hospital delay in acute stroke patients.

**METHODOLOGY**

The study included 177 patients reporting to the hospital with acute stroke. All the male and female patients aged more than 18 years were made part of the study who presented with non-traumatic ischemic stroke and/or hemorrhagic stroke. We used CT scan and MRI brain to confirm the diagnosis.

The patient who developed in-hospital stroke, presenting with of tumors, poisoning, or trauma , patients having transient ischemic attack and patients presenting seven days after stroke symptoms were excluded from the study.

The data was obtained using a structured questionnaire after explaining the purpose of the study and obtaining consent from every patient or their parents/family. The time between onsets of the symptoms to arrival at the OPD of the hospital was termed as prehospital Delay. In this study, the time greater than 4 hours is termed at prehospital Delay (which means that the patients was

brought to the hospital after 4 hours of onset of the symptoms). Besides sociodemographic data, we obtained the data regarding the medical history, stroke manifestations.

The data was entered and analyzed using SPSS version 26.0. The categorical data was reported in frequency and percentage however, we used mean and SD to report the numerical variables. Chi- Square test was employed to evaluate the association between factors resulting in late arrival to the hospital. P-value< 0.05 was considered as statistically significant.

**RESULTS**

In the present study there were 177 patients who reported with stroke, 124(70.06%) were male, and 53(29.94%) were female. Overall 42(23.73%) presented with hemorrhagic stroke and 135(76.27%) presented with ischemic stroke. A total of 15(8.47%) were aged between 18 to 40, 73(41.24%) between 41 to 60 while 89(50.28%) were above 60 years. Furthermore 163(92.09%) were married and 14(7.91%) were unmarried. Most of the participants 64(36.16%) were not working followed by educated professionals 53(29.94%). Most of the participants 103(58.19%) reported urban type of residence. Nearly $1/10^{th}$ (11.86%) of the total participants reported recurrent stroke. (As shown in Table I)

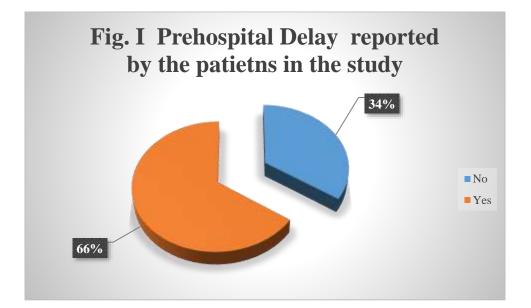**Table I   Frequency Distribution of the Socio-Demographic Factors in the study**

| Factors | n | % |
|---|---|---|
| **Age (Years)** | | |
| 18-40 | 15 | 8.47 |

| | | |
|---|---|---|
| 41-60 | 73 | 41.24 |
| 61 and above | 89 | 50.28 |
| **Gender** | | |
| Male | 124 | 70.06 |
| Female | 53 | 29.94 |
| **Marital Status** | | |
| Married | 163 | 92.09 |
| Unmarried | 14 | 7.91 |
| **Education** | | |
| No education | 52 | 29.38 |
| Primary | 81 | 45.76 |
| Secondary | 18 | 10.17 |
| More than Secondary | 26 | 14.69 |
| **Occupation** | | |
| Not working | 64 | 36.16 |
| Skilled Professional | 42 | 23.73 |
| Educated Professional | 53 | 29.94 |
| Business | 18 | 10.17 |
| **Place of Residence** | | |
| Rural | 74 | 41.81 |
| Urban | 103 | 58.19 |

**Type of Stroke**

Ischemic                                                                                      135    76.27

Hemorrhagic                                                                                    42    23.73

**History of Stroke**

First time                                                                                    156    88.14

Recurrent                                                                                      21    11.86

In the study 116 (65.53%) participants reported prehospital delay as they took more than 4 hours to report at the hospital after the onset of the symptoms of the stroke. (As shown in Fig I)



Fig. I  Prehospital Delay  reported by the patietns in the study

The most common risk factors in the study included hypertension 143(80.79%), Diabetes Mellitus 123(69.49%), followed by hyperlipidemia 106(59.89%). (As shown in Table II)

**Table II Distribution of Risk Factors of Stroke Among Study Participants (n=177)**

| Risk Factors | n | % |
|---|---|---|
| Hypertension | 143 | 80.79 |
| Diabetes Mellitus | 123 | 69.49 |
| Hyperlipidemia | 106 | 59.89 |
| Family history of stroke | 34 | 19.21 |
| Previous stroke | 24 | 13.56 |
| Valvular heart disease | 6 | 3.39 |
| Congestive heart failure | 4 | 2.26 |
| Atrial fibrillation | 4 | 2.26 |
| Transient ischemic attack | 3 | 1.69 |
| Coronary heart disease | 2 | 1.13 |

The chi square test of association was employed to evaluate the factors associated with prehospital delay for the patients presenting with the stroke. The occupation of the participants and type residence showed the significant relationship with p value 0.04 and 0.03 respectively, however, the association of pre hospital with other risk factors didn't show significant association. (As shown in Table III)

| Table III  Chi Square Association Between  Prehospital Delay and Socio-Demographic Factors (n=177) | | | | | | |
|---|---|---|---|---|---|---|
| Demographic factors | | | **Prehospital delay PHD** | | | **P-value** |
| **Age (Years)** | n | % | No | Yes | % | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 18-40 | 15 | 8.47 | 4 | 26.67 | 11 | 73.33 | |
| 41-60 | 73 | 41.24 | 31 | 42.47 | 42 | 57.53 | |
| 61 and above | 89 | 50.28 | 26 | 29.21 | 63 | 70.79 | 0.07 |
| **Gender** | | | | | | | |
| Male | 124 | 70.06 | 40 | 32.26 | 84 | 67.74 | |
| Female | 53 | 29.94 | 21 | 39.62 | 32 | 60.38 | 0.12 |
| **Marital Status** | | | | | | | |
| Married | 163 | 92.09 | 55 | 33.74 | 108 | 66.26 | |
| Unmarried | 14 | 7.91 | 6 | 42.86 | 8 | 57.14 | 0.09 |
| **Education** | | | | | | | |
| No education | 52 | 29.38 | 13 | 25.00 | 39 | 75.00 | |
| Primary | 81 | 45.76 | 34 | 41.98 | 47 | 58.02 | |
| Secondary | 18 | 10.17 | 5 | 27.78 | 13 | 72.22 | 0.13 |
| More than Secondary | 26 | 14.69 | 9 | 34.62 | 17 | 65.38 | |
| **Occupation** | | | | | | | 0.13 |
| Not working | 64 | 36.16 | 22 | 34.38 | 42 | 65.63 | |
| Skilled Professional | 42 | 23.73 | 15 | 35.71 | 27 | 64.29 | |
| Educated Professional | 53 | 29.94 | 17 | 32.08 | 36 | 67.92 | |
| Business | 18 | 10.17 | 7 | 38.89 | 11 | 61.11 | 0.04 |
| **Place of Residence** | | | | | | | |
| Rural | 74 | 41.81 | 22 | 29.73 | 52 | 70.27 | |
| Urban | 103 | 58.19 | 39 | 37.86 | 64 | 62.14 | 0.03 |
| **Type of Stroke** | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Ischemic | 135 | 76.27 | 45 | 33.33 | 90 | 66.67 | | |
| Hemorrhagic | 42 | 23.73 | 16 | 38.10 | 26 | 61.90 | 0.08 |
| **History of Stroke** | | | | | | | |
| First time | 156 | 88.14 | 52 | 33.33 | 104 | 66.67 | |
| Recurrent | 21 | 11.86 | 12 | 57.14 | 9 | 42.86 | 0.06 |

## DISCUSSION

In the present study 116 (65.53%) participants reported prehospital delay as they took more than 4 hours to report at the hospital after the onset of the symptoms of the stroke. Out of the several reasons of the delay at the end of patients and their attendants, it was noted that substantial proportion of patients (51%) contacted their local or community doctor first rather than going directly to emergency department [17].

In the present study there were 1124(70.06%) male, and 53(29.94%) female. Overall 42(23.73%) presented with hemorrhagic stroke and 135(76.27%) presented with ischemic stroke. A total of 15 (8.47%) were aged between 18 to 40 years, 163(92.09%) were married Most of the participants 64 (36.16%) were not working followed by educated professionals 53(29.94%). Most of the participants 103 (58.19%) reported urban type of residence. However, in line with our findings there are several studies which didn't report any significant association between sociodemographic factors and prehospital delay [18, 19, 20].

In contrast to our observations, some studies reported that the gender has also been associated with the time of arrival at the hospital. In some studies, it has been concluded

that the female gender negatively impacts the time of arrival [21,22].In agreement with our results, a study concluded that gender has no association with the time of arrival at the hospital [23].

The most common risk factors in the study included hypertension 143(80.79%), Diabetes Mellitus 123(69.49%), followed by hyperlipidemia 106(59.89%). Our findings are nearly similar to the results reported by Ali K et al, who reported that 83.7% of the stroke patients were hypertensive, 67.3% were diabetic, however, the proportion of hyperlipidemia was only 25.5% [24].

In the present study, only the occupation of the participants and type residence showed the significant relationship with p value 0.04 and 0.03 respectively, however, the association of pre hospital with other risk factors didn't show significant association. In line with our findings, Revathi S et al reported that there was no any statistical significance between prehospital delay and sociodemographic factors [25].

**CONCLUSION**

In conclusion, this study evaluated several factors associated with delayed presentation of acute stroke at the study settings and identified the significance of association with different factors. Though most of factors didn't show statistical significance however, distance from the hospital, education level of the patients, type of residence and occupation of the respondents appeared to have significant association with pre hospital delay.

**PERMISSION**

It was taken from the ethical committee

**CONFLICT INTEREST**

The authors declared no any conflict of interest

## SOURCE OF FUNDING

There was no any funding involved

## REFERENCES

1. World Health Organization. Stroke, Cerebrovascular accident. 2022. Available from: http://www.emro.who.int/health-topics/ stroke-cerebrovascular-accident/index.html.

2. 2.Moussaddy A, Demchuk AM, Hill MD. Thrombolytic therapies for ischemic stroke: Triumphs and future challenges. J Neuro-pharm 2018;134:272–279 doi:10.1016/j.neuropharm.2017.11.010

3. 3.Čerlinskaitė K, Javanainen T, Cinotti R, Mebazaa A,Global Research on Acute Conditions Team (GREAT) Network.Acute Heart Failure Management. Korean Circ J 2018;48(6):463-480.doi:10.4070/kcj.2018.0125.s

4. Richter D, Weber R, Eyding J, Bartig D, Misselwitz B, Grau A,et al. Acute ischemic stroke care in Germany-further progress from 2016 to 2019.Neurol Res Prac 2021;3(1):14

5. Psychogios K, Magoufis G, Safouris A, Kargiotis O, Katsanos AH, Spiliopoulos S, etal. Eligibility for intravenous thrombolysis in acute ischemic stroke patients presenting in the 4.5-9 h window.Neuroradiol2020;62(6):733–739

6. Campbell, B.C.V.; De Silva, D.A.; MacLeod, M.R.; Coutts, S.B.; Schwamm, L.H.;

Davis, S.M.; Donnan, G.A. Ischaemic stroke. Nat. Rev. Dis. Prim. 2019, 5, 70.

7.  Nogueira, R.G.; Jadhav, A.P.; Haussen, D.C.; Bonafé, A.; Budzik, R.F.; Bhuva, P.; Yavagal, D.R.; Ribo, M.; Cognard, C.; Hanel, R.A.; et al. Thrombectomy 6 to 24 hours after stroke with a mismatch between deficit and infarct. N. Engl. J. Med. 2018, 378, 11–21.

8.  Albers, G.W.; Marks, M.P.; Kemp, S.; Christensen, S.; Tsai, J.P.; Ortega-Gutierrez, S.; McTaggart, R.A.; Torbey, M.T.; Kim-Tenser, M.; Leslie-Mazwi, T.; et al. Thrombectomy for stroke at 6 to 16 hours with selection by perfusion imaging. N. Engl. J. Med. 2018, 378, 708–718.

9.  Meinel, T.R.; Kaesmacher, J.; Mordasini, P.; Mosimann, P.J.; Jung, S.; Arnold, M.; Heldner, M.R.; Michel, P.; Hajdu, S.D.; Ribo, M.; et al. Outcome, efficacy and safety of endovascular thrombectomy in ischaemic stroke according to time to reperfusion: Data from a multicentre registry. Ther. Adv. Neurol. Disord. 2019, 12, 1756286419835708.

10. Saver, J.L.; E Smith, E.; Fonarow, G.C.; Reeves, M.J.; Zhao, X.; Olson, D.M.; Schwamm, L.H. GWTG-stroke steering committee and investigators The "Golden Hour" and acute brain ischemia. Stroke 2010, 41, 1431–1439.

11. Saver, J.L.; Goyal, M.; Van Der Lugt, A.; Menon, B.K.; Majoie, C.B.L.M.; Dippel, D.W.J.; Campbell, B.C.; Nogueira, R.G.; Demchuk, A.M.; Tomasello, A.; et al. Time to treatment with endovascular thrombectomy and outcomes from ischemic stroke: A meta-analysis. JAMA 2016, 316, 1279–1288.

12. Rothwell, P.M.; Algra, A.; Chen, Z.; Diener, H.-C.; Norrving, B.; Mehta, Z. Effects of aspirin on risk and severity of early recurrent stroke after transient ischaemic attack and ischaemic stroke: Time-course analysis of randomised trials. Lancet 2016, 388, 365–375

13. Meretoja, A.; Strbian, D.; Mustanoja, S.; Tatlisumak, T.; Lindsberg, P.J.; Kaste, M. Reducing in-hospital delay to 20 minutes in stroke thrombolysis. Neurology 2012, 79, 306–313.

14. Pulvers, J.N.; Watson, J.D.G. If time is brain where is the improvement in prehospital time after stroke? Front. Neurol. 2017, 8, 617.

15. Evenson, K.R.; Foraker, R.E.; Morris, D.L.; Rosamond, W.D. A comprehensive review of prehospital and in-hospital delay times in acute stroke care. Int. J. Stroke 2009, 4, 187–199.

16. Furlan, A.J. Endovascular therapy for stroke—It is about Time. N. Engl. J. Med. 2015, 372, 2347–2349.

17. Ashraf VV, Maneesh M, Praveenkumar R, Saifudheen K, Girija AS. Factors delaying hospital arrival of patients with acute stroke. Ann Indian Acad Neurol 2015;18:162-

18. Nepal G, Yadav JK, Basnet B, Shrestha TM, Kharel G, Ojha R. Status of prehospital delay and intravenous thrombolysis in the management of acute ischemic stroke in Nepal. BMC Neurol 2019;19:155.

19. Wang R, Wang Z, Yang D, Wang J, Gou C, Zhang Y, et al. Early hospital arrival after acute ischemic stroke is associated with family members' knowledge about stroke. Front Neurol 2021;12:652321.

20.Gonzalez-Aquines A, Cordero-Pérez AC, Cristobal-Niño M, Pérez-Vázquez G, Góngora-Rivera F; GECEN Investigators.

Contribution of onset-to-alarm time to prehospital delay in patients with ischemic stroke. J Stroke Cerebrovasc Dis 2019;28:104331.

21.Madsen TE,Sucharew H, Katz B, Alwell KA, Moomaw CJ, Kissela BM, et al. Gender and Time to Arrival among Ischemic Stroke Patients in the Greater Cincinnati/Northern Kentucky Stroke Study. J Stroke Cerebrovasc Dis 2016; 25(3):504–510

22.Kaesmacher J, Maamari B, Meinel TR, Piechowiak EI, Mosimann PJ, Mordasini P, et al; BEYOND-SWIFT Investigators. Effect of Pre-and In-Hospital Delay on Reperfusion in Acute Ischemic Stroke Mechanical Thrombectomy. Stroke2020;51(10):2934-2942.

23..Powers WJ, Rabinstein AA, Ackerson T, Adeoye OM, Bam-bakidis NC, Becker K, et al.Guidelines for the early management of patients with acute ischemic stroke: 2019 update to the 2018 guidelines for the early management of acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke 2019;50(1):e440–e441

24.Ali, K., Nawaz, K. H., Hassan, W. U., & Waqar, R. M. (2023). Pre-Hospital Delaying Factors in Patients of Acute Ischemic Stroke who are Candidates for Thrombolytic Therapy. Pakistan Armed Forces Medical Journal, 73(3), 624–28.

25. Revathi S, Kavitha MS, Shankar V. Factors associated with prehospital delay in patients with acute stroke in South India. Indian Journal of Community Medicine. 2023 Jan 1;48(1):82-90.