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OBJECTIVE

- Stroke is the major cause of disability worldwide imposing heavy financial burden on patients and health systems.¹
- This study aims to estimate stroke cost according to type and severity of stroke using the Health Benefit Schedule (HBS) and Ministry of Health (MoH) pharmaceutical price list among geographical distributions in Turkey.

METHODS

- The study consisted of five phases (Figure 1).
- Resources used in stroke management were determined with the opinion of an experienced neurologist.
- In the first phase, *examination, diagnostic tests, consultations, emergency admission, hospitalization, intensive care support, physical therapy and drugs used* were listed separately as outpatient and inpatient treatment.
- In the second phase, *utilization rates and frequencies* were determined according to stroke type and severity.
- Stroke was classified as ischemic and hemorrhagic, each of which was sub-classified as mild, moderate and severe to calculate treatment costs.
- Resource utilization rates and frequencies for each sub-class were determined by clinician.
- The third and fourth stages were focused on calculating the cost of stroke treatment. The costs were calculated by associating all resources in the disease severity categories of the ischemic and hemorrhagic stroke with the prices from HBS and Turkish Medicines and Medical Devices Agency (TMMDA).
- Finally, weighted average cost of stroke treatment was calculated according to incidence rate of ischemic and hemorrhagic stroke (Figure 1).
- Furthermore, a literature review was conducted to find similar studies carried out in other countries, including Turkey, to interpret the results of this study (Table 1).

RESULTS

- In Turkey, the annual weighted average cost of stroke treatment was \$1,351 for ischemic stroke (mild: \$324, moderate: \$435, severe: \$592) and \$2,198 for hemorrhagic stroke (mild: \$62, moderate: \$668, severe: \$1,468).
- The annual weighted average cost of stroke treatment (both ischemic and hemorrhagic) according to the incidence rates was \$1,478 (Table 2).

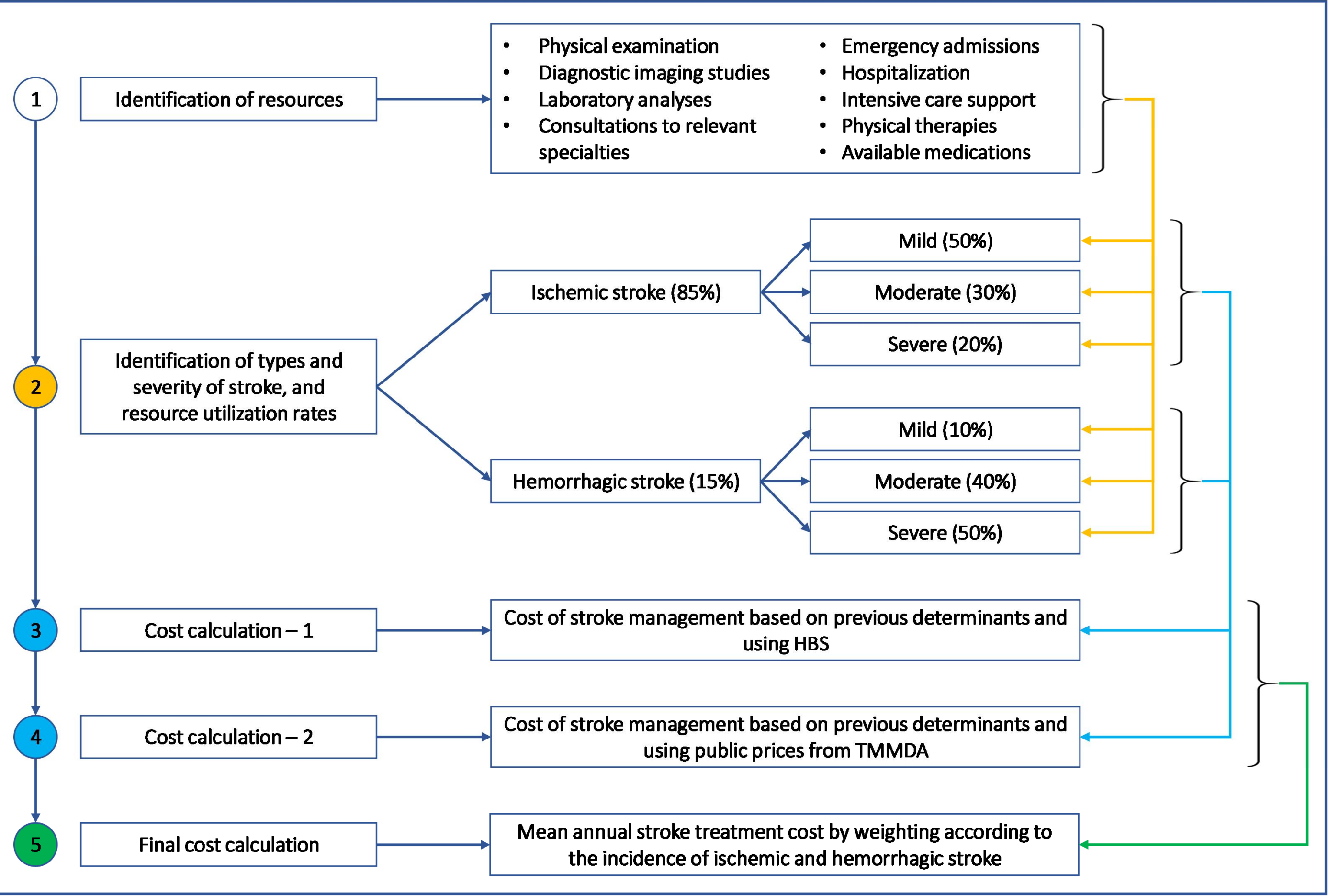


Figure 1. Study flowchart.

Abbreviations: HBS, health benefit schedule; TMMDA, Turkish Medicines and Medical Devices Agency

Table 1. Cost of stroke treatment in the world.

	Average inpatient cost (USD)	Average outpatient cost (USD)	Country	Year
Weighted annual average stroke cost		1,478		Current study
Annual average ischemic stroke cost	572	779	Turkey	(2021)
Annual average hemorrhagic stroke cost	921	1,278		
Weighted annual average stroke cost		1,682	China	2020 ²
Annual average ischemic stroke cost	3,827	NA		
Annual average hemorrhagic stroke cost	16,442	NA	Brazil	2018 ³
Annual average stroke cost		18,671	UK	2018 ⁴
Annual average stroke cost		2,939	Turkey	2017 ⁵
Annual average ischemic stroke cost	6,845	636	Netherlands	2016 ⁶
Annual average ischemic stroke cost	7,019	3,195		
Annual average hemorrhagic stroke cost	5,841	2,599	Spain	2016 ⁷
Annual average ischemic stroke cost	9,988	NA		
Annual average hemorrhagic stroke cost	11,951	NA	Denmark	2015 ⁸
Annual average stroke cost		3,393	Greece	2015 ⁹
Annual average stroke cost	5,230	NA	Pakistan	2014 ¹⁰
	2,020	NA	Malaysia	
	2,711	NA	India	
	3,626	NA	China	
	2,115	NA	Thailand	
	1,624	NA	Brazil	
	3,548	NA	Argentina	
	2,249	NA	Turkey	

Abbreviations: USD, United States dollar; NA, not applicable

Table 2. Cost of stroke treatment in Turkey.

	Ratio (%)	Inpatient Cost	Outpatient Cost	Total Cost	Weighted Average Cost
ISCHEMIC STROKE					
Mild	50	3,537 TL 281 USD	4,623 TL 367 USD	8,161 TL 648 USD	4,080 TL 324 USD
Moderate	30	7,877 TL 625 USD	10,393 TL 825 USD	18,270 TL 1,450 USD	5,481 TL 435 USD
Severe	20	15,345 TL 1,218 USD	21,959 TL 1,743 USD	37,305 TL 2,961 USD	7,461 TL 592 USD
Average Treatment Cost					17,022 TL 1,351 USD
HEMORRHAGIC STROKE					
Mild	10	3,073 TL 244 USD	4,764 TL 378 USD	7,840 TL 622 USD	784 TL 62 USD
Moderate	40	6,313 TL 501 USD	14,734 TL 1,169 USD	21,048 TL 1,671 USD	8,419 TL 668 USD
Severe	50	17,547 TL 1,393 USD	19,458 TL 1,544 USD	37,005 TL 2,937 USD	18,502 TL 1,468 USD
Average Treatment Cost					27,705 TL 2,198 USD
ANNUAL AVERAGE COST OF STROKE TREATMENT					18,625 TL 1,478 USD

Abbreviations: TL, Turkish Lira; USD, United States dollar

CONCLUSIONS

- Cost of stroke treatment varies among countries due to the heterogeneity of healthcare systems. Length of hospital stay, and severity of stroke appear to be major determinants of treatment costs.

REFERENCES

1. Katan M, Luft A. Global Burden of Stroke. *Semin Neurol*. 2018 Apr;38(2):208-211. doi: 10.1055/s-0038-1649503. Epub 2018 May 23. PMID: 29791947.
2. Zhu D, Shi X, Nicholas S, et al. Medical Service Utilization and Direct Medical Cost of Stroke in Urban China. *Int J Health Policy Manag*. 2022 Mar 1;11(3):277-286. doi: 10.34172/ijhpm.2020.111.
3. Vieira LGDR, Safanelli J, Araujo T, et al. The cost of stroke in private hospitals in Brazil: a one-year prospective study. *Arq Neuropsiquiatr*. 2019;77(6):393-403. doi:10.1590/0004-282X20190056
4. Xu XM, Vestesson E, Paley L, et al. The economic burden of stroke care in England, Wales and Northern Ireland: Using a national stroke register to estimate and report patient-level health economic outcomes in stroke. *Eur Stroke J*. 2018;3(1):82-91. doi:10.1177/2396987317746516
5. İcağasıoğlu A, Baklacioğlu S, et al. Economic burden of stroke. *Turk J Phys Med Rehab* 2017;63(2):155-159. doi: 10.5606/tftrd.2017.183
6. Buisman LR, Tan SS, Nederkoorn PJ, Koudstaal PJ, Redekop WK. Hospital costs of ischemic stroke and TIA in the Netherlands. *Neurology*. 2015;84(22):2208-2215. doi:10.1212/WNL.0000000000001635
7. Alvarez-Sabin J, Quintana M, Masjuan J, et al. Economic impact of patients admitted to stroke units in Spain. *Eur J Health Econ*. 2017;18(4):449-458. doi:10.1007/s10198-016-0799-9
8. Jennum P, Iversen HK, Ibsen R, Kjellberg J. Cost of stroke: a controlled national study evaluating societal effects on patients and their partners. *BMC Health Serv Res*. 2015;15:466. doi:10.1186/s12913-015-1100-0
9. Persefoni K, et al. Resource utilization and costs for treatment of stroke patients in an acute stroke unit in Greece *Clinical Neurology and Neurosurgery* 142 (2016) 8–14
10. Kaur P, Kwatra G, Kaur R, Pandian JD. Cost of stroke in low and middle income countries: a systematic review. *Int J Stroke*. 2014;9(6):678-682. doi:10.1111/ijls.12322