

**INCIDENCE, PREVALENCE, AND BEST PRACTICE LEARNINGS
FOR STROKE MANAGEMENT IN INDIA AND THE US: A
SYSTEMATIC REVIEW**

Dissertation Submitted to



The IIHMR University, Jaipur

for the partial fulfillment for the award of the degree of

Master of Business Administration (MBA)

in

Hospital and Health Management

by

Guncha Kapur

Under the Supervision and Guidance of

Dr. Susmit Jain

2022

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DECLARATION BY STUDENT

I hereby declare that this dissertation titled Incidence, Prevalence, and Best Practice Learnings for Stroke Management in India and the US: A Systematic Review is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

(Signature)

Name of Student: Guncha Kapur

Date: 23rd June 2022

CERTIFICATE

This is to certify that Guncha Kapur in partial fulfillment of the requirements for the award of the degree of MBA Hospital and Health Management from the IIHMR University, Jaipur has successfully completed her internship at Healthcare Business Insights, Part of Clarivate during March 22, 2022 to June 19, 2022.

Place:

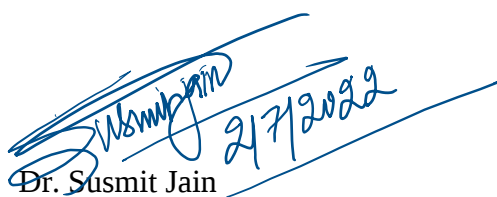
Preceptor/Head of the Organization

Date:

Healthcare Business Insights, Part of Clarivate

CERTIFICATE

This is to certify that dissertation titled Incidence, Prevalence, and Best Practice Learnings for Stroke Management in India and the US: A Systematic Review is a record of the research work undertaken by Guncha Kapur in partial fulfillment of the requirements for the award of the degree of MBA Hospital and Health Management from the IIHMR University, Jaipur under my guidance and supervision and her approach to the research study has been sincere, scientific, and analytical.



Dr. Susmit Jain
Faculty Guide
IIHMR University, Jaipur
Date: 02/07/2022

School Dean
IIHMR University, Jaipur

Date

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And, to my gracious family who have always supported me in my endeavours.

—Guncha Kapur

Abstract

Title: Incidence, Prevalence, And Best Practice Learnings For Stroke Management In India And The Us: A Systematic Review

Submitted by: Guncha Kapur

Guided by: Dr. Susmit Jain

Introduction: Stroke is one of the foremost reasons of disability and death globally. It has a high burden in the US and India, and every year billions of dollars are spent across these countries in catering to patient treatment and rehabilitating from its effects, as by 2035, the associated costs are expected to rise to \$143 billion. Additionally, it poses economic implications as it contributes to highest numbers of disability adjusted life years (DALYs) lost as 57% of all cause DALYs globally, are due to stroke.

Objectives: 1. To study the burden of stroke in India and the US; 2. To identify the diagnosis, treatment and rehabilitation protocol for AIS adopted in India and US; and 3. To review the best practices adopted for stroke management in India and US.

Methodology: To answer the research questions, descriptive study design was chosen and a systematic review was conducted with a fixed inclusion and exclusion criteria. Systematic sampling was done to collect the secondary data, where all research materials (Journal Articles, blogs, surveys, reports, webpages) from 2018 originating from India or the US were included, while research materials older than 2018 and not from either India or the US were excluded. Review Matrix using MS Excel was utilized in aggregating the information (16 articles shortlisted after identifying 44 articles which were well within the inclusion criteria), over the three months of study. Exceptionally, a report from ICMR published in 2017 has been included.

Keywords used: Stroke, best practice recommendations, guidelines, policies, standard operating procedures, primary prevention, diagnosis, treatment, rehabilitation etc.

Findings and Conclusion: The incidence and prevalence rates of stroke in the US are about 2.4% and 3.4% [95% CI, 2.4%–3.1%] respectively, according to a BRFSS report. In the Indian context, the crude incidence rate and prevalence rates have been estimated to range within 108 to 172 per 100,000 persons and 26 to 757 per 100,000 individuals respectively. Research shows that extensive stroke systems which emphasise primary prevention, rapid diagnosis with emergency care, prompt treatment with the shortest door to needle time, better care transitions,

and improved follow-up and rehabilitation services aid in lowering stroke-related morbidity and mortality. Healthcare providers can benefit substantially from utilising technology to introduce mobile tele neurological care services, remote care delivery through tele-stroke ICUs employing telehealth, and enhanced frequency of follow-ups using software and tools.

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Abbreviations

1. **AHA:** American Heart Association
2. **ANM:** Auxiliary Nurse Midwife
3. **ASHA:** Accredited Social Health Activist
4. **AIS:** Acute Ischemic Stroke
5. **ASA:** American Stroke Association
6. **BP:** blood pressure
7. **BRFSS:** Behavioral Risk Factor Surveillance System
8. **CDC:** Centers for Disease Control and Prevention
9. **CI:** confidence interval
10. **COMPASS:** Comprehensive Post-Acute Stroke Services
11. **CSC:** Comprehensive Stroke Centre
12. **DALY:** Disability-Adjusted Life Year
13. **FAST:** Frenchay Aphasia Screening Test
14. **GCS:** Glasgow Coma Scale
15. **GWTG:** Get With The Guidelines
16. **GoI:** Government of India
17. **MoHFW:** Ministry of Health and Family Welfare
18. **MSU:** Mobile stroke unit
19. **NIHSS:** National Institute of Health Stroke Scale
20. **PHC:** Primary Health Centre
21. **TIA:** Transient Ischemic Attack
22. **tPA:** Tissue Plasminogen Activator
23. **US:** United States
24. **VHSNC:** Village Health, Sanitation, and Nutrition Committee
25. **WAB:** Western Aphasia Battery

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Chapter 1: Introduction

Strokes, also referred to as cerebral vascular accidents, are common in patients and can be a significant cause of illness and death. There are three types of strokes: ischemic, hemorrhagic, and subarachnoid. A stroke happens when a blood artery that supplies the brain with oxygen and nutrients is either obstructed by a clot or bursts. In this situation, a part of the brain suddenly lacks the oxygen and blood that it needs, which results in the death of the blood artery and brain cells.

Globally, in 2019, there were 122 million incident stroke cases, 101 million prevalent cases, 143 million DALYs as a result of stroke, and 655 million fatalities from a stroke. The 3rd most frequent cause of death and impairment overall was stroke (57% of all DALYs) and the 2nd-leading root cause of fatalities (116% of all fatalities) globally in 2019 (approximate figures with related CI). Absolute numbers of stroke mortality increased by 43%, incident strokes by 70%, prevalent strokes by 85%, and DALYs attributable to stroke increased by 32% between 1990 and 2019 [\(1\)](#). Strokes account for 70% or more of all deaths in developing nations, including India [\(2\)](#). In India, 70-75% of all strokes are ischemic, with blood clots or plaque deposition in linings of blood vessels blocking flow of blood to the brain—meanwhile, in the US—87% of all stroke cases are ischemic. Stroke survivors and their families/caregivers bear the brunt of the strain. Poor caregiver quality of life is linked to greater rehospitalization and care expenses for stroke survivors. The anticipated overall cost associated with stroke in US was \$66.3 billion in 2015, and by 2035, the amount is expected to rise to \$143 billion [\(3\)](#)

Primordial prevention marks a significant shift in how resources and policies are combined to target bigger populations of people who are at risk. It consists of initiatives to lessen risk factors and, as a result, avoid chronic ailments in particular/entire populations. Programs addressing socioeconomic issues (such as insufficient housing and inadequate access to care), lifestyle factors (such as sedentary behaviour, smoking or its exposure) and dietary patterns (high fat/sodium) reduces chances of incurring hypertension issues, heart conditions, obesity, and ultimately—stroke. The AHA and ASA created the GWTG-Stroke Program—serving as a surveilling national registry and operational improvement program, it helps in enhancing care delivery and stroke outcomes by encouraging constant adherence to the most recent evidence-based guidelines and serving as a scientific resource for new information. Enhancing the care

delivery and outcomes in hospitalised patients is the main objective of the program. This is achieved by facilitating top-notch research on stroke, encouraging stroke centre designations, fostering quality assurance and the development of regional/local system of stroke [\(4\)](#). There is a lack of information on stroke statistics data collection and surveillance system in India. To address the need of high-quality studies of stroke, researchers at ICMR propose to establish The National Stroke Registry Program in India composing of hospital-based stroke registry (HBSR) to care patterns and patient outcomes with stroke in various treatment areas, and population-based stroke registry (PBSR) to collect accurate epidemiological data of first-ever stroke episodes in set populations [\(5\)](#).

Rationale:

Stroke is becoming an increasingly common cause of disability and fatalities in India; Currently, it ranks as the fourth-leading cause of mortality and disability. To face the increasing stroke burden in India—reliable data on incidence, prevalence, and outcomes of stroke are required to develop health guidelines and policies, organise stroke services, and monitor the effects of any changes in care. However, data is scarce and consistency is lacking in data collection techniques across literature. This review will aid in learning epidemiology and the best practices from the countries with suggestions derived upon the literature available.

Research Question:

1. What is the incidence and prevalence of AIS in India and the US?
2. What are the various diagnosis, treatment and rehabilitation protocols adopted by India and the US to manage AIS?
3. What are the best practices conducted within India and the US for stroke management?

Objectives:

1. To study the burden of stroke in India and the US.
2. To identify the diagnosis, treatment and rehabilitation protocol for AIS adopted in India and the US.
3. To review the best practices adopted for stroke management in India and the US.

Chapter 2: Review of Literature

As per the US CDC, a stroke occurs to someone in the US every 40 seconds, and a person succumbs to it, by every 4th minute. Stroke has affected approximately 7.2 million Americans under the age of 20. Every year, in the US, new or reoccurring strokes affect about 800,000, making it an incident rate of 2.4%. According to a BRFSS report, the prevalence of stroke in adults in the US is 3.4% (18). Stroke is the 5th leading cause of death in US, with 150,005 casualties in 2019 (6). In India, as per the 2017 ICMR report titled "India: Health of the Nation's States," stroke was the 4th leading cause of death and is responsible for 3.5% of DALY (7). According to a recently published study which reviewed literary evidence, in India, rate of incident (crude) ranged from 108 to 172/100,000 persons whereas a significant variation was seen in the figures denoting crude prevalence rates 26 to 757/100,000 individuals (19).

In India, given the complexity of stroke management, the function of the PHC is restricted to risk evaluation, early symptom diagnosis, stabilisation, and fast referral to higher-level facilities with management capabilities.

- Primary care includes primary prevention, early detection and referral, and rehabilitation.
- Stroke management, secondary prevention and follow-up, and rehabilitation are all examples of secondary health care.
- Tertiary health care consists of sophisticated and higher level acute case management, stroke follow-up for empowerment and support services, and therapy for persistent impairment.

In rural areas, Population-Based Screening detects potential instances of hypertension and diabetes in the community. All women and men above the age of 30 are screened. The ANM, aided by the ASHA and members of the VHSNC, conduct assessments for hypertension and diabetes, two established risk factors for stroke, on a scheduled day of the week in the Village or Sub Centre, depending on the distance/ topography. With the implementation of Ayushman Bharat in 2018, all existing HSCs and PHCs are expected to be converted to HWCs, delivering a spectrum of primary health care services covering the preventive, promotional, curative, and rehabilitative components of a scope of services that cover the entire population. A suitably educated PHC team comprised of Multi-Purpose Workers, ASHAs—led by a Mid-Level Health Provider would staff the HWC at the SHC level. PHCs would also be strengthened in order to act as the HWC for the community in its immediate neighbourhood (8).

The American Heart Association promotes preventive measures for heart attacks and strokes in communities by increasing access to healthy and affordable diets, updated food labelling, and PE programs in schools and workplaces. The US DHHS developed the Million Hearts Program with the goal of preventing one million strokes and heart attacks through scientific, programs, collaborations with private agencies, political administration and commercial initiatives.

Effective stroke care systems can improve communication between clinical areas, identify key performance indicators and patient-centered outcomes—providing patients, families, as well as providers with the resources they need for prevention, treatment, and rehabilitation. These services should extend the delivery of care from primary prevention to treatment and recovery. As a result, deficient care systems should receive special attention because they may be linked to worse stroke outcomes. A stroke system that is optimised has significant effects on global and US public health. As per a 2019 Policy Statement from ASA, 20,000 less fatalities in the US itself and 400,000 lesser global fatalities would result from a stroke-care system that reduced stroke-related fatalities by just 2% to 3% year. Keeping poststroke disability to a minimum would also enhance quality of life, save expenses, and have a minimal negative effect on patients, caretakers, third-party payers, and states [\(3\)](#).

Time is crucial in stroke treatment. For efficient and effective stroke therapy, a cohesive team from the emergency room to the neurologist and the interventional neurologist is required. Correct imaging selection, prompt care to stabilise the patient, and accurate diagnosis can all significantly alter a patient's prognosis. Every minute wasted on a misdiagnosed imaging or laboratory test reduces the functional outcome and, in the end, causes irreversible paralysis. The effectiveness of stroke treatment depends on the entire team operating effectively [\(9\)](#).

Recommendations from Stroke Management guidelines by the MoHFW and ASA

The CDC [\(3\)](#) and Government of India [\(8\)](#) support many public health programs in respective countries to combat various cardiovascular diseases including stroke.

In the guidelines by MoHFW, measures to prevent stroke at various levels of Indian public health system are presented. The guidelines by American Stroke Association give their recommendations for developing an acute stroke care model and extending it to other areas

such as access to primary care for prevention of stroke, awareness programs, and rehabilitation and recovery.

Table 1. Stroke management protocol recommendations by India and the US		
Protocol	India	US
Prevention	Primary Prevention: Expansion of services at HWC must cover: - Population census, community-based risk evaluation, and community mobilisation for NCD screening by ASHAs. - Availability of screening at the HSC/ HSC-HWC and PHC/ PHC-HWC levels at the facility or in the village, depending on the situation and availability of appropriate screening venues. 3. Referral of tested persons to PHC / PHC-HWC for confirmation of diagnosis and treatment commencement - Monthly check-ups and medication administration as per the treatment plan at the SHC/ SHC-HWC level - Health Promotion to raise awareness about risks factors and encourage lifestyle changes	Primary Prevention: Stroke systems must - create mechanisms to aid communities and health systems in launching preventive programs for larger populations. - support systems to help communities, patients, and providers stick to long term prevention strategies. - support national and regional education programs aimed at the general population to increase stroke awareness, especially targeting high risk populations and poor post-stroke outcomes. - track efficacy of community awareness programs.
Diagnosis	- Patients who have two or more TIAs in a week should be categorised with a higher risk of stroke and must be evaluated as soon as feasible within 24hrs. "Dekhna, dikhna, hath, paer, bol, chal" is a simple mnemonic. Any	In order to ensure that all patients with known or suspected stroke are quickly identified and assessed using an approved and standardised tool for stroke screening (FAST/LA Prehospital Stroke Screen/CPSS) triage

	abrupt onset disruption in dekhna, dikhana, hath, paer, bol, or chal should raise the possibility of a Stroke and warrant immediate medical attention. iii. To recognize stroke, FAST (Face drooping, A numb/weak arm, S slurred speech, T - Time) [Time must not be wasted, must act quickly for treatment] abbreviation should be used.	paradigms and protocols must be developed in collaboration with all stakeholders. ii. Patients screening positive for suspected stroke should be triaged using a standard technique to assess prehospital stroke severity. Modify the Mission: Lifeline SOP to meet the demands of the people. iii. Protocols that include a paramedic prearrival alert that a stroke patient is on the way should always be employed.
Treatment	i. It is important to record each patient's GCS score (individually for best motor, best verbal, and eye-opening responses). ii. Validated stroke assessments, such as the NIHSS, may be used to gauge the severity of neurological loss. . iii. systematic ways must be used (e.g., stroke teams with minimum of two stroke-trained physicians/doctors, four nurses, and a physiotherapist, stroke units, and SOPs). iv. Every district hospital must have around the clock CT scan facility.	Stroke centres should i. use methodical strategies (e.g., teams to manage stroke, special units, and written procedures). ii. For patients presenting with stroke history/TIA or suspicion of having had one, implement secondary prevention strategies addressing all reversible risk factors, in consistency with formal guidelines in order to lower mortality, maximise rehabilitation, and prevent reoccurring stroke and cardiovascular problems.

For an overall shift in thinking on holistic stroke care, the following three suggestions were made by the Columbia University Irving Medical Centre, in their special report ([10](#)):

- The AHA and ASA should bring about a wider GWTG-Stroke program, focusing on rehabilitation preparedness and 90-day outcome measures.
- Additionally, a public health initiative to provide upbeat and practical messages for secondary prevention should be launched.

- The main requests from patients and family—improved access, greater secondary prevention, stroke recovery, and individualised care—must be honoured right away.

AHA, in its recently issued scientific statement [\(11\)](#) recommends incorporating following elements to ensure safe and efficient management of in-hospital stroke incidents:

- Train all hospital employees to initiate in-hospital stroke warnings during a stroke training session.
- Establish RRTs, with specialised training in stroke management and quick access to neurological knowledge.
- Institutionalize the physical examination and imaging procedures used to evaluate patients who may be experiencing an in-hospital stroke.
- Address any potential hurdles, such as facility transfers for advanced stroke care.
- Evaluation and surveillance of quality of stroke care provided in hospitals, providing data-driven performance feedback, and guiding focused quality improvement initiatives.

Discharge and rehabilitation

In both countries, it has been emphasized that:

- i. As soon as patient is stable, discharge planning involving patient and family should be initiated.
- ii. All required training in caring for the patient, should be given to caregivers.
- iii. All issues, including secondary prevention, should be discussed to patients, along with the necessity and scheduling of follow-up visits following discharge.
- iv. In order to decide whether rehabilitation services are required and what kind, when, where, and how long such therapy should last, the stroke system should make sure that every stroke survivor has evaluated periodically during their initial hospitalisation.
- v. Stroke patients should receive rehabilitation from a multidisciplinary team that includes a doctor, a physiotherapist, an occupational therapist, a nurse, a speech therapist, a clinical psychologist, an orthotist, a dietician, and a social worker.
- vi. Patients with persistent disabilities should be identified through long-term primary care and follow-up by an expert (physician or neurology) so that these patients can receive the right kind of ongoing rehabilitation.
- vii. A stroke system should routinely evaluate the quality of its available community resources and rehabilitation programs.

Stroke management best practices:

Table 2. Stroke Management Best Practices: Examples from Evidence			
Author (year)	Title	Result	Salient Features
Buerck A. et al ¹² (2019)	Improved 30 Day Readmission Rates in the Acute Stroke Population Through Patient Teach Back	In a study conducted in the US between 2015-2017, a hospital managed to reduce its' readmission rates by 3.2%, from 9% in 2015 to 5.8% in 2017 and improved patient satisfaction by over 9.5% by improving patient education and patients' capacity to comprehend discharge instructions through implementation of teach back education and patient follow-up.	Improved health literacy of patient and caregiver reduced readmissions.
Haranath et al ¹³ (2021) (India)	eNeuroIntensive Care in India: The Need of the Hour	The feasibility of tele-health capacities for neuro intensive care has been affirmed, and the need and scope of establishing remote critical care facilities in rural India, to cater to emergencies has been emphasized.	Reaching out to rural communities by leveraging technology.
Paplikar et al ¹⁴ (2020) (India)	A Screening Tool to Detect Stroke Aphasia: Adaptation of Frenchay Aphasia Screening Test (FAST) to the Indian Context	Researchers adapted and validated the aphasia diagnostic test (ab. FAST) to Kannada and Telugu, addressing the language barrier of literacy in the population. The results reported a strong association between the WAB (widely used diagnostic instrument), and the Aphasia Quotient of the Indian version of the FAST total scores and found it to be a simple screening tool in the Indian context, for identifying	Adoption of screening tools in a regional language helps accurate and quick diagnosis of stroke related complications.

		linguistic difficulties associated with stroke.	
(In collaboration with multiple health systems) 15 (2014-ongoing) (US)	BEnefits of Stroke Treatment Delivered Using a Mobile Stroke Unit (BEST-MSU)	According to an ongoing study at a health system in US, 53% of stroke patients who were treated by a MSU received clot-busting drug tPA etc faster, frequently, and recovered fully as opposed to 43% individuals not receiving care on a MSU.	Early identification and administration of clot busting drugs prevents morbidity and disability from stroke.

Chapter 3: Methodology

Study Design: Descriptive study (Systematic review)

Study Population

- **Inclusion criteria:** All research materials (Journal Articles, blogs, surveys, reports, webpages) from 2018 originating from India or the US.
- **Exclusion criteria:** All research materials older than 2018 and not from either India or the US.
- **Study tools:** Review Matrix using MS Excel

Duration Of Study: 3 months

Sample Size: 16 articles

Sampling Technique: Systematic sampling with fixed inclusion and exclusion criteria.

Data Collection Procedure: Secondary data (Research studies, blogs, surveys, reports, webpages).

Keywords used: Stroke, best practice recommendations, guidelines, policies, standard operating procedures, primary prevention, diagnosis, treatment, rehabilitation etc.

Exceptions: A report from ICMR published in 2017 has been included.

Chapter 4: Results and Discussion

Every year, 800,000 new strokes occur in the US. Every 40 seconds, a new stroke occurs. The #1 primary cause of disability and fifth most common cause of loss of life are both strokes [\(6\)](#). Research shows that the stroke incidence in India ranges from 33 to 123/100,000 people. The overall prevalence of stroke in rural and urban population was estimated to be 44.54 to 150/100,000 individuals. In rural areas the prevalence ranged from 55 to 388.4/100,000 people, while they range from 45 to 487/100,000 persons in urban areas. The stroke case mortality rate within 30 days was estimated to range from 41.08 to 42.06 % in urban areas and from 18 to 46.3% in rural areas [\(16\)](#). The incidence and prevalence rates of stroke in the US are about 2.4% and 3.4% [95% CI, 2.4%–3.1%] respectively [\(17\)](#)

The two main types of acute strokes—also referred to as cerebrovascular accidents—are hemorrhagic and ischemic. Acute strokes result in the loss of blood flow, nutrients, and oxygen in a specific area of the brain, which damages the neurons and leads to neurological abnormalities. Early, targeted treatment, therapeutic interventions, and long-term lifestyle changes can all boost the likelihood of a significant recovery.

Acute stroke treatment is intricate, multifaceted, and involves numerous healthcare organisations. A thorough stroke system of care can enhance stroke prevention, treatment, and outcomes. Policymakers must actively participate in enhancing stroke care since they have significant influence over these systems and a duty to do so. Supporting the establishment of primary stroke centres in both urban and rural areas, accessibility to advanced stroke centres with endovascular and surgical expertise, adoption of tele stroke as a successful method of delivering acute stroke consultation, on-call consultations, and use of cutting-edge technological services are some examples of what is covered by this.

Limitation: Since each study chooses and selects a sample of participants to represent the study population, estimates of the prevalence of stroke may vary slightly between studies (e.g., state, region, or country).

Chapter 5: Conclusion

Research shows that comprehensive systems of stroke which focus on primary prevention, timely diagnosis with emergency care, prompt treatment with least door to needle time, better transitions of care and improved provisions of follow-up and rehabilitation help in reducing morbidity and mortality caused by stroke. Leveraging technology in this day to introduce mobile tele neurological care services, remote care provision through tele-stroke ICUs using telehealth, and improved frequency of follow-ups using software and tools can greatly help healthcare providers.

In the course of this review, comprehensive data, studies, best practices along with guidelines and policies adopted by hospitals based in the US were available in the public domain compared to research content available in the Indian context. Recent evidence on the epidemiological measures of stroke in India and the best practises for stroke management that have been adopted in the Indian setting, are lacking. There is a significant lack of literature in the Indian context which has a scope of being addressed in future studies.

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Annexure

Tools:

1. *NIH Stroke Scale:* ([here](#))
2. *Glasgow Coma Scale:* ([here](#))
3. *Western Aphasia Battery Test:* ([here](#))