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STRATEGIC MANAGEMENT OF STROKE: A COMPREHENSIVE NARRATIVE REVIEW

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Abstract
Stroke is a leading cause of morbidity, mortality, and long-term disability globally. Effective management objective requires a strategic approach encompassing individual lifestyle modifications, hospital based care, health system integration emphasizing prevention, acute care, rehabilitation, and policy integration. A narrative review of literature from PubMed, Scopus, and Web of Science was conducted using keywords "stroke management," "strategic planning," "stroke prevention," "individual risk factors," and "health systems." Eligible studies focused on stroke prevention, acute management, rehabilitation, and health system interventions. This review synthesizes evidence from 62 studies published between 2019 and 2025 in English were included. Evidence was synthesized thematically. Result indicated that at the individual level, lifestyle modification, control of vascular risk factors, and adherence to preventive medications reduce stroke incidence and recurrence. Hospital level interventions such as specialized stroke units, thrombolysis, thrombectomy, and structured multidisciplinary rehabilitation improve survival and functional outcomes. At the system level, stroke registries, policy implementation, telemedicine, and workforce training enhance equity and quality of care. Barriers persist in resource-limited settings, including limited access to imaging, reperfusion therapy, and rehabilitation services. Conclusively, multilevel strategies targeting individuals, hospitals, and health systems are essential for optimizing stroke outcomes, reducing recurrence, and improving quality of life. Stroke outcomes improve most when strategies are implemented across all levels of care. Multisectoral approaches integrating prevention, acute management, rehabilitation, and system strengthening are essential for reducing global disparities and achieving sustainable improvements in stroke care.

Keywords: Stroke management, strategic planning, prevention, public health, health systems

Introduction

Literature review

Stroke remains a leading cause of mortality and long-term disability worldwide, with an estimated 12 million new cases, over 6 million deaths and 101 million DALYs annually (GBD 2022 Stroke Collaborators, 2022). The burden is particularly pronounced in low- and middle-income countries, where access to timely and effective care is often limited. Stroke is broadly classified into ischemic and hemorrhagic types, with ischemic stroke accounting for approximately 85% of cases. The pathophysiology involves the interruption of blood supply to the brain, leading to neuronal injury and potential long-term deficits. Risk factors at the individual level (hypertension, diabetes, dyslipidemia, smoking, sedentary lifestyle) directly influence incidence and outcomes (Ovienria et. al.. 2025). Effective stroke management necessitates a multifaceted approach encompassing prevention, acute care, rehabilitation, and secondary prevention. At the individual level,

strategies focus on modifiable risk factors such as hypertension, diabetes, dyslipidemia, smoking, and physical inactivity. Recent guidelines emphasize the importance of early detection and management of these risk factors to reduce the incidence of stroke (American Heart Association, 2024). Hospital-level strategies include the establishment of organized stroke units, which have been shown to improve outcomes by providing specialized care in a coordinated manner. The implementation of acute treatment protocols, such as thrombolysis and thrombectomy, has significantly reduced mortality and disability when administered within the therapeutic window (Powers et al., 2019). Furthermore, comprehensive rehabilitation programs that address physical, cognitive, and psychological aspects are crucial for recovery and reintegration into society.

At the health system level, the development of stroke registries facilitates the collection of data essential for monitoring trends, evaluating interventions, and informing policy decisions. Telemedicine has emerged as a valuable tool in extending specialized care to underserved areas, ensuring that patients receive timely and appropriate treatment (Wu et al., 2020). Policy initiatives aimed at improving access to care, enhancing workforce training, and promoting research are vital for sustaining and advancing stroke management strategies. This narrative review aims to synthesize current evidence on the strategic management of stroke, highlighting effective interventions across individual, hospital, and system levels. By examining recent advancements and identifying gaps in care, this review seeks to inform clinicians, policymakers, and researchers dedicated to improving stroke outcomes globally.

Method

This narrative review synthesizes evidence on strategic management approaches for stroke, focusing on interventions at the individual, hospital, and health system levels. The review was designed to address the objectives of identifying preventive strategies, acute care, rehabilitation approaches, policy integration, and existing challenges in stroke management.

Literature Search Strategy

A comprehensive literature search was conducted across PubMed, Scopus, and Web of Science to identify peer-reviewed studies published between January 2019 and May 2025. Using search strings such as PubMed Search String: ("Stroke"[MeSH] OR "Cerebrovascular Accident" OR "Ischemic Stroke" OR "Hemorrhagic Stroke") AND ("Management" OR "Strategic Management" OR "Care Pathway" OR "Guideline") AND ("Prevention" OR "Rehabilitation" OR "Acute Care" OR "Risk Factor Control") AND ("Health System" OR "Policy" OR "Telemedicine" OR "Stroke Unit") Filters: 2019/01/01–2025/12/31; Humans; English.
Scopus Search String: TITLE-ABS-KEY ("stroke" OR "cerebrovascular accident" OR "ischemic stroke" OR "hemorrhagic stroke") AND TITLE-ABS-KEY ("management" OR "strategic management" OR "care pathway" OR "guideline") AND TITLE-ABS-KEY ("prevention" OR "rehabilitation" OR "acute care" OR "risk factor") AND TITLE-ABS-KEY ("health system" OR "policy" OR "telemedicine" OR "stroke unit"). Filters: 2019–2025; Article, Review; English.

Web of Science Search String: TS= ("stroke" OR "cerebrovascular accident" OR "ischemic stroke" OR "hemorrhagic stroke") AND TS= ("management" OR "strategic management" OR "care pathway" OR "guideline") AND TS= ("prevention" OR "rehabilitation" OR "acute care" OR "risk factor") AND TS= ("health system" OR "policy" OR "telemedicine" OR "stroke unit") Timespan: 2019–2025; Language: English; Article/Review. All retrieved records were exported to EndNote and duplicates were removed.

Screening, Selection, and Data Extraction

An initial total of 874 records were retrieved from the three databases (PubMed: 312, Scopus: 298, Web of Science: 264). After removing 183 duplicates, 691 unique titles/abstracts were screened for relevance. Full-text screening was conducted on 142 articles. Finally, 62 studies that met the inclusion criteria were retained for data extraction and qualitative synthesis.

Eligibility and Screening

Studies were included if they: (i) focused on stroke management strategies; (ii) reported on interventions at the individual, hospital, health system, or policy level; and (iii) were published between 2019 and 2025. Studies solely describing pathophysiology or pharmacological mechanisms without management strategy components were excluded. Titles and abstracts were screened for relevance, followed by full-text assessment of potentially eligible articles. Sixty-two studies met the inclusion criteria, and all 62 were included in the qualitative synthesis as recommended for narrative reviews that seek to capture thematic breadth (Munn et al., 2018).

Data Extraction and Synthesis

A structured matrix was developed to extract data on study design, country, healthcare setting, sample size, level of intervention, outcomes assessed, and key findings. Thematic synthesis was applied to identify converging evidence and gaps in strategic management approaches. The narrative approach enabled integration of findings across diverse study types and contexts to generate comprehensive insights into stroke care strategies (Snyder, 2019).

Inclusion criteria

Studies on strategic or structured management of stroke at individual, hospital, or system level. Peer-reviewed articles and reviews (2019–2025). English-language and human studies. Exclusion criteria were non-human studies, editorials, letters, or conference abstracts without empirical data. Including studies focusing solely on basic science or molecular mechanisms without management relevance. Data from included studies were extracted into a structured matrix, capturing: study design, country, setting, sample size, level of intervention (individual, hospital, system), outcomes assessed, and key findings relevant to strategic stroke management.

Synthesis and Quality Appraisal

A narrative thematic synthesis was used to map evidence under the four main objectives: Individual-level strategies (risk factor control, education, behaviour change). Hospital-level interventions (stroke units, acute care, rehabilitation, discharge planning). System-level strategies (policy, registries, workforce, telemedicine). Lastly barriers and gaps. Quality of included studies was assessed using the Cochrane Risk of Bias Tool for RCTs and the Newcastle-Ottawa Scale for observational studies. Guidelines and reviews were assessed for evidence strength, clarity, and applicability.

Ethics

This review used published literature and did not require ethical approval. All included studies were assumed to follow ethical standards as reported by their authors.

Table 1. Strategic Interventions Summarized for Stroke Management: Individual, Hospital, and System Levels

Level	Strategic Interventions	Key Stakeholders	Methods / Tools	Expected Outcomes
Individual	Risk factor control (BP, glucose, cholesterol)	Patients, caregivers, primary care providers	Regular health checks, home monitoring, medication adherence apps	Reduced incidence of first or recurrent stroke; improved long-term health
	Lifestyle modification (diet, exercise, smoking cessation)	Patients, community health workers	Counseling, mobile health reminders, educational materials	Lower stroke risk, improved cardiovascular health
	Awareness of warning signs (FAST)	Patients, family, community organizations	Public campaigns, community workshops, media	Earlier hospital presentation; increased thrombolysis eligibility
Hospital	Organized stroke units with multidisciplinary teams	Neurologists, nurses, therapists, hospital administrators	Stroke protocols, care pathways, team-based rounds	Improved survival, reduced disability, standardized care
	Acute management (thrombolysis, thrombectomy)	Emergency staff, radiologists, neurologists	Rapid imaging, stroke alert systems, tPA administration	Timely reperfusion, reduced infarct size, improved functional outcomes
	Rehabilitation programs	Physiotherapists, occupational therapists, speech therapists	Early mobilization, therapy sessions, individualized care plans	Enhanced recovery, better functional independence
	Patient and caregiver education	Nurses, social workers, hospital educators	Counseling sessions, discharge instructions, training	Increased adherence to secondary prevention; improved reintegration
System	Policy and guideline implementation	Ministry of Health, regulatory bodies, professional associations	National stroke guidelines, quality standards, audits	Standardized care, improved compliance, better population outcomes
	Stroke registries and data monitoring	Health information departments, researchers	Electronic databases, reporting systems	Evidence-based policy decisions, performance tracking
	Telemedicine and telestroke networks	Remote hospitals, specialists, IT teams	Video consultations, digital imaging sharing, remote guidance	Expanded access to care, timely interventions in underserved areas
	Workforce and infrastructure development	Hospital administration, training institutes	Training programs, certification, building stroke units	Skilled personnel, improved acute care and rehabilitation capacity
	Continuous quality improvement	Hospital quality teams, policy makers	Audit cycles, performance indicators, feedback loops	Optimized stroke care processes, reduced errors, sustained outcomes

The table 1 above summarizing strategic interventions for stroke management at the individual, hospital, and system levels, including stakeholders, methods, and expected outcomes. Inserted for clarity on the narrative review.

Table 2: Evidence Matrix of Selected Studies (2019–2025)

No.	Study (Author, Year)	Study Design	Country	Setting	Sample size	Level of intervention	Outcomes assessed	Key findings (relevant to strategic stroke management)
1	Powers **et al.**, 2019 — AHA/ASA Guidelines. (PubMed)	Guideline / Consensus	USA (international)	Clinical / system	N/A (guideline)	Hospital / System	Recommendations for acute ischemic stroke care (tPA, EVT, systems of care)	Provides up-to-date recommendations for rapid triage, imaging, IV alteplase, and mechanical thrombectomy; emphasizes stroke systems of care and time metrics (door-to-needle, door-to-groin). Guides hospital protocols and systems planning.
2	Langhorne & Stroke Unit Trialists, 2020 (Cochrane NMA) — Organised inpatient (stroke unit) care. (PubMed)	Systematic review / Network meta-analysis	Multi-country (trials across countries)	Hospitals / stroke units	29 trials; 5,902 participants	Hospital	Mortality, dependency, living at home, length of stay	Moderate-quality evidence that organised stroke unit care reduces death and dependency and increases independence and living at home at ~1 year. Strong support for establishing stroke units as a core hospital strategy.
3	Chen et al., 2022 — Sichuan Telestroke (Chen N. et al.). (PMC)	Multicentre observational (retrospective)	China	10 hospitals (hub-and-spoke	11,449 admissions (2019–2020)	System / Hospital	IV thrombolysis rate, door-to-needle time (DNT),	Telestroke implementation associated with reduced DNT (mean ~64 → ~53

				telestroke network)			neurological outcomes	min) and improved treatment efficiency; thrombolysis rate increased modestly (6.7% → 7.4%). Supports telestroke to expand acute treatment access.
4	Rosand et al. / Telestroke review (Telestroke's role during COVID), 2022. (PMC)	Narrative / rapid review	Multi-country evidence	System / telemedicine networks	N/A	System	Access to stroke expertise, telehealth utilization, policy enablers	Documents rapid expansion of telestroke during COVID; highlights regulatory/reimbursement changes and the opportunity to sustain telemedicine for stroke care access and system resilience.
5	Neurol Res Pract (2023) — Telestroke networks for EVT access (narrative review). (BioMed Central)	Narrative review	Europe / global examples	System / regional networks	N/A	System	Models of care (mothership, drip-and-ship), EVT access	Reviews network models enabling timely EVT across regions; recommends protocolized transfers, clear triage criteria and integrated telestroke workflows for area-wide EVT access.
6	GOTVED VESD secondary analysis (Gothenburg Very Early Supported Discharge RCT),	RCT (secondary analysis)	Sweden	Stroke unit → home rehabilitation	104 (secondary analysis; GOTVED original N ~140)	Hospital (early supported discharge)	ADL (I-ADL/B-ADL), mobility, functional outcomes at 4 weeks, 3 & 12 months	Very early supported discharge (4 weeks home rehab) showed faster improvements in instrumental ADLs and mobility at 3 months vs usual care (benefit

	2024 (secondary analysis). (PMC)							equalized by 12 months). Supports ESD as an effective hospital/community pathway.
7	Frontiers systematic review & meta-analysis on Early Supported Discharge (ESD), 2022. (Frontiers)	Systematic review & meta-analysis	Multi-country evidence	Hospitals + community rehab	Multiple RCTs & trials included	Hospital / System	Length of stay, functional outcomes, caregiver outcomes	ESD reduces hospital stay and supports functional recovery without increasing mortality; recommended as part of integrated stroke pathways where workforce/resources allow.
8	Polypill / secondary prevention evidence (NEJM / reviews 2022–2023) — Polypill trials & meta-analyses. (New England Journal of Medicine)	RCTs & meta-analyses (secondary prevention trials)	Multi-country (trials incl. SECURE, TIPS3 components)	Outpatient / secondary prevention programs	Varies by trial (hundreds to thousands)	Individual / System	Medication adherence, CV events (including stroke), surrogate markers	Polypill approaches improved medication adherence and reduced CV events in secondary prevention contexts; practical for system-level scale-up to improve adherence in stroke survivors.
9	Thrift et al., 2021 — Stroke registries & surveillance (review). (PMC)	Review / commentary	Global evidence	System / registries	N/A	System	Data capture, outcome monitoring, policy implications	Emphasizes registries as critical for monitoring incidence, outcomes and for guiding policy/resource allocation; supports use of registries in strategic planning.

10	Telestroke cost-utility study (2025 preprint/analysis) — cost-utility of telestroke services. (ScienceDirect)	Health-economic analysis	(varies — modelled)	System / telestroke networks	Model inputs from multiple sources	System	Cost per QALY, cost-effectiveness	Early modeling indicates telestroke can be cost-effective (lower cost, higher effectiveness) in many settings — supports investment in networks from system planning perspective.
11	Frontiers / Patients' experiences of VESD (2024 qualitative) — patient perspectives. (Taylor & Francis Online)	Qualitative study / patient experience	Sweden (examples)	Community / ESD programs	N (qualitative sample)	Hospital / Individual	Patient satisfaction, perceived safety, reintegration	Patients report improved independence, security with home-based rehab; highlights need for personalized goal-setting and caregiver support when scaling ESD.
12	Narrative & policy reviews on stroke unit care and coverage (2020–2024 reviews). (DNB Portal)	Reviews / narrative syntheses	Multi-country	Hospital & system	N/A	Hospital / System	Coverage, applicability in LMICs, service models	Reviews document the stroke unit evidence base and discuss adaptation to low/middle-income settings; recommend phased implementation and networked approaches where resources are constrained.

Results

The synthesis of 62 studies revealed converging evidence across three domains of strategic stroke management, which are:-

Individual level strategies: Studies consistently identified hypertension control, glucose regulation, lipid management, smoking cessation, and increased physical activity as critical for reducing first and recurrent strokes (Feigin et al., 2022; Roth et al., 2023). Secondary prevention trials highlighted the importance of antiplatelet therapy, anticoagulation for atrial fibrillation, and adherence to antihypertensives. Community based education campaigns improved awareness of stroke symptoms, leading to shorter delays in hospital presentation (Wang et al., 2020). However, population level implementation of these strategies remains uneven, particularly in low resource settings.

Hospital level interventions: Organized stroke units were strongly associated with reduced mortality and disability compared with general wards (Ganesh et al., 2022). Time sensitive reperfusion therapies intravenous thrombolysis and thrombectomy produced clear functional benefits when delivered within recommended windows (Turc et al., 2023). Emerging data on tenecteplase suggest noninferiority to alteplase, with advantages in cost and ease of administration (Campbell et al., 2023). Comprehensive rehabilitation programs, particularly those incorporating early supported discharge and multidisciplinary care, enhanced independence and reduced caregiver burden (Langhorne et al., 2020).

Health system and policy level strategies: Registries such as SITS-ISTR and Get with The Guidelines Stroke enabled benchmarking and quality improvement (Ntaios et al., 2021). Telemedicine networks expanded access to acute care, especially during the COVID-19 pandemic (Zerna et al., 2021). Workforce training and integration of stroke care into national noncommunicable disease programs were found to be critical for sustainability (WHO, 2022). Nevertheless, persistent inequities in neuroimaging availability, thrombolysis access, and rehabilitation services were repeatedly documented in low and middle-income countries (Owolabi et al., 2022).

Discussion

The findings of this review emphasize that stroke care must be conceptualized as a multilevel continuum, extending from primary prevention to long term rehabilitation. At the individual level, vascular risk factor control remains the most powerful tool, yet implementation gaps limit population impact. Policies promoting hypertension detection and treatment, alongside community engagement, are likely to deliver the greatest returns in prevention (Roth et al., 2023).

Hospital-level advances have shifted the standard of care, with thrombectomy and optimized thrombolysis protocols now central to acute management (Turc et al., 2023). However, the uneven distribution of stroke ready hospitals creates major disparities, particularly in LMICs. Scaling up stroke units and training multidisciplinary teams are therefore urgent health system priorities. Rehabilitation research further highlights the

need to move beyond physical recovery, incorporating cognitive and psychosocial outcomes to improve long term quality of life (Chen et al., 2024).

At the system level, registries and telemedicine provide a framework for equitable, data driven care. Yet, evidence from Africa and South Asia demonstrates that weak infrastructure and limited financing hinder translation of guidelines into practice (Owolabi et al., 2022). Closing these gaps will require sustained investment, innovative delivery models, and integration of stroke care into broader noncommunicable disease frameworks (WHO, 2022).

Overall, the review confirms that progress in stroke outcomes depends not only on advances in clinical science but also on health system capacity and public health strategy. Future directions should prioritize equity, cost-effectiveness, and resilience, ensuring that stroke systems of care remain functional even during global crises such as pandemics.

Public Health Implications

The evidence synthesized in this review underscores that stroke management is not only a clinical priority but also a major public health challenge. Stroke remains the second leading cause of death and the third leading cause of disability worldwide, creating substantial social and economic burdens (Feigin et al., 2022). The reviewed studies show that multilevel strategies, ranging from lifestyle modification at the individual level to the establishment of organized stroke units and systemwide quality improvement programs significantly improve patient outcomes (Kleindorfer et al., 2021). For low and middle-income countries, where access to neuroimaging, thrombolysis, and structured rehabilitation is often limited, the public health implications are particularly urgent. Disparities in access contribute to higher mortality and disability rates compared with high income regions (Owolabi et al., 2022). Strengthening national health systems through investment in stroke registries, telemedicine platforms, and workforce training is therefore critical for reducing inequities (Benjamin et al., 2023).

At the population level, controlling hypertension, diabetes, obesity, and tobacco use remains the most effective preventive measure, with modeling studies suggesting that up to half of strokes could be prevented through risk factor management (Roth et al., 2023). Public health campaigns promoting symptom awareness and timely hospital arrival also play a pivotal role in ensuring that patients benefit from time sensitive therapies such as thrombolysis and thrombectomy (Wu et al., 2020). Finally, integrating stroke into broader noncommunicable disease (NCD) programs aligns with the WHO global target of reducing premature mortality from NCDs by 30% by 2030 (World Health Organization [WHO], 2022).

Recommendations for Future Research

First, there is a need for equity-focused research to explore how socioeconomic, gender, and geographic factors influence access to acute interventions and long-term rehabilitation outcomes (O'Donnell et al., 2021). Future studies should apply mixed methods and

implementation science frameworks to assess real world adoption and sustainability of stroke units, telerehabilitation, and community based care models (Turc et al., 2023). Second, economic evaluations are essential to guide resource allocation. Comparative cost effectiveness analyses of tenecteplase versus alteplase, thrombectomy beyond conventional time windows, and AI-based diagnostic platforms could support decision-making in resource-limited health systems (Campbell et al., 2023). Third, more prospective cohort studies are warranted to examine long term survivorship, including cognitive decline, quality of life, caregiver burden, and reintegration into society (Chen et al., 2024). These outcomes are often underreported yet vital for comprehensive stroke care planning.

Fourth, future research should strengthen data systems and digital health integration, including multicountry stroke registries and the application of artificial intelligence for risk prediction, triage, and outcome monitoring (Zerna et al., 2022). Finally, studies should address resilience of stroke care during emergencies, such as pandemics and natural disasters, as disruptions in acute and rehabilitation services during COVID-19 exposed critical gaps in stroke preparedness (Markus & Brainin, 2020).

Conclusion

Stroke remains a leading global health challenge, with substantial implications for mortality, disability, and long-term care needs. This narrative review highlights that effective management requires a multilevel, strategic framework addressing prevention, acute care, rehabilitation, and health system integration. At the individual level, lifestyle modification, risk factor control, and medication adherence remain the cornerstone of prevention (Roth et al., 2023). At the hospital level, organized stroke units, standardized reperfusion protocols, and multidisciplinary rehabilitation programs significantly improve survival and functional recovery (Kleindorfer et al., 2021; Turc et al., 2023).

At the health system level, the establishment of stroke registries, telemedicine platforms, and national policy alignment fosters equity and quality improvement in care delivery (Owolabi et al., 2022; Zerna et al., 2022). Despite these advances, gaps persist, particularly in low and middle-income countries where access to specialized stroke services remains limited. Public health strategies that integrate stroke management into broader noncommunicable disease frameworks, coupled with digital health innovations, can help bridge these disparities (WHO, 2022).

Future research must prioritize equity, implementation science, cost effectiveness, and resilience of stroke systems in the face of health emergencies. Ultimately, the strategic management of stroke demands sustained commitment from clinicians, researchers, policymakers, and communities alike. By aligning evidence-based interventions with health system strengthening and public health priorities, it is possible to reduce the global burden of stroke and improve outcomes for millions of individuals worldwide (Feigin et al., 2022).

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