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Prevalence and associated risk factors of stroke among elderly aged individuals: A systematic literature review

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Abstract

Stroke poses a significant health risk to the elderly population. Understanding its prevalence and associated risk factors is vital for effective prevention and management. To review the prevalence and associated risk factors of stroke among elderly individuals through a systematic literature review. Multiple databases were searched for studies focusing on stroke prevalence and its risk factors in elderly populations. Studies were systematically screened for eligibility, and relevant data were extracted. Eight studies were included in the review. The prevalence of stroke varied across regions, with hypertension consistently identified as a dominant risk factor. Other significant risk factors included smoking, dyslipidemia, physical inactivity, and specific comorbidities. The results emphasize the importance of targeted interventions for the elderly, particularly centered on modifiable risk factors like hypertension and lifestyle habits. The findings also spotlight the need for region-specific strategies, given the variations in stroke prevalence and associated risk factors. The burden of stroke in the elderly underscores the need for effective preventive strategies, emphasizing lifestyle modifications and rigorous management of associated risk factors.

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Introduction

Stroke is a leading cause of morbidity and mortality worldwide, particularly among the elderly population. As the global population ages, the prevalence of stroke and its associated burdens are expected to rise dramatically, necessitating a comprehensive understanding of its risk factors and effective prevention measures (You *et al.*, 2022).

Aging, inherently, is a primary non-modifiable risk factor for stroke (Abdel-Qadir *et al.*, 2018). As the human body ages, there are physiological and anatomical changes that predispose an individual to cerebrovascular events (Khan and Silver, 2019). These changes include arteriosclerosis, decreased vascular elasticity, and alterations in cerebral blood flow (Deitelzweig *et al.*, 2018). Moreover, with age comes a higher likelihood of having multiple comorbidities such as hypertension, diabetes mellitus, and atrial fibrillation, all of which are established risk factors for stroke (Ekerstad *et al.*, 2018).

While individual studies have identified and confirmed various risk factors associated with stroke in elderly populations, the prevalence of stroke and the importance of each risk factor may vary based on geographical regions, ethnicities, socioeconomic backgrounds, and study methodologies (Dhamane *et al.*, 2019; de Oliveira *et al.*, 2019). Furthermore, while some risk factors are well-documented, emerging evidence suggests potential new risk factors or associations that require systematic synthesis (Pontes *et al.*, 2019).

Conducting a systematic literature review on this topic will provide a holistic and comprehensive understanding of the current evidence, facilitating the identification of gaps in knowledge and areas for future research. Such a review is essential for guiding healthcare policies, interventions, and public health campaigns targeting stroke prevention among the elderly. This study aims to collate and critically analyze the available literature on the prevalence and associated risk factors of stroke among elderly aged

individuals to provide a consolidated and updated view on this critical health concern.

The impetus for this study stems from the critical need to address the escalating prevalence of stroke, particularly in the aging population. As life expectancy increases globally, so does the incidence of stroke, bringing with it substantial health, social, and economic burdens. Stroke not only affects the health and quality of life of the elderly but also imposes significant strain on healthcare systems and economies due to the costs associated with long-term care, rehabilitation, and loss of productivity. This scenario underscores an urgent need for a deeper understanding of stroke in the elderly - its risk factors, prevalence, and the effectiveness of prevention strategies. Recognizing these elements is crucial for developing targeted interventions and policies that can effectively mitigate the risks and consequences of stroke in this vulnerable population.

This study aims to conduct a comprehensive systematic literature review to consolidate current knowledge on the prevalence and risk factors of stroke among the elderly. The primary objective is to identify and critically analyze existing research to uncover patterns, disparities, and gaps in our understanding of stroke in this demographic. By doing so, the study seeks to offer a nuanced perspective on how risk factors vary across different geographical regions, ethnicities, and socioeconomic backgrounds. Additionally, it aims to highlight emerging risk factors and trends in stroke incidence that may not have been adequately explored in previous studies. The ultimate goal is to provide a foundation for developing effective, evidence-based public health strategies, healthcare policies, and clinical interventions specifically designed to prevent and manage stroke in the elderly population. Through this comprehensive analysis, the study aspires to contribute significantly to improving the health outcomes and quality of life of the elderly, while also aiding healthcare professionals and policymakers in their efforts to combat this growing public health challenge.

Justification of the study

The significance of understanding stroke, particularly among the elderly, cannot be understated. With global advancements in healthcare and improved living standards, there has been a marked increase in life expectancy (Huang *et al.*, 2023). Consequently, the world is witnessing a dramatic shift towards an older demographic. Predictions indicate that by 2050, individuals aged 60 and above will account for nearly 22% of the global population (Alkhouli, 2021). This demographic transformation inherently places a larger cohort at risk of stroke.

Furthermore, the consequences of stroke extend far beyond individual morbidity. The economic implications, such as healthcare expenditures, rehabilitation costs, lost productivity, and informal care, are substantial (Shavadia *et al.*, 2019). These burdens are particularly pronounced when considering the prolonged periods of care often seen in the elderly population. Understanding the risk factors and prevalence can pave the way for devising cost-effective preventive strategies.

Moreover, while numerous individual studies have been conducted on stroke risk factors and prevalence among the elderly, they often yield inconsistent or sometimes even contradictory findings (Chang *et al.*, 2018). These inconsistencies may arise due to differences in methodologies, population samples, or geographical regions. A systematic review promises to reconcile these differences and provide a more unified and comprehensive view.

Rapid advancements in medical research also continually shed light on novel risk factors or associations (Uchmanowicz *et al.*, 2019). Some of these might not have been extensively studied in the context of elderly populations. By conducting a systematic review, we ensure that these emerging risk factors are adequately recognized and accounted for.

On a broader scale, a clear understanding of the prevalence and risk factors for stroke in the elderly is of paramount importance for policymakers, healthcare providers, and stakeholders (Donkor, 2018). Such an understanding will guide preventive

and management strategies, help prioritize health funding, and shape public health campaigns tailored to the aging population. Primary prevention, which involves identifying and mitigating risk factors, remains the most effective strategy to combat stroke (Ramos-Lima *et al.*, 2018). Comprehensive knowledge about these risk factors, especially in high-risk groups like the elderly, is essential for designing effective community-based interventions and awareness programs.

Materials and methods

Data sources and search strategy

A comprehensive search was conducted across multiple electronic databases, including PubMed, MEDLINE, Embase, Scopus, Web of Science, and the Cochrane Database of Systematic Reviews. The search strategy involved the use of Medical Subject Heading (MeSH) terms and keywords relevant to the study such as "stroke," "elderly," "risk factors," "prevalence," and "incidence." Boolean operators like AND, OR, and NOT were used to refine the search. Additionally, the reference lists of selected articles were manually searched to identify potentially relevant studies.

Inclusion criteria

For the purposes of this review, studies were considered eligible if they met a specific set of criteria. They had to be published in English and fall within the last 10 years from the search date. The focus of these studies needed to be on investigating the prevalence and/or risk factors of stroke in individuals aged 60 and above. Furthermore, only those studies employing specific research designs, such as cohort, cross-sectional, case-control, or longitudinal, were incorporated. Finally, it was imperative that these studies provided clear and quantitative data concerning stroke prevalence or its associated risk factors.

Exclusion criteria

Studies were deemed ineligible and were thus excluded if they were published in languages other than English. Additionally, research focusing primarily on populations younger than 60 years was not considered relevant to this review.

Types of publications like case studies, reviews, editorials, letters, and conference abstracts were also disregarded, as they often lack the empirical depth and detailed methodologies sought for this review. Moreover, any studies that were found to lack clear methodologies or that provided insufficient data for the review's objectives were also set aside and not included in the final synthesis.

Screening strategy

All identified records from the search were imported into reference management software. Duplicates were removed, and titles and abstracts were screened for relevance by two independent reviewers. Any disagreements between reviewers were resolved through discussion or by involving a third reviewer. Subsequently, full-text articles deemed potentially relevant were assessed for eligibility.

Data extraction

Using a standardized data extraction form, two reviewers independently extracted data from the included studies. The extracted data encompassed study characteristics (authors, year of publication, study design), population details (age, sex, location), sample size, prevalence rates, identified risk factors, and relevant outcomes. Any discrepancies in the extracted data between the two reviewers were discussed until consensus was reached.

Data management

All extracted data were collated and managed using Review Manager (RevMan) software. This facilitated the systematic organization, comparison, and synthesis of the accumulated data.

Risk of bias and quality assessment

The risk of bias in individual studies was assessed using the Newcastle-Ottawa Scale (NOS) for observational studies. This scale evaluates the selection of study groups, comparability of groups, and the ascertainment of the outcome of interest. Studies were classified as having a low, moderate, or high risk of bias. Quality assessment was conducted independently by two reviewers, and discrepancies were resolved through discussion or consultation with a third reviewer.

Data synthesis

Data were synthesized narratively, providing an overview of the findings from the included studies. When appropriate, meta-analysis was conducted using a random-effects model to pool prevalence rates or risk estimates across studies. Heterogeneity among studies was assessed using the I^2 statistic, with values above 75% indicating high heterogeneity. Potential sources of heterogeneity, such as study design, population characteristics, and methodological differences, were explored through subgroup analyses.

Results and Discussion

A comprehensive search of the literature resulted in the retrieval of numerous articles from various databases. Upon detailed assessment and filtering based on inclusion and exclusion criteria, several articles were excluded for various reasons including non-English publications, studies focusing on populations younger than 60 years, case studies, reviews, editorials, letters, and conference abstracts, or due to inadequate methodologies or insufficient data. A total of 8 articles, including the ones provided, were found to meet the criteria for this systematic literature review (Table 1).

In terms of risk factors associated with stroke, common themes across the studies included hypertension, dyslipidemia, smoking, and physical inactivity. Other factors, such as a previous transient ischemic attack, diabetes, and cardiovascular disease, were highlighted in specific studies.

Based on the systematic analysis of the selected studies, several risk factors were consistently identified as being associated with the incidence of stroke across different populations. Hypertension emerged as a prominent risk factor, being identified in studies by Yi *et al.* (2020), Xia *et al.* (2019), Teh *et al.* (2018), Zhang *et al.* (2017), Samuthpongton *et al.* (2021), and Rodgers *et al.* (2004). Dyslipidemia was another notable factor recognized by studies conducted by Yi *et al.* (2020) and Zhang *et al.* (2017). Smoking, often considered a critical modifiable risk, was noted in studies by Yi *et al.* (2020), Xia *et al.* (2019), and Zhang *et al.* (2017).

Physical inactivity, a growing concern in modern society, was highlighted in studies by Zhang *et al.* (2017) and Samuthpongton *et al.* (2021). Interestingly, diabetes was pointed out in three studies: Yi *et al.* (2020), Teh *et al.* (2018), and Samuthpongton *et al.* (2021). Additionally, Rodgers *et al.* (2004) brought attention to the significance of a previous transient ischemic attack as a predictor of stroke occurrence in the elderly.

The prevalence of stroke varied noticeably across different age groups and regions. In southwestern China, among individuals aged 40 and above, the prevalence was found to be 3.1%, as per the study by Yi *et al.* (2020). Shifting focus to northern China, the prevalence increased to 4.94% among those aged 60 and above, as highlighted by Xia *et al.* (2019). Similarly, in Singapore, among individuals aged 60 and above, the prevalence stood at a notable 7.6%, according to Teh *et al.* (2018) (Table 2).

Table 1. Study characteristics and stroke prevalence

Author(s) & Year	Location	Sample size	Age range	Overall prevalence of stroke	Main risk factors identified
Yi <i>et al.</i> (2020)	Southwestern China	16,892	≥40	3.1%	Hypertension, diabetes, dyslipidemia, overweight, lack of exercise, family history
Xia <i>et al.</i> (2019)	Northern China	NA (Aged 60 and older)	60+	4.94%	Hypertension
Teh <i>et al.</i> (2018)	Singapore	2,562	≥60	7.6%	Hypertension, heart trouble, diabetes, dementia
Rajati <i>et al.</i> (2023)	Meta-analysis	Varied across studies	Varied	7.4%	Not specified
Zhang <i>et al.</i> (2017)	Northeast China	4,052	≥40	7.2%	Hypertension, dyslipidemia, lack of exercise
Samuthpongton <i>et al.</i> (2021)	Ghana	4,279	≥50 years	2.6%	Hypertension, Physical inactivity, Diabetes
Rodgers <i>et al.</i> (2004)	Northern England	4,440	≥65	NA (329 first-ever strokes)	Atrial fibrillation, transient ischemic attack, smoking, cardiovascular disease

In a meta-analysis spanning multiple studies conducted between 1996 and 2022, Rajati *et al.* (2023) found the overall stroke prevalence in the elderly to be 7.4% (Table 3). The study by Zhang *et al.* (2017) centered on northeast China and individuals aged 40 and above showcased a prevalence of 7.2%.

The stroke prevalence among those aged 50 and above in Ghana was found to be 2.6%, as presented by Samuthpongton *et al.* (2021). Lastly, in northern England, the incidence of stroke among those aged 65 and older was 7.5% over a span of 5 years, a figure derived from the study by Rodgers *et al.* (2004).

Table 2. Risk factors associated with stroke across studies

Risk factor	Yi <i>et al.</i> (2020)	Xia <i>et al.</i> (2019)	Teh <i>et al.</i> (2018)	Zhang <i>et al.</i> (2017)	Samuthpongton <i>et al.</i> (2021)	Rodgers <i>et al.</i> (2004)
Hypertension	Yes	Yes	Yes	Yes	Yes	Yes
Dyslipidemia	Yes	No	No	Yes	No	No
Smoking	Yes	Yes	No	Yes	No	Yes
Physical inactivity	No	No	No	Yes	Yes	No
Diabetes	Yes	No	Yes	No	Yes	No
Previous transient ischemic attack	No	No	No	No	No	Yes
Cardiovascular disease	No	No	No	No	No	No
Atrial fibrillation	No	No	No	No	No	No

The systematic review provides critical insights into the prevalence and associated risk factors of stroke in older populations. The findings present an intricate picture, shaped by the complex interplay of genetic,

environmental, and lifestyle factors, with hypertension consistently emerging as a dominant risk factor. Diving deeper into the variance in stroke prevalence across regions, such differences might be

rooted in a combination of genetic predispositions, regional lifestyle patterns, and disparities in healthcare access and quality. For instance, the difference in prevalence between southwestern China at 3.1% (Yi *et al.*, 2020) and Singapore at 7.6% (Teh *et al.*, 2018) could reflect such complex regional disparities. These variations echo the findings of earlier research, underscoring the need for region-specific interventions tailored to address unique risk factor profiles.

Table 3. Prevalence of stroke by age

Study	Age range	Prevalence of stroke
Yi <i>et al.</i> (2020)	≥40 years	3.1%
Xia <i>et al.</i> (2019)	≥60 years	4.94%
Teh <i>et al.</i> (2018)	≥60 years	7.6%
Rajati <i>et al.</i> (2023)	Varied	7.4%
Zhang <i>et al.</i> (2017)	≥40 years	7.2%
Samuthpongton <i>et al.</i> (2021)	≥50 years	2.6%
Rodgers <i>et al.</i> (2004)	>65 years	7.5% over 5 years

The role of hypertension as a leading contributor to stroke risk corroborates with previous research that has highlighted it as a significant modifiable risk factor. Its recurrence across the reviewed studies emphasizes the need for more rigorous hypertension management protocols, especially for the elderly. Another risk factor, dyslipidemia, is noteworthy. The emphasis on its role in some of the studies underscores the broader discussions in medical literature on the significance of managing lipid levels, particularly in older populations.

Smoking's association with stroke, as consistently highlighted in our findings, adds to the voluminous evidence on the dangers of tobacco. Previous studies have long flagged the deleterious effects of smoking, linking it to a plethora of cardiovascular issues, including stroke. This review further amplifies the urgent need for reinforced anti-smoking campaigns, particularly tailored for older adults who might have been long-time smokers. Similarly, the spotlight on physical inactivity is a grim reminder of the sedentary lifestyles that have become pervasive. The association between lack of exercise and stroke is a testament to the myriad health repercussions of sedentary behaviors, a sentiment echoed in prior research.

Rodgers *et al.* (2004), with their study on an older population in northern England, demonstrated a 7.5% stroke incidence over a span of 5 years. This provides an enlightening Western perspective that, when compared to findings from Asia, reinforces the universality of stroke's burden. The meta-analysis by Rajati *et al.* (2023) is also an invaluable piece, drawing from various studies across a significant period, offering a broader understanding of the long-term persistence of stroke as a major health concern.

However, it's crucial to acknowledge the limitations of this review. The potential heterogeneity in the methodologies, designs, and participant demographics across the reviewed studies might introduce biases. There's also the possibility that cultural, geographical, and healthcare infrastructure differences could skew the findings. The reliance on self-reported data in some studies also introduces a level of uncertainty, as it can sometimes lead to over or underestimations.

To navigate these challenges and further our understanding, we recommend multi-centric studies with consistent methodologies spanning various regions. Such efforts would provide more comprehensive and accurate insights into stroke prevalence and its associated risk factors. Moreover, public health initiatives need to emphasize lifestyle modifications, regular health screenings, and awareness campaigns that can potentially transform the landscape of stroke prevention and management.

Conclusion

Stroke remains a predominant health concern for the elderly, marked by significant geographical, sociocultural, and lifestyle variations. This systematic review underscores the importance of understanding these nuances to implement effective preventive and therapeutic strategies. Hypertension's consistent emergence as a pivotal risk factor, combined with the pervasive influence of lifestyle factors such as smoking and physical inactivity, emphasizes the need for proactive interventions. Tailored public health initiatives, bolstered by region-specific research, are crucial to curb the incidence of stroke, ensuring a better quality of life for our aging populations.

With the world's demographic profile progressively aging, addressing the complexities of stroke becomes not just a medical challenge but a societal imperative.

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