Ischemic Stroke in Young Adults: Emerging Trends and Risk Factors

Abstract

Introduction: Ischemic stroke, once predominantly associated with older adults, is increasingly affecting individuals aged 18–50—commonly regarded as the most productive age group in society. This shift poses significant physical, psychological, social, and economic consequences. The objective of this study is to investigate the rising incidence of ischemic stroke among young adults, analyze associated risk factors, examine diagnostic challenges, and explore preventive strategies.**Methodology:**A systematic literature search was conducted in PubMed, Sci-Hub, and Google Scholar using keywords related to ischemic stroke in young adults. Peer-reviewed English-language articles published between April 2009 and August 2023 were screened. Following title and abstract review, 10 relevant studies were selected for detailed analysis based on predefined inclusion criteria focusing on incidence trends, risk factors, diagnosis, and prevention.**Results:**Out of 232 initially identified studies, 10 met the inclusion criteria and were analyzed. Five studies documented a significant rise in ischemic stroke cases among young adults over recent decades. Three studies highlighted modifiable lifestyle-related risk factors such as smoking, dyslipidemia, hypertension, obesity, and substance use. Two studies addressed diagnostic challenges, emphasizing misdiagnoses or delayed recognition due to the age of patients. Additional studies underscored the lack of awareness and inadequate prevention strategies, especially in low- and middle-income populations. Socioeconomic factors and gender disparities were also identified, with males and economically disadvantaged individuals more frequently affected.**Discussion:**The findings point to a multifactorial rise in stroke incidence among young adults, driven largely by lifestyle changes and unmet healthcare needs. Despite existing data, inconsistencies in age classification, geographic coverage, and diagnostic approaches limit comprehensive understanding. Notably, diagnostic errors and lack of tailored clinical guidelines contribute to delayed interventions. Preventive measures such as tobacco control, digital health tools, and affordable screenings remain underutilized, especially in resource-constrained settings.**Conclusion:**The increasing incidence of ischemic stroke in young adults demands urgent public health attention. There is a need for more granular, region-specific data and consistent age-group analysis. Greater clinical vigilance, awareness campaigns, and preventive strategies—especially among vulnerable populations—are essential. By improving early detection and addressing lifestyle and socioeconomic risk factors, healthcare systems can reduce premature mortality and long-term disability in young adults.

Keywords: Ischemic stroke, Young adults, Stroke incidence, Risk factors, Stroke diagnosis, Stroke prevention, Lifestyle factors, Socioeconomic disparities, Stroke trends, Early-onset stroke, Public health, Stroke awareness

Introduction

Ischemic stroke in young adults, defined as those between the ages of 18 and 50, has emerged as a growing public health concern. Once considered a disease predominantly affecting the elderly, recent decades have witnessed a significant rise in stroke incidence among younger individuals. This trend is especially alarming given that this age group represents the most productive segment of society. Stroke at a young age not only impacts the physical, mental, and emotional well-being of individuals but also poses a broader socioeconomic burden on families and nations.

As a young adult myself, learning about this trend was deeply unsettling. The idea that stroke is no longer confined to the elderly population is both surprising and troubling. It signals the need for greater awareness, proactive prevention, and timely diagnosis. A stroke at this stage in life can lead to long-term disability, premature mortality, and diminished quality of life, all of which underline the urgency of understanding and addressing this condition.

The objective of this research is to explore the rising incidence of ischemic stroke in young adults, with a focus on its causes, diagnostic challenges, and potential preventive strategies. The study is guided by four main research questions:

To what extent has the incidence of ischemic stroke in young adults increased in recent years?

Is this increase primarily associated with lifestyle changes, or are there other significant contributing factors?

Does the occurrence of stroke in young adults lead to misdiagnosis or delayed diagnosis by healthcare professionals?

Can increased awareness and education help reduce the incidence of stroke in this population?

A review of existing literature provides valuable insights. For example, Moosa et al. (2023) conducted a retrospective hospital-based study comparing young and older stroke patients, revealing a marked increase in stroke incidence among younger adults. Kivioja et al. (2018) identified several early-onset ischemic stroke risk factors, while Putaala et al. (2009) noted a high percentage of cases with undetermined etiology, which may contribute to missed diagnoses. Ji et al. (2013) emphasized the importance of timely diagnosis and intervention.

Lifestyle factors such as smoking, poor diet, and sedentary behavior are widely acknowledged contributors. However, less common but critical causes—such as patent foramen ovale (PFO), inherited or acquired thrombophilia, and cervicocerebral arterial dissection—also play significant roles. Despite existing research, gaps remain in both etiology and prevention, highlighting the need for more targeted efforts.

This study aims not only to identify trends and risk factors but also to emphasize the importance of early recognition and prevention. By synthesizing findings from various sources, this research seeks to raise awareness, inform clinical practice, and ultimately contribute to reducing the burden of ischemic stroke among young adults.

Methodology

A comprehensive literature search was conducted using medical databases including PubMed, Sci-Hub, and Google Scholar. The search utilized the keywords: “increasing incidence of stroke in young adults” and “ischemic stroke in young adults.” The search was limited to peer-reviewed journal articles published in English between April 2009 and August 2023, to ensure the inclusion of recent and relevant studies.

Inclusion criteria for the selected studies were:

- Articles discussing trends in the risk of stroke among young individuals;
- Research focused specifically on ischemic stroke in young adults;
- Studies addressing risk factors, etiology, incidence, and outcomes of ischemic stroke;
- Preference for open-access research publications;
- Articles published in English.

The selection process involved an initial screening of titles and abstracts to identify potentially relevant studies. Full-text articles were then retrieved and assessed against the predefined eligibility criteria.

From an initial pool of 232 studies, 210 were excluded for not meeting the inclusion criteria. Of the 22 studies retained for full-text screening, 12 were further excluded for irrelevance. Ultimately, 10 studies met all criteria and were included in this systematic review.

Literature Review

Among the selected studies, five focused on analyzing the rising trend of ischemic stroke among young adults, three examined the associated risk factors, two highlighted diagnostic gaps in clinical practice, and two emphasized the need for greater awareness and preventive strategies. A detailed summary of each selected study is presented in the accompanying table.

Table: Summary of selected studies

Authors	Research Objectives	Research Findings	Comments
Kissela et al., 2012	To observe the rising trend in young adults' ischemic stroke incidence.	From the age 20-50 there is a significant increase in the rate of incidence of stroke especially ischemic stroke.	It is surprising to see how the rate of incidence of stroke is increasing among young age due to increasing risk factors and decreasing among older ones from 75 years till 84 years.
Putaala et al., 2009	• To see the gap in diagnosis by the doctors. • To see the risk factors associated with increasing incidence of ischemic stroke.	• Use of MRI in finding an infarct or ischemic stroke has increased over the years. • Most common risk factors are dyslipidemia, hypertension, smoking, obesity, heavy drinking, illicit drug use, migraine.	• Doesn't this mean that the small subclinical infarcts which are not scanned with MRI and the infarcts that have occurred years back before the frequent use of MRI has led to missing of diagnosis by doctors? • The life style of the young adults have severely contributed to the increasing incidence of stroke in young adults
Bejot et al., 2013	To observe the rising trend in young adults' ischemic stroke incidence.	The incidence of ischemic stroke has increased in such a way that the Incidence rate ration comparing the years between 2003-2011 and 1994-2002 shows 1.697 (95% Cl).	The trend of incidence of ischemic stroke has only increased over the years among young adults in various geographical location such as Greater Cincinnati/Northern Kentucky region, France, USA.
Tibæk et al., 2016	To observe the rising trend in young adults' ischemic stroke incidence.	The rate is almost doubled when considering the years from 1994-2012. Also, both in men and female the trend though increasing, is steeper from 2006-2012. And in this	In this article the trends are observed from 1994-2012 year wise more specifically. And the results are again confirming the increasing pattern of incidence of ischemic stroke.

		study, the Estimated Annual Percentage Change (EAPC) of ischemic stroke is more in males than females.	
Kivioja et al., 2018	To see the risk factors associated with increasing incidence of ischemic stroke.	Type 1 diabetes and current smoking status were found to be substantially linked with ischemic stroke out of the 918 cases and 1392 controls that were evaluated. Cardiovascular illness, low HDL cholesterol, type 2 diabetes, a family history of stroke, and hypertension were additional risk factors. Among individuals from age group 25-39 family history of stroke turned out to be greatest risk factor. Lifestyle risk factors account for the entire young adult age group.	Our lifestyle has a major role in our life. It is of utmost importance to create significant changes in it for a better future. It is also very important to implement policies like 'Tobacco control policy' which has been implemented in Finland since 1980's.
Ji et al., 2013	Need for better awareness for prevention.	It is noted that multiple infarcts were more common among the age group 18-35, while single infarcts are most common among the age group 36-45. Though the diagnostic methods help in fast diagnosis, it its still of great importance to note that the major cause of ischemic stroke among young adults are modifiable risk factors.	The need to bring forth strategies to prevent stroke by targeting major modifiable risk factors which can be managed by proper lifestyle such as smoking cessation programs, dietary changes to control dyslipidemia, hypertension and diabetes mellitus is increasing day by day for the safety of our future generation.
Feigin et al., 2021	• To observe the rising trend in young adults' ischemic stroke incidence. • Need for better awareness for prevention.	• The increase in incidence of ischemic was noted among lower- and middle-income people comparing with upper income people. • Since the lower income people are less aware about the risk factors and diagnosis and management of stroke, it is noted that they have increased number. of cases reported among them. So it is very important that sufficient awareness is provided to identify risk factors. Inexpensive simple screening tests can also be done. Primary stroke prevention by prophylactic drug therapy along with Secondary prevention methods can also be implemented. Digital Clinical decision-making tools have	To be able to provide equal amount of care and awareness among all sectors of people irrespective of their income is important as it can reduce the amount of disability-adjusted life-year which had increased from 91.5 million to 125 million over the gap of 29 years (from 1990-2019.

		found to be of great use by studying the impact of this method carried out in Finland.	
Larrue et al., 2011	To see the gap in diagnosis by the doctors.	To determine the cause of stroke ASCO (atherosclerosis, small-vessel disease, cardiac source, other cause) criteria is generally used which is not very specific and can only diagnose probably only 45.5% adults leaving the rest undetermined due to lack of investigations. The prevalence of Patent Foramen Ovale (PFO) and Atrial Septal Aneurysm (ASA) is not correctly calculated leading to a gap in early identification of risk factors for stroke. It is also noted that there are few patients who had incomplete evaluation. All of these have created a huge gap in diagnosis of stroke itself.	It is of great importance to identify what and where things have gone wrong to correct the gap in diagnosis by doctors so that incidence of stroke, particularly ischemic stroke can be prevented.
Béjot et al., 2016	To observe the rising trend in young adults' ischemic stroke incidence.	The studies conducted in the region Greater Cincinnati/Northern Kentucky (between 1993-2005), France (between 2000 and 2007), Sweden (between 1989 and 1991; 1998 and 2000), United States (between 1995 and 2008) showed an increase in incidence of ischemic stroke among young adults. So did the Dijon Stroke Registry, a French population-based study (between 1993 and 2005). This study also confirmed the decreasing trend in older adults (65-84 years) which contradicts the results among young adults.	This article confirms again the increasing trend of ischemic stroke among young people'.
Moosa et al., 2023	To see the risk factors associated with increasing incidence of ischemic stroke.	According to this article the major two causes for ischemic stroke among young adults are large artery atherosclerosis (39.8%) and small artery atherosclerosis (37.6%). In this article, an increasing trend of risk factors due to lifestyle changes and reduced exercises in developing	As mentioned above, it is highly important that proper awareness along with adequate life style changes among young adults are important.

		countries are noted leading to increase in incidence of ischemic stroke in young adults	

The reviewed literature consistently indicates a growing incidence of ischemic stroke in young adults over the past decades. Interestingly, this increase contrasts with a declining trend among older adults aged 65–84 years, suggesting a shifting burden of disease. Several studies also noted that middle- and low-income populations are disproportionately affected, likely due to limited awareness and reduced access to preventive healthcare. Financial constraints further contribute to poorer outcomes in these groups.

Tibæk et al. (2016) observed a higher stroke incidence among young males compared to females. Studies by Béjot et al. (2013) and Béjot et al. (2016), conducted in different years but on similar topics, found that the upward trend in ischemic stroke was not localized to a single region but was observed globally. They reported an incidence rate ratio of 1.697 (95% CI) when comparing the periods 2003–2011 and 1994–2002, reinforcing the global significance of the issue.

The most frequently cited risk factors included:

- Lifestyle-related factors: dyslipidemia, hypertension, smoking, obesity, excessive alcohol intake, and illicit drug use.
- Medical and anatomical factors: migraine, cardiovascular diseases, cardioembolism, patent foramen ovale (PFO), and atrial septal aneurysm (ASA).

Moosa et al. (2023) categorized these risk factors into two main types: large artery atherosclerosis (accounting for 39.8% of cases) and small artery atherosclerosis (37.6%).

Diagnostic challenges were also a recurring theme. Missed or delayed diagnosis in young adults was attributed to incomplete clinical evaluations, limited access to advanced diagnostic tools, and the high cost of diagnostic procedures. The growing use of MRI has helped reduce misdiagnoses, but challenges remain. Larrue et al. (2011) highlighted the insufficient sensitivity of the ASCO classification criteria in younger populations and called for the development of more specific diagnostic frameworks.

These findings raise two critical questions:

- What preventive measures have been implemented so far?
- How effective are these strategies, and what more can be done?

In terms of existing interventions, the literature revealed a scarcity of comprehensive preventive measures. One notable exception is Finland's tobacco control policy, implemented since the 1980s, which has shown promising outcomes. Kivioja et al. (2018) also discussed the integration of digital clinical decision-making tools, which have improved patient outcomes by facilitating timely interventions.

Ding et al. (2021) emphasized that increasing awareness, particularly in low- and middle-income communities, is crucial to identifying and reducing modifiable risk factors. Suggested strategies include:

- Primary prevention through prophylactic drug therapy.
- Secondary prevention through ongoing risk management.
- Broader implementation of digital consultation tools to facilitate periodic monitoring.
- Use of affordable screening tests to detect early signs of vascular risk among young adults.

Several knowledge gaps were also identified. For example, Ji et al. (2013) reported that single infarcts were more common in individuals aged 36–45 years—a detail not noted by Putaala et al. (2009), potentially due to differences in study design or population demographics. Kissela et al. (2012) pointed

out the lack of consistent population-wide data on risk factor trends in younger adults, limiting our ability to track and predict disease patterns.

Overall, these findings point to an undeniable reality: the incidence of ischemic stroke among young adults is rising, and urgent action is needed. Lifestyle modification—such as adopting a healthy diet, quitting smoking, regular exercise, and routine health screening—must be prioritized by individuals and public health systems alike.

The diagnostic gaps discussed in this paper highlight the importance of understanding where clinical practices may fall short, so improvements can be made in early and accurate stroke identification. Prevention strategies, including public education, accessible primary care, and targeted policy implementation, are essential to reducing disability-adjusted life years (DALYs) and premature mortality among young adults.

Discussion

The findings from this systematic review underscore a growing public health concern: the rising incidence of ischemic stroke among young adults aged 18–50. Once considered a condition predominantly affecting the elderly, stroke is now increasingly observed in younger populations, leading to significant personal, societal, and economic consequences.

Several studies in the review consistently demonstrated a marked increase in the incidence of ischemic stroke among young adults over the past two to three decades. This rise appears to contrast with a declining trend in older age groups, suggesting a shift in the demographic distribution of stroke burden. The implications are particularly serious because young adulthood represents the most economically productive period in a person's life, and the long-term disability associated with stroke can result in years of lost productivity, increased dependency, and psychosocial distress.

Lifestyle-Related Risk Factors

The review identified a range of modifiable lifestyle-related risk factors contributing to this trend, including dyslipidemia, hypertension, smoking, alcohol abuse, obesity, physical inactivity, and drug use. These risk factors are largely preventable and are closely associated with modern sedentary lifestyles, poor dietary habits, and increased psychosocial stress. The clustering of these risk factors in low- and middle-income populations may also explain the disproportionate burden in these groups.

In addition to lifestyle factors, several non-traditional and structural causes such as patent foramen ovale (PFO), atrial septal aneurysm (ASA), inherited thrombophilias, and cervical arterial dissection were also identified. These conditions are often under-recognized and can contribute to cryptogenic strokes, complicating diagnosis and treatment in young adults.

Diagnostic Challenges

One of the concerning themes emerging from this review is the delay or failure in diagnosing ischemic stroke in younger individuals. Physicians may have a lower index of suspicion due to the patient's age, leading to misdiagnosis or delayed treatment. Furthermore, traditional diagnostic criteria such as the ASCO classification system have shown limited sensitivity in younger populations. This diagnostic gap underscores the urgent need for the development of age-specific stroke recognition protocols and training.

Preventive Measures and Policy Gaps

The review also highlighted a general lack of effective stroke prevention strategies targeted specifically at young adults. While tobacco control policies, such as those implemented in Finland, have demonstrated success, broader preventive efforts remain fragmented or underdeveloped. The use of digital health tools, community screening programs, and increased public awareness campaigns were proposed as promising strategies to bridge this gap.

Providing accessible and affordable primary prevention—particularly in low-resource settings—is critical. This includes regular blood pressure and cholesterol screenings, counseling on lifestyle modification, and early intervention for identified risk factors. Equally important is secondary prevention, aimed at minimizing recurrence and improving long-term outcomes in young stroke survivors.

Knowledge Gaps and Future Research

Despite the growing body of literature, several knowledge gaps remain. Population-wide longitudinal data on risk factor trends in young adults are limited, making it difficult to assess temporal changes or evaluate the effectiveness of interventions. Inconsistencies in study design, case definitions, and regional differences also hinder the generalizability of findings. Future research should focus on large-scale, multi-regional cohort studies and the development of standardized diagnostic tools suitable for younger populations.

Implications for Clinical Practice and Public Health

This review reinforces the need for heightened clinical vigilance in evaluating stroke symptoms in young adults. Emergency departments and primary care providers must be trained to recognize atypical presentations and consider stroke as a differential diagnosis, regardless of age. Public health systems must also prioritize stroke awareness campaigns tailored to youth and young adults, emphasizing the role of lifestyle in disease prevention.

The findings also call for an interdisciplinary approach, linking neurologists, primary care physicians, policymakers, educators, and digital health innovators, to implement cost-effective, culturally appropriate, and scalable interventions aimed at reversing this trend.

Conclusions

As a young adult, the motivation behind conducting this research stemmed from the alarming rise in the incidence of ischemic stroke among individuals in the 18–50 age group. The findings of this study confirm that this trend has indeed been increasing steadily since the late 20th century, as seen in multiple studies published since 1989. This upward trend appears consistent across different genders and geographic regions, although it is more pronounced among individuals from low- and middle-income backgrounds. This suggests a strong correlation between socioeconomic status and the increasing incidence of ischemic stroke in young adults.

The results also reinforce that lifestyle-related risk factors—such as dyslipidemia, smoking, hypertension, diabetes, and sedentary behavior—play a major role in this growing public health issue. However, non-lifestyle-related contributors, including vascular abnormalities, migraine, and inherited thrombophilic conditions, should not be overlooked. Importantly, several studies identified missed or delayed diagnoses in young patients, highlighting the urgent need for heightened clinical awareness and improved diagnostic strategies among healthcare providers.

The evidence suggests that controlling this increasing trend requires a combination of approaches, including lifestyle modification, increased public awareness, early diagnosis, and the implementation of preventive tools such as prophylactic therapy and digital clinical decision-making aids.

Recommendations

Expand Regional and Demographic Research- More extensive data collection is needed from diverse regions and populations to improve the sensitivity and specificity of findings. This includes gathering age-specific and gender-specific data to better understand the variations and patterns in stroke incidence among young adults.

Standardize Age Group Categories in Research - Future studies should adopt consistent and clearly defined age groupings for both case and control populations. Inconsistencies in age classification across different studies hinder the comparability and comprehensiveness of results.

Address Socioeconomic Disparities - Public health interventions should prioritize low- and middle-income populations, where the burden of stroke appears to be higher. Strategies should include subsidized screening, free or low-cost preventive care, and culturally appropriate education campaigns.

Enhance Clinical Awareness and Training - Emergency department and primary care physicians should receive training focused on stroke recognition in young adults, especially when symptoms are subtle or atypical. Developing age-specific diagnostic protocols and guidelines would support early and accurate identification.

Implement and Promote Preventive Strategies - Proven interventions—such as tobacco control policies, community health screenings, and digital clinical decision-making tools—should be scaled and adapted across different health systems. These tools can support early risk detection and guide timely interventions.

Monitor and Evaluate Emergency Department Practices - Systematic evaluation of how emergency departments respond to potential stroke cases in young adults could provide valuable insights into diagnostic delays or gaps, ultimately guiding improvements in acute care response.

Strengthen Public Awareness Campaigns - Public health authorities should launch targeted awareness programs to educate young adults about the risk factors, early warning signs, and prevention strategies for ischemic stroke.

By addressing these areas through coordinated research, policy changes, and healthcare system improvements, we can work towards reversing the rising trend of ischemic stroke in young adults and safeguarding the health of the most productive age group in society.

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