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EDITORIAL

Death from stroke in Europe: if you can't measure it, you can't improve it

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This editorial refers to 'Epidemiology report: trends in sex-specific cerebrovascular disease mortality in Europe based on WHO mortality data', by X.X. Shah *et al.*, doi:10.1093/eurheartj/ehy378.

Stroke is a devastating and mostly preventable disease. Across Europe, it accounts for over one in ten of all deaths each year and is the third leading cause of disability-adjusted years lost.[1] Worldwide, as in Europe, stroke is the second largest single cause of death after ischaemic heart disease, with a greater burden in developing countries.[2] For those aged <65 years, stroke, joint with breast cancer, is the second most common cause of death in women, and the third most common in men, after ischaemic heart disease and lung cancer.[1] International data depict a decline in stroke mortality, which is evident primarily in Western countries.[3] Yet, little is known about temporal trends in stroke-related mortality across Europe and, specifically, for the ischaemic, haemorrhagic, and subarachnoid subtypes of stroke.

In this issue of the *European Heart Journal*, Shah and colleagues evaluate the temporal trends in all-cause mortality after stroke in 51 countries of the World Health Organization European region.[4] Between 1980 and 2016, the investigators studied age-standardized mortality rates according to the recognized International Classification of Disease-10 codes for stroke, and used Joinpoint regression to determine if and where statistically significant inflexion points occurred. The breadth of the data, as well as the numbers of cases (e.g. nearly 1 million deaths following stroke), permit the investigation of several important questions.

During the 37 years of study, stroke-related mortality declined across Europe; the median annual percentage change for included countries was -2.7% for men and -2.7% for women. This was not, however, the case for all countries or all stroke subtypes. The decline in death following stroke was only evident in 34 (67%) countries for men and women, with declines being more frequent and steeper in Western Europe and least frequent and less steep in Central Asia. Notably, over the full study period there was in increase in deaths following stroke in Macedonia. Temporal improvements were more frequently seen for haemorrhagic stroke (with the greatest decline in Central Asia), followed by ischaemic stroke, and then subarachnoid haemorrhage (each with the greatest decline in Western Europe).

Perhaps more alarming, is the evidence of a recent plateauing among ten countries, and a statistically significant upturn in four countries (Azerbaijan, Georgia, Tajikistan and Uzbekistan), in deaths following stroke. Such recent increases in death following stroke were more frequent for ischaemic stroke and subarachnoid haemorrhage than for haemorrhagic stroke.

Importantly, Shah *et al.* provide data on all-cause mortality following stroke in Europe as a whole, and up to the year 2016. Moreover, higher resolution insights are gained as to the changing spatial and temporal burden of mortality for stroke subtypes. The decline in deaths following stroke is encouraging because of the sheer volume of the population that cerebrovascular disease encompasses. Nonetheless, two fundamental questions remain unanswered; what is responsible for the decline in mortality following stroke across Europe, and why has there been a recent plateau or increase in stroke-related mortality in some European countries?

The reasons for the decline in stroke-related mortality are not completely understood. It is likely that it is due to a combination of reduced incidence of index and recurrent stroke as well as lower case fatality rates.[5] Such progress in population outcomes is consistent with international improvements in cardiovascular risk factor control. Indeed, the international decline in death following stroke mirrors that seen for cardiovascular disease mortality that has also, in part, been attributable to changes in its determinants.[1,6]

A reduction in stroke incidence will have a direct impact on the stroke-related mortality rates. It has been suggested that the understanding of the causal relationship between blood pressure and vascular events, and the treatment of hypertension at scale has had a substantial influence on the decline in stroke mortality.[7] Clearly, other factors are also relevant, including the detection and treatment

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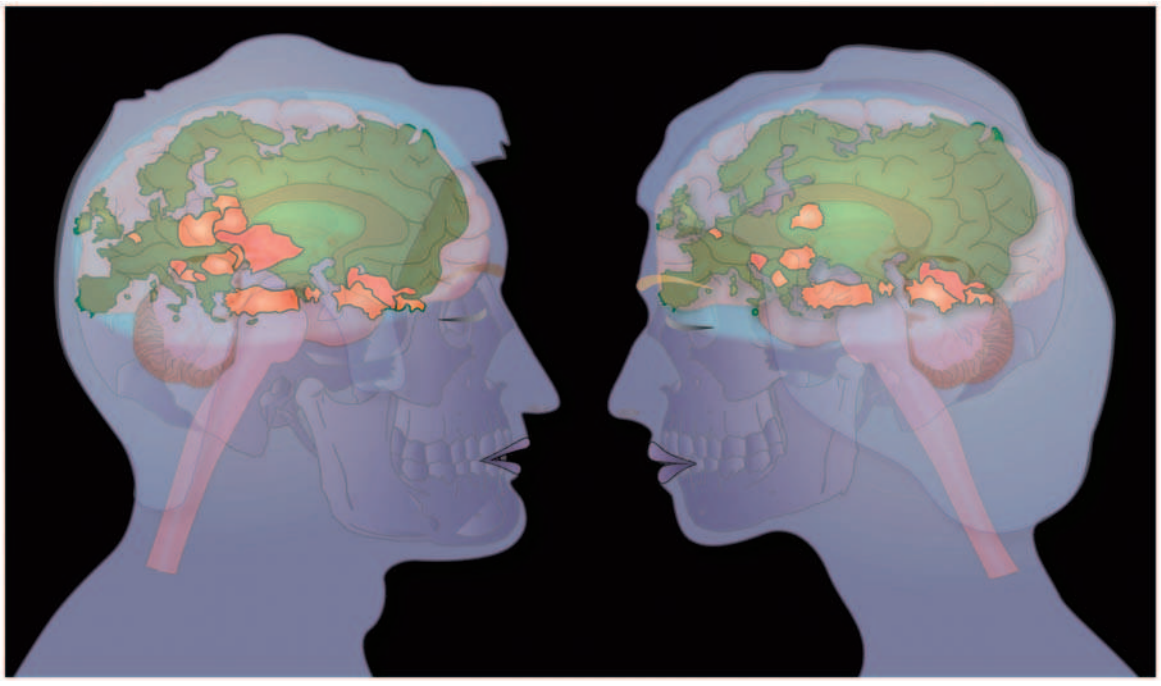

Take home figure Sex-dependent differences in recent trends in cerebrovascular age-standardized mortality rates in Europe.

of diabetes mellitus and dyslipidaemia, smoking cessation, diet and physical exercise.[8] The importance of oral anticoagulants rather than aspirin in stroke prevention among patients in atrial fibrillation at high risk of stroke has had increasing emphasis in national and international guidelines, and over time there has been an increase in incident cases of atrial fibrillation prescribed an oral anticoagulant.[9] Undoubtedly, this will have also contributed to the decline in the incidence of stroke.[10]

The decline in the incidence of recurrent stroke is an important factor contributing to the decline in death following stroke. Up to 18% of strokes within the first year and 9.5% in the first 5 years are recurrent and convey high early mortality rates.[11,12] The decline in recurrent stroke rates largely results from evidence for and the subsequent implementation of secondary preventive therapies. Moreover, it is estimated that four-fifths of recurrent vascular events in patients with stroke may be prevented by the application of a combined lifestyle and pharmacotherapeutic approach.[13]

Improved tools for brain imaging evaluation (enabling us to know what to treat), endovascular treatment modalities (more effective therapies), and greater stroke systems (improved access to and delivery of care) have all advanced stroke management and thus contributed to favourable trends in stroke outcomes. For example, compared with 35 years ago, it is now recommended that non-contrast computed tomography (CT) should be provided (and expeditiously from time of arrival in the Emergency Department) for all patients presenting to hospital with suspected stroke.[14] Doing so enables the rapid detection of intracranial haemorrhage and therefore the avoidance of antithrombotics in these patients, the diagnosis of stroke in those presenting with puzzling signs, and risk stratification for endovascular treatment.

The INTERSTROKE study found that the use of evidence-based treatments, diagnostics, and stroke units was less commonly available in low and middle income countries.[15] A similar pattern has been described within the UK, whereby those at higher risk for stroke were less frequently receiving oral anticoagulation.[16] This could be attributed to constraints around infrastructure and education, which, however, may not entirely explain why inauspicious trends in stroke case fatalities are also found in higher income countries. Whilst it is possible that adverse trends may be due to more accurate recording of stroke events, one must not discount the increasing population burden of obesity, diabetes, and hypertension in higher income countries and the effect this may have on stroke incidence and mortality.

Akin to many epidemiological studies, the research undertaken by Shah and colleagues has limitations. Many countries did not have data that covered the full study period, the recording of death and the definition of its cause varied across the countries, and some had poor data quality as defined by the World Health Organization. Equally, a description of death following stroke by age is not presented, which would offer readers insight into the geographical burden of premature deaths due to stroke. Importantly, the study used aggregated data and we should not, therefore, make inferences about individuals from country-based statistics.

The fact that there is geographic variation in mortality from stroke suggests that the opportunity to prevent deaths from stroke has not been realized. This concept is underscored by the tailoring of the decline and the upturn in death following stroke in some European

countries. Local-level and international quality improvement initiatives are therefore needed. In the UK, the National Institute for Health and Care Excellence recommends opportunistic detection of atrial fibrillation in patients with co-morbidities who are attending their general practitioner (though currently the National Screening Programme does not recommended population-based screening because their review found that it was not clear that those identified as at risk through screening would benefit from early diagnosis). Given that the use of primary and secondary prevention pharmacotherapies for stroke has a central role in reducing stroke and subsequent stroke-related mortality, their implementation will also be key in ensuring that the temporal decline continues. Equally, the importance of measuring quality of care through large-scale studies for the development of quality improvement cannot be overemphasized.

Unless health disparities are addressed and innovative strategies to change behaviour are developed and adopted, the cerebrovascular health of the population is unlikely to improve.

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