

Subarachnoid hemorrhage

Another reason not to smoke

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Subarachnoid hemorrhage (SAH) has high morbidity and mortality¹ and represents a serious and substantial personal and public health burden. Therefore, we need studies of incidence, mortality, and risk factors to understand the disease and enable primary preventive measures.

Differences in study designs and case finding procedures complicate comparison among studies of SAH incidence.² Case identification via hospital discharge registers or cause of death registers, while retrospective and with likely inherent biases, offers an inexpensive and procedurally straightforward approach. The gold standard community-based studies with hot pursuit identification of incident strokes² are expensive and time- and work-consuming, and therefore typically include few cases of SAH, limiting statistical power and precision.

A substantial proportion of SAH patients die suddenly, away from hospital or at least before they reach a CT scanner. Studies that only included hospitalized patients generally do not include these individuals. Routines for autopsy differ by country, region, and over time. Similarly, the intensity of diagnostic workup and likelihood of referral to neurosurgical centers also vary, especially in ill and old patients. These factors influence the proportions of identified and eligible patients for inclusion in different studies.

Commonly, calculated age-specific incidence is standardized and translated to the general population, yielding different incidence estimates depending on the admixture of age groups. In addition, some studies provide only crude incidence rates or rates adjusted to the country population, making it difficult to compare incidence rates across countries.

In this issue of *Neurology*®, Korja et al.³ present a register-based study of the national incidence of SAH in Finland. They used the nationwide Cause of Death Register and Hospital Discharge Register to identify SAH events between 1998 and 2012. By coupling this with the population statistics in Finland, they calculated crude annual incidence rates of SAH, as well as standardized rates, using the 2013 European Standard Population. The authors also gathered information

on changes in nationwide smoking rates from a national database.

During 79 million person-years, the authors identified almost 7,000 SAH cases. The mean age at diagnosis increased from 54 in 1998 to 60 in 2012. The 3-year average of European Standard Population standardized incidence decreased 24% from 11.7 in 1998–2000 to 8.9 per 100,000 person-years in 2010–2012. The decrease was especially strong in women under the age of 50, with an especially strong decrease of 45%. During the same time period, Finns have decreased daily smoking, especially among high school students (44% and 41% decrease in girls and boys, respectively). The rate decreased 30% in the whole population aged 15–64 years. The incidence of SAH decreased sharply during a relatively short time period and especially in younger age groups, suggesting the declining smoking rates may partly explain the observed changes. The increased mean age at diagnosis may reflect the reduction in smoking, the major preventable risk factor in younger age groups.

The study also challenges the belief that there is a higher incidence of SAH in Finland than in other high-income countries. When comparing their results with incidence rates from the other Nordic countries, which have relatively similar autopsy rates, health care systems, nationwide health registries, and diagnostic criteria for diseases,^{4–6} the discrepancies diminish and possibly can be explained by different autopsy rates. The investigators argue that differences in case finding, hospitalization, and autopsy rates, as well as standardizing incidence from the included age groups to the general population, may have led to the reported discrepancies and high incidence rates in previous Finnish studies (see also reference 7).

There are few studies of nationwide incidence rates of SAH, rendering these data especially valuable. The fact that as many as one-fourth of the patients died suddenly (outside of hospital or in the emergency department) underlines the importance of including out-of-hospital patients in incidence studies of SAH. A high autopsy rate improves identification of patients who may have the most serious disease, and who should

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therefore absolutely be included in studies of risk factors. A high autopsy rate and good population registers in Finland make it especially well-suited for performing SAH studies, if one can now conclude that incidence rates do not differ substantially from other high-income countries, as this study suggests.

The study also has some limitations. First, the inability to study smoking habits at the individual level precludes the possibility of causal inferences. Second, the authors did not have information on other important modifiable risk factors for SAH such as blood pressure. Indeed, blood pressure also dropped in the Finnish population between 1997 and 2007,⁸ and this may well have contributed to the decreased incidence of SAH. Third, even though the Hospital Discharge Register and the Cause of Death Register are validated and are relatively accurate, with agreement rates and sensitivity of 89%–95%, there may be misclassifications, as the specific diagnoses are not carefully validated.

The overall message is that primary prevention on a population level helps, and should encourage everyone working with smoking prevention to provide us with a new argument against smoking. With the trend of reduced smoking rates in high-income countries, the incidence of SAH and other smoking-related diseases will probably continue to decrease. However, in low to middle income countries, there is time for action against smoking and other cardiovascular risk factors to prevent a stroke boom.⁹

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