Atrial fibrillation (AF) occurs in 1 to 1.5% of populations in developed countries and is independently associated with a 5-fold increase in stroke risk. Up to one-third of patients with first stroke in population studies have AF, with consequent greater neurological impairment, worse disability, increased recurrence risk, and more frequent dementia and requirement for institutional care compared with stroke of other causes.\textsuperscript{1,2}

The prevalence of AF is highly age-dependent, ranging from 0.1% in those aged <55 years to 9% in those aged ≥80 years.\textsuperscript{3} With greater life-expectancy, the absolute number of individuals with AF is anticipated to increase substantially in the coming decades, even if current incidence rates remain unchanged. However, data indicate that AF incidence is increasing, leading to projections of an increase in AF prevalence in the United States by at least 2.5-fold by 2050.\textsuperscript{3,4} The consequences of this increase in AF prevalence on the frequency of AF-related stroke will depend on the effectiveness of AF detection and implementation of prevention with anticoagulants and other vascular medications and behaviors.

As health costs rise and health budgets become constrained in many developed countries, cost of illness studies are becoming increasingly important to understand the financial burden of chronic diseases to society, to identify modifiable cost drivers, and to inform rational decisions relating to reimbursement strategies for preventive medications, hospital treatments, and community care. In addition to being a leading cause of global death, disability, and dementia, stroke is an expensive disease, costing an estimated $34 billion annually in the United States alone.\textsuperscript{5}

Cost-of-illness studies have described substantially higher hospital costs of AF-stroke compared with other stroke mechanisms, associated with greater stroke severity and longer hospital stays.\textsuperscript{6,7} However, most studies were limited by inclusion of selected, hospital-admitted patients, which may have led to bias and underestimation of true costs. No studies to date have estimated population-based projections for the future burden of AF-stroke measured in terms of the total numbers affected, and the accompanying cost implications at a state-wide or national level.

In this issue of Circulation, Yin and colleagues\textsuperscript{8} describe a comprehensive analysis of the incidence, event rates, outcomes, and costs of ischemic stroke and systemic embolism associated with AF in the population-based Oxford Vascular Study (OXVASC) from 2002 to 2012 compared with the earlier Oxford Community Stroke Project (OCSP), conducted from 1981 to 1986 in the same region. Their main findings are a 3-fold increase in the numbers of AF-strokes in patients aged ≥80 years, partly related to increased incidence in older individuals. After adjusting for age and sex, the incidence of AF-stroke in those aged >80 years increased 1.5-fold, but was unchanged in those aged <80 years ($P$ for interaction 0.014).

Although oral anticoagulation use had increased in OXVASC compared with OCSP (12.3% versus 3.5%), no improvement was seen in OXVASC when 2002 through 2007 was compared with 2007 through 2012. In patients with known AF, only 16.7% were treated with warfarin before stroke onset and the international normalized ratio was subtherapeutic in 60% of these at stroke onset. Oral anticoagulation was particularly underused in high-risk individuals defined by CHADS2/CHADS2VA2SC scores.

Projected rates for AF-stroke by 2050 were estimated assuming a neutral scenario of no change in current incidence rates, and a worst-case scenario of continuing increase in AF-stroke incidence based on the observed change between OCSP and OXVASC. Under the neutral constant-incidence scenario, the number of UK individuals with AF-embolic events was projected to increase 2.5-fold, from 35,000 to 87,000, 84% occurring in those aged >80 years. Under the worst-case scenario, 156,000 strokes and systemic embolic events were projected, a 4.5-fold increase.

Observed average per-patient hospital costs for AF-stroke were similar regardless of age, but costs of long-term institutional care were doubled in those aged >80 years. Under their constant-incidence scenario, annual UK costs were estimated at almost £2 billion by 2050, =70% of which was incurred by those aged >80 years.

How are these results to be interpreted by clinicians and policy-makers within and outside the United Kingdom? First, in contrast to earlier studies of selected hospital patients, the OXVASC group used robust and rigorous methodology to minimize the possibility of selection bias, including the population-based design and overlapping ascertainment methods.\textsuperscript{9,10} Other strengths include prospective and prolonged

© 2014 American Heart Association, Inc.

\textbf{Article see p 1236}

Circulation is available at http://circ.ahajournals.org

DOI: 10.1161/CIRCULATIONAHA.114.012738
follow-up of study participants, inclusion of posthospital community costs, and inclusion of systemic embolic events. Their crude incidence rates of AF-stroke (41/100,000 person-years) are similar to other recent population studies in Dublin and Dijon, which strengthens the validity of their findings. Similar methods for ascertainment of stroke and AF were used in OCSP and OXVASC, which reduces the likelihood that their findings relate to improved ascertainment over time. Ambulatory cardiac monitoring for paroxysmal AF was not routinely performed in either study, which may have led to underdetection of some patients with AF, but this is unlikely to have differed between the 2 studies.

Second, the degree to which their findings may be generalized beyond the Oxfordshire population should be considered. Stroke incidence rates are influenced by socioeconomic profile, health behaviors, and use of vascular preventive therapies in the underlying population. The degree to which their population sample is representative of other populations or healthcare systems is unclear, as the authors rightly acknowledge. In contrast to the Oxford findings, other long-term population studies in the United States and France have observed reductions of 1.5% to 3% annually in AF-stroke incidence between the 1980s and 2000s, associated with substantial increases in the use of oral anticoagulation and other preventive therapies, despite the increasing age profile of their underlying populations.

The Oxford study is a timely warning call alerting clinicians, health advocates, and policy-makers of the flood of community costs, and inclusion of systemic embolic events. Their crude incidence rates of AF-stroke (41/100,000 person-years) are similar to other recent population studies in Dublin and Dijon, which strengthens the validity of their findings. Similar methods for ascertainment of stroke and AF were used in OCSP and OXVASC, which reduces the likelihood that their findings relate to improved ascertainment over time. Ambulatory cardiac monitoring for paroxysmal AF was not routinely performed in either study, which may have led to underdetection of some patients with AF, but this is unlikely to have differed between the 2 studies.

Second, the degree to which their findings may be generalized beyond the Oxfordshire population should be considered. Stroke incidence rates are influenced by socioeconomic profile, health behaviors, and use of vascular preventive therapies in the underlying population. The degree to which their population sample is representative of other populations or healthcare systems is unclear, as the authors rightly acknowledge. In contrast to the Oxford findings, other long-term population studies in the United States and France have observed reductions of 1.5% to 3% annually in AF-stroke incidence between the 1980s and 2000s, associated with substantial increases in the use of oral anticoagulation and other preventive therapies, despite the increasing age profile of their underlying populations.

The Oxford study is a timely warning call alerting clinicians, health advocates, and policy-makers of the flood of community costs, and inclusion of systemic embolic events. Their crude incidence rates of AF-stroke (41/100,000 person-years) are similar to other recent population studies in Dublin and Dijon, which strengthens the validity of their findings. Similar methods for ascertainment of stroke and AF were used in OCSP and OXVASC, which reduces the likelihood that their findings relate to improved ascertainment over time. Ambulatory cardiac monitoring for paroxysmal AF was not routinely performed in either study, which may have led to underdetection of some patients with AF, but this is unlikely to have differed between the 2 studies.

Second, the degree to which their findings may be generalized beyond the Oxfordshire population should be considered. Stroke incidence rates are influenced by socioeconomic profile, health behaviors, and use of vascular preventive therapies in the underlying population. The degree to which their population sample is representative of other populations or healthcare systems is unclear, as the authors rightly acknowledge. In contrast to the Oxford findings, other long-term population studies in the United States and France have observed reductions of 1.5% to 3% annually in AF-stroke incidence between the 1980s and 2000s, associated with substantial increases in the use of oral anticoagulation and other preventive therapies, despite the increasing age profile of their underlying populations.

The Oxford study is a timely warning call alerting clinicians, health advocates, and policy-makers of the flood of community costs, and inclusion of systemic embolic events. Their crude incidence rates of AF-stroke (41/100,000 person-years) are similar to other recent population studies in Dublin and Dijon, which strengthens the validity of their findings. Similar methods for ascertainment of stroke and AF were used in OCSP and OXVASC, which reduces the likelihood that their findings relate to improved ascertainment over time. Ambulatory cardiac monitoring for paroxysmal AF was not routinely performed in either study, which may have led to underdetection of some patients with AF, but this is unlikely to have differed between the 2 studies.

Second, the degree to which their findings may be generalized beyond the Oxfordshire population should be considered. Stroke incidence rates are influenced by socioeconomic profile, health behaviors, and use of vascular preventive therapies in the underlying population. The degree to which their population sample is representative of other populations or healthcare systems is unclear, as the authors rightly acknowledge. In contrast to the Oxford findings, other long-term population studies in the United States and France have observed reductions of 1.5% to 3% annually in AF-stroke incidence between the 1980s and 2000s, associated with substantial increases in the use of oral anticoagulation and other preventive therapies, despite the increasing age profile of their underlying populations.

The Oxford study is a timely warning call alerting clinicians, health advocates, and policy-makers of the flood of community costs, and inclusion of systemic embolic events. Their crude incidence rates of AF-stroke (41/100,000 person-years) are similar to other recent population studies in Dublin and Dijon, which strengthens the validity of their findings. Similar methods for ascertainment of stroke and AF were used in OCSP and OXVASC, which reduces the likelihood that their findings relate to improved ascertainment over time. Ambulatory cardiac monitoring for paroxysmal AF was not routinely performed in either study, which may have led to underdetection of some patients with AF, but this is unlikely to have differed between the 2 studies.

Second, the degree to which their findings may be generalized beyond the Oxfordshire population should be considered. Stroke incidence rates are influenced by socioeconomic profile, health behaviors, and use of vascular preventive therapies in the underlying population. The degree to which their population sample is representative of other populations or healthcare systems is unclear, as the authors rightly acknowledge. In contrast to the Oxford findings, other long-term population studies in the United States and France have observed reductions of 1.5% to 3% annually in AF-stroke incidence between the 1980s and 2000s, associated with substantial increases in the use of oral anticoagulation and other preventive therapies, despite the increasing age profile of their underlying populations.
Preventing the Rise of Atrial Fibrillation-Related Stroke in Populations: A Call to Action
Peter J. Kelly

Circulation. 2014;130:1221-1222; originally published online September 10, 2014;
doi: 10.1161/CIRCULATIONAHA.114.012738

The online version of this article, along with updated information and services, is located on the
World Wide Web at:
http://circ.ahajournals.org/content/130/15/1221

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published
in Circulation can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial
Office. Once the online version of the published article for which permission is being requested is located,
click Request Permissions in the middle column of the Web page under Services. Further information about
this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation is online at:
http://circ.ahajournals.org//subscriptions/