Is There Evidence That Performance Measurement in Stroke Has Influenced Health Policy and Changes to Health Systems?

Dominique A. Cadilhac, PhD; Bhasker Amatya, MPH; Erin Lalor, PhD; Anthony Rudd, PhD; Patrice Lindsay, PhD; Kjell Asplund, PhD

Over the past 20 years or more, use of meta-analysis and establishment of clinical guidelines for stroke have provided a strong evidence base for performance measurement. Performance measurement, defined as the evaluation of organizational or clinical practice activities and outcomes against agreed standards, has been used to identify care gaps. With the associated development in health services research, this has laid the foundation for providing evidence for health policy decisions.

Performance measures may be designed to assess the structural environment (eg, the organizational features of health facilities), processes of care (such as adherence to recommended clinical interventions), or outcomes (eg, mortality). Furthermore, performance measures may be used to monitor the quality of care within an individual institution or across the health care system, to compare different institutions over time (benchmarking), to provide information to the consumers in choosing health care providers, or to promote quality improvement activities. Performance measurement results provide valuable information for strategic planning by organizations, policy-makers, and funding providers.

Health policy may be broadly defined as a statement of actions to achieve goals for health care usually reflecting priorities and values for increasing well-being in a society and/or the optimal allocation of health resources. It is generally agreed that health policy should be based on the best and most current scientific evidence. Performance measurement offers policy-makers information to make judgments on the extent to which various aspects of the health system meet policy goals. However, it is uncertain what impact efforts to monitor health care performance have had on policy and/or health systems in the area of stroke. Examples in which performance measurement can be linked to stroke policy may include policy documents on clinical guidelines or strategic plans, financial incentives or reimbursement criteria for stroke care, credentialing standards for health care organizations or clinicians, regulations or legislation for how care between different sectors of the health system operate, and programs of routine (or mandated) data collection such as registries.

The purpose of this review was to explore what evidence exists that performance measurement in stroke has influenced health policy and health systems. We assumed that there would be studies designed to measure temporal relationships between measuring performance followed by changes to health policy or health systems (Figure 1); however, many of these concepts are interwoven and not necessarily linear. It was not possible to cover all aspects of policy reform based on performance measurements. Therefore, we sought to answer some specific questions. What is the evidence that performance measurement has influenced health policy and changes to health systems? To what extent have clinical guidelines influenced the development of performance measures?

In addition, the authors chose to provide a case study specific to each of their own countries to illustrate the temporal and nonlinear relationship between performance measurement initiatives and health policy formulation related to hospital care for stroke.

Materials and Methods

This narrative review includes 3 stages: (1) a systematic approach for searching relevant peer-reviewed and gray literature; (2) a qualitative appraisal of the included literature to group and report on the main themes from stage 1; and (3) provision of case studies on the temporal relationship between performance measurement and the establishment of policy-related activities related to hospital care for stroke in Australia, Canada, Sweden, and the United Kingdom.

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From the National Stroke Research Institute, Florey Institute of Neuroscience and Mental Health, Heidelberg, Victoria, Australia (D.A.C.); Stroke and Ageing Research Centre, Southern Clinical School, Monash University Clayton, Victoria, Australia (D.A.C.); Royal Melbourne Hospital, Melbourne, Australia (B.A.); National Stroke Foundation, Melbourne, Victoria, Australia (E.L.); King’s College London, University of London, London, UK (A.R.); Canadian Stroke Network, Ottawa, Ontario, Canada (P.L.); Department of Public Health and Clinical Medicine, Umeå University, Umeå, Sweden (K.A.).
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Correspondence to Dominique A. Cadilhac, Stroke and Ageing Research Centre, Level 1 Monash Health Research Precinct Building, 43–51 Kanooka Grove, Monash University Clayton, 3168 Victoria, Australia. E-mail dominique.cadilhac@monash.edu

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Peer Review Literature Search Strategy
A comprehensive search of the literature published from January 1990 to September 2010, was undertaken using EbscoHost to search various electronic databases, which included Medline, CINHAL, and PsycINFO. A structured search also was conducted separately using Embase and Cochrane Library databases. A search for systematic reviews and clinical trials (filter) using the PubMed database was conducted, and PubMed Clinical alerts were set-up to identify literature published from September 2010 to November 2010. No restrictions were applied with respect to research design. Medical subject heading search terms were used for all databases and a key word search was used if the medical subject heading term was unavailable. Table 1 provides an outline of the search terms used. The detailed search strategy is available in Supplementary Table I. We did not include financial, legislative, or economic search terms. This is because these terms were too specific given the broad nature of our research questions, and we thought relevant literature based on these issues would indirectly be identified from the key search terms of “health policy,” “healthcare reform,” or “healthcare quality improvement program.”

Article Identification and Selection
Titles of articles were first reviewed (by author B.A.) to exclude those that did not address the review questions. Abstracts were then appraised (by authors B.A. and D.C.) based on the eligibility criteria. Publications for which authors reported performance measurements for stroke were included if they met the following criteria: the title or abstract was relevant to the review purpose; adequate articulation of methods; and the main purpose of the study included 1 of the following: (1) development of health policy; (2) reform and/or restructure of health system/health policy; (3) use of performance data to provide evidence of an impact on health policy and changes to health systems; and (4) the impact of various performance measurement activities on health care outcomes.

Publications were excluded if: studies were not related to health care delivery and studies were not published in English. The bibliographies of identified articles were scrutinized for additional references. A manual search of relevant journals such as Stroke, Journal of Stroke and Cerebrovascular Diseases, Quality and Safety in Health Care, British Medical Journal, BMC Health Services Research, and The Lancet was also undertaken for the same review period.

Gray Literature Search
A search of the gray literature was performed to identify existing performance measurement and quality improvement programs in stroke, and to identify any relevant reports, health technology assessments, or other related materials. A topic search was conducted using Internet search engines such as Google, Google Scholar, and MS search, and by combining the following terms: “stroke,” “cerebrovascular accident” or “stroke center,” “stroke program,” “stroke

Table 1. Outline of Search Terms Used for Literature Search†

<table>
<thead>
<tr>
<th>Condition</th>
<th>Performance measurement initiatives to provide evidence that policies and clinical practice changes have been occurring</th>
<th>Synthesis of performance monitoring data = assessment of associations with patient outcomes</th>
<th>Review and modifications to policies and programs to ensure care gaps are narrowed and patient outcomes optimized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condition specific services</td>
<td>Managed care program</td>
<td>Disease management program</td>
<td>Stroke centre</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Outcome assessment, healthcare</td>
<td>Patient outcome</td>
<td>Healthcare outcome</td>
</tr>
<tr>
<td>MeSH Terms</td>
<td>Quality indicators, healthcare</td>
<td>Quality of care</td>
<td>Clinical indicators</td>
</tr>
<tr>
<td>Other Terms</td>
<td>Performance indicators</td>
<td>Benchmarking</td>
<td>Health indicators</td>
</tr>
<tr>
<td></td>
<td>Quality assurance, healthcare</td>
<td>Quality measures</td>
<td>Performance measures</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Patient safety</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Organization* benchmarking</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Clinical practice guidelines</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Transient ischemic attack or TIA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cerebrovascular accident or CVA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Stroke</td>
</tr>
<tr>
<td>Condition</td>
<td>Stroke program</td>
<td>Stroke service</td>
<td>Stroke centre</td>
</tr>
<tr>
<td>Condition</td>
<td>Stroke service</td>
<td>Stroke program</td>
<td>Healthcare quality improvement program</td>
</tr>
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</table>

†Financial incentives/payments were not included.

CVA indicates cerebrovascular accident; MeSH, medical subject headings; TIA, transient ischemic attack.
*Terms were searched using English and United States English spelling. MeSH is the United States National Library of Medicine’s controlled vocabulary used for indexing articles for MEDLINE/PubMed. MeSH terminology provides a consistent way to retrieve information that may use different terminology for the same concepts (http://www.ncbi.nlm.nih.gov/mesh, accessed November 10, 2010).

These case studies are used to illustrate the relationship between each of the main themes described in stage 2.
service performance measurements;” “performance measurements;” “quality indicators;” “clinical indicators;” “health policy;” “healthcare outcomes;” and “quality improvement.” A list of specific government and nongovernment web sites, such as World Health Organization, Canadian Stroke Network, International Society for Quality in Health Care (USA), and National Health Service (UK), were also searched (Supplementary Table II). Results were scrutinized to remove duplications identified from >1 source.

Analysis and Interpretation Methods
Potentially relevant publications were retrieved in full text and independently assessed for inclusion by the 2 reviewers. A descriptive summary of the included studies was then undertaken with additional gray literature included when relevant. Data extracted was then grouped in broad themes related to performance measurement and policy (by D.C. and B.K.). Disagreements were resolved through discussion and consensus among the reviewers, and the other coauthors provided additional relevant literature that may have been inadvertently omitted.

Results
The peer review literature search identified a potential 815 articles, 7 of which were duplicates (Figure 2). Fifty of these articles met the abstract inclusion criteria, and 7 of these also were identified from the bibliographies of relevant articles or from the gray literature search. Overall, 34 relevant articles were retrieved for full text review. Ten articles did not meet the inclusion criteria (Supplementary Table III) and the remaining 24 were reviewed. The 24 articles covered a range of broad topics that were not mutually exclusive and represented several different countries6–29 (Table 2, Figure 2).

Table 2. Summary of Overall Literature Review*

<table>
<thead>
<tr>
<th>Policy Theme</th>
<th>Performance Measurement Methods</th>
<th>Main Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improving overall evidence-based care delivery in hospitals and clinical guidelines</td>
<td>Clinical audit</td>
<td>Clinical registries when established for several years can be used to show changes across various performance measures and in health outcomes and can be used to develop comprehensive clinical quality improvement programs7,13,17,21</td>
</tr>
<tr>
<td></td>
<td>Clinical registries</td>
<td>Clinical audits and registries reveal heterogeneity in practice across individual hospitals and regions9,11,20,29</td>
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<td></td>
<td>Few assessments of rehabilitation services have been reported to know how well guideline recommendations have been implemented26</td>
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<tr>
<td></td>
<td></td>
<td>Performance measurements can be used to base credentialing standards for stroke services and the changes to clinical practice after credentialing19,79</td>
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<td></td>
<td></td>
<td>Performance monitoring can be used to show the influence on the quality of hospital care given different health insurance schemes or programs6,14,15,22–26</td>
</tr>
<tr>
<td>Establishment of stroke units</td>
<td>Surveys</td>
<td>Clinical registries when established for several years can be used to show increases in stroke unit access and better management of patients when cared for on stroke units compared with other types of inpatient care7</td>
</tr>
<tr>
<td></td>
<td>Clinical audit</td>
<td>Clinical audits and organizational surveys are also effective for providing the temporal progress in access to stroke units15,21,27</td>
</tr>
<tr>
<td></td>
<td>Clinical registries</td>
<td></td>
</tr>
</tbody>
</table>

*Further details of individual studies are provided in Supplementary Table III.
Details of each article and the main quantitative finds regarding change to health policy or health systems are summarized in Supplementary Table IV. Overall, the quality of the existing evidence varied, and most studies were descriptive or narrative reviews (Table 2, Supplementary Table IV). The included publications varied in the methodology used, making any direct comparisons problematic. Among the articles we reviewed, there were a number of performance measurement programs that had been established to improve the quality of stroke care, which may have a direct or indirect impact on policy developments and health system reform.

In this article, 2 main themes were identified from our review and are presented in detail. They cover the relationship between clinical guidelines and performance measurement using registries and clinical audit and a description of policy for establishing stroke units (SUs) as a direct and indirect response to the influence of performance measurement on health systems. To illustrate each of the 2 major themes more fully, an outline of the temporal progress of performance measurement and policy development is provided for Australia, Canada, Sweden, and the United Kingdom as case studies.

**Clinical Guideline Development, Performance Monitoring, and Influence on Other Policy Initiatives**

Our results confirm that the temporal relationship between performance measurement, clinical guideline development, and health policy developments is not always linear. There is limited evidence of clinical guidelines having been used as the basis for establishing performance-monitoring activities, such as cross-sectional national clinical audits and prospective clinical registries that include all eligible patients.23,30–33 Performance measurement therefore may be an indirect link to demonstrate the potential impact of clinical guidelines on health care over time. However, some performance monitoring programs predate formal establishment of national clinical guidelines and have been adapted over time to measure processes of care relevant to these guidelines that reflect best available evidence (Table 3).29,34

As an example, the Canadian Stroke Network includes performance measures as part of the stroke guideline document, which was a major step in using performance measurement to drive system change and policy in that country. This was motivated by evidence of persisting gaps in translating best available scientific evidence into clinical practice.23

Overall, we found that registries and clinical audits provide feedback to local stroke professionals, administrators, and politicians so they can evaluate or monitor adherence to desired standards, compare present data with that of the past, and make appropriate changes to clinical practice or policy. The findings from these systems of regular or continuous data monitoring offer policy-makers the opportunity for securing health system improvements and accountability. For example, Appelros7 evaluated the Riks-Stroke Swedish register and reported changes in stroke outcome such as case fatality,

### Table 3. Summary of Case Studies of Guidelines and Reports on Policy in Relation to Performance Measurement and Health Systems Development for Stroke in Hospitals From Four Countries*

<table>
<thead>
<tr>
<th>Years</th>
<th>Guidelines/Policy Documents</th>
<th>Performance Measurements/Policy</th>
<th>Guidelines/Policy Documents</th>
<th>Performance Measurements/Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001–2005</td>
<td>Australia</td>
<td>Regional stroke care outcomes measurements and plans National Stroke Unit Program Report, including performance indicators Stroke Services model and formative evaluation</td>
<td>Canada</td>
<td>Canadian Stroke Network launched</td>
</tr>
<tr>
<td>2006–2010</td>
<td>Australia</td>
<td>National stroke audit National Stroke Rehabilitation Audit National Stroke Clinical Indicators Set Australian Stroke Clinical Registry (AuSCR) piloted</td>
<td>Canada</td>
<td>Canadian Stroke Network’s vision for data infrastructure to monitor stroke treatment Registry of the Canadian Stroke Network (RCSN) established Final indicators for evaluating Telestroke</td>
</tr>
</tbody>
</table>

NICE indicates National Institute for Health and Clinical Excellence; SINAP, Stroke Improvement National Audit Programme; SPIRIT, Stroke Performance Indicators for Reporting, Improvement, and Translation; TIA, transient ischemic attack; UK, United Kingdom; WHO, World Health Organization.

*Comprehensive information is available in Supplementary Table V.
living conditions, and daily activity performance in relation to fluctuations in registration of cases. Benefits of this registry have included demonstrated increases in the access to SUs (from ∼50% in 1994 to 86.5% in 2009) and reductions in delays in arriving to hospital after stroke onset (median 4 hours in 1996 to ∼2.5 hours in 2009), and have provided evidence about the costs of care in Sweden for patients with stroke.35–37 In Spain, a stroke program was commenced as part of a comprehensive Stroke Strategy in 2004. As a part of this initiative, Abilleira et al9 assessed the quality of in-hospital stroke care across the Catalonia region before and after the release of new stroke guidelines along with territory-based interventions delivered by the stroke program. The main results of this audit provided evidence that the quality of in-hospital stroke care was heterogeneous across hospital levels and could be improved.8 However, these authors did not describe if the results of the audit and associated performance feedback initiatives to clinicians led to changes in policy or health system priorities by the relevant authorities.

Authors from the United States also have used registries to show substantial improvements across various performance measures (eg, dysphagia screening, lipid testing, and smoking cessation counseling) over time. For example, low rates of adherence to performance measures (eg, use of emergency medical services for transport to hospitals, time to receive thrombolytic therapy for ischemic stroke) were identified for ongoing attention by George et al17 representing the Paul Coverdell National Acute Stroke Registry. The authors also explained that a collaborative, state-based, and hospital-based quality improvement registry could be used to develop comprehensive stroke care protocols and to identify disparities in care by ethnicity, geographic region, and gender, enabling targeted improvements to achieve greater quality of care for various patients with stroke. The benefit of this approach is that various quality improvement initiatives and focused discussions on barriers and opportunities to implement best practices as part of regional collaborations with hospitals can be undertaken.17 Censullo and Chiu13 have assessed 13 comprehensive quality measures based on recommendations derived from the Brain Attack Coalition comprehensive center guidelines at a tertiary hospital in the United States. The authors highlighted that having standardized methodology for quantitative quality assessment provided a tool to evaluate the quality and capability of comprehensive stroke centers with selected measures used for certification processes. The results from these studies highlighted how systems of performance measurement could be used to form the basis of clinical quality improvement programs and could be used to base broader stroke policy on credentialing standards for hospitals.

The relationships between clinical guideline development, performance monitoring, and other policy initiatives were also outlined by Park and Schwamm25 in their narrative review describing various aspects of care delivery models for stroke in the United States and other developed countries. These authors described various successful initiatives and

Table 3. Continued

<table>
<thead>
<tr>
<th>Guidelines/Policy Documents</th>
<th>Performance Measurements/Policy</th>
<th>Guidelines/Policy Documents</th>
<th>Performance Measurements/Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO consensus document</td>
<td>National stroke quality register (Riks-Stroke) established, covering acute phase and a 3-mo follow-up</td>
<td>National framework for assessing performance, including stroke death</td>
<td>National Sentinel Audit of stroke report: regional variation in stroke care</td>
</tr>
<tr>
<td>The Helsingborg Declaration in Treatment of Stroke in Europe</td>
<td>All hospitals admitting acute stroke patients included in the stroke quality register</td>
<td>Health outcome indicators: Stroke, a report National Sentinel Audit of stroke report: regional variation in stroke care</td>
<td></td>
</tr>
<tr>
<td>First national stroke guidelines</td>
<td>First report from the quality register Swedvasc, including carotid surgery, with public access to between-hospital comparisons</td>
<td>National Service Framework for Older People with milestone on stroke units</td>
<td>National Sentinel Audit (2nd to 4th rounds), The Scottish Stroke Care Audit (SSCA) established</td>
</tr>
<tr>
<td>Update of the national stroke guidelines, now including priority-setting</td>
<td>National stroke guidelines now including 26 quality indicators</td>
<td>National Stroke Strategy with 10-y plan to deliver radical improvements in stroke care</td>
<td>National Audit Office report: Reducing Brain Damage; faster access to better stroke care</td>
</tr>
<tr>
<td>Competence Certification for stroke unit staff</td>
<td>Public access to between-hospital comparisons of stroke care performance</td>
<td>Third Edition of National Clinical Guidelines NICE guidelines on Acute Stroke and TIA</td>
<td>National Sentinel Audit (5th and 6th rounds)</td>
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<tr>
<td></td>
<td>First and second editions of National Clinical Guidelines for Stroke</td>
<td></td>
<td>Organizational Audit Round 7 Report</td>
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<td></td>
<td></td>
<td></td>
<td>Prospective acute stroke audit (SINAP) starts</td>
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their implications on health policy and health system changes, highlighting where performance measurement, including certification processes by The Joint Commission and use of registries, had been used to monitor the effects of policy change over time. These authors emphasized that the success of various programs to improve use of evidence-based medicine stemmed from a format of performance measurement and providing structured feedback. For example, the American Stroke Association adapted its already successful “Get with the Guidelines” program in coronary artery disease into Get with the Guidelines Stroke, which used a quality improvement model that incorporates sharing of best practices, collaborative learning sessions, and an online patient management tool for data collection and performance measurement to improve stroke care delivery within hospitals.35

Various authors have emphasized the importance of policy reform in ensuring optimal stroke care delivery.5,14,25,38 Crawford et al14 used performance measurement to demonstrate that differing health insurance policies were associated with significant differences in adherence to recommended processes of patient care. The authors compared patients with stroke in the Republic of Ireland, where there is a mixed public and private health coverage policy, with patients treated in Northern Ireland, which has universal free hospital health care. Northern Ireland performed significantly better on 15 of 16 quality of care (Sentinel Audit) items.14 The implications of this work for policy are significant and highlight the influence of a number of differences in the policy environments of these countries.14

Performance Measurement Influencing Policy for Stroke Unit Establishment
Organized management in SUs is regarded as the most generalizable and effective intervention for acute stroke care.39 In many countries there have been policies developed to increase access to SUs. In countries like the United Kingdom, Australia, Austria, Finland, Sweden, and Canada, routine organizational surveys of hospitals, clinical audit, and/or registries have been used to demonstrate the increases in, access to, and the number of SUs.32–34,40–42 For example, Irwin et al21 presented the results of 3 rounds of National Stroke Audit in England, Wales, and Northern Ireland. The data were used to show that standards of care on SUs were notably better than in general wards. Evidence from repeated audits in the United Kingdom also have shown that 68% of patients spend at least 50% of their admission in a SU in 2008 compared with only 18% in 1998.43 The results of the United Kingdom National Sentinel Audit have been quoted in the National Audit Office review of stroke care and the National Stroke Strategy, a policy with a key focus on increasing access to SUs. Without regular audits, the success of such policies would not be quantifiable. Similar findings have been reported using audit and registry data in several other countries.5,17,20

To illustrate these interwoven concepts presented in our results, the temporal progress of policy development and performance measurement of hospital care for stroke from Australia, Canada, Sweden, and the United Kingdom is summarized in Table 3. Full details for each country are provided in Supplementary Table V.

Discussion
The aim of this review was to explore evidence that performance measurement in stroke care had influenced health policy development or changes to the health system. We found limited direct evidence reported on the use of stroke performance measures to support reforms to health policy or changes in health care systems. The topic search was general and we did not include specific aspects of policy, which may have an influence of performance measurement based on financial, economic, or legislative outcomes. We also did not specifically include the search term of “stroke unit.” To illustrate the complex relationships, we provided case studies from 4 countries of how clinical audit and registries have been used to influence policy reforms in hospitals. We accept that these case studies are limited because they only represent English-speaking and Western nations. Nevertheless, for the first time, data on the trajectory of performance measurement and policy development from several countries have been compiled.

Overall we found that the literature providing evidence of the direct effect of and relationship with performance measurement and health policy development or the impact of these measures on changes to health systems were limited. A rerun of the peer-reviewed search strategy from October 2010 to February 2012, revealed another 3 potential articles that may have been relevant to our review. Inclusion of these additional articles would not have changed our main findings. Generally, we found that the quality of the existing evidence varied. Among the literature reviewed we found that although there were apparent policy implications of the findings from these studies, either most authors did not describe the links between health care processes/outcomes and policy strongly or the discussions provided in these articles seemed removed from addressing the policy formation opportunities. These findings highlight inadequacies of coordination between the outcomes research and health policy development or health systems. Given the availability of a range of validated performance measures for stroke, it is important to translate findings of research of these measures to address the policy relevant questions in the future. It is also essential that the temporal progress over time has been captured, as provided in the case studies of SUs from several countries.

Strengths of this review included the use of a structured search strategy that was broad in scope and included qualitative and quantitative data from peer-reviewed and nonpeer-reviewed sources. Limitations included the restriction to articles written only in English, limiting generalizability. Moreover, heterogeneity among published studies limited generalization of individual study results to other contexts, especially where different types of health systems, such as public and private, may exist. Different methods and lack of clarity about the mechanisms by which the study findings have impacted on health policy or health systems constrained the possibility to pool the results. The restriction of case studies to Australia, the United Kingdom, Canada, and Sweden means that the information may not be generalizable to other
countries, particularly where the health system model varies. This is because the countries used for the case studies are in high-income countries that have mostly publically funded health insurance systems.

We also may have missed some important literature on policy reforms related to legislation or financial incentives because search terms such as “financial,” “legislation,” or “economic” were not included. Future work in this area may include unpacking the factors associated with success, eg, involvement of various stakeholders to advocate for change (nonprofit organizations, professional societies, and other), type of health care system, size of country, use of financial incentives such as “payment for performance policy,” and whether stroke is listed as a national priority for the country or region. In addition, multifaceted quality improvement programs such as Get with the Guidelines Stroke and the United States Department of Veteran Affairs Quality Enhancement Research Initiative provide platforms in which health services research may be used to drive changes in health policy and health systems and may be used to fill some of the gaps identified in this review.

Conclusion

Our review shows that there is limited direct evidence that stroke performance measures have been used to impact health policies or health systems. Published information concerns mainly the relationship between clinical guidelines, audit and registries, and policy. This is evidenced from at least 4 countries on how guidelines have been used together with performance measures to increase access to SU care. Our results highlight that more robust research is required to demonstrate the associations between performance measurements, health policy decisions, and subsequent change to health systems. Authors of performance measurement studies need to draw stronger links between their findings and changes to health policy and health systems, and this may require longitudinal or follow-up studies because many of these changes will be seen over several years, as exemplified in the cases studies presented.

Acknowledgments

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Disclosures

None.

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