Comparative Effectiveness Research in Ontario, Canada: Producing Relevant and Timely Information for Health Care Decision Makers

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Context: Comparative effectiveness research is increasingly being recognized as a method to link research with the information needs of decision makers. As the United States begins to invest in comparative effectiveness, it would be wise to look at other functioning research networks to understand the infrastructure and funding required to support them.

Methods: This case study looks at the comparative effectiveness research network in Ontario, Canada, for which a neutral coordinating committee is responsible for prioritizing topics, assessing evidence, providing recommendations on coverage decisions, and determining pertinent research questions for further evaluation. This committee is supported by the Medical Advisory Secretariat and several large research institutions. This article analyzes the infrastructure and cost needed to support this network and offers recommendations for developing policies and methodologies to support comparative effectiveness research in the United States.

Findings: The research network in place in Ontario explicitly links decision making with evidence generation, in a transparent, timely, and efficient way. Funding is provided by the Ontario government through a reliable and stable funding mechanism that helps ensure that the studies it supports are relevant to decision makers.

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Conclusions: With the recent allocation of funds to support comparative effectiveness research from the American Recovery and Reinvestment Act, the United States should begin to construct an infrastructure that applies these features to make sure that evidence generated from this effort positively affects the quality of health care delivered to patients.

Keywords: Health services research, evidence-based medicine, investigational therapies, health care reform, health policy.

ALL HEALTH CARE SYSTEMS FACE THE SIMULTANEOUS challenge of improving quality and containing costs. In the United States, interest in comparative effectiveness research as a means of satisfying these linked goals has recently increased. The Institute of Medicine (IOM) broadly defines *comparative effectiveness* as “the clinical and/or economic evaluations of specific medical interventions (including pharmaceuticals, medical devices and medical procedures) relative to other available alternatives for a selected clinical indication” (Institute of Medicine 2007). Several government agencies, including the IOM, the Congressional Budget Office (CBO), and the Medicare Payment Advisory Commission (MedPAC), have published reports favoring a coordinated program to carry out comparative effectiveness research (Congressional Budget Office 2007; Institute of Medicine 2007; Medicare Payment Advisory Commission 2007).

On January 6, 2009, the U.S. federal government confirmed its support of this effort by allocating a total of \$1.1 billion to the Agency for Healthcare Research and Quality (AHRQ), the secretary of the Department of Health and Human Services (HHS), and the National Institutes of Health (NIH) to fund comparative research efforts through the American Recovery and Reinvestment Act (ARRA) of 2009. In addition, a federal coordinating committee was appointed to ensure that the relevant agencies’ resources were used efficiently. The ARRA states that this money should be used to

conduct, support, or synthesize research that compares the clinical outcomes, effectiveness, and appropriateness of items, services, and procedures that are used to prevent, diagnose, or treat diseases, disorders, and other health conditions; and encourage the development and use of clinical registries, clinical data networks, and other forms of

electronic health data that can be used to generate or obtain outcomes data. (American Recovery and Reinvestment Act of 2009)

The ARRA's investment in comparative effectiveness research (CER) increases the urgency of creating the infrastructure necessary to support it. In making near-term investments to expand the workforce, clinical research networks, data systems, methods, and other elements required to conduct CER, we might look to international initiatives to gain insight from the lessons they have learned.

An example of a well-developed system to support the generation of clinical and cost-effectiveness evidence is in Ontario, Canada, where the Ministry of Health and Long Term Care developed a unique process to address the evidence gaps important to clinical and coverage decision making. Although health care delivery in Canada is primarily a provincial responsibility, the federal government does provide funding contingent on the provinces' adhering to the conditions set forth in the Canada Health Act of 1984. According to this act, the provinces must provide all "medically necessary" hospital and physicians' care free of charge (Iglehart 2000; Lewis et al. 2001). Hospital services include such inpatient care as diagnostic tests, biologic supplies and equipment, inpatient drugs, psychiatric care, and most outpatient services. In contrast to in-hospital medication use, public coverage of outpatient prescription medications varies by province. In most provinces, public coverage is limited to the elderly and/or those receiving welfare. Most working Canadians receive private drug insurance through their employer. The provinces also differ in their coverage of home care, nursing homes, and other community-based care (Iglehart 2000; Lewis et al. 2001).

Within this system, where the provincial governments pay for the majority of health care costs, the development of promising medical technologies for which there is little to no evidence of clinical or cost-effectiveness has placed added pressure on both public payers (i.e., provincial ministries of health) and providers (i.e., hospitals) throughout Canada (Levin et al. 2007). Hospital officials throughout Ontario have expressed frustration with the public pressure to adopt new technologies without objective information regarding their benefits and risks compared with those currently available (Levin et al. 2007).

In response, the Ontario Health Ministry created a system by which decision makers (primarily hospitals and health ministry officials) can request a medical technology review by the Ontario Health Technology

Advisory Committee (OHTAC). Following the review, if OHTAC considers the evidence of the technology's clinical effectiveness, safety, and/or cost-effectiveness to be inadequate, it can request a prospective clinical study, usually a pragmatic clinical trial (Tunis, Stryer, and Clancy 2003), to be conducted to answer questions of importance to decision makers (Goeree and Levin 2006; Levin et al. 2007).

This article describes the main programs involved in Ontario's comparative effectiveness research network for nondrug medical technologies. (A similar network has not yet been established to assess emerging drug technologies. Although new drugs are evaluated by a federal agency using a cost-effectiveness framework before they are listed on public formularies in Canada, this agency cannot commission research in situations in which there is more uncertainty than is desirable.) We then look at the workforce and funding requirements and discuss possible lessons from the Ontario experience for policymakers in the United States.

Establishing an Agenda and Making Policy Recommendations

The MAS/OHTAC Partnership

As in most other jurisdictions, nondrug medical interventions have usually rapidly entered the Ontario health care system, even without definitive clinical evidence of their benefit. One reason for this is that technologies can enter the health care system through a variety of "portals," including hospitals and other health care providers, community programs, and nursing homes (Goeree and Levin 2006). Therefore, so that only those new cost-effective technologies with a proven clinical benefit are used, the Ministry of Health and Long Term Care established the Medical Advisory Secretariat (MAS) in 2001 and the Ontario Health Technology Advisory Committee (OHTAC) in 2003. These two entities work in concert to provide guidance on which technologies have a sufficient evidence base and should be financed with public funds; which technologies should be covered only in a formal program of evidence development; and which should not be covered at all (see figure 1). In making this decision, the Ontario Health Ministry considers many factors, including not only clinical effectiveness and safety but also cost-effectiveness and the impact on the budget.

Notes: ^aMedical Advisory Secretariat;
^bMinistry of Health and Long Term Care;
^cOntario Health Technology Assessment Committee;
^dProgram for the Assessment of Technologies in Health;
^eToronto Health Economics and Technology Assessment Collaboration;
^fInstitute for Clinical Evaluative Sciences.

FIGURE 1. Schematic of Explicit Link between Decision Makers and Comparative Effectiveness Entities

Any potential payer or purchaser of a new medical technology can ask OHTAC to assess the available evidence to determine whether it is sufficient for a decision. MAS, a unit within the health ministry that is staffed by an information specialist, two policy analysts, ten clinical epidemiologists, and three administrative staff, processes these requests and presents them in a template format to OHTAC for review. OHTAC prioritizes these requests based on the information provided in the template, which includes the potential size of the clinical effect; the burden of disease for which the technology would be used; the potential pressure for diffusion, including public or professional pressure to use the new technology, as well as for adoption by other jurisdictions nationally and internationally; the availability of an alternative technology; a

preliminary comparison with alternative health care interventions; and the estimated overall cost of implementing the technology (Goeree and Levin 2006; Levin et al. 2007).

OHTAC is an arm's-length advisory committee to the Ontario Health Ministry composed of a minimum of twelve members (currently, the committee has twenty-five members). The committee is made up of representatives of the provincial physician and hospital associations and the community and long-term care sectors, as well as a single representative from the national association representing Canada's medical device industry (MEDEC). Members have expertise in nursing, medicine, health economics, epidemiology, ethics, and/or technology assessment (Goeree and Levin 2006; Ontario Health Technology Advisory Committee 2008). They are appointed by the deputy minister of health and long term care for two-year terms (Ontario Health Technology Advisory Committee 2008). OHTAC has clear guidelines and processes pertaining to conflicts of interest that apply to all its members. Including a single industry representative has the advantage of making sure that the industry perspective is considered but does not dominate. This approach, as well as an explicit focus on evidence, has protected OHTAC from being influenced by industry. To date, industry has not funded any field evaluation studies.

The members of OHTAC meet monthly to provide feedback to MAS and policy recommendations to the deputy minister of health and long term care. Based on MAS's initial analysis, OHTAC can choose to request a systematic review, commonly referred to as a *health technology assessment* (HTA) (see figure 1); reject the application; or ask for more information before making a final decision.

If OHTAC asks for an HTA, MAS, in collaboration with academic partners at the University of Toronto and McMaster University with recognized expertise in economic analysis, will produce the assessment within sixteen weeks of the initial request to help see that important topics are addressed in a timely manner to aid in decision making (Goeree and Levin 2006; Levin et al. 2007). These assessments include a review of the evidence relating to the technology's safety, clinical effectiveness, efficacy (produced by MAS), and cost-effectiveness through decision analysis modeling or systematic review (produced through academic collaborations). The quality of evidence is accompanied by a rating consistent with the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) guidelines (Goeree and Levin 2006). Evidence can

be given a GRADE quality rating of “high” (future research is unlikely to change the estimate of the effect), “moderate,” “low,” or “very low” (any estimate of the effect is very uncertain) (GRADE Working Group 2004). The GRADE framework takes into account a number of factors, including the type of evidence available (e.g., randomized controlled trials versus observational studies), the quantity of evidence (e.g., the number of studies), and the consistency of the evidence, as well as an assessment of any potential biases. The GRADE framework provides consistency and transparency in the way that MAS’s recommendations are made.

During the analysis, experts are appointed by MAS to provide knowledge content; industry is notified and invited to share nonproprietary information; and the analyses are subject to peer review by an independent expert as well as a detailed review by at least one OHTAC member before being presented to OHTAC. Based on the HTA, which includes estimates of cost-effectiveness, OHTAC can make a recommendation to the Ontario Health Ministry and the health system on the optimal use of the technology. If there is uncertainty regarding clinical effectiveness or safety, OHTAC can ask that a “conditionally funded field evaluation” be performed (see figure 1).

Targeted public and professional engagement is solicited for three weeks following OHTAC’s draft recommendation, in addition to its being posted on the OHTAC website for public comment. Public engagement is targeted at disease advocacy agencies and professional engagement through professional bodies. Comments elicited from them are reviewed and considered before final decisions are made and published (Medical Advisory Secretariat 2007). Following publication of the final recommendation, there is a sixty-day period during which a direct appeal can be made to OHTAC, based on evidence contained in the analysis or the recommendation itself.

OHTAC has determined that a multifaceted approach to public engagement is preferable to a single strategy. Therefore, the committee has applied targeted approaches to engage public stakeholders and disease advocacy groups. Examples of this approach have been polling one thousand women to gain a better understanding of acuity and preferences for stress urinary incontinence; a “barriers to access to prescribed treatment and devices” study to inform policy in diabetes; and focus groups to understand access to epilepsy-related surgery. More recently, researchers at McMaster University were awarded a research grant to establish a

citizens' council, which will be independent of OHTAC. Members of the council will provide public perspectives on generic issues related to health technology and its assessment, in addition to offering appropriate feedback on specific OHTAC recommendations. The citizens' council and inviting patients affected by the technology to help form the appropriate questions for the analysis are in the early stages of development.

MAS receives a fixed budget from the Ontario government to carry out technology assessments, support the OHTAC's, and provide grant support for field evaluations. Field evaluations are guaranteed five years of support, and each is subject to review and incremental funding allocation. To date, all of OHTAC's recommendations for field evaluation studies have been approved.

Programs to Conduct Field Evaluations

All of Ontario's programs with the capacity to carry out field evaluations for promising technologies are formally independent from government but are primarily publicly funded. Since requests for field evaluations come directly from decision makers, studies can be designed to address the specific evidence needed to make coverage or purchasing decisions. Field evaluations can take many forms, including randomized control trials, observational studies (e.g., registries or cohort studies, with or without contemporaneous controls), time-series studies, chart reviews, and multisite safety assessments. OHTAC and the health ministry may also use information from polling studies or from the development of microeconomic policy models to inform policy decisions.

These independent programs, in collaboration with experts in the health technology under investigation, decide on an appropriate study design. In addition, each field evaluation also contains an assessment of the technology's cost-effectiveness. All field evaluations are approved by a university-based research ethics board, and appropriate measures are instituted to maintain confidentiality and to obtain informed consent from patients. While the evaluations are being conducted, if the technology is already insured, the Ontario Health Ministry covers physicians' costs for medical technologies for patients participating in the study (Goeree and Levin 2006; Levin et al. 2007). If the technology is not yet insured, alternative funding arrangements are usually made to grant access to the technology conditional on the development of evidence. This

framework gives patients access to emerging technologies (and secondarily gives manufacturers access to the market) before a more definitive policy decision has been reached, and it also leads to a better-informed decision based on the new information gathered. Field evaluations are allocated to one of the first two programs described next, based on existing capacity. The data collected during field evaluations are owned by the academic institution overseeing the study and are shared at the discretion of that institution.

Program for the Assessment of Technologies in Health (PATH)

The longest-standing program designed to conduct government-funded field evaluations is the Program for the Assessment of Technologies in Health (PATH), located at McMaster University and St. Joseph's Healthcare Centre. The program has approximately twenty staff members: four graduate students, fourteen research associates, a biostatistician, and university faculty members (PATH Research Institute 2008b). Four or five staff work on a given field evaluation with the help of various project consultants. In addition, PATH has been actively developing both master's and doctoral degree programs at McMaster University in the field of health technology assessment (PATH Research Institute 2008a).

Over the past few years, PATH has completed several studies, whose results have had a significant impact on decision making. One of these studies is described in box 1.

BOX 1

Comparative Effectiveness Study Comparing Drug-Eluting Stents with Bare-Metal Stents to Treat Coronary Artery Disease

In 2002, MAS completed a gray literature-based health technology assessment of the clinical effectiveness of drug-eluting stents (DES) compared with bare-metal stents (BMS). It concluded that randomized control trial (RCT) evidence would likely show that DES was more effective than BMS, after which there would be a steep diffusion curve for DES. But when the initial RCT results on DES were published later that year, they expressed uncertainty regarding generalizability. Accordingly, OHTAC recommended that the

Ontario Health Ministry commission a field evaluation from PATH. PATH proposed a prospective observational study, which took advantage of both an existing province-wide registry set up by the Cardiac Care Network (CCN) of Ontario and the ability to link this registry to administrative databases housed at the Institute for Clinical Evaluative Sciences. Additional fields were added to a preexisting CCN database to facilitate a study comparing different stent designs. The objective was to estimate the reduction in risk of revascularization within two years of treatment with DES, compared with BMS. The study also would estimate the cost-effectiveness of DES compared with BMS. During the study, hospitals were able to provide DES free of charge to patients enrolled in the study (Bowen et al. 2007; Tu et al. 2007).

The study provided evidence of the benefits of using DES in some “off-label” indications but suggested that DES may be no more effective than BMS for many “on-label” indications. The results demonstrated an incremental benefit for DES only in high-risk patients, defined as those with two of three risk factors for restenosis (diabetes, small vessels, and long lesions) (Bowen et al. 2007; Tu et al. 2007). Based on these results, OHTAC recommended that DES be used only in patients at high risk for restenosis. Data continue to be collected on patients who receive DES, and the initial estimates are that this controlled diffusion of DES led to a cost savings of about \$20 million in 2007 and 2008 (Bowen et al. 2007). This has resulted in an estimated conversion rate of 25 percent from BMS to DES in Ontario, compared with an estimated conversion rate of 90 percent in the United States, as reported in *The New York Times* (Feder 2006).

Toronto Health Economics and Technology Assessment (THETA) Collaborative

In July 2007, the Ontario Health Ministry funded the establishment of the Toronto Health Economics and Technology Assessment (THETA) Collaborative at the University of Toronto. The group now has twenty-eight investigators, including health economists, decision analysts, biostatisticians, and health service researchers (Toronto Health Economics and Technology Assessment Collaborative 2008b). In addition to designing and executing field evaluations, THETA is creating courses on health technology assessment and field evaluations at the University of Toronto (Toronto Health Economics and Technology Assessment Collaborative 2008a).

Institute for Clinical Evaluative Sciences (ICES)

PATH and THETA are often able to increase the impact of their studies by collaborating with researchers at the Institute for Clinical Evaluative Sciences (ICES). ICES is an independent, nonprofit organization that receives the core funding for its activities from the Ontario Health Ministry (Institute for Clinical Evaluative Sciences 2007). In addition to direct, project-specific funding from various provincial and national organizations, ICES faculty compete for peer-reviewed research grants (Institute for Clinical Evaluative Sciences 2007). The organization has approximately seventy-five faculty members and two hundred staff. ICES faculty are able to link large datasets to monitor patterns of use of various drugs and medical technologies as well as patterns of quality of care (Institute for Clinical Evaluative Sciences 2008). Information from these large datasets has been invaluable to conducting various field evaluations. For example, ICES research played a significant role in the PATH study comparing drug-eluting stents to bare-metal stents described in box 1.

University Health Network Usability Laboratories

University Health Network Usability Laboratories are a nonprofit group primarily concerned with assessing the safety of medical technologies and conducting human factors analyses, which are important considerations for policymakers and purchasers (Center for Global eHealth Innovation University Health Network 2008). The Usability Laboratories have fifteen employees, including human factors analysts and engineers, and receive most of their support from the Ontario Health Ministry for OHTAC-related safety and human factors analyses. This group answers requests from OHTAC for information relating to the technology's ease of use, the qualifications necessary to manage the technology, and/or the risks to hospital staff or patients (Levin et al. 2007). Some of the topics completed or currently under review from the Usability Laboratories are safety concerns regarding CT radiation exposure, MRI, and human factors studies of automated external cardiac defibrillators and smart infusion pumps (Center for Global eHealth Innovation University Health Network 2008).

Workforce and Funding Requirements for the Comparative Effectiveness Research Network

Supporting comparative effectiveness research in Ontario requires staff from a variety of backgrounds, such as health policy experts, health economists, clinical epidemiologists, biostatisticians, health services researchers, and engineers, as well as physicians, nurses, hospital representatives, and information specialists. In addition, the network's success is dependent on the willingness of university faculty and clinical experts to help design studies and collect data. They are willing to devote their time and expertise to this process for several reasons, including the desire to contribute to better policymaking, the prestige of being involved with or appointed to OHTAC, and the freedom to publish results from the study. This last point is particularly important because if researchers felt that their academic freedom were compromised or limited, they would likely be less willing to assist in the process, thereby setting up the system to fail.

Despite the limited number of core staff, the system itself encompasses a far greater range of human resources working collaboratively. In addition, both PATH and THETA are establishing workshops, classes, and degree programs at McMaster University and the University of Toronto to increase capacity and meet future workforce needs (PATH Research Institute 2008a; Toronto Health Economics and Technology Assessment Collaborative 2008a).

Currently, through a permanent funding mechanism, the Ontario Health Ministry is spending a total of C\$8 million to C\$10 million each year on field evaluations for high-demand, emerging medical technologies. Although technology costs are generally excluded from this figure, they also are paid by the health ministry through a different funding stream. It is likely that the cost of these technologies would be financed even without the field evaluation studies, as these technologies would likely have diffused rapidly throughout the health care system. This figure also excludes the cost of university and medical researchers' contributions to the studies, as they are generally paid by their home institutions. Approximately C\$5 million of this funding is invested in the Positron Emission Tomography (PET) registries, leaving C\$3 million to C\$5 million for additional field evaluations. The PET registries

cost more because they are paid directly out of OHTAC's budget instead of through other government sources, as is generally the case.

Implications for Comparative Effectiveness Research in the United States: Policy and Methods

The design and experience of the Ontario programs reviewed in this article highlight a number of potentially useful implications for discussions in the United States on expanding the capacity for comparative effectiveness research. Below we review those elements of comparative effectiveness research that may be important to the success of the enterprise, many of which have already received attention in the United States.

Establish a Sustainable, Unbiased, and Nimble Funding Source

Stable government funding for Ontario's comparative effectiveness programs has been critical because product manufacturers often lack the incentive and hospitals usually lack the resources to support many high-priority studies. In addition, both are inhibited by the "public goods" problem, in that any investment made by individual organizations would generate information that could be used by entities that did not contribute. Important research questions are identified through the OHTAC process, and studies are quickly designed, approved, and implemented, with funding decisions made simultaneously, mainly because a pool of resources is available to support this work. Efficiency is essential to evaluating promising emerging technologies in a timely way to inform clinical and health policy decision making. The lengthy process typical of many competitive grant submission and review mechanisms is not appropriate for this type of applied research. To create a similar capacity, the United States should secure a continuously available, renewable, and neutral source of funding. In addition, there is a need for a process that facilitates rapid decisions about the research methods most suitable to address the question, as well as timely allocation of the funds and efficient implementation of the studies. Ontario's approach combines

ready access to resources with research organizations that understand the unique requirements of policy-relevant research. Accordingly, although sustainable funding is a major concern, it must be coupled with an improved infrastructure and an emphasis on increasing the efficiency of the grant approval process as well as establishing effective, sustained communication between researchers and decision makers.

Develop and Maintain Strong Ties between Decision Makers and Researchers

The close and ongoing contact among the Ontario Health Ministry, OHTAC, MAS, and the research programs that conduct field evaluations in Ontario ensures that studies are completed in a timely fashion and are responsive to the questions of importance to their primary audience: policymakers, payers, and purchasers. Conversely, establishing a comparative effectiveness capacity that is insulated from decision making will likely result in CER projects that are less responsive and relevant to decision making. Comparative effectiveness research should not be viewed principally as an academic exercise; rather, it is inherently applied research and therefore somewhat unfamiliar to most researchers who have built their careers around investigator-initiated projects.

The United States still does not have sufficient communication between researchers (and research funders) and decision makers, though the AHRQ has made great progress in this respect over the past several years, a trend that is likely to continue as its importance to CER is appreciated more widely. Although researchers from Ontario's academic institutions play a large role in designing and implementing field evaluations, they are guided primarily by the needs of the decision makers at the health ministry and are willing and able to work with them to make sure they are answering the relevant research questions. In the United States, the AHRQ, the NIH, and HHS must see that grant support is given to researchers who demonstrate an ability to engage effectively with patients, consumers, clinicians, and payers as they refine study questions, develop protocols, implement studies, and disseminate results. The development of efficient mechanisms will be required to guide priority setting, protocol development, and study implementation to ensure that comparative effectiveness research studies receive

input and feedback from these decision makers, as well as from other experts and stakeholders.

*Ensure Independence and Transparency
of Research Programs and Decision-Making
Process*

Although the government is the main source of funding for comparative effectiveness research in Ontario, the research programs conducting the various field evaluations have remained independent. This independence from the Ontario Health Ministry allows these programs to design and implement studies without undue political influence and to engage freely with consultants and experts. They have achieved a reasonable balance between taking direction from the decision makers and retaining sufficient scientific independence. In addition, the fact that OHTAC is at “arm’s length” from the Ontario Health Ministry keeps the process for coverage recommendations separate from the ministry, thereby detaching it from the final decision-making process. Because the province of Ontario is significantly smaller than the United States and has a single-payer health care system, its approach to balancing institutions’ responsiveness while maintaining objectivity cannot be directly replicated in the United States, but it does highlight the importance of attending to both elements of a functional comparative effectiveness research enterprise.

The Ontario government and OHTAC have put a good deal of effort in making sure that the technology review and research process is open to the public. Targeted approaches are used to solicit stakeholder engagement and feedback, and all decisions and reasons for those decisions are made available on the Internet. Recognizing the importance of building public trust in these important policy decisions, policymakers in Ontario continue to devise new methods to increase the level of public engagement. As comparative effectiveness research is expanded in the United States, it will be important to focus on strategies to make patients and consumers aware of these efforts and encourage them to engage in the process. In addition to Ontario, most countries with comparative effectiveness research programs have developed a variety of mechanisms to support public awareness and involvement, some of which have been more successful than others. Effectively engaging the public is resource

intensive and generally cannot be confined to simply reserving positions on advisory boards for patient and consumer representatives.

Create Ongoing Partnerships with Academic Programs Responsible for Conducting Comparative Effectiveness Research

The Ontario technology assessment process relies on sustained, defined partnerships between programs conducting field evaluations and various universities, such as the University of Toronto (THETA), McMaster University (PATH), and the University Health Network Usability Laboratories. These partnerships allow these programs, when designing and implementing various studies, to draw on the expertise of academics and physicians working at these universities. This connection also has led to the development of dedicated courses and degree programs to help produce a workforce with highly relevant skills.

The maintenance of relationships between the Ontario Health Ministry and academic programs specializing in comparative effectiveness studies appears to be important to their efficiency and effectiveness. While the fundamental research skills necessary to conduct comparative effectiveness research overlap with those required to conduct more traditional clinical and health services research, there are important differences in how comparative effectiveness studies are designed and used. Since one's ability to design and conduct this research improves with experience over time, it is unlikely that Ontario would achieve the same results with its existing funds simply by distributing those funds to a wide range of academic institutions that are less familiar with the work needed by the Ontario policymakers. This network is similar to the network of evidence-based practice centers in the United States and Canada (Agency for Healthcare Research and Quality 2008), as well as a number of other similar, academically based networks with the expertise and relationships to conduct these types of projects. We should thus explore the establishment of a dedicated network of centers with expertise in a range of methods for conducting comparative effectiveness studies. These centers should maintain active relationships with critical health care decision makers, including medical professional societies, patient and consumer groups, the Centers for Medicare and Medicaid Services (CMS), private payers, and others.

Draw on Existing Capacities to Support Comparative Effectiveness Studies

Government funding for comparative effectiveness research in Ontario is relatively modest because MAS, PATH, and THETA are able to rely on existing analytic resources in the province, such as ICES and university researchers and clinicians, to help support their projects. Once these programs receive requests from OHTAC, they are able to launch studies quickly and efficiently.

Numerous health services research organizations as well as an extensive network of universities and teaching hospitals could be leveraged to help support a comparative effectiveness research agenda in the United States. Ontario's mechanism of assigning individual projects to research programs may not be feasible in the United States; a competitive procurement process may be more suitable. While a competitive process may be advisable, the turnaround time for this process should be months, as opposed to years, so that the results of these studies remain relevant to policymakers. In order to ensure timeliness, agencies conducting technology assessments would benefit from using existing, high-quality, and widely recognized tools, such as the GRADE system, for assessing the quality of existing evidence. Furthermore, to ensure that the studies are designed and implemented in ways that are useful to decision makers, research organizations must be judged on their ability to produce work of practical importance as well as academic excellence. Because CER will be conducted by a large number of public- and private-sector organizations, there will be a critical need for effective coordination through some central entity or program.

Invest in a Centralized Capacity to Set Up and Collect Information from Patient Registries

The Ontario network takes advantage of the separate, larger institute (ICES) responsible for creating clinical registries and cross-linking health care databases. Although these databases address a range of policy questions other than coverage decisions, these databases, as well as various ICES analyses, support many of the field evaluations designed by PATH and THETA. In addition, the ICES databases allow PATH and THETA to implement studies more quickly and at a lower cost than they could without them.

In the United States, several payers, including Medicare, United Healthcare, Kaiser Permanente, and the Blue Cross/Blue Shield Association, as well as the U.S. Department of Veterans Affairs, routinely collect large volumes of administrative data and, increasingly, clinical data from electronic health records. A U.S. comparative effectiveness research enterprise would benefit greatly from the development of methods to link these databases with one another and with prospective clinical trial data.

Use a Variety of Research Approaches to Inform Decision Makers

Ontario's technology assessment system relies on various study designs to assess emerging technologies and address critical evidence gaps. Decision makers in Ontario use information from systematic reviews, cost-effectiveness modeling, and (if necessary) field evaluations that include randomized controlled trials and observational studies. In Ontario, the most appropriate study design is decided by policymakers and researchers on a case-by-case basis, taking into consideration the available evidence and the decision(s) to be made. In the United States, there continues to be a debate about the optimal methods for comparative effectiveness research that remains separate from discussions about specific research questions. Ontario's experience, however, suggests that there are important roles for all available methods when applied with technical proficiency to the appropriate research questions. Both Ontario and the United States still need to develop generalizable approaches to determining which type of study design will provide sufficiently robust evidence for policy decisions associated with specified categories of technologies.

Leverage Medicare's Influence on Private Payers

One reason for the effectiveness of Ontario's system may be that decisions regarding reimbursement are relatively centralized compared with the United States. The payer (the Ontario Health Ministry) decides how new nondrug technologies will be used in Ontario. In the United States, the multiplicity of decision makers creates a barrier to adopting a systematic and coherent approach to the evaluation, dissemination, and use of

emerging medical technologies because they can enter the health care system through private as well as public payers.

Although the United States does not have one central decision maker, private payers are often influenced by Medicare's coverage decisions. Therefore, Medicare's influence on private coverage decisions could be used to help expand comparative effectiveness research, especially if Medicare were to rely more on the Medicare Evidence Development and Coverage Advisory Committee (MEDCAC) to help identify research priorities and establish methodological standards for comparative effectiveness research. MEDCAC has experience identifying and prioritizing research topics and could use its experience to develop more refined approaches for future efforts (Medicare Evidence Development and Coverage Advisory Committee 2008). Furthermore, Ontario's experience with field evaluations suggests that Medicare could use its "coverage with evidence development" policy to support studies that are appropriately designed to address questions of importance to Medicare coverage decisions (Tunis and Pearson 2006). Private-payer models of "coverage with evidence development" have attracted interest as well, and it would be particularly effective to have public and private payers supporting the same studies using this policy mechanism.

Another relevant difference between the United States and Ontario is that in Ontario, policymakers are expected to use the results of field evaluations to make coverage decisions, whereas in the United States, creating a link between CER and reimbursement decisions has created controversy. Ontario's success rate in applying its CER studies to clinical and policy decision making suggests that decision makers and other stakeholders find the information useful and credible when generated through a robust, independent, transparent process.

Conclusion

Diffusion of novel health technologies, devices, and drugs can occur rapidly despite the absence of adequate evidence to fully understand their comparative clinical effectiveness and value. This can lead to a highly variable and inefficient use of limited health care resources and reduce the overall health benefits available to patients served by the United States' health care system.

The demand for evidence-based medicine is gaining momentum. Yet without adequate evidence on which to base decisions, payers, physicians, and patients are left guessing about choices that could have a significant impact on spending and health outcomes. To ensure that investment in comparative effectiveness has a positive impact on the generation of evidence and the quality of medical care, we must develop a sustainable, transparent, and efficient infrastructure and funding mechanism.

The Ontario network shows that it is possible to provide decision makers with valuable information on clinical effectiveness and cost-effectiveness that can significantly influence the appropriate diffusion of emerging technologies into the health care system within a relatively modest budget.

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