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**HEALTH EVIDENCE APPLICATION AND LINKAGE NETWORK
(HEALNet)**

Accomplishments and Impacts 1995-2002¹

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Introduction

The Health Evidence Application and Linkage Network (HEALNet) was established in September 1995 as a national health information research network funded by the federal Networks of Centres of Excellence (NCE) Program through the Canadian Institutes of Health Research (CIHR) (formerly the Medical Research Council of Canada) and the Social Sciences and Humanities Research Council of Canada (SSHRC), in partnership with Industry Canada.

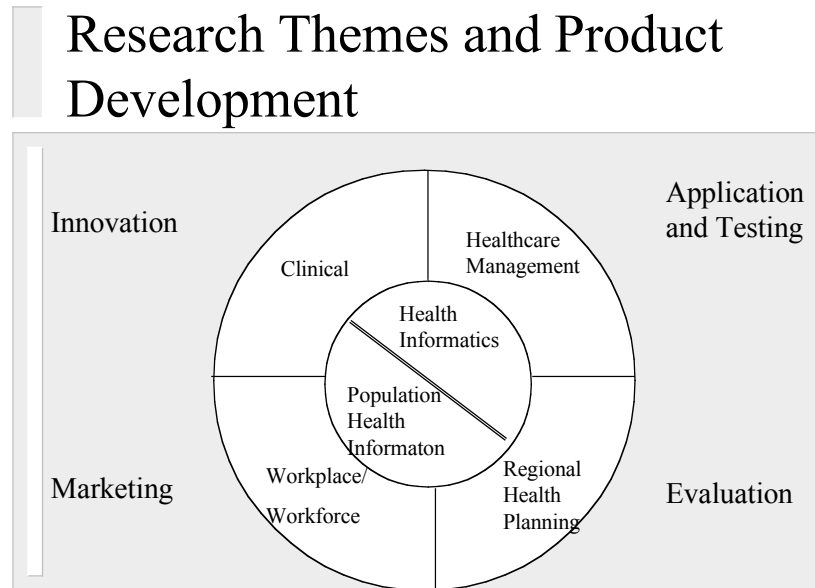
Through applied health information research, undertaken in collaboration with academic, private sector, and public and not-for-profit partner organizations, HEALNet contributed to advancements in the health and well-being of Canadians by improving decision-making at all levels of the health care system and within workplace settings. Between 1995 and 2002 the Networks of Centres of Excellence Program invested \$16 million in the HEALNet project. In addition, the private, academic and public/not-for-profit sectors collectively invested an additional \$6 million in cash and in-kind support for a total of \$22 million. This support funded 140 projects. Over 150 Network Investigators and 230 research collaborators were involved in Network research from 21 academic disciplines. Researchers employed more than 60 technical staff. Of particular importance is that over 160 students were supported by and involved in the Network's research program.

There were two distinct phases in HEALNet's development. Phase I, the Network-building stage, occurred from 1995 to 1997. Phase II, the mature phase of the Network, occurred between 1998 and 2002.

In Phase 1, the Network organized itself around six research themes and a product development plan as illustrated in Diagram 1.

¹ This paper is based on the HEALNet final report, submitted to the Network of Centres of Excellence program, June, 2002

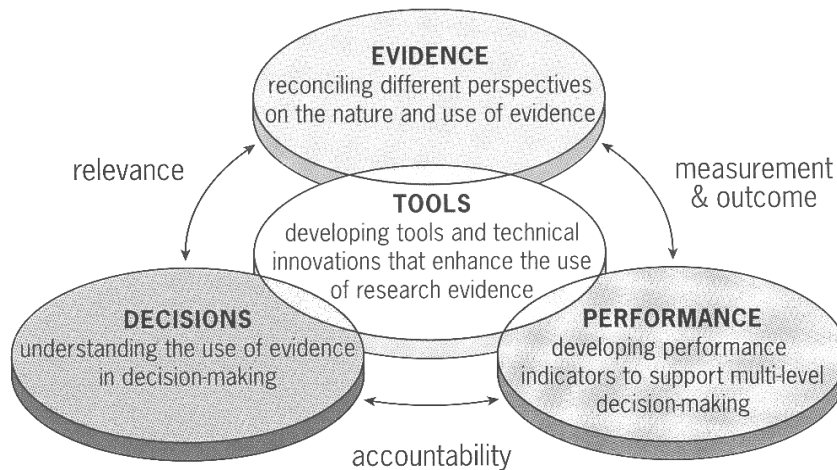
Diagram 1: HEALNet Research Foci 1995-1997



A great deal of energy was expended in the Network-building phase working through disciplinary and contextual boundaries in order that Network researchers could work more effectively together. In 1997, a strategic planning process involving broad consultation with health information, policy and services sector representatives and the academic health services research community resulted in a refined mandate and a more integrated research program structure.

In phase II, the network conducted an integrated research program that enabled health information users to optimize the use of the best evidence in decisions at all levels within the health system and in the workplace (Diagram 2).

Diagram 2: HEALNet Research Foci 1998-2002



By embracing the dual objectives of social innovation and commercialization, HEALNet research supported *the creation of products that can themselves be commercialized, and products and practices with direct social utility* (i.e. that can be broadly disseminated and used to decrease costs and/or improve quality of life).

Research Accomplishments and Impacts 1998-2001

Following the report of the National Forum on Health in 1997, and concerns expressed by a range of leading Canadian health organizations and provincial political leaders, a number of national priorities were identified as essential for enabling the Canadian health system to become more efficient, effective and evidence-based. These included an improved understanding of the nature of evidence-based decision-making beyond the clinical context and across levels of decision-making. Much of HEALNet's Phase I research anticipated these needs. The Phase II research program was consistent with national priorities and the needs of health system and workplace decision-makers.

Of primary importance to the HEALNet research program was the uptake of research evidence by decision-makers within and across five levels of decision-making:

1. health system governance / health policy / citizens;
2. health services management / administration;
3. health care provision / clinical settings;
4. health care users (consumers / patients); and,
5. workplace health and productivity.

By ensuring that decision-makers were involved in the research process and ensuring research results were transferred in easily accessible formats specific to their target audience, HEALNet research made a significant impact on decision-making processes and structures in the health system and the workplace, as well as on the manner in which information is provided to consumers to enable them to benefit from health research in making individual health decisions. Provided below are some examples of HEALNet's research accomplishments and impacts in relation to the targets for research uptake identified above.

Innovations Benefiting Health System Governors, Policy-makers and Citizens

HEALNet, in partnership with a range of health system governors, policy-makers and citizens undertook the following initiatives with significant results:

Understanding How Canadian Policy-Advisors Use Health Research

A general synthesis and distillation of more than 25 years of research since the publication of the Lalonde Report in 1974 has confirmed that non-medical determinants of health are important, but knowledge about their importance hasn't been effectively disseminated outside the health field, particularly to finance. Policy levers in the health, finance, labour and social services sectors vary, and decision-makers tend to consider evidence from their respective sectors in order to achieve their objectives. The implications of linkages between health status

and health spending are even more profound for government than for health care providers, because of the potential use of this evidence in formulating policy decisions.

HEALNet-funded research led by Dr. John Lavis of McMaster University involved a survey of policy- and decision-makers at various levels of government across Canada, to determine decision-making processes and awareness of population health concepts. “What we ended up finding was that Health is not that much different from Social Services and Labour. But the three of them are entirely different from Finance,” says Dr. Lavis. “Most public policies have explicit objectives. In Finance they tend to have economic objectives, in Ministries of Labour they tend to have labour market objectives. Health tends to have health objectives.” The goals and objectives of the government as a whole are often not considered within individual departments or ministries. The explicit realization that consequences of decisions in one realm of policy may affect others facilitates tradeoffs in decision-making. This appreciation should not only shape government policy, “it will influence research agendas in the long run,” says Dr. Lavis. “We need to focus knowledge transfer efforts.”

This research has attracted considerable attention for the synergistic, transdisciplinary theoretical underpinnings and its practical implications for decision-makers. The Canadian Population Health Initiative provided funding for an interview-based follow-up study. In addition, this HEALNet-funded research was featured at the Fourth International Conference on the Scientific Basis of Health Services in Sidney, Australia in September 2001. The New Zealand Department of Health has approached Dr. Lavis about using his work to inform a similar survey in that country.

Improving the Use of Evidence in Public Consultation Processes on Health Issues

As governments increasingly engage in public consultation regarding health as well as other issues, HEALNet-funded research in Ontario and Quebec can help identify when it is appropriate to conduct public consultations and what format is appropriate. Without clear knowledge about what modes of consultation are effective or appropriate, consultations can be costly and time-consuming.

HEALNet research demonstrated that for public consultation to be effective, it is important to have a good grasp of the desired outcome, and to select the appropriate format, such as mailings, telephone or face-to-face models such as public panels, which tend to have the most impact, although they affect a narrow segment of the population. HEALNet research also showed that complex issues must be simplified so that they can be understood by the public in order to make participation meaningful. Background documentation is also important. Other insights include the fact that people’s opinions tend to be firmly held at the extremes, but those in the mid-range can be swayed. In addition, the research shows that opinions are not stable, but can be swayed over time by media exposure and public discussion.

The work included a literature review—including the grey literature of government and organizations—as well as interviews with decision-makers in Ontario and Quebec, headed respectively by Dr. Julia Abelson of McMaster University, and Dr. Pierre-Gerlier Forest of Université Laval. Dr. Abelson says HEALNet served as a launching pad for the research, essentially providing seed funding for a program of research in its infancy. HEALNet’s support helped establish credibility for the investigators and legitimize their work. For example, it became a stepping-stone to a much larger study in five provinces, funded by the Canadian Health Services Research Foundation (CHSRF).

Would the research have been conducted if HEALNet didn't exist? "I don't think it would have happened. Or it would have taken that much longer," says Dr. Abelson. If the research had been delayed through one or more funding cycles, it might have had less value, because it would have been less timely. Part of the work involved a description and evaluation of the strengths and weaknesses of various public consultation processes. The dissemination strategy includes posting that information on the web site of the Regionalization Research Centre, created under the auspices of another HEALNet project.

"My hope is that over the next little while we will start to get a very strong and clear message out, that public consultation processes can be designed systematically and rigorously, on the basis of sound evaluation principles," says Dr. Abelson.

The research has also been written up as two working papers from the Centre for Health Economics and Policy Analysis (CHEPA), "Obtaining Public Input for Health Systems Decision-making: Past Experiences and Future Prospects" and "Deliberations About Deliberative Methods: Issues in the Design and Evaluation of Public Consultation Processes," released respectively in April and June 2001. The research has been significant enough to form the basis of pilot projects being used in communities in Ontario and Quebec.

One of the Ontario initiatives is the Brant County Health Goals Project, a collaboration between researchers, the Grand River District Health Council (DHC) and the Brant County Health Unit and Medical Officer of Health. The DHC had just produced its Community Health Status report, based on predetermined indicators, and the organizations wanted to engage the community in dialogue about setting medium- to long-term health goals. Dr. Abelson says foundations and management consulting firms wanting more information about how to proceed with consultations have also approached her.

These HEALNet findings about strategies to enhance public participation in the resource allocation decisions of regional health authorities are also being used by the "Romanow" Commission on the Future of Health Care in Canada to refine its public consultation processes. HEALNet Principal Investigator, Dr. Pierre-Gerlier Forest, is the Director of Research for the Commission.

Bringing Health Research to Regionalization

Regionalization of health systems across Canada has resulted in the creation of new organizational structures for health decision-making and care delivery. Regionalization was identified as an important research opportunity for HEALNet during the 1998-2002 period, and projects on research transfer and decision-making in the context of regional health organizations are integrated across the research program. HEALNet funded six interrelated projects that share a focus on regional health authorities (RHAs). These projects involved RHAs as research partners and as targets for the use of research results and the implementation of decision-support tools. Taken together, this research is assisting regional health decision-makers to:

- make more effective use of appropriate research evidence and performance indicators when faced with performance assessment and resource allocation decisions (Bilodeau, Champagne, Sicotte);
- understand the social "framing" and ethical implications of resource allocation decisions (Giacomini, Kluge, Kouri, Lewis, Porter);

- identify best-practices in obtaining public input for RHA decision-making (Abelson, Forest);
- understand the impact of population health research on the decision-making choices of senior policy makers from the local to the national levels of government (Lavis); and
- understand and share aggregate performance indices within and across organizations, and to make comparisons across time, regions, sub-regions, and types of organizations(Champagne et al) (this research will eventually result in software for use in regional health authorities across Canada).

Underpinning this research activity has been HEALNet's support for the establishment of a national resource centre on regionalization and decision-making in RHAs. The HEALNet Regionalization Research Centre, currently located at the Health Services Utilization and Research Commission in Saskatchewan, "spun out" from the Network in April 2002 as an incorporated partner-managed and supported, evidence-based knowledge transfer "node." Renamed the Canadian Centre for Analysis of Regionalization and Health Inc., this Centre will continue to promote the study of regionalization and the improvement of performance of regional health authorities across Canada by enhancing linkages between researchers and health decision-makers. (www.regionalization.org)

Innovations Benefiting Health System Managers and Administrators

By developing ways to measure and track performance in health systems, HEALNet research is helping health system managers and administrators to make informed resource allocation and management decisions.

Creating a "COMPASS" for Health System Management

Senior managers at regional health authorities struggle to define and evaluate performance within and among regions. Working with regional health authorities in Quebec, Dr. François Champagne developed a comprehensive performance assessment framework (*COMPASS*) to improve access to evidence that supports management decisions in regional acute care networks.

A team of HEALNet investigators produced a theoretically-grounded conceptual framework for performance, and has used that framework to determine what values stakeholders apply to performance in the health system. The framework has been adopted and applied internationally, in Belgium, China, France and Mexico. Network research has also produced a framework for creating software tools that can measure performance from the perspectives of hospitals, regional health authorities and other organizations, stakeholder groups such as managers, physicians and nurses, and the public. "It's work that is clearly relevant to publicly-funded health care systems," says HEALNet Principal Investigator, Dr. François Champagne of the University of Montreal.

What the researchers have learned is that people have different values, and that they are dynamic, rather than static, so organizations must be cognizant of that when measuring performance. "It has all kinds of different dimensions, and it's legitimate for people to have different views," says Champagne. Health system performance is not merely a matter of finding the "right" indicator or indicators and then measuring progress in that direction, because of the lack of consensus. Another important lesson is that no matter what system of performance measurement is used, it will not be the exclusive one, due to the complexity of health care

systems and the different organizations that are involved. The social utility of the HEALNet-funded work comes from contributing to a broader, more comprehensive understanding of what performance in health care is to different groups.

The research is finding its way into the training and education of health care managers, as well as influencing organizations that want to develop systems for evaluating performance. The research, led by Dr. Champagne and Dr. Claude Sicotte at the Université de Montréal, Dr. Henriette Bilodeau at the Université du Québec à Montréal, and Drs. Louise Lemieux-Charles and Jan Barnsley at the University of Toronto, has provided a context for the Canadian government's investment of almost \$100 million in the Canadian Institute for Health Information. It is also shaping the standards of the Canadian Council on Health Services Accreditation, and has already been used by regional authorities in Quebec and Ontario.

“Health system performance has become a major concern, high on the agenda of all governments that have to deal with the complexities of publicly-funded systems,” says Dr. Champagne. A measure of the unique and innovative nature of this HEALNet-funded research is the fact that it has resulted in collaborations with researchers in Belgium, China, France and Mexico who want to study the values of stakeholders and then develop operational tools.

Measuring Performance in Health Care

The usefulness of hospital report cards and balanced scorecards for front-line and middle managers, as well as senior managers, was evaluated through HEALNet-funded research led by Dr. Ross Baker of the University of Toronto. This research will facilitate the redesign of such reports, which are increasingly coming into use for performance assessment. “This work will have a feedback loop into future work in balanced scorecards, and, just as importantly, it will have a significant impact on additional research projects that look at the uptake of information and the changing nature of decision-making,” Baker says.

What the HEALNet-funded research about performance in health care has revealed is that “partnerships with people in the practice world are absolutely essential. They’re difficult to initiate, and they’re difficult to maintain and manage, but they’re critical. The second lesson is that there are multiple ways of framing problems, from different disciplinary perspectives, and we need to find ways to continue this dialogue across disciplines.” These lessons illustrate the applied research “know-how” that has developed through participation in HEALNet.

Health care is very complex, and so are the social sciences and disciplines that surround it. “HEALNet was very good at creating an intellectual marketplace of ideas,” which helped shape the research agenda since 1995, Baker says. “HEALNet was an important innovation that will have lasting, although difficult-to-quantify, benefits,” he says.

Innovations Benefiting Health Care Providers

HEALNet's identification of health knowledge gaps and ways to bridge them through the development of practical tools, is meeting the needs of Canadian health care providers. HEALNet's research program supported a number of research projects, in collaboration with research users and other funding agencies that benefited those delivering health care in Canada.

Integrating Knowledge and Applications

ViviDesk, (Hayward) building on the CLINT™ Clinical Integrator technology supported by HEALNet funding in Phase I was subsequently commercialized further by Alberta-based iW Technologies Inc. (formerly InfoWard Inc.). A distributed desktop portal company; it uses an Internet-based approach to simplify the integration and management of applications and knowledge at the desktop. Subsequent development was supported in partnership with the Alberta Heritage Foundation for Medical Research. This product was highlighted as an investment opportunity at the eHealthcare World conference in New York in December 2000. It is currently in use at numerous sites around the world. In 2001, the technology was installed in a range of organizations including St. Louis University Hospital, Missouri, and the Alfred I. DuPont Hospital for Children of the Nemours Foundation, Delaware.

Improving Information Retrieval

A number of projects funded by HEALNet were aimed at improving information retrieval methods, with the goal of providing clinicians with increased access to evidence-based health information through the Internet.

- Research related to the development of information hedges—search strategies to improve retrieval of clinically relevant and scientifically sound study reports from the MEDLINE database (Haynes)—received developmental funding from HEALNet in the Phase II research program, and subsequently was awarded a two-year grant from the National Institute of Health (NIH) in the United States valued at \$189,000.00 US. These information hedges are also now included in the National Library of Medicine’s PubMed system.
- A research project at the University of Western Ontario resulted in medical indexing and filtering tools that enabled clinical health decision-makers to customize Web-filtering tools and Web-pages and that help them monitor the most recent and relevant research evidence as it becomes available (Quintana).
- Research rooted in cognitive psychology has been funded to assess the use of Web-based clinical guidelines by physicians and trainees, and to develop principles for the design of evidence-based material on the Internet to enable optimal use (Patel, Kushniruk, Arocha).

Partnering with Industry to Improve Diagnostic Tools

A collaboration, originally based on HEALNet investigator Dr. Andrew Grant’s HEALNet-funded Autocontrol project, has resulted in a contract worth more than \$2 million between the Centre hospitalier universitaire de Sherbrooke and Sand Technology Inc. for infrastructure to support data warehousing and mining of health information based on CRM (Customer Relations Management) solutions. The infrastructure will be relevant for clinical, biomedical and health services research. In 1998, Dr. Andrew Grant (Sherbrooke), used HEALNet’s investment to attract an additional \$1.5 million in funding from the Bayer Diagnostics Division of Bayer Health Care. Autocontrol is an advanced information system that analyzes practice patterns in doctors’ offices, clinics and hospitals to promote evidence-based care management. With Bayer providing the technological platform and diagnostic tools, a subsequent grant was obtained from the Health Transition Fund to support the development of evidence-based tools to ensure

appropriate use of diagnostic tests and equipment in the clinical environment. HEALNet and Bayer researchers are also collaborating on a website supporting patient care and technical performance.

Innovations Benefiting Health Information Consumers and Patients

The challenge that consumers face in having too much information and not enough knowledge is being addressed through the development of tailored, Web-enabled decision-support and search tools that enable information users to find the best quality evidence quickly and easily, in a format they can understand.

Using Evidence-based Stories to Improve Health Decisions for Consumers

Research by Dr. Alex Jadad (Toronto) *et al* is based on the fact that information presented within stories is easily understood and retained by health consumers and patients. His research team has developed three short evidence-based stories on colorectal cancer screening methods and has mounted these on a website (<http://hiru.mcmaster.ca/stories/introtogerry.htm>) with hyperlinks to clinical research databases and related evidence. Pilot testing is currently underway with consumers to evaluate its benefit as a consumer decision-aid. An evidence-based stories site for consumer health information will be launched in 2002.

Adapting Technology to Facilitate Patient Health Choices

In collaboration with the Institute for Clinical Evaluative Sciences (ICES) and the Canadian Cancer Society, HEALNet researchers (Quintana and Goel) have provided consumers with access to interactive Web-based decision-support guides related to breast cancer (<http://condor.fims.uwo.ca/ices/bc22/>). An assessment of the effectiveness of these decision aids will inform the planned extension of this project to the development of Web-enabled decision-support tools for AIDS sufferers, heart disease victims and stroke patients.

The Impact of HEALNet Research on Health Decision-making in the Workplace

HEALNet's involvement in research to create healthier workplaces through improved use and application of research evidence has paid significant dividends to employers that will continue beyond the life of the Network. Musculoskeletal injuries are among the top sources of disability and health care costs, estimated at \$9 billion per year. HEALNet research has resulted in effective ways of preventing some of these costs, and in strategies for getting workers back on the job sooner without compromising their rehabilitation.

HEALNet research on reducing disability costs and increasing the productivity of injured workers in three sectors—the automotive industry, the electronic and electrical sector, and health care—through injury prevention and safe return to work is paying off substantively in terms of new knowledge, new injury prevention tools and improved return-to-work strategies.

Assessing Ergonomic Risk Factors

Research based at the University of Waterloo under the leadership of Dr. Robert Norman and Dr. Mardon Frazer has produced *Ergowatch*, a software tool for assessing ergonomic risk factors in the workplace. This tool measures an individual's risk of injury and enables employers to develop strategies to minimize that risk in the workplace. This is a spin-off from HEALNet-funded research in the automotive industry by the same research team that determined that cumulative physical stress is just as significant as peak stress in causing injuries and disability. Researchers found that educating workers about risk behaviour is valuable, but must be accompanied by redesigning jobs to avoid injuries. The researchers have worked with General Motors Canada Ltd. and two other companies that produce auto parts to help them develop effective interventions at all levels to reduce compensation costs. A non-sectoral model for effective implementation of ergonomic change processes has also been developed. Distribution and marketing of the *Ergowatch* tool has been assisted by HEALNet. To date, approximately 40 copies of the program have been sold, and ongoing interest in the tool continues to be high.

Encouraging Effective Return-to-Work Strategies

In Montreal, research led by Dr. Susan Stock of the Direction de la santé publique de Montréal-Centre is placing the final touches on decision-support tools to help workers in the electrical and electronics sector return to work sooner and more safely following an injury by performing modified tasks based on the best available health research evidence. Stock's project, like many of the other workplace projects, evolved out of HEALNet research funded in Phase I that focused on the need for tools to support evidence-based decisions about when to return injured workers to work, what work they could safely do, and effective ways for communicating with treating physicians.

"What we developed is both an organizational strategy for implementing a return-to-work program and a series of tools," Stock says. Four prototype tools (for back, neck and shoulder, elbow, and hand/wrist injuries) that assist the clinician, employer and the employee to review and assess the ability to perform modified work are being field-tested at three companies in Quebec and will be evaluated before final versions are released. "It should decrease the costs of work-related musculoskeletal disorders, both to companies and workers' compensation boards, and increase productivity of workers," by encouraging earlier return to appropriate work based on evidence of physical ability, Stock says. This will make a difference at the individual level, the corporate level, and to the Canadian economy.

As Dr. Stock's research illustrates, there is a need to train people in appropriate decision-making about how and when to get workers back on the job. This need has been met by HEALNet researcher, Dr. Patrick Loisel at the Université de Sherbrooke, who developed a critical path for multi-disciplinary teams to follow when engaged in complex decision-making processes regarding return-to-work for workers with musculoskeletal disabilities. Dr. Loisel's project found "huge variability" in the way cases are currently handled. "Work disability is quite a new paradigm," Dr. Loisel explains. "It is different from disease, because it depends on issues inside the workplace, the health care system itself, and also the compensation system." What the research revealed is that "if we want to be successful with return-to-work, we must address all these components, and that makes decision-making very complex, because it has to involve all these stakeholders."

Drs. Stock and Loisel made presentations at the 4th International Scientific Conference on Prevention of Work-Related Musculoskeletal Disorders in Amsterdam in October 2001, and say international interest in their research products is high. They also presented their findings at the Knowledge Transfer Conference of the Association of Workers' Compensation Boards of Canada, in Toronto in November 2001.

Using Evidence to Prevent Injury and Disability in Health Care Workers

Evidence-based tools can eliminate emotional factors in labour and management discussions about returning injured workers to the job. This is critical in the health sector, where there are growing shortages of nurses and other staff. Those tools must be user-friendly, so that they can be easily used in the decision process, says Annalee Yassi, founding Executive Director of the recently-established Occupational Health and Safety Agency for Healthcare (OHSAH) in British Columbia. On the strength of her HEALNet-funded research findings from Phase I, which resulted in savings to Winnipeg Health Sciences Centre of \$700,000.00 per year, Dr. Yassi was recruited to OHSAH as its first Executive Director. Dr. Yassi has continued her HEALNet research program supporting the development of decision support information tools for the health sector. These new tools will be made available through the OSAH website.

Dr. Yassi's research team is now extending its research in innovative directions to evaluate the role of equipment and training, policies and procedures, work organization and culture, secondary prevention activities, and injury tracking systems in reducing the occurrence and costs of work-related disability. These findings will be applied to musculoskeletal injury prevention, violence prevention and chemical and biological risk management.

Assessing Healthy Workplaces

Additional HEALNet workplace health research in progress includes the development of a healthy workplace performance balanced scorecard (Robson). The development of this assessment tool grew out of the Network's ongoing work on balanced scorecards for assessing hospital performance. This innovative tool is being developed in collaboration with St. Michael's Hospital in Toronto. It will play an important role in creating and sustaining a healthy work environment and improving health care worker retention rates.

Academic Innovations and Conceptual Frameworks

The Network undertook a limited number of basic research projects on issues such as a conceptual framework for health decision-making and health system performance, and the nature of evidence across disciplines and sectors that were critical to the advancement of the Network's long-term multi-disciplinary research agenda. The impact of the development of a transdisciplinary evidence taxonomy was especially significant.

A taxonomy of research evidence that examines issues related to evidence-based decision-making in health care was created through the multidisciplinary expertise of HEALNet researchers in informatics, philosophy and biomedicine, building on previous HEALNet research. A research paper entitled *Meaning and Measurement: An Inclusive Model of Evidence in Health Care* (Upshur, VanDenKerkhof, Goel) was published in early 2001. This taxonomy bridges qualitative and quantitative research paradigms and subjective and objective perspectives. It is an integrated model that allows for evidence of different types to be considered

across many levels and contexts of decision-making. This research was critical to the development of foundational cross-disciplinary conceptual frameworks and definitions used both within the Network and by problem-based health services research teams. In order to disseminate and facilitate uptake of these principles, a Web-based interface and related linkages have been developed in the form of an on-line reasoning skills course.

The Result: A Network of Mature Partnerships and Meaningful Results

Between 1998 and 2002 HEALNet achieved further integration within and across different disciplines by creating project teams spanning three research modules (evidence & decisions, performance, and tools) with cross-cutting themes (clinical, regionalization and workplace settings). This approach enabled the Network to tackle more complex problems that required the participation and input of a greater range of partners and stakeholders. It resulted in innovative, useful research products, and increased communications among diverse organizations. The examples above illustrate the value of HEALNet research to multidisciplinary and multi-sectoral networking and partnerships among Network investigators, public sector and private sector organizations, labour, health information consumers, and citizens across sectors, institutions and provinces.

Knowledge Transfer Initiatives

HEALNet supported the dissemination of research results, using audience-specific and multi-faceted dissemination strategies. In addition to disseminating research to academics through peer-reviewed publications, the Network has promoted the sharing of research findings internally through regularly scheduled research workshops and through major conferences involving a range of research partners and decision-makers. In these venues, methodological issues and partnership strategies were shared and critiqued. The HEALNet Annual Conference became a significant instrument that brought researchers and research users together to share and critically assess the latest research innovations.

As part of its commitment to improve and increase partnerships and improve knowledge translation and uptake, HEALNet steadily expanded the audience for its annual conference (Calgary 1999 [225 participants, 33 sponsors]; Toronto 2000 [335 participants, 41 sponsors]; published proceedings of annual conferences; and held regular meetings with the executive leadership of major national health services research organizations. HEALNet also held a number of institutional memberships relevant to its mandate. The HEALNet Board of Directors, broadly representative of the range of decision-makers that could use Network research, facilitated opportunities for the establishment of additional partnerships.

In addition, Network researchers regularly organized tailored learning and research transfer opportunities for policy-makers and health system governors, health system and human resource managers/administrators, health care providers, and health information consumers and patients as appropriate. For example, in April/May 2002, HEALNet, in collaboration with the University of Toronto Department of Health Policy, Management and Evaluation (HPME), the Central East Health Information Partnership (CEHIP), and the Institute for Clinical Evaluative Sciences (ICES), sponsored three workshops to improve the evidence-based decision-making skills of health planners, policy analysts, managers, data analysts, senior managers and organizational leaders working with district health councils, public health units and the Ontario Ministry of Health and Long-Term Care.

For its final research meeting in November of 2001, the Network organized a symposium in Ottawa that brought together the leaders of the major funders of health information and health services research including: the Canadian Institutes of Health Research (CIHR) Institute of Population and Public Health, and Institute of Health Services and Policy Research; the Social Sciences and Humanities Research Council; CANARIE; the Canadian Population Health Initiative; the Canadian Health Services Research Foundation; and the Health Canada Office of Health and the Information Highway. The purpose of this meeting was to exchange information about what HEALNet has accomplished that was applicable to these organizations' respective health information and health research agendas, as well as to enable Network researchers and students to learn more about future funding opportunities that would enable them to continue to develop the research programs originating within HEALNet. Notably, many of the leaders of these organizations had participated in HEALNet.

As the research from HEALNet's Phase II funding is completed between 2002 and March 2004 and research findings arise, an intensive period of research transfer will be undertaken through the Centre for Global e-Health Innovation in Toronto, to ensure dissemination to and uptake of Network research by health decision-makers. Network research will be permanently posted on the Centre's website at <http://www.uhnres.utoronto.ca/ehealth/>

Legacy Organizations

Although HEALNet has concluded its activities, a range of legacy organizations will continue to pursue a mandate of applied health information research to improve the quality of health decisions. The legacy organizations to which HEALNet participants have provided leadership include:

- the Canadian Knowledge Management and Transfer Centre, Laval, Quebec;
- the Canadian Research Transfer Network;
- the Canadian Association of Researchers in Work and Health;
- the E-Health Accelerator, Centre for Global e-Health Innovation, University Health Network, Toronto, Ontario;
- the Quebec Society for Biomedical Health; and
- the Canadian Centre for Analysis of Regionalization and Health Inc., Saskatoon, Saskatchewan.

Contributions to the Development of Highly Qualified Personnel

Health services research is an area of growing demand. Research funding and new opportunities are at record levels, and existing health services researchers are spread thinly across the country providing research and teaching services within our universities to an increasing number of students. The user sectors—universities, public and private organizations—are absorbing graduates as soon as they become available. The current production of health services researchers in Canada does not meet society's present or future anticipated needs. In Victoria, for example, the number of co-op places offered by employers seeking health informatics students far exceeds the number of available students.

HEALNet has pursued the following initiatives to increase the number of highly qualified personnel with health information research and research transfer expertise, as outlined in its 1998 Strategic Plan:

- The Student Exchange Program to promote cross-disciplinary expertise;
- The Student Support Program to promote employment opportunities;
- Professional Development for Health Professionals to promote knowledge transfer; and
- Development of Canadian Health Informatics Model Curricula.

HEALNet's Student Programs

HEALNet provided students with unique opportunities to work directly with senior researchers on applied and multi-disciplinary research projects involving partners and collaborators from a range of sectors. This experience, bolstered by opportunities to present Network research at conferences and research workshops, has equipped the next generation of health services researchers with academic perspectives and a range of personal contacts that far exceed the norm.

An example of HEALNet's success in mentoring and supporting new talent is undergraduate student Erica Zarcovitch, who worked with HEALNet researcher Dr. Ross Upshur on a HEALNet grant. While on this grant she applied for and was successful at winning an Undergraduate Science Writer Scholarship and Internship. This award is given to one English and one French student. The award consists of a \$5,000 annual scholarship for a maximum of two years and up to \$5,000 for a four-month internship at CIHR or in affiliation with CIHR.

A recent survey of former students (November 2000) revealed that students themselves credit their success in obtaining prime academic and employment opportunities related to their studies and research in part to their involvement with the Network. As one former student noted:

"HEALNet enabled me to conduct a quality dissertation research project. This work has led to most of the successes I've achieved since ... publications based on the data-sets, a CHSPR and a SSHRC post-doc, and the CIHR New Investigator Award that enabled me to obtain my position at UBC."

Another student attributed the expanded range of opportunities provided by the Network to her continued development as a researcher:

"I have finished my Ph.D...at McGill University in Montreal and received funding from CIHR to do a fellowship at Harvard Medical School, Boston, MA, with Dr. Charles Safran. I am currently working in the area of health care informatics, particularly the use of Internet-based technology and videoconferencing by parents of very low birth weight babies in the Neonatal Intensive Care Unit at Beth Israel Deaconess Medical Center in Boston. Being part of the HEALNet community provided an additional dimension to my doctoral work, allowing me to see the interconnections between Canadian researchers and taking part in the general meetings and poster presentations."

HEALNet has provided a unique context in which the next generation of Canadian health services and health informatics researchers and innovators are being trained in multi-disciplinary, multi-sectoral methods of applied research. The report (February 2000) of the NCE-appointed Expert Panel noted that the Network *"has attracted and maintained a critical mass of world-class investigators and students, which is important to the future evolution of the Canadian*

health care system.”

A November 2000 survey of the employers of 63 HEALNet graduates confirmed their value in the workplace. An employer of a former HEALNet student wrote that the student's HEALNet experience had given him “confidence (in dealing) with other researchers” and “enabled him to access other researchers and research resources” using his HEALNet contacts. This level of confidence and the early development of personal networks ensure that HEALNet students are able to make significant contributions in the health sector from the moment that they are hired.

Professional Development for Researchers

The trend toward problem-based research framed by strategic partnerships and multi-sectoral funding sources has increased the value of the HEALNet experience and the currency of HEALNet researchers and students in the current academic environment. Since 1995, the Network has seen internal academic succession whereby HEALNet research leaders are passing the leadership of key aspects of Network research over to former students now employed as faculty at universities across Canada (e.g., Patel to Arocha and Kushniruk; and Norman to Fraser).

In a labour market where there is international competition to attract and retain the best and brightest as intellectual capital, a number of HEALNet researchers have indicated that HEALNet's success in creating a critical mass of high quality researchers working on leading edge health information issues has been highly influential in their remaining in Canada to conduct research, and to teach and work with the emerging generation of young Canadian researchers. By providing Canadian researchers with opportunities for professional development in Canada and for networking with internationally recognized peers, HEALNet enabled them to achieve their professional goals while remaining in Canada.

HEALNet and the Development of Canadian Health Informatics Education

HEALNet's contribution to the development of a dynamic health informatics research community in Canada is perhaps one of the Network's most significant accomplishments. Prior to HEALNet, Canadian researchers in this rapidly developing field were isolated and fragmented, interacting as individuals with colleagues in the United States and Europe more than with domestic colleagues. Strong relationships and collaborations across Canada have been developed through HEALNet, which has served as a catalyst for the development of educational initiatives in this field.

HEALNet developed model health informatics curricula for clinical, applied, and research and development health informatics programs to address the gap in Canadian curricula and expertise, in partnership with the Canadian Institutes of Health Research, which provided a \$50,000 grant, and over 100 academics and employers from across Canada. Broader educational and training programs in the area of health informatics, which simply involves “understanding, managing and using health information,” are desperately needed in Canada, says Dr. Frances Lau of the University of Victoria, who has been spearheading efforts to form a critical mass of health informaticists to support a national health informatics graduate-level university degree program.

A survey conducted at the e-Health 2001 conference (co-sponsored by COACH and CIHI) in June 2001, where Dr. Lau was a plenary speaker, found that 96 per cent of the 296 people surveyed said that they believed there was an unmet need in Canada for training and education in health informatics. Furthermore, 80 per cent of respondents said that they would like some health informatics education and training. There are well over 100,000 health care professionals in Canada, most of who have to deal with information technology in one way or another. Electronic health records, telehealth or consumer health information, it all falls under health informatics. That is what is driving Dr. Lau's efforts to establish what he calls a "pan-Canadian Health Informatics Collaboratory," which would be a nation-wide school or program for health informatics. HEALNet funded the development of the curriculum to support this concept. In addition, in collaboration with the Universities of Alberta, Calgary, Victoria, and British Columbia, Dr. Lau is currently coordinating the development of a distance learning-based health information program for professionals in health settings. The program will utilize the VIVIDESK distributed desktop portal technology developed by iW Technologies Inc.—a Canadian IT Corporation that originated as INFOWard, a spin off company developed in phase one of the HEALNet research program.

On the strength of achievements made through HEALNet-funded research at the University of Victoria, a group of radiation oncologists on Vancouver Island approached Dr. Lau about the possibility of developing an interactive patient-focused electronic health record system. HEALNet's emphasis on health informatics is also having an impact in other areas; British Columbia's Ministry of Health has agreed to provide job placements for graduate students to work on data warehousing, and the Canadian Health Records Association contacted Dr. Lau to initiate collaboration.

In the private sector, Sierra Systems has asked the University of Victoria to help it develop a workshop in health informatics for its Information Technology consultants, so that they could obtain a better grasp of the field's unique requirements. In that context, health informatics offers knowledge management skills that are becoming increasingly essential in today's economy, says Dr. Lau.

The research funded by HEALNet is also having international ramifications. China and Taiwan have both approached HEALNet researchers about building capacity in medical informatics in those countries, Lau adds. If the Network hadn't been created, much of the work he has been engaged in would not have been possible, both in terms of conceptualization and in terms of collaborations with other researchers, he says.

"I could never have got to this point in my career without HEALNet. This is all subjective, but I think it has accelerated my career development by a good 5-10 years," says Lau.

He says that a nurturing environment, rich in stimulating ideas, such as that provided by HEALNet is essential to the creation of world-class researchers.

In recognition of HEALNet's instrumental role in catalyzing the development of advanced health informatics research and education programs in Canada, a HEALNet-University of Victoria Office of Health Information Education has been established to promote and support the advancement of Canadian health informatics higher education and research through Canada-wide collaborations and consortiums.

Conclusion

The landscape in Canada for health services research has changed considerably since HEALNet was established. One constant, however, has been the vision and leadership of the individuals who make up the Network. As the nation-wide consultation known as *Listening for Directions* recently discovered, the program of research outlined by HEALNet for the future captures the relevant issues, and HEALNet researchers will continue to be engaged in answering relevant questions. The consultation, conducted by the Canadian Health Services Research Foundation (CHSRF), the Canadian Institutes of Health Research (CIHR) Institute of Health Services and Policy Research, the Canadian Institute for Health Information (CIHI), the Advisory Committee on Health Services of the Conference of Federal/Provincial/Territorial Deputy Ministers of Health, and the Canadian Coordinating Office for Health Technology Assessment (CCOHTA), identified primary and secondary issues for the sector that overlapped considerably with those identified by HEALNet in its 2002-2009 *Strategic Plan*.

In developing the plan for 2002-2009, the Board and Network researchers collaboratively identified strategic initiatives, building on the accomplishments and strengths of the Phase III Network research program. Specifically, they identified research that will promote the transfer and use of evidence in decision-making in conjunction with health information technology to improve health system performance, workplace productivity and the health of Canadians. These initiatives are now being supported by organizations more recently committing resources to the improved use of health information, and their support will ensure that in the post-HEALNet period (i.e. beyond March 2002), the health services research community in Canada can take the results of HEALNet's work further afield.

Future research, identified by HEALNet as critical for improving the health of Canadians, to increased productivity in the workplace, and to the enhancement of the quality and efficiency of the health care system in Canada, includes:

Managing with Evidence:

- Creation and evaluation of “digital dashboards” that deliver real-time health performance information to health system managers;
- Assessment of factors that influence appropriate adoption of new health technologies and health information innovations.

Evidence-based Policy Instruments:

- Creation and evaluation of tools for delivering information on health access, organizational quality and performance from diverse sources to consumers;
- Identification of evidence-based policy instruments that improve public accountability and facilitate consumer participation in the health system governance process.

Using Evidence for Healthier Workplaces:

- Development and evaluation of evidence-based methods and tools for workplace health measurement, ergonomic assessment, and improving the use of evidence in return-to-work decisions.

Digital Libraries of Health Care Evidence:

- Evaluation and use of evidence-based resources for digital libraries of health care, and customized data libraries' content for electronic records.

Emerging Health Network Technologies:

- Development and evaluation of the use of next-generation technologies and electronic health records, to enhance the delivery and use of, and access to health evidence to improve the decision-making of clinicians, health care managers and providers, and consumers.

In conclusion, *HEALNet* was an efficient meeting place for academics, policy-makers and the private sector to gather to learn from each other and work together to solve complex challenges facing the health decision-makers of the day. It provided prestige and a national vantage point for many researchers from smaller, regional universities in Canada. It promoted meaningful involvement of students in a national research network and gave those same students the opportunity to actively participate in the creation and dissemination of new knowledge alongside the leading thinkers and practitioners in their field of study.

The true measure of *HEALNet's* success will be more evident in the next 7 to 10 years. The core of committed individuals that have been with the Network since 1995 know first hand what a labour intensive endeavour network-building can be. However, they are also the same individuals that will take the lessons learned from the *HEALNet* experience and apply them to the betterment of the next generation of research networks around the world. It is these individuals to whom the torch of innovation, creativity, and commitment is passed as *HEALNet* concludes its activities in June 2002.