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TECHNOLOGICAL INNOVATION IN HEALTH CARE

Report of the Standing Committee on Health

Joy Smith
Chair

JUNE 2013

41st PARLIAMENT, FIRST SESSION

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THE STANDING COMMITTEE ON HEALTH

has the honour to present its

FOURTEENTH REPORT

Pursuant to its mandate under Standing Order 108(2) the Committee has studied technological innovation in health care and has agreed to report the following:

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TECHNOLOGICAL INNOVATION IN HEALTH CARE

Introduction

On 9 February 2012, the House of Commons Standing Committee on Health (Committee) agreed to study innovation in health care, adopting the following motion:

> That the Committee undertake a study of technological innovation, including best practices, in health care in Canada; that it hold ten (10) meetings on this study to hear from witnesses; and that it report its findings to the House of Commons.[1]

According to the Conference Board of Canada, "technological innovation in health can be defined as the transformation of scientific and engineering creations into new medical devices, drugs and biologics, health-care information technologies, and medical and surgical procedures, all of which bring social and economic value."[2] The Committee agreed to focus on technological innovations in health care in the following areas: e-health, telehealth and telerobotics, pharmaceuticals, medical devices, genomics, nanotechnology, and the treatment and management of chronic and rare diseases. The Committee was also interested in studying the costs associated with the adoption of technological innovations in health care systems, as well as the challenges associated with the commercialization of these products. The Committee also wanted to learn about the federal government's role in promoting technological innovation in health care, as well as the initiatives that it was currently undertaking in this area. During the course of its study, the Committee also received testimony from witnesses about other types of innovation occurring in health care, including organizational innovation in health care delivery, which refers to transformed or improved production and delivery processes that were occurring inside health care systems and health care organizations[3], as well as innovations in the training of health care professionals and health human resource planning.

In order to examine these subjects in depth, the Committee agreed to extend its study, holding a total of 27 meetings ending in May 2013. In addition, the Committee held one meeting on diabetes and subsequently agreed on 6 December 2012 that the testimony from this hearing would also be taken into consideration as part of the Committee's study.[4] During the course of these meetings, the Committee heard from a broad range of witnesses, including: federal and provincial government officials; researchers and academics; health care providers and delivery organizations; representatives from industry; and other interested stakeholders.

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1 House of Commons, Standing Committee on Health, *Minutes of Proceedings*, 9 February 2012.

2 Conference Board of Canada, *Exploring Technological Innovation in Health Systems*, August 2007.

3 Ibid.

4 House of Commons Standing Committee on Health, *Minutes of Proceedings*, 1st Session, 41st Parliament, 6 December 2012.

Based upon the testimony received during these meetings, this report highlights innovations in health care occurring across the country, and identifies areas where the federal government could take further action to promote health care innovation in Canada. The report is divided into two parts. The first part focuses on technological innovation in health care and consists of seven chapters, which reflect the main themes of the Committee's study. The first chapter provides an overview of the federal government's role and initiatives in the promotion of technological innovation in health care. The second chapter focuses on technological innovations in e-health, telehealth and telerobotics. The third chapter highlights innovations in pharmaceuticals and medical devices, including developments in genomics and nanotechnology, which are regulated as either drugs or medical devices depending upon their application. The fourth and fifth chapters focus more specifically on technological innovations occurring in the treatment and management of rare diseases and the prevention, and management of chronic diseases respectively. The sixth chapter examines how to manage the costs associated with the adoption of technological innovations in health care systems across Canada. The seventh chapter looks at how technological innovation in health care could be promoted in Canada, focusing on the innovation continuum from research and development to commercialization. The second part of the report summarizes testimony that the Committee received on other types of innovations occurring across the country in health care delivery, the training of health care professionals and the management of health human resources.

PART ONE: TECHNOLOGICAL INNOVATION IN HEALTH CARE

CHAPTER 1: OVERVIEW OF THE FEDERAL GOVERNMENT'S ROLE AND INITIATIVES

This chapter provides an overview of the federal government's role and initiatives related to the promotion of innovation in health care in Canada. Witnesses appearing before the Committee identified four main areas in which the federal government is currently playing a role in this area, including: the development of a regulatory framework that is responsive to innovations in pharmaceuticals and medical devices; the funding of research leading to the development and commercialization of innovative technologies and innovative practices in health care; providing support for the evaluation of the clinical and cost effectiveness of health care technologies, including pharmaceuticals, medical devices and clinical procedures; and investing in the development and adoption of e-health and telehealth across Canada, including in First Nations and Inuit communities.

A. Regulation of Pharmaceuticals and Medical Devices

According to a federal official, Health Canada is responsible for the regulation of food and health products, which involves assessing the health-related benefits and risks of products such as pharmaceuticals, biologics and medical devices.[5] In order to ensure that Canada's regulatory system remains responsive to scientific innovation, the Committee heard that the Department was taking steps to modernize its regulatory framework to support emerging technologies. In particular, the Committee heard that Health Canada had introduced a priority review process that would allow for a shorter review time for new drugs and devices intended for the treatment, prevention or diagnosis of serious, life-threatening or severely debilitating diseases or conditions. The Committee heard that, under the priority review process, the review time for a typical new active drug substance has been reduced from 300 days to 180 days, and for a class IV or high-risk medical device, the review time is now 45 days, as opposed to 90 days.

The Committee heard that this change to the regulatory system has resulted in Canadians having timelier access to new innovative therapies and treatments.[6] For example, Health Canada granted priority review status to the Edwards Sapient heart valve, which was licensed on 22 June 2011. This heart valve provides certain patients who cannot undergo open heart surgery with the option of a valve replacement. In the area of oncology, Health Canada approved Jakavi, a treatment for the effects of a

5 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 18 October 2012, Meeting No. 58 (Ms. Barbara Sabourin, Director General, Health Canada).

6 Ibid.

rare blood cancer, on 19 June 2012 through its priority review process, because the treatment had demonstrated a marked and durable improvement in patient quality of life. Finally, the Committee also heard that through the priority review process, Canada became the first country in the world to licence a stem cell therapy for the treatment of transplants in children in May 2012.

In addition to the priority review process, the Committee heard that Health Canada is enhancing access to innovative therapies by establishing internationally competitive performance targets for its review times for all drugs; providing 30-day default review process for applications for clinical trials; and enhancing access to drugs that have shown promising results in clinical trials.[7]

Furthermore, the Committee learned that Health Canada is also taking steps to promote technological innovation by reducing the regulatory burden on industry. For example, in response to the globalization of the health products industry, the Department is collaborating with other jurisdictions to promote the harmonization of regulatory standards and technical requirements in order to reduce duplication in reviewing and evaluating new drugs and devices.[8] In addition, Health Canada has produced guidance documents for manufacturers to facilitate the authorization of innovative drugs and treatments, such as biologics, plant molecular pharming, cellular therapies and pharmacogenomics.[9] Meanwhile, the Department has also developed new regulations for positron-emitting radiopharmaceuticals. These regulations reduce the administrative burden on researchers by introducing an abbreviated clinical trial application process for studies evaluating these new imaging agents.[10]

B. Supporting Research and Commercialization of Emerging Health Care Technologies and Innovations in Health Care Delivery

The Committee heard from Dr. Alain Beaudet, President of the Canadian Institutes of Health Research (CIHR), that the federal government supports innovation in health care by providing research funding for the development of emerging health technologies, as well as innovations in the delivery of health care.[11] CIHR works in partnership with other federal partners, including the Natural Sciences and Engineering Research Council of Canada (NSERC), the National Research Council of Canada and Genome Canada to provide research funding in this area. According to Dr. Beaudet, since 2006, CIHR has invested more than $200 million to fund over 200 projects related to robotics, nanotechnology and medical devices.[12] Table 1 outlines CIHR's initiatives and

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7 Ibid.

8 Ibid.

9 Health Canada, "Initiatives supporting the development of innovator therapies and expert knowledge exchanges," Brief submitted to the House of Commons Standing Committee on Health, 18 October 2012.

10 Ibid.

11 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 18 October 2012, Meeting No. 58 (Dr. Alain Beaudet, President, CIHR).

12 Ibid.

investments related to technological innovation in health and health care delivery based upon a written submission provided by the agency.[13]

Table 1 – CIHR's Technological Innovation Initiatives and Investments

Area of Research	Initiative(s)	Funding
Innovative Drugs and Devices	Proof-of-Principle Program (PoP), the Joint CIHR–NSERC Collaborative Health Research Program (CHRP) and the Networks of Centres of Excellence Program fund research that may lead to the development of innovative drugs and devices. PoP has led to the creation of 150 start-up companies.	Between 2006 and 2012, CIHR invested approximately $24 million in PoP.
Robotics	Funds research at the frontline of natural sciences, engineering and health sciences.	CIHR invested approximately $14.9 million in over 90 projects related to robotics.
Nanotechnology	CIHR funds nanomedicine14 through the Open Program, the Regenerative Medicine and Nanomedicine Initiative, and the Collaborative Health Research Program.	Between 2006 and 2012, CIHR has invested over $121 million in over 400 projects.
Innovative Health Care Delivery	CIHR's signature initiatives involving large scale funding, including the Community-Based Primary Health Care initiative, the personalized medicine initiative, evidence informed health care and the Strategy for Patient-Oriented Research all address different aspects of emerging technologies and health care delivery.	N/A.[15]
E-health and telemedicine	CIHR has supported over 80 research projects since 2006 focusing on the evaluation of health, law, ethics and the development of new e-tools.	CIHR has invested $10 million since 2006.

13 See: CIHR, "Standing Committee on Health: Study on Emerging Technologies in Health Care, Canadian Institutes of Health Research," Brief submitted to the House of Commons Standing Committee on Health, 18 October 2012.

14 Nanomedicine is the use of an intervention that is at a molecular scale of 1 to 100 nanometres (nm) inclusive to treat a disease or restore function.

15 Overall funding levels for these initiatives were not provided to the Committee as part of CIHR's written submission.

The Committee was provided with specific examples of how these research investments have led to the development of innovations in health care. Dr. Beaudet highlighted CIHR-funded projects that support the development and commercialization of medical devices to help persons with disabilities.[16] For example, Dr. Ptito from the Université de Montréal has developed a sensory substitution device that could potentially help blind people with navigation through the use of a tongue display unit that transmits visual information through a camera to the person's brain, enabling the person to develop strategies to avoid obstacles and move adequately. Similarly, the Committee also heard about CIHR funded researchers at Ryerson University who have developed an artificial muscle-operated arm that allows one to control an artificial limb just by thinking about it, which offers a greater range of movement than traditional prostheses, and does not require the amputee to undergo invasive surgery. According to Dr. Beaudet, these researchers have translated their work into commercial success through the creation of a start-up firm, Bionik Laboratories, which has attracted interest from major hospitals in Canada and the United States.

The Committee heard how CIHR's Regional Partnerships Program has played a role in developing treatments for diseases as a result of discoveries made in genomics.[17] Dr. Beaudet explained that through early funding from CIHR, Dr. Patrick Parfrey and his colleagues from Memorial University were able to discover a gene responsible for young men in Newfoundland dying suddenly from heart failure. This discovery led to the development of a simple blood test to determine whether an individual has the condition and the implantation of defibrillators in those who test positive for the gene. This has resulted in virtually eliminating this sudden death syndrome in Newfoundland and Labrador.

In addition, the Committee also received a written brief from NSERC, which outlined how its federally funded research programs are leading to the development and commercialization of different health technologies and innovations in clinical practice.[18] The brief described how NSERC's Idea to Innovation Grant program, which provides funding to college and university faculty members in the early stages of developing new technologies and seeking to bring these technologies to market[19], has led to the development of new medical devices. For example, with the help of an NSERC Idea to Innovation grant, researchers at the University of Calgary were able to develop a medical device to treat obstructive sleep apnea and upper airway resistance, which led to the creation of a company called Calgary-based Zephyr Sleep Technologies. The medical

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16 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 18 October 2012, Meeting No. 58 (Dr. Alain Beaudet, President, CIHR).

17 Ibid.

18 Dr. Daniel Muzyka, Council Member, Natural Sciences and Engineering Research Council of Canada (NSERC) and Mr. André Isabelle, Associate Vice-President, Networks of Centres of Excellence, "Moving New Health Technologies from the Lab to the Marketplace," Brief submitted to the House of Commons Standing Committee on Health, May 2013.

19 NSERC, "Idea to Innovation Grant", *What we do*.

device is now available in the United States and the company has plans to seek regulatory approval in Canada and Europe in 2013.

The brief also outlined how NSERC supports academics developing technologies to improve surgical techniques through its NSERC/Medtronic Industrial Research Chair program.[20] For example, Professor Carl-Éric Aubin, holder of the NSERC/Medtronic Industrial Research Chair in Spine Biomechanics at the École Polytechnique de Montréal, has developed surgeon-friendly software that allows users to virtually plan a spinal instrumentation surgery, and a patient positioning device to provide optimal alignment during a procedure. The brief explained that Professor Aubin's efforts to improve biomedical devices and treatment approaches of spinal pathologies will lead to further innovations in surgical technologies.

Finally, the brief also highlighted the Networks of Centres of Excellence of Canada, which offers different programs to mobilize Canada's expertise in research, development and entrepreneurship in strategic areas and to address specific issues.[21] The Networks of Centres of Excellence of Canada provide grants to not-for-profit corporations supporting the commercialization of pharmaceuticals and medical devices through public-private partnerships, such as: the Quebec Consortium for Drug Discovery ($20,847,181 for 2009–2017); the Centre for Drug Research and Development ($22,955,575 for 2008–2018); the Centre for Commercialization of Regenerative Medicine ($15,000,000 for 2011–2016); MaRS Innovation ($29,911,150 from 2008–2016); and the Centre for Probe Development and Commercialization ($28,755,575 from 2008–2018).

C. Evaluation of the Clinical and Cost-Effectiveness of Pharmaceuticals, Medical Devices, and Clinical Procedures

The Committee heard that the federal government also plays a role in the assessment of health technology, including pharmaceuticals, diagnostics, and medical, dental and surgical devices and clinical procedures through the Canadian Agency for Drugs and Technology in Health (CADTH).[22] The Committee heard that CADTH was established as a not-for-profit organization by the federal/provincial/territorial (F/P/T) governments in 1989 with a mandate to provide policy-makers with evidence-based assessment of the clinical and cost effectiveness of pharmaceuticals and health technologies, including devices, diagnostics and procedures. CADTH receives its $22 million operating budget from Health Canada and provincial and territorial

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20 Ibid.

21 Dr. Daniel Muzyka, Council Member, Natural Sciences and Engineering Research Council of Canada (NSERC) and Mr. André Isabelle, Associate Vice-President, Networks of Centres of Excellence, "Moving New Health Technologies from the Lab to the Marketplace," Brief submitted to the House of Commons Standing Committee on Health, May 2013 and Networks of Centres of Excellence, About the Networks of Centres of Excellence.

22 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 18 October 2012, Meeting No. 58 (Dr. Brian O'Rourke, President and Chief Executive Officer, CADTH).

governments and reports to the F/P/T deputy ministers of health through a board of directors.[23]

The Committee heard that the purpose of health technology assessment (HTA) is to support the effective management of health technologies through their life cycle to ensure that they are adding value to the health care system; improving patient outcomes and/or health system sustainability; and are true innovations and not simply cost drivers.[24] CADTH provides a range of HTA services in support of these objectives. In particular, the Committee learned about CADTH's Common Drug Review (CDR) initiative, which is an F/P/T process used to review the clinical and cost effectiveness of new drugs and of existing drugs with new indications. Based upon its review of the evidence, CADTH, through the CDR, provides jurisdictions with recommendations regarding the coverage of pharmaceuticals under publicly funded drug plans in Canada, with the exception of Quebec who has their own system in place. It is important to note that while CDR provides evidence to support coverage decisions, final formulary listing decisions are made by F/P/T governments themselves.

The Committee also heard that CADTH provides comprehensive and complex technology assessments in areas such as robotic surgery, magnetic resonance imaging (MRI) units, medical isotopes and pharmaceutical-based therapies for smoking cessation.[25] In addition, the agency provides more rapid reviews of the medical literature in response to urgent requests from jurisdictions. Finally, CADTH also provides reviews and recommendations regarding appropriate prescribing and utilization of drugs and other technologies to promote effective use of these products.

According to Dr. Brian O'Rourke, President and Chief Executive Officer of CADTH, HTAs conducted by CADTH have made significant contributions to identifying the appropriate use of drugs and other technologies, which have also brought cost savings to health care systems.[26] For example, research conducted by CADTH on the use of test strips to measure blood glucose levels found that people with diabetes who do not use insulin do not need to routinely self-test with these test strips, which account for $500 million in expenditure for both private and public drug plans in Canada.[27] The Committee heard that acting on these findings could save health care systems in Canada between $450 million and $1.2 billion between 2012 and 2015.[28] The Committee also heard that CADTH's research on surgical robots had confirmed that they do lead to improvements in some short-term outcomes, such as length of hospital stay, blood loss and transfusion rates. Its work also identified ways of making this technology more cost effective, such as using the robot for several different kinds of surgeries, thereby

23 Ibid.

24 Ibid.

25 Ibid.

26 Ibid.

27 Ibid.

28 Ibid.

increasing surgical volumes and providing the right kind of support systems for these devices. This research therefore promoted the adoption of innovative technologies in health care systems by optimising their use.

D. Promoting the Adoption of E-Health and Telehealth Across Canada through Canada Health Infoway Inc.

The Committee heard that the federal government is also playing a role in technological innovation in health care by promoting the adoption of e-health and telehealth across Canada through Canada Health Infoway Inc. E-health is a broad term referring to the application of information and communication technologies (ICTs) within the health care sector and has a broad range of applications from administration to health care delivery.[29] Telehealth refers to the delivery of services by healthcare organizations using ICT solutions when the clinic and patient are not in the same location and includes the use of technologies such as live videoconferencing, storing and transmission of data between health care providers, and telemonitoring, the remote monitoring and transmission of clinical data from a patient's home to a centralized facility for review and action by a health care team.[30]

According to Mr. Richard Alvarez, President and CEO, Canada Health Infoway Inc. was created based upon an agreement between First Ministers to invest in digital health and telehealth systems in order to improve the quality, access and productivity of health care systems.[31] The Committee heard that the federal government had invested $2.1 billion in Canada Health Infoway Inc. and that these funds are being leveraged with financing from provincial and territorial governments and health agencies in support of projects aimed at the development of electronic health records (EHRs),[32] telehealth systems, drug information systems and digital diagnostic imaging.[33] He further explained that projects funded by Infoway must meet its national standards for interoperability to ensure that the ICT systems that they fund will be able to connect to each other both within

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29 Health Canada, Health Care System: eHealth.

30 Gartner and Praxia, Telehealth Benefits and Adoption: Connecting People and Providers Across Canada, 30 May 2011.

31 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 25 October 2012, Meeting No. 60 (Mr. Richard Alvarez, President and CEO, Canada Health Infoway Inc.).

32 An EHR is a "longitudinal" health record that provides a digital lifetime record of a person's key health history and care within the health care system. The EHR contains data from multiple sources (e.g., hospitals, physician's records) that are shared electronically by authorized practitioners across different health care delivery organizations, as well as different provincial/territorial jurisdictions. The sharing of health information across different organizations, as well as jurisdictions requires a common info-structure that has many different components, including: registries for personal information, data banks for different types of health information (e.g., test results); interfaces where health professionals can enter and view information, as well as communication services that ensure interoperability with other systems. Canada Health Infoway Inc., EHRS Blueprint: An Interoperable EHR Framework, April 2006, pp. 10–12.

33 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 25 October 2012, Meeting No. 60 (Mr. Richard Alvarez, President and CEO, Canada Health Infoway Inc.).

and between different jurisdictions.[34] In addition, the projects must meet its requirements for the privacy of the data included in these systems.[35]

Mr. Alvarez highlighted for the Committee progress that had been made in e-health and telehealth as a result of investments made by Infoway. According to Mr. Alvarez, a recent study found that Canada has the world's largest video conferencing network, with 5,700 telehealth sites located in 1,200 communities, including 423 sites in northern, remote First Nations and Inuit communities.[36] This video conferencing network delivered a quarter of a million sessions in 2011, which eliminated the need for patients to leave their communities and their social networks to receive care. The use of this technology has also resulted in innovations in health care delivery, including in the treatment of mental health and drug addictions; monitoring chronic disease patients; remote wound care assessment for diabetics; and consultations among different health care providers in different settings.

Mr. Alvarez also explained how investments in digital diagnostic imaging, which collects, stores, manages and shares patient x-rays, computerized tomography (CT) scans, MRI and other images and reports, has increased productivity in health care systems. Research has shown that digital diagnostic imaging has increased the productivity of radiologists and technicians by 25%, allowing for 11 million more exams annually.[37] Moreover, over 90% of most common radiology examinations in Canadian hospitals are now digitized, an increase of 52% from six years ago.[38] The Committee learned that the annual benefits of this technology would be valued at $1 billion, once it is fully implemented.

In addition, Mr. Alvarez outlined how the use of Drug Information Systems, which allow authorized clinicians to access, manage and share patient medication, have resulted in the avoidance of harmful drug interactions and the better management of patient medications. This in turn has led to a savings of $436 million per year and a reported 9% increase in productivity among pharmacists.[39]

Finally, he also explained that Canada Health Infoway Inc. is funding projects to encourage adoption of e-health in clinical settings.[40] For example, the Committee heard that Canada Health Infoway Inc. had launched a challenge to clinical teams to demonstrate their use of innovative solutions for electronic scheduling, medication reconciliation, patient access to their own health information and clinical synoptic reporting. Furthermore, Canada Health Infoway Inc. announced an investment of $380 million for the

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34 Ibid.

35 Ibid.

36 Ibid.

37 Ibid.

38 Ibid.

39 Ibid.

40 Ibid.

implementation of an EHRs program in February 2011, which would result in an additional 12,000 clinicians registered in the program by March 2013.[41]

Given that much of the digital health info-structure is in place in Canada, Mr. Alvarez explained that his organization is now looking to the future.[42] Consultations with over 500 stakeholders had revealed that it was important for the organization to focus on: bringing care closer to home; providing to tools to support patient centric models of care; using technology to improve patient safety; and making use of the data provided by electronic health information systems to support research and analysis evaluating the performance of health care systems.

E. Promoting the Adoption of E-health and Telehealth in First Nations and Inuit Communities

The Committee heard that Health Canada is promoting the adoption of e-health and telehealth in First Nations and Inuit communities through its eHealth Infostructure Program. This program is being implemented in close partnership with Aboriginal Affairs and Northern Development Canada, Canada Health Infoway Inc., provincial governments, regional health authorities, private sector organisations and First Nations leaders and communities.[43] The aim of Health Canada's eHealth Infostructure Program is to ensure that First Nations and Inuit have access to the same quality and availability of e-health services as the rest of the Canadian population. The Committee also learned that the Department had invested approximately $130 million over the past five years in the project.[44]

The Committee heard from Ms. Kathy Langlois, Assistant Deputy Minister from Health Canada, that the the e-Health Infostructure Program focuses on the development of telehealth systems, broadband connectivity, the electronic surveillance of communicable diseases, and providing training and support for health professionals working in First Nations and Inuit communities. With respect to the development of teleheatlh systems, Ms. Langlois explained that there are currently more than 300 telehealth or video-conferencing sites in First Nations' communities that offer a number of services, including televisitation for family members, tele-education, telediabetes and tele-mental health.[45] Ms. Langlois explained that the program also had plans to introduce more clinical services in these areas.

As sustainable broadband connectivity is a necessary precursor to the use of e-health and telehealth services in First Nations communities, the Committee learned that

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41 Ibid.

42 Ibid.

43 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 23 October 2012, Meeting No. 61 (Ms. Kathy Langlois, Assistant Deputy Minister, Health Canada).

44 Ibid.

45 Ibid.

the eHealth Infostructure Program is investing in the development of broadband networks in partnership with other federal government departments, First Nations communities, provincial governments and services providers. For example, a partnership between Health Canada, SaskTel and the Federation of Saskatchewan Indian Nation was announced in July 2012, which will provide $5.8 million over five years to improve Internet access in 83 First Nations communities.[46] The Committee also heard that $81 million ($23 million from the federal government, $32 million from the Government of Ontario, and $26 million from the private sector) has also been invested in a project to bring fibre optics network to 26 communities in northern Ontario.[47]

To enhance the surveillance of communicable diseases in First Nations and Inuit communities, the Committee was informed that the eHealth Infostructure Program is contributing to the development of Panorama, a bilingual, electronic management and surveillance tool for front-line health care workers dealing with communicable diseases, including their identification, management and control. [48]The Committee heard Panorama will also integrate First Nations and Inuit clients into provincial efforts to implement the program. Certain provincial implementations are expected to proceed in the 2012-2013 fiscal year.[49]

Finally, the Committee also heard about e-health and telehealth initiatives aimed at supporting the needs of primary care nurses working in First Nations and Inuit communities. For example, Health Canada has developed programs aimed at providing primary care nurses with support in the management of medication, as well as providing them with new software to manage prescription labelling and the maintenance of medication inventories.[50] A centralized nurse practitioner 24/7 on-call service has also been established in Alberta to provide consultation and treatment support to primary care nurses on duty in remote and isolated communities.[51]

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46 Ibid.

47 Ibid.

48 Ibid.

49 Ibid.

50 Ibid.

51 Ibid.

CHAPTER 2: E-HEALTH, TELEHEALTH AND TELEROBOTICS

This chapter highlights innovations employed across the country in e-health, telehealth and telerobotics, including the benefits that these technologies offer for health care delivery. In particular, it examines the role of mobile health devices and web-based applications in promoting self-care among patients; the implementation of EHRs in different jurisdictions and organizations; and the role of telehealth and telerobotics in improving access to health care in rural and remote areas. It also outlines the challenges associated with the development and adoption of some of these technologies, as highlighted by witnesses. Finally, it also examines the adoption of these technologies in First Nations and Inuit communities. The chapter concludes with the Committee's observations and recommendations in this area.

A. Technological Innovation in E-Health, Telehealth and Telerobotics

1. The Role of Mobile Health Devices and Web-based Applications in the Promotion of Self-Care among Patients

Several witnesses described to the Committee how e-health tools such as mobile health devices and web-based applications could be used to promote self-care among patients. Self-care e-health tools can effectively help patients manage diseases, such as diabetes, cardiovascular disease, renal disease and HIV, in turn resulting in improved health outcomes and lower health care costs. For example, the Committee heard about a program led by the Centre for Global eHealth Innovation, called home hemodialysis, which provides patients with end-stage renal disease with a dialysis machine in the home.[52] Home hemodialysis has improved health outcomes for patients in comparison to in-hospital treatment. Patients can get as much as 60% renal replacement function via home hemodialysis in comparison to an increase of only 15% within a hospital setting. This increased function reduces the amount of toxins in the blood, which has allowed patients of child-bearing age receiving the treatment to conceive and bring pregnancies to term. In addition, providing hemodialysis in the home instead of a health care facility saves approximately $10,000 per patient annually. These savings are mostly due to the fact that patients administer their care themselves and rely less on nurses.[53]

The Committee learned that the Centre for Global eHealth Innovation has also developed several mobile phone applications to promote self-care among patients. One of them is an application for mobile phones called Bant, which aims to help teenagers with diabetes manage their blood sugars on a regular basis. The Bant application communicates with patients' blood glucose meters and regularly captures the blood sugar

52 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 23 October 2012, Meeting No. 59 (Mr. Joseph A. Cafazzo, Lead, Centre for Global eHealth Innovation).

53 Ibid.

readings.[54] A study conducted on the outcomes of the application showed that teenagers using the application tested their blood 50% more frequently than in the three months previous to using the application.

Another example of an application promoting self-care and self-management is a Bluetooth-enabled blood pressure monitor that communicates with patients' BlackBerrys.[55] The application encourages patients to measure their blood pressure regularly, which improves their awareness of their blood pressure. After one year, the cardiovascular mortality risk of patients using the new device dropped by 20%. The Committee learned that this reduction was attributable solely to the new application since there were no additional medications prescribed and no additional visits to physicians among these patients. Committee members were told that an application for consumer asthma management was also available.[56]

Finally, the Committee also heard about web-based initiatives aimed at self-care, including providing patients with the skills to manage their diseases. For example, Ms. José Côté, the Research Chair in Innovative Nursing Practices at the Université de Montréal, has developed TAVIE, a virtual nursing assistance program that consists of providing patients with the skills necessary to manage their chronic health problems through interactive web-sessions led by a nurse in another location.[57] TAVIE focuses on helping patients in self-management, self-observation, emotional-regulation and social-skills learning processes. The program has also been adapted for patients living with HIV, HIV-TAVIE focuses on helping patients improve the management of their antiretroviral medications.

Similarly, the Committee heard from Dr. Scott Lear from the British Columbia Alliance on Telehealth Policy and Research about a virtual cardiac rehabilitation program, which consists of a website that mimics the hospital-based standard cardiac rehabilitation program.[58] Patients participating in the program are given a recordable heart rate monitor that they can wear while they exercise. They can upload the data to the website, which allows the health staff in the hospital to monitor the patients' heart rate and provide feedback as needed. According to Dr. Lear, patients participating in the virtual cardiac rehabilitation program increased their physical activity levels and reduced their cholesterol levels to rates that were comparable to those participating in hospital-based programs. This virtual model is now being applied to the management of other diseases such as, diabetes, renal disease and lung disease.

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54 Ibid.

55 Ibid.

56 Ibid.

57 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 1 November 2012, Meeting No. 62 (Ms. José Côté, Research Chair in Innovative Nursing Practices, Université de Montréal).

58 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 12 February 2013, Meeting No. 73 (Dr. Scott Lear, As an Individual).

The Committee also heard from Mr. Paul Lepage that TELUS, in partnership with the Lawson Health Research Institute, has developed a personal health record to help monitor patients with mental illness.[59] According to Mr. Lepage, patients suffering from mental illnesses, including schizophrenia, are supplied with an electronic personal health record that is configured in such a way that both the patient and provider have access to the record. The patient is able to enter information in the system during the day about their mood and experiences, which allows for exchanges of information with the physician. Mr. Lepage explained that physicians had received more information through this program than through regular treatment, allowing them to move their patients' treatment forward faster.

Many of the witnesses indicated that the use of mobile health devices and web-based applications in the treatment and management of diseases is the way of the future, as the devices promote the engagement of patients in their own care and reduce costs to the health care system while improving patient outcomes.[60] In addition, these e-health applications are also successful in improving patient access by enabling patients to overcome geographic barriers to receive care and treatment for their diseases.[61] For these reasons, witnesses recommended that CIHR maintain and possibly increase funding to its e-health funding program to support research developing and evaluating new projects in this area.[62] However, one witness also explained that one of the challenges with e-health applications is ensuring that the most disadvantaged groups in society have access to these technologies.[63] This witness suggested that they could be provided through community settings. The Committee also heard about the importance of ensuring that patients, including seniors, who may have physical and/or cognitive challenges, are able to use these innovations as well, a subject that is dealt with in greater detail in chapter 5. Mr. Joseph Cafazzo, appearing on behalf of the Centre for Global eHealth Innovation also noted that while mobile health devices reduce costs for the health care system, the cost-savings associated with these devices do not account for the contribution made by informal care givers as a result of shifting care to the home.[64] Consequently, he explained that it is necessary to ensure that informal care givers are also provided with the

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59 Ibid. (Mr. Paul Lepage, President of Health and Payment Solutions, TELUS).

60 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 12 February 2013, Meeting No. 73 (Dr. Scott Lear, As an Individual, Mr. Paul Lepage, President of Health and Payment Solutions, TELUS, Dr. David Price, Chair of the Department of Family Medicine, McMaster University) and House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 23 October 2012, Meeting No. 59 (Mr. Joseph A. Cafazzo, Lead, Centre for Global eHealth Innovation, Mr. Jonathan Thompson, Assembly of First Nations).

61 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 12 February 2013, Meeting No. 73 (Dr. Scott Lear, As an Individual) and House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 1 November 2012, Meeting No. 62 (Ms. José Côté, Research Chair in Innovative Nursing Practices, Université de Montréal).

62 Ibid.

63 Ms. José Côté, "Technological Health Innovations for Informed Choices," Brief submitted to the House of Commons Standing Committee on Health, 2012.

64 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 23 October 2012, Meeting No. 59 (Mr. Joseph A. Cafazzo, Lead, Centre for Global eHealth Innovation).

necessary supports. Finally, witnesses believed that for self-care to be fully realized through mobile health applications, patients need to have access to their personal health information through EHR systems.[65]

2. The Implementation of Electronic Health Record Systems Across Canada

It is important to note that an Electronic Health Record (EHR) is sometimes confused with an Electronic Medical Record (EMR). The EMR stores complete patient's health information (i.e., lab results, images, consultant or hospital notes) in a single location, such as a physician's office or a community health centre; this information is accessible only by authorized professionals working in that location. EMRs are a key component of a comprehensive EHR. An EHR refers to a secure and private record that provides, in a digital or computerized format, lifetime information on a person's history within the health care system.[66] There are six main components that make up EHR systems, including a patient registry; provider registry; diagnostic imaging repositories; laboratory information repositories; drug information repositories; other information repositories.[67] The patient health information stored in these different components comes from various sources such as physicians, hospitals, diagnostic laboratories and pharmacists. In order to achieve the goal of sharing information across a region and jurisdiction, a common, interoperable or compatible network needs to be developed to link the different components of the system to each other.

Witnesses outlined progress towards the implementation of different components of EHRs within their respective jurisdictions and health care organizations across Canada. The Committee heard about Manitoba's efforts to implement different components of an EHR system through Manitoba eHealth, the agency responsible for the delivery of all e-health projects within the province.[68] The Committee heard that since 2006, the province has invested over $260 million in health ICT projects across the province .[69] These projects have been facilitated by additional funding from Canada Health Infoway Inc, amounting to $67 million.[70] As a result of these investments, all of the provinces diagnostic imaging services in hospitals and other public facilities are fully digital; approximately 70% of family doctors have EMRs in place; and their version of an EHR, called E-chart has gone live and is deployed in 78 locations across all of Manitoba.[71] The implementation of these projects has reduced wait times for health care services in remote areas, improved the coordination of patient care and improved patient safety by reducing the

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65 Ibid.

66 Canada Health Infoway Inc., EHRS Blueprint (v2) Factsheet.

67 Canada Health Infoway Inc., EHRS Blueprint (v2) Factsheet.

68 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 23 October 2012, Meeting No. 59 (Mr. Roger Girard, Chief Information Officer, Manitoba eHealth Program).

69 Ibid.

70 Ibid.

71 Ibid.

number of medication incidents by 45% in St. Boniface Hospital in Winnipeg alone.[72] Mr. Roger Girard, Chief Information Officer for Manitoba's e-Health Program explained that this progress would not have been achieved without the investments and partnership of Canada Health Infoway Inc., which also ensured the interoperability of the province's system. Despite this progress, he noted that automation still needs to occur across different areas of the health care system, including home care, community care and mental health, and long-term care and consequently, on-going support from Canada Health Infoway Inc. is necessary.

The Committee also heard about how the Ottawa Hospital is implementing different components of EHR systems, resulting from support received from eHealth Ontario and Canada Health Infoway Inc.[73] According to Dr. Glen Geiger, the Ottawa Hospital is now electronically linked to regional hospitals and they were rolling out EMRs that would link primary care physicians to the health records of their patients in the Ottawa Hospital. He also explained that the initiatives being introduced are not simply about introducing new technologies, but are focused on changing health care delivery processes that increase efficiencies and improve health outcomes for patients. For example, he explained that their electronic ordering of diagnostic imaging at the Ottawa Hospital is paperless from end to end, from the creation of the order to the receipt of the order in the radiology department and the return of the report to the physician on their iPad. He noted that the Ottawa Hospital's lab tests were done the same way.

Finally, the Committee learned that efforts are being made to develop EMRs that do not simply automate processes for physicians but are designed to promote meaningful use by the physician. The Committee heard from Dr. David Price from McMaster University, who had participated in the development of an EMR called OSCAR, which is now one of the leading EMRs in the country and has been adopted by approximately 2,000 family physicians.[74] Apps or add-ons for OSCAR are being developed to help physicians prevent, monitor and treat different diseases, such as chronic kidney disease, through prompts in the system. Similarly, McMaster University's BORN initiative is introducing prompts in the system to manage perinatal and pregnant women to ensure they receive appropriate screenings and tests based upon certain risk factors such as age and weight that are included in the EMR system. In addition, the Committee heard that McMaster, in partnership with the Federal Economic Development Agency for Southern Ontario, York University and NexJ, is developing a personal health record called MyOscar, which is a platform for patients to both store their health information and provide a secure electronic medium for patients to interact with their clinicians.

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72 Ibid.

73 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 25 October 2012, Meeting No. 60 (Dr. Glen Geiger, Chief Medical Information Officer, the Ottawa Hospital).

74 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 12 February 2013, Meeting No. 73 (Dr. David Price, Chair of the Department of Family Medicine, McMaster University).

While the Committee heard from witnesses that jurisdictions and health care organizations are well on their way in terms of developing and implementing different components of EHR systems, there are several on-going challenges in this area. In particular, witnesses highlighted challenges associated with the interoperability, or the ability of different electronic health systems to communicate with each other. Dr. Peter Rossos, Chief Medical Information Officer from the University Health Network explained that problems of interoperability result from the fact that different health care organizations had initially implemented different types of electronic information systems that were not readily designed to communicate with each other.[75] He explained that most community-based EMRs in Canada are provided by local or smaller vendors, whereas hospital EMRs have been designed by larger or foreign companies, but not necessarily for local interoperability. Consequently, hospital systems need to be upgraded to link with regional or province-wide EHRs developed in line with Canada Health Infoway Inc.'s standards for interoperability. Moreover, these hospital information systems were not designed for the current more mature uses of these systems. As a result of these challenges, Dr. Rossos indicated that most Canadian hospitals ranked low on the HIMSS Analytics maturity model of the adoption of EMRs.

According to witnesses, the federal government has a role to play in ensuring that there are common interoperability and privacy standards across Canada through its on-going support for Canada Health Infoway Inc. and its common EHR service blueprint.[76] Some witnesses suggested that the dynamic nature of the electronic health information systems market in Canada means that the private sector would also be able to develop solutions to address problems related to interoperability.[77]

Witnesses also pointed out that clinician adoption is also an issue, as approximately only 39% of Canadian physicians are currently using EMRs, in comparison to 50%-55% in the United States and up to 90% in other countries.[78] It was suggested that some health professionals do not use e-health systems because of a lack of familiarity or understanding of e-health tools that are available or the benefits for their patients.[79] In order to promote clinician adoption, one witness suggested that e-health training could be integrated into both medical student training and continuing education of physicians,

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75 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 25 October 2012, Meeting No. 60 (Dr. Peter Rossos, Chief Medical Information Officer, University Health Network).

76 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 12 February 2013, Meeting No. 73 (Dr. David Price, Chair of the Department of Family Medicine, McMaster University and Mr. Paul Lepage, President of Health and Payment Solutions, TELUS) and House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 25 October 2012, Meeting No. 60 (Dr. Kendal Ho, Professor, University of British Columbia).

77 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 12 February 2013, Meeting No. 73 (Mr. Paul Lepage, President of Health and Payment Solutions, TELUS).

78 Ibid. (Dr. David Price, Chair of the Department of Family Medicine, McMaster University).

79 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 25 October 2012, Meeting No. 60 (Dr. Kendal Ho, Professor, University of British Columbia).

nurses and pharmacists.[80] Another witness proposed that incentives in the form of compensation be considered.[81] However, another witness suggested that physician adoption would no longer be an issue, as physicians currently graduating from medical school would not move back to paper records and there could be a shift in adoption patterns in the next three to five years.[82]

3. The Role of Telehealth and Telerobotics in Improving Access to Health Care in Rural and Remote Settings

Witnesses highlighted the important role that telehealth and telerobotics are playing in improving access to health care for people living in rural and remote areas, while also reducing health care costs. The Committee heard that improving access to health care in rural and remote settings is necessary because individuals living in rural and remote areas face poorer health outcomes in comparison to those living in urban areas, including higher morbidity and mortality rates, which is due, in part, to a lack of access to health care services.[83] In addition, the Committee heard that rural and remote communities also face higher costs of care because of their dependence on medical travel to access care in urban centres.[84]

i. Telehealth

The Committee heard examples of how telehealth initiatives in different jurisdictions are improving access to care, while reducing health care costs. For example, the Committee heard that Manitoba has established 125 telehealth sites that are allowing people living in rural areas to connect with specialists in urban centres by visiting their local health centres, saving rural Manitobans both time and money. It has been estimated that, in Manitoba, telehealth saves over one million kilometres of patient travel, $2.6 million in out-of-pocket expenses for families and $1 million per year in travel costs for health professionals.[85] Mr. Girard, Chief Information Officer of Manitoba's eHealth Program explained that telehealth has an important role to play improving access to services for people living in rural and remote areas, but also cannot replace the health care practitioners that are necessary to deliver hands-on care in these communities.[86]

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80 Ibid.

81 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 12 February 2013, Meeting No. 73 (Mr. Paul Lepage, President of Health and Payment Solutions, TELUS).

82 Ibid. (Dr. David Price, Chair of the Department of Family Medicine, McMaster University).

83 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 6 December 2012, Meeting No. 69 (Dr. Michael Jong, Professor, Memorial University, As an Individual).

84 Ibid.

85 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 23 October 2012, Meeting No. 59 (Mr. Roger Girard, Chief Information Officer, Manitoba eHealth Program).

86 Ibid.

Another example that the Committee heard about was the Ontario Telemedicine Network (OTN), which is an independent not-for-profit corporation that provides telehealth services for the Province of Ontario, including rural areas and remote areas of the province. OTN also works in partnership with Canada Health Infoway Inc., Keewaytinook Okimakanak Telemedicine, and eHealth Ontario. The Committee heard that OTN is one of the largest and most active telemedicine networks in the world, providing support to more than 1,500 telemedicine sites in Ontario and 3,000 video-conferencing platforms that deliver care to more than 200,000 patients a year.[87] OTN offers a number of services in the Province of Ontario, including routine health consultation and emergency services, such as telestroke, teleburn, sign language services, mental health crisis services, critical care services and a trauma pilot program.[88] Other programs offered by the OTN include: education and training of health professionals, telehomecare, which supports remote monitoring and nurse coaching for people living with chronic diseases, and an e-consult service through which primary care physicians can send data and pictures to a specialist to seek advice. The Committee learned that these services had resulted in a savings of about 207 million kilometres in travel in 2011. It also saved the Ontario government $45 million in travel grant subsidies in 2011, which it normally offers to people living in Northern Ontario.

ii. Telerobotics

The Committee heard that telerobotics, like telehealth, could also be an effective tool in improving access to health care in rural and remote settings. The Committee heard from Dr. Ivar Mendez from Dalhousie University that Nova Scotia has developed a RP-7 telerobot system to deliver care in different parts of the province and in Nain, Labrador. These telerobots enable physicians in one location to appear in a hospital in another location by videoconference through a human-sized robot, whose movements they are able to control at a distance.[89] The robot enables the physician to move virtually in health care facilities and enter patients' rooms to deliver care, assess patients, speak with them directly and provide hands-on support to nurses and other health care professionals that are physically with the patients. Moreover, advanced practice procedures could be performed by nurses with the assistance of physicians through the telerobots. The Committee heard that other applications of telerobotics include: patient follow ups with cancer specialists; medication and care management; resuscitations; ultrasound exams; mental health services; nutritional consultations; surgical consults, as well as education and training.[90]

The Committee heard that Nova Scotia's network of telerobots consists of five units in Nova Scotia and one in Nain, Labrador, a community of around 1,300 Inuit people with

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87 Ibid.

88 Ibid.

89 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 6 December 2012, Meeting No. 69 (Dr. Ivar Mendez, Professor of Neurosurgery, Dalhousie University).

90 Ibid.

only six nurses. The telerobot in Nain is a project that was implemented through collaboration among Dalhousie University, Labrador-Grenfell Health, the Nunatsiavut Government's Department of Health and Social Development, and Health Canada's First Nations and Inuit Health Branch.[91] The placement of a telerobot in Nain means that the community now has 24/7 access to a physician, who otherwise would be available only through the telephone, or a visit that occurs once every six weeks. The Committee heard that the presence of "Rosie the Robot" has reduced medical travel for people living in Nain by half.[92] Furthermore, it has reduced the stress and difficulties faced by nurses working in the community. As a result, they are much more satisfied and more willing to remain in the community. Because of the positive impact "Rosie" is having in the community, the Committee heard that the Government of Newfoundland and Labrador will continue funding the use of telerobotic medicine in Nain. Furthermore, witnesses indicated that this remote telerobotic presence is helping to improve access to health services for individuals living in remote health communities.

Dr. Mendez also discussed other types of telerobotic devices that are being tested and used in his province to improve access to care, in particular, portable telerobotic systems that work through cellular phone connectivity.[93] These portable systems are used by first responders, who are able to bring them to the location of the accident. The devices allow physicians to see patients more quickly at the scene of the accident rather than only at the hospital. Through these portable systems, physicians are not only able to see the patient right away and diagnose a condition from a remote location, but are also able to start managing the patient. Moreover, portable systems allow patients to be followed by physicians during their transportation in ambulance.

Finally, he also described another telerobotics program developed and located in Halifax, which improves access to health care specialists located across Canada for patients with movement disorders. In order to control movement disorders such as dystonia[94] and tremors, it is necessary to put electrodes in patients' brains.[95] These internal computers can be programmed remotely through portable systems that nurses can bring to patient's homes. Through these portable systems, patients can receive their follow-up treatments at home with the help of a nurse, rather than travelling to Halifax. Consequently, patients with these disorders from all over Canada have on-going access to this treatment from their homes.

Witnesses felt that the use of telerobotics in the delivery of health care is "unstoppable" and part of the future of health care delivery in Canada. However, they

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91 Ibid. (Ms. Gail Turner, Consultant, Nunatsiavut Government).

92 Ibid. (Dr. Michael Jong, As an Individual).

93 Ibid. (Dr. Ivar Mendez, Professor of Neurosurgery, Dalhousie University).

94 Dystonia is a neurological movement disorder, in which sustained muscle contractions cause twisting and repetitive movements and abnormal postures.

95 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 6 December 2012, Meeting No. 69 (Dr. Ivar Mendez, Professor of Neurosurgery, Dalhousie University).

noted that there are some challenges to its adoption in Canada.[96] In particular, there are jurisdictional barriers associated with delivery care across provincial and territorial boundaries including: the need to establish governance and accountability models and identify how health care professionals using these systems would be paid. The Committee also heard that improvements in broadband access in remote communities are also necessary to realize these systems.[97] In addition, health professionals need adequate training to make use of these systems.[98] Witnesses did not indicate that the costs to acquire telerobots and portable telerobotic are a significant barrier, since the alternative to these systems is medical transportation, which occurs mostly through relatively expensive plane travel in northern Canada. In fact, Committee members were told that the portable systems that first responders carry with them cost the equivalent of two trips on a plane for medical patients. The Committee heard that the cost of a telerobot is around $140,000, whereas the portable units cost about $25,000 each.[99]

4. The Implementation of E-Health and Telehealth in First Nations Communities[100]

The Committee heard from the Assembly of First Nations that e-health and telehealth are indispensable tools for the development of comprehensive effective and efficient health systems in First Nations communities. E-health and telehealth systems offer many benefits to First Nations communities, including: extending basic and specialist health services, as well as health promotion and disease prevention education to underserviced areas; creating efficiencies within the health system by reducing medical transportation costs; providing support and continuing education opportunities to health professionals in turn improving their recruitment and retention; improving the management and storage of health information within the communities; and helping evidence-based policy development. Furthermore, the Committee heard that the development and use of EHR systems could improve the coordination of care between jurisdictions, described as a constant challenge for First Nations people.

According to the Assembly of First Nations, e-health and telehealth projects are underway in First Nations communities across the country. For example, in British Columbia, the Cowichan Tribes have developed their own EMR, called Mustimuhw cEMR, which is also being used by communities in Saskatchewan and Manitoba. Similarly, British Columbia's tripartite agreement process aimed at integrating health care delivery for First Nations communities is also prioritizing the development and implementation of comprehensive and integrated information management and information technology

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96 Ibid.

97 Ibid. (Dr. Michael Jong, As an Individual).

98 Ibid.

99 Ibid. (Dr. Ivar Mendez, Professor of Neurosurgery, Dalhousie University).

100 Unless otherwise noted, this section is based upon the following testimony: House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 23 October 2012, Meeting No. 59 (Mr. Jonathan Thompson, Director, Health and Social Secretariat, Assembly of First Nations).

services. Furthermore, the Committee heard that the Kenora Chiefs Advisory in Ontario has also developed a client registry project that is collating data from seven First Nations communities into a single database.

Finally, the Committee also heard that the Assembly of First Nations is working on engaging First Nations and federal, provincial, territorial partners in discussions on how to accelerate e-health alignment, convergence and clinical data integration. The Committee was informed that on 20 June 2012, the Assembly of First Nations and Canada's Health Informatics Association, with the support of Health Canada and Canada Health Infoway Inc., had hosted the First Nations eHealth Convergence Forum. The Assembly of First Nations is now focusing on data sharing, including the creation of a guide to develop data sharing agreements.

Despite this progress, the Committee heard that the development and implementation of e-health and telehealth in First Nations communities remains challenging. The development of e-health projects in First Nations communities were described as lagging behind in comparison to initiatives in the rest of Canada. The Assembly of First Nations was of the view that sufficient investments in infrastructure and capacity to support these projects have not been made.[101] It therefore recommended that funding for Health Canada's EHealth Infostructure Program be maintained to help First Nations communities realize the full potential of these technologies. In addition, the Committee heard that a lack of access to broadband networks remains a key concern, as at least 10% of First Nations communities still do not have access to broadband networks. Jurisdictional barriers also remain a concern, as Canada Health Infoway Inc. works mainly with provinces rather than First Nations communities. The Committee heard that the Assembly of First Nations and Health Canada were working closely with Canada Health Infoway Inc. to address this issue.

Finally, the Committee also heard that e-health and telehealth systems alone could not address the gap in health outcomes between First Nations communities and other Canadians. The Assembly of First Nations explained that the rates of type 2 diabetes in on-reserve First Nations communities are three to five times higher than rates among the general population and that infant mortality is approximately 1.5 times higher than the national average. Moreover, the Committee heard that First Nations people lack access to health care for a variety of reasons beyond geography, which were identified in a recent First Nations health survey and include: the inability to cover child care costs, difficulty arranging and paying for medical transportation, excessive wait times, and inadequate and culturally inappropriate care.[102] Consequently, they believe that it is also necessary to examine the broader social determinants of health, including: housing, education, poverty, mental health and addictions, in order to reduce health disparities for First Nations people, particularly those living in more northern and remote communities.

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101 Ibid.

102 Ibid.

B. Committee Observations and Recommendations

The Committee's study found that innovations in e-health, telehealth and telerobotics are leading to improved health outcomes for patients and lowering the costs of health care delivery in Canada. The Committee learned that mobile health devices and web-applications for the management of diseases are engaging patients in the management of their health. Furthermore, these devices are helping patients overcome geographic barriers to accessing hospital-based disease management programs without affecting the quality of their care. The Committee heard that there is an on-going need for CIHR to continue its investment in the development and evaluation of research programs promoting the implementation of these e-health tools. With respect to the implementation of EHRs, the Committee heard that there are still on-going challenges particularly in the area of interoperability. Witnesses saw Canada Health Infoway Inc. as having a key role to play in ensuring that EHR systems are being developed and implemented in accordance with common standards for interoperability and privacy.

The Committee also heard that Canada is a world leader in the area of telehealth and telerobotics, which is improving access to care for residents of rural and remote communities and providing significant savings to health care systems by reducing the need for medical travel. In particular, the Committee heard about the benefits of "Rosie the Robot," which provides the community of Nain, Labrador with round-the-clock access to a physician. Evaluations of Rosie's impact on the community suggest that a telerobotic presence can have a positive impact on health care delivery in northern Canada. Finally, the Committee learned that progress is being made in First Nations communities in the development and implementation of e-health and telehealth systems, as a result of investments made by Health Canada's eHealth Infostructure Program in partnership with First Nations communities, provincial governments and private partners. Consequently, there is a need for Health Canada to continue investing in this program to ensure that the development of e-health and telehealth systems in First Nations communities does not lag behind the rest of Canada. Furthermore, the Committee heard that there is a need to ensure that the remaining First Nations communities have access to broadband networks, and that Health Canada, Canada Health Infoway Inc., and First Nations communities continue to work together to address jurisdictional barriers in the development and implementation of these systems.

Reflecting these findings, the Committee therefore recommends that:

1. **The Canadian Institutes of Health Research continue to fund research promoting the development, implementation and evaluation of e-health tools in Canada.**

2. **The Government of Canada and Canada Health Infoway Inc. focus its investments on the development of e-health tools that engage patients in their own care.**

3. **The Government of Canada continue to fund Health Canada's e-Health Infostructure Program.**

4. **Health Canada, through its e-Health Infostructure Program, continue to ensure that remote and northern First Nations and Inuit communities have sufficient access to broadband networks.**

5. **Canada Health Infoway Inc. continue to work with Health Canada, First Nations, Inuit communities and provincial governments to address jurisdictional challenges in the development and implementation of e-health and telehealth systems.**

6. **Health Canada, in partnership with First Nations and Inuit communities, provincial and territorial governments, and other relevant stakeholders, consider promoting the adoption of telerobotic systems in northern and remote communities where feasible.**

CHAPTER 3: PHARMACEUTICAL DRUGS AND MEDICAL DEVICES

This chapter provides an overview of innovations in the development of pharmaceutical drugs and medical devices, as well as particular challenges facing innovation in these areas. It also examines more specifically how developments in nanotechnology and genomics are leading to the development of new drugs and medical devices and how innovation in these areas will lead to new ways of diagnosing and treating different diseases and disorders, as well as improve our understanding of them. The chapter concludes with the Committee's observations and recommendations about fostering further innovation in these areas.

A. Medical Devices

Medical devices are used in the diagnosis, treatment, mitigation or prevention of a medical condition. They include a vast range of equipment from thermometer or tongue depressors, to MRI machines or robotically assisted surgical equipment.[103] The *Food and Drugs Act*, which authorizes Health Canada to regulate the safety, efficacy and quality of these products, defines a medical device as, "any article, instrument, apparatus or contrivance, including any component, part or accessory thereof, manufactured, sold or represented for use" in the medical treatment of human beings.[104] The Committee heard from witnesses that the medical device industry in Canada consists of approximately 1000 companies, employing about 35,000 people in Canada and has sales between $6 and $7 billion.[105] The majority of these companies are small- and medium-sized Canadian-owned companies.[106]

Witnesses highlighted examples of innovative medical devices developed and utilized in Canada, which were leading to improvements in the understanding and treatment of different diseases. The Committee heard from Dr. Ravi Menon, Canada Research Chair at the Robarts Research Institute at the University of Western Ontario, who was conducting research that employs an ultra-high magnetic field MRI machine to study brain structure and function, which is leading to greater understandings of Alzheimer's disease, multiple sclerosis, brain cancer and Lou Gehrig's disease.[107]

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103 Office of the Auditor General of Canada, Status Report of the Auditor General of Canada to the House of Commons: Chapter 6: Regulating Medical Devices-Health Canada, June 2011.

104 Ibid.

105 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 7 February 2013, Meeting No. 72 (Mr. Brian Lewis, Canada's Medical Technology Companies [MEDEC]).

106 Ibid.

107 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 October 2012, Meeting No. 61 (Dr. Ravi Menon, Professor, University of Western Ontario).

The Committee also heard about how the Juvenile Diabetes Research Foundation Canada had received $20 million in 2009 from the Government of Canada's Federal Economic Development Agency for Southern Ontario to support the development of a clinical trial network that will examine, among other things, the development of an artificial pancreas, a closed-loop system that connects information from continuous glucose monitors with insulin pump delivery systems.[108] Computer programs will automatically digest all the information and give the correct signal to deliver proper amounts of insulin, depending on the circumstances of the individual. The Committee heard that three clinical trials involving the artificial pancreas were currently taking place focusing on children and adolescents with type 1 diabetes, as well as pregnant women with type 1 diabetes.

Witnesses identified several obstacles related to the adoption of innovative medical devices into Canadian health care systems. One obstacle identified by some witnesses was the regulatory system. Mr. Brian Lewis, President of Canada's Medical Technology Companies (MEDEC) articulated that though he recognized the need for strict regulatory requirements, he believed that Health Canada's many regulations are difficult to navigate, particularly for small businesses.[109] Furthermore, Health Canada's cost-recovery system also poses challenges to small businesses. He suggested that this could be an area where the federal government could take action.[110] He, as well as Dr. David Jaffray, Head of the Radiation Physics Department at Princess Margaret Cancer Centre, also said that the regulatory process is slow, though they recognized that Health Canada is making its best efforts in this area.[111] These witnesses also highlighted the need to ensure that Health Canada's regulatory processes are harmonized with other jurisdictions, including the United States and Europe, as Canadian companies often seek market approval in those jurisdictions before they do so in Canada because those jurisdictions represent larger markets for their products.[112]

Witnesses also outlined the challenges that Canadian medical technology companies face at the provincial and regional level in having their devices adopted by health care organizations.[113] The Committee heard that provinces and health care organizations rely on HTAs in determining which medical devices will be adopted by health care systems. However, HTAs, which evaluate the clinical and cost-effectiveness of health

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108 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 27 November 2012, Meeting No. 66 (Mr. Andrew McKee, Juvenile Diabetes Research Foundation Canada).

109 Ibid.

110 Ibid.

111 House of Commons Standing Committee on Health, *Evidence*,1st Session, 41st Parliament, 7 March, 2013, Meeting No. 78 (Dr. David Jaffray, Head of the Radiation Physics Department, Princess Margaret Cancer Centre) and House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 6 December 2012, Meeting No. 69 (Mr. Brian Lewis, Canada's Medical Technology Companies [MEDEC]).

112 Ibid.

113 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 7 February 2013, Meeting No. 72 (Mr. Brian Lewis, Canada's Medical Technology Companies [MEDEC] and Mr. John Soloninka, President and Chief Executive Officer, Health Technology Exchange).

technologies, are being carried out by different organizations in different jurisdictions without common pan-Canadian recommendations. As a result, companies have to go through different HTA processes with local health organizations across the country. Furthermore, companies face challenges generating the necessary data to support evaluations of the cost effectiveness of their products. The Committee heard that organizations, such as MaRS Discovery District, are now helping companies evaluate the cost-effectiveness of their products during their development to promote their adoption by health care organizations. However, witnesses suggested that CADTH could focus on coordinating HTAs across the country and sharing best practices in this area.[114]

Finally, some witnesses indicated that local hospitals and health care organizations lack resources and incentives to adopt Canadian-developed medical technologies. They therefore recommended that the federal government provide grants, either through federal government regional economic development agencies or the Canada Foundation for Innovation, to health care organizations to adopt clinically and cost effective technologies that had been developed in Canada, or examine ways that it could adopt these technologies within its jurisdiction.[115]

B. Pharmaceutical Drugs

Health Canada defines pharmaceutical drugs, as synthetic products made from chemicals that include prescription and non-prescription drugs; disinfectants; and products such as sunscreens and antiperspirants.[116] Like medical devices, pharmaceutical drugs are regulated by Health Canada under the *Food and Drugs Act*.[117] During the course of its study, the Committee heard about innovations in the development of pharmaceuticals that were leading to improvements in the treatment and understanding of various diseases and disorders. For example, the Committee heard from representatives from the Canadian Light Source (CLS), a facility that conducts research using a synchrotron, an electronic accelerator that produces light at an extremely high X-ray intensity allowing for penetration of materials at the molecular level.[118] The Committee heard that synchrotron radiation has various applications for drug development because it allows for a better understanding of the molecular structure of viruses, which then allows scientists to develop drugs and treatments that target diseases caused by viruses at the molecular level rather than the patient's whole body, leading to fewer side effects. One of the CLS's facilities allow users to conduct macromolecular crystallography, which detects the three-dimensional structure of biological molecules such as viruses and proteins, including those related to cancer, parasitic diseases, Crohn's disease, and cardiovascular diseases. This knowledge is then used by pharmaceutical companies to develop drugs based upon the three dimensional

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114 Ibid.

115 Ibid.

116 Health Canada, Access to Therapeutic Products: The Regulatory Process in Canada, 2006.

117 Ibid.

118 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 October 2012, Meeting No. 61 (Dr. Josef Hormes, Executive Director, Canadian Light Source.).

structure of these molecules. In addition, the Committee heard that the CLS's facilities are also being used to enhance the detection of diseases such as breast cancer, which are currently detected not at the molecular level, but rather through secondary processes such as the detection of calcifications. According to representatives of the CLS, research being conducted at the facility is being used to develop techniques to detect cancerous tissue at the molecular level, which would allow for earlier diagnosis and treatment of the disease.

However, witnesses also explained that innovation in both the Canadian and global pharmaceutical industry was stalling, as fewer new innovative drugs are being developed. In a brief submitted to the Committee, Dr. Marc-André Gagnon from Carleton University provided a graph that showed that the introduction of new molecular entities globally declined from approximately 225 in the period from 1996 to 2000 to approximately 150 between 2001 and 2010.[119] His brief further explained that according to the French journal *Préscrire*, of the 82 new pharmaceutical drugs approved for sale in France in 2012, only 5% of these drugs were considered to bring therapeutic advances. The remaining drugs were considered to be "me too" drugs, which are reformulations of existing drugs.[120] The Committee also heard from Dr. Weaver, who explained that fewer drugs are being discovered in Canada than should be expected given its investments in research and human capital.[121] According to his calculations, Canada should have discovered 16 new drugs from 1990 to 2010, but only discovered 6 new drugs during this period.

Witnesses offered different explanations for the lack of innovation in the pharmaceutical industry. Dr. Gagnon pointed to a reduction in investments in research and development by pharmaceutical companies, despite incentives provided by the Government of Canada through patent protection and tax credits.[122] Dr. Weaver explained that there are no major multi-national drug companies doing industrial research in Canada.[123] Consequently, he suggested that there is a need for a new model of drug development called "micro-pharma," which is academia-originated biotech start-up companies that are efficient, innovative, product-focused and small.[124] However, he explained that "micro-pharma" companies would also face challenges in relation to accessing both venture capital and appropriate business expertise. Dr. Aled Edwards from the Structural Genomics Consortium attributed the problem to a lack of basic understanding of human biology and the need for scientists in academia and

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119 Dr. Marc-André Gagnon, "IP and the Canadian Pharmaceutical Sector: From Innovation Economy to Corporate Welfare," Brief submitted to the House of Commons Standing Committee on Health, 12 February 2013.

120 Ibid.

121 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 October 2012, Meeting No. 61 (Dr. Weaver, Professor, Dalhousie University, As an Individual).

122 Dr. Marc-André Gagnon, "IP and the Canadian Pharmaceutical Sector: From Innovation Economy to Corporate Welfare," Brief submitted to the House of Commons Standing Committee on Health, 19 March 2013.

123 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 October 2012, Meeting No. 61 (Dr. Weaver, Professor, Dalhousie University, As an Individual).

124 Ibid.

pharmaceutical companies to research genes that are currently not the focus of scientific research.[125] He also advocated for a new model of drug development, which will be discussed in detail in the genomics section below.

C. Genomics

Genomics is defined by the World Health Organization as the study of genes and their function, as well as their inter-relationships in order to identify their influence on the growth and development of living organisms.[126] The Committee heard that the federal government funds research in genomics through Genome Canada, a not-for-profit corporation dedicated to developing and applying genomics science and technology to create economic wealth and social benefit for Canadians. The Committee heard that since its inception in 2001, Genome Canada has received $1 billion in federal funding, which has been leveraged to secure an additional billion dollars in co-funding from other partners. The Committee heard that 60% of this funding has been invested in health-related genomics research and applications.[127] Dr. Pierre Meulien, President and Chief Executive Officer for Genome Canada, highlighted the organization's most recent $150 million research initiative in personalized medicine, which is being conducted in partnership with CIHR, provincial governments and pharmaceutical companies. Personalized medicine focuses on the customization of health care to the unique needs of an individual based upon an understanding of his or her genetic profile.[128] Dr. Meulien explained that personalized medicine had many benefits for health care delivery, such as helping physicians determine which medications are appropriate for patients based upon an understanding of their genetic profile, as well as avoid prescribing medications that could cause adverse reactions in certain individuals, as a result of the presence of particular genetic markers.[129]

The Committee also heard from other witnesses about the different health applications of genomic research and genomic sequencing. In particular, witnesses highlighted how the Genome Sciences Centre's DNA sequencer at the British Columbia Cancer Agency is leading to new treatments in cancer and the development of new vaccines for communicable diseases.[130] Funded by Genome Canada, Genome British Columbia, CIHR, the U.S. National Institutes of Health and the Canada Foundation for Innovation, the Genome Sciences Centre is one of four international early access sites for a new brand of DNA sequencer machine, which is capable of reading all the letters in the

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125 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 5 March 2013, Meeting No. 77 (Dr. Aled Edwards, Director and Chief Executive Officer, Structural Genomics Consortium).

126 World Health Organization, "WHO Definitions of Genetics and Genomics" *Human Genetics programme*.

127 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 5 March 2013, Meeting No. 77 (Dr. Meulien, President and Chief Executive Officer, Genome Canada).

128 U.S National Library of Medicine, *Genetics Home Reference: Glossary: personalized medicine*.

129 Ibid.

130 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 4 December 2012, Meeting No. 68 (Dr. Marco Marra, Director, Michael Smith Genome Sciences Centre, BC Cancer Agency).

human genome at vastly increased rates. It has reduced the cost of genome sequencing from $50 million to $5,000.[131] According to Dr. Marra, Director of the Genome Sciences Centre, this DNA sequencer machine has the capacity to sequence accurately 3,000 human genomes annually.

The Committee heard that the use of this rapid DNA sequencer has led to the development of possible new treatments and diagnostic techniques for cancer. For example, Dr. Janessa Lakstin and Dr. David Huntsman from the B.C. Cancer Agency are using the sequencing of the genetic code of a rare cancer to evaluate which existing drugs, new drugs or new drug combinations could be used to treat the patient.[132] The Committee also heard that Centre for Translational and Applied Genomics, OvCaRe at the University of British Columbia is also using the rapid DNA sequencer to find mutations that drive and underpin several types of ovarian cancer, which has led to the development of new diagnostic strategies and will also lead to new treatments for this disease in the near future.[133]

In addition, the Committee learned that rapid DNA sequencing machines are also being used to understand the genetics of viruses and bacteria and their hosts to help create vaccines and treatments for communicable diseases, as well as understand why some people are susceptible to certain viruses and others are not.[134] According to Dr. Frank Plummer from the National Microbiology Laboratory at the Public Health Agency (PHAC) of Canada, collaboration with the Genome Sciences Centre and the B.C. Centre for Disease Control resulted in the genetic sequencing of the SARS coronavirus in 2003 and the H1N1 virus in 2009, as well as the sequencing of E. coli and listeriosis strains involved in certain disease outbreaks. Dr. Plummer also explained that other genetic engineering technologies are being used by the National Microbiology Laboratory to create new ways of developing vaccines for HIV, influenza and Ebola by genetically modifying harmless viruses in order to give them the properties of these diseases to elicit stronger immune responses. He further noted that the National Microbiology Laboratory is working with the private sector to commercialize these types of vaccines.

Finally, Dr. Aled Edwards from the Structural Genomic Consortium highlighted how genomic research is leading to the development of new pharmaceuticals.[135] Dr. Edwards explained to the Committee that one of the reasons why there is limited innovation occurring in the pharmaceutical industry in Canada and globally is because scientists do not have enough knowledge of basic human biology, as researchers in academia and

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131 Ibid.

132 Ibid.

133 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 4 December 2012, Meeting No. 68 (Dr. David Huntsman, Centre for Translational and Applied Genomics, University of British Columbia).

134 Ibid. (Dr. Frank Plummer, National Microbiology Laboratory, Public Health Agency of Canada).

135 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 5 March 2013, Meeting No. 77 (Dr. Aled Edwards, Director and Chief Executive Officer, Structural Genomics Consortium).

pharmaceutical companies tend to focus their research on the same genes rather than focusing on those genes that are less known. In order to address this issue, the Committee heard that Dr. Edwards has developed a new model for drug research called the Structural Genomics Consortium, which is a public-private partnership that focuses on genetic research and, in particular, genes that have not been studied yet. The Structural Genomics Consortium has two academic centres at the University of Toronto and the University of Oxford, and receives funding from the Canada Foundation for Innovation, CIHR, Genome Canada, the Government of Ontario, and pharmaceutical companies.

The Committee learned that the research produced by the Structural Genomics Consortium is not patented and could be used by pharmaceutical companies and other researchers to develop new drugs. The Committee heard that the Structural Genomics Consortium is responsible for producing over 25% of the world's whole domain of protein crystal structures.[136] Dr. Edwards explained to the Committee that the discoveries made by the Structural Genomics Consortium have led to the development of a drug called Gleevec, a drug that is effective in the treatment of chronic myelogeneous leukemia. He further explained that the Structural Genomics Consortium's open research model accelerates the development of drugs because it promotes collaboration between pharmaceutical companies and researchers and avoids the legal and financial hurdles associated with patent protection. Dr. Edwards explained that Canada could be a leader in this area by continuing to support and develop this new open access model for biomedical research, which would in turn attract increased investments by pharmaceutical companies in Canada.

Witnesses also identified ways in which further advancements in genomics research and personalized medicine could be realized. The Committee heard that that on-going access to large scale funding for research infrastructure through the Canada Foundation for Innovation is necessary, as it provides researchers with access to leading-edge technology that allows for further innovation in genomic sequencing.[137] Furthermore, on-going and more frequent investments in this area from the Canada Foundation for Innovation are necessary to ensure that the rapid DNA sequencer at the Genome Sciences Centre remains current.[138]

In addition, witnesses explained that Health Canada's regulatory system needs to be adapted in order for Canadians to realize the full benefits of personalized medicine. Witnesses said that physicians sometimes lack access to new drugs or combinations of drugs to be used in personalized medicine because they had not been approved by Health Canada for the specific purposes that physicians are seeking.[139] These witnesses noted

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136 Ibid. (Dr. Pierre Meulien, President and Chief Executive Officer, Genome Canada).

137 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 4 December 2012, Meeting No. 68 (Dr. David Huntsman, Centre for Translational and Applied Genomics, University of British Columbia).

138 Ibid.

139 Ibid.

that large scale phase III clinical trials currently used by the Department as the basis of its approvals would not work for approvals for drugs for personalized medicine, because personalized medicine focuses on the effectiveness of a drug in only one individual rather than the general population. According to these witnesses, the Department should begin brainstorming around how to address this issue, which will pose regulatory challenges in the future.[140]

D. Nanotechnology[141]

Finally, the Committee also heard about the application of nanotechnology to detect and treat diseases. According to witnesses, nanotechnology refers to the intentional design, synthesis, characterization, application of structures, devices and systems by controlling size and shape in the 1 to 100 nanometre range, which has a broad range of applications from computers to health. In particular, the Committee heard about how nanotechnology is being applied to the detection and treatment of cancer. For example, the Committee heard from Dr. Normand Voyer from the Université Laval, who is conducting research in the area of nanochemotherapeutics, which uses nanoscale toxins and proteins to puncture the membrane of cancer cells causing them to die. According to Dr. Voyer, the next phase of research is to focus on improving the selectivity of the killing of cells to ensure that the nanoscale toxins kill only cancer cells and not healthy cells. With respect to diagnostics, the Committee heard from Dr. Warren Chan, a Professor at the University of Toronto, that nanomaterials are being used to develop molecular scale barcodes that will be able to scan different kinds of proteins associated with diseases. According to Dr. Chan, efforts now were focusing on converting this technology into hand-held devices that would allow for diagnosis at the point of care.

Despite the potential of nanotechnology research for innovation in health care delivery, the Committee heard that there are some obstacles to realizing its benefits. Dr. Chan explained that there are challenges surrounding Health Canada's regulation of nanotechnology, including determining whether it should be regulated as a drug or a medical device. The Committee heard that the Department is currently regulating health-related applications of nanotechnology on a case-by-case basis. In addition, the Committee heard from Dr. Chan that nanotechnology research is not a priority in Canada in comparison to other countries such as the United States, South Korea and China. Dr. Normand Voyer explained that it is necessary for the Government of Canada to prioritize nanotechnology research because industry is less willing to fund this type of research, since discoveries in this area would only be able to be commercialized in the next 10 to 20 years. Prioritization of nanotechnology research would also help attract researchers into this field and build up Canadian capacity in this area. Dr. Chan and Dr. Voyer therefore recommended that the federal government establish a research

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140 Ibid.

141 Unless otherwise noted this section is based upon the following testimony: House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 4 December 2012, Meeting No. 68, (Dr. Normand Voyer, Professor, University of Laval, As an Individual and Dr. Warren Chan, Professor, University of Toronto, As an Individual).

funding agency, similar to Genome Canada, which would focus on supporting nanotechnology research and its applications in a broad range of areas, including health.

E. Committee Observations and Recommendations

The Committee's study revealed that discoveries resulting from genomics and nanotechnogy research are leading to innovation in the diagnosis, treatment and understanding of diseases and disorders. Similarly, the Committee learned that medical devices are being used to treat type 1 diabetes and gain insight into the function of the brain. The Committee also heard how the Canadian Light Source's synchrotron is helping to detect the three-dimensional structure of viruses and proteins related to various diseases, leading to the development of new drugs and vaccines. However, witnesses also highlighted some of the obstacles preventing Canada from fully realizing the benefits of innovations in medical devices, pharmaceuticals, genomics and nanotechnology. With respect to medical devices, the Committee heard from witnesses that Health Canada's regulatory system needs to be more responsive to the needs of small medical technology businesses, as well as ensure that its system is in line with those in other jurisdictions. Furthermore, the CADTH could also facilitate the adoption of medical devices into health care systems by coordinating HTAs across Canada, as well as sharing best practices in this area. Witnesses explained that the pharmaceutical industry in Canada and globally is not as innovative as it could be. They suggested that new models of drug development should be promoted and supported to drive innovation in this area. To ensure that Canada remains at the leading edge of advances in genomics, the Committee heard that on-going investments in genomic sequencing infrastructure is necessary, as well as ensuring that Health Canada's regulatory system is responsive to developments in personalized medicine and nanotechnology. Finally, the Committee heard that the federal government needs to continue to support nanotechnology research in order to both build capacity in this area, as well as to be able to realize the benefits of this technology in Canadian health care systems.

Reflecting these findings, the Committee therefore recommends that:

7. **Health Canada continue to identify efficiencies to reduce the burden that the regulatory system places on small- and medium-sized enterprises producing medical devices.**

8. **Health Canada continue its efforts to harmonize the regulatory system for pharmaceutical drugs and medical devices with those of other jurisdictions.**

9. **Health Canada ensure that its regulatory framework for pharmaceuticals and medical devices is responsive to developments in genomics, personalized medicine and nanotechnology.**

10. **The Canadian Agency for Drugs and Technologies in Health work with health technology assessment organizations across Canada to coordinate their activities and share best practices.**

11. **The Government of Canada continue to provide support for new models of drug development, such as the Structural Genomics Consortium.**

12. **The Government of Canada maintain its support for genomic sequencing infrastructure in Canada through the Canada Foundation for Innovation.**

13. **The Government of Canada continue to support nanotechnology research.**

CHAPTER 4: THE TREATMENT OF RARE DISEASES

This chapter provides an overview of Health Canada's proposed orphan drug framework, reviews some innovations in the treatment of rare diseases, and addresses strengths of and challenges facing Canadian research on rare diseases. The chapter concludes with the Committee's observations and recommendations to support innovation in research and treatment for rare diseases.

A. Rare Diseases in Canada[142]

Rare diseases are defined as diseases that affect less than one in 2000 individuals worldwide.[143] A specific rare disease may affect fewer than 12 people in Canada. Despite the low prevalence of individual rare diseases, however, because approximately 7,000 rare diseases have been identified, many Canadians are living with rare diseases. It is estimated that 1 in 12 Canadians has been diagnosed with a rare disease. Rare diseases are often serious chronic conditions that may be debilitating or even life-threatening. Many have very early onset and can be diagnosed in childhood. About 80% of rare diseases have a genetic basis.[144]

Rare diseases present challenges to patients, clinicians and researchers that are distinct from those associated with more common illnesses. From the patient's perspective, people living with rare diseases usually do not have access to the resources of charities, associations and support groups available to individuals living with common diseases. Patients may also experience years of misdiagnosis and social isolation.[145] Many clinicians including family physicians and paediatricians may not be sufficiently familiar with rare diseases to be able to diagnose them.[146] For researchers, the small population size makes conducting clinical trials of potential treatments very difficult.

The drugs that are used to treat rare diseases are referred to as "orphan drugs." Currently, there is no approval process for orphan drugs in Canada, so physicians face

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142 Unless otherwise noted, this section reflects testimony from: House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 2 May 2013, Meeting No. 85 (Mr. David Lee, Director, Office of Legislative and Regulatory Modernization, Policy, Planning and International Affairs Directorate, Health Products and Food Branch, Health Canada).

143 Health Canada, An Orphan Drug Framework for Canada, *News Release,* 3 October 2012.

144 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 2 May 2013, Meeting No. 85 (Dr. Durhane Wong-Rieger, President and Chief Executive Officer, Canadian Organization for Rare Disorders).

145 Darren J. Bidulka, Brief submitted by the Canadian Fabry Association, 10 May 2013.

146 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 2 May 2013, Meeting No. 85 (Dr. Durhane Wong-Rieger, President and Chief Executive Officer, Canadian Organization for Rare Disorders) and House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 7 May 2013, Meeting No. 86 (Ms. Jacquie Micallef, Manager, Member Relations, Policy & Partnerships, Neurological Health Charities Canada).

challenges in obtaining these drugs for patients. Health Canada announced on 3 October 2012, however, that it is developing a modern framework for orphan drugs in Canada.

B. Canada's Proposed Orphan Drug Framework

Mr. David Lee of Health Canada's Office of Legislative and Regulatory Modernization, Policy, Planning and International Affairs Directorate explained Health Canada's forthcoming orphan drug framework to the Committee.[147] The framework was specifically designed with the knowledge that rare diseases have "small, vulnerable patient populations." The framework is intended to allow Health Canada greater flexibility in the approval of orphan drugs, given the challenges associated with rare disease research.

First, the framework will align Canada's drug regulations with those established in the United States and Europe, which is intended to help scientists pool resources in rare disease research and treatment. Reduced regulatory barriers are also expected to facilitate international collaboration and enable increased innovation. Second, the framework will allow for increased post-market surveillance of orphan drugs to ensure their safety and effectiveness. Third, the framework will allow for patient input into the decision-making process. Most importantly, the proposed framework is intended to increase access to drug treatments for rare diseases. Mr. Lee reported that the Department would soon be engaging in public consultation on the framework and would incorporate feedback into the final framework proposal.

Each witness who appeared before the Committee to discuss rare diseases expressed strong support for the proposed orphan drug framework.

C. Innovations in the Treatment of Rare Diseases

At the same time that Health Canada announced its proposed orphan drug framework, it announced that the CIHR would fund Canada's participation in Orphanet, an international reference portal focused on rare diseases.[148] Dr. Micheil Innes, National Coordinator of Orphanet Canada explained to the Committee the innovation that Orphanet brings to the rare diseases community in Canada. Orphanet provides comprehensive information on rare diseases and is accessed over 20,000 times daily. The Canadian portal provides rare disease information in French and English, including an inventory of orphan drugs and a directory of services such as clinics, laboratories, research projects, registries and family support groups where available. Dr. Innes told the Committee that Orphanet can also be a particularly useful tool for primary care physicians who may not be familiar with rare diseases.

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147 Unless otherwise noted, this section reflects testimony from: House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 2 May 2013, Meeting No. 85 (Mr. David Lee, Director, Office of Legislative and Regulatory Modernization, Policy, Planning and International Affairs Directorate, Health Products and Food Branch, Health Canada).

148 Health Canada, *Harper Government Takes Action to Help Canadians with Rare Diseases - Launch of First Ever Canadian Framework to Increase Access to New Treatments and Information and Orphanet-Canada Online Portal*, News Release, 3 October 2012.

Dr. Innes also spoke more broadly about how advances in genetic technologies will lead to increased access and faster diagnosis for individuals with rare diseases.[149] For example, he explained that currently testing for one gene of the approximately 22,000 genes in the human genome costs between $1,000 and $3,000. However, individuals with rare diseases have to undergo multiple genetic tests to identify which specific gene they might have in order to determine which condition they have, which could cost in excess of $10,000. There are currently about 2,500 genes for which there are tests and of these, about 150 tests are available in Canada. Now with advances in new technology and next generation genome sequencing, which were described in chapter 3, it is possible to sequence the entire genetic code, which is the equivalent of having approximately 22,000 genes tested at once, at a cost ranging from $2,000-$3,000 for research purposes[150] to $5,000.[151]

Ms. Jacquie Micallef with the Neurological Health Charities Canada described an innovation that has been used to enable communication for non-verbal individuals.[152] She used the example of Rett syndrome, which is associated with certain physical and cognitive impairments, including an inability to speak. Ms. Micallef described a communication device based on eye gaze technology, which enabled a 25-year old woman, previously assumed to have the cognitive capacity of a six-month-old, to communicate preferences to her mother. For this woman and others living with similar challenges, this technology can contribute to greater autonomy and a better quality of life. Ms. Micallef reported that the technology was validated in a study of 100 individuals and has been used for children as young as three years of age.

In a brief submitted to the Committee, Mr. Darren Bidulka, President of the Canadian Fabry Association, described innovations that affect people suffering from Fabry disease.[153] Fabry disease is a rare condition that affects an estimated 362 known individuals in Canada. Without treatment, the disease leads to heart and kidney failure in early middle age, as well as strokes and other complications. Mr. Bidulka explained that the most recent innovations in Fabry treatment have led to enzyme replacement therapy, which addresses many of the complications associated with the disease. However, he suggested that additional innovations are needed as the treatment does not appear to address the risk of stroke and the enzyme replacement therapy requires intravenous treatment every two weeks.

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149 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 7 May 2013, Meeting No. 86 (Dr. Allan Micheil Innes, National Coordinator, Orphanet Canada).

150 Ibid.

151 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 4 December 2012, Meeting No. 68 (Dr. Marco Marra, Director, Michael Smith Genome Sciences Centre, BC Cancer Agency).

152 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 7 May 2013, Meeting No. 85 (Ms. Jacquie Micallef, Manager, Member Relations, Policy & Partnerships, Neurological Health Charities Canada).

153 Darren J. Bidulka, Brief submitted by the Canadian Fabry Association, 10 May 2013.

D. Strengths of and Challenges Facing Rare Disease Research and Treatment in Canada

The Committee heard from Dr. Durhane Wong-Reiger that Canada is a leader in genetic research, and given that 80% of rare diseases have a genetic basis, Canada is well-placed to make significant contributions to rare disease research.[154] She noted, however, that while Canada contributes heavily to our understanding of the mechanisms underlying rare diseases, especially through CIHR and Genome Canada, Canada is behind other nations in developing treatments and screening tests, particularly for newborns.

The Committee heard that that the rare disease community is one that relies on international collaboration, in part out of necessity because of the small patient populations, and in part because the small number of clinicians who specialize in a particular disorder often know each other.[155] Mr. David Lee suggested that the proposed orphan drug framework would be responsive to new developments in other countries, with safety data flowing from international sources, and consistency in regulations across international jurisdictions. Dr. Wong-Reiger noted that because of Canada's ethnic diversity and its "pockets of geographic isolation," a particular rare disease may be overrepresented, making Canada an ideal place to conduct rare disease clinical trials.

As Dr. Micheil Innes of Orphanet Canada explained to the Committee, one of the most difficult challenges for people living with rare diseases is getting a diagnosis; in fact, estimates suggest that over 50% of individuals with rare diseases do not have a correct diagnosis of their condition. Dr. Innes added that beyond the challenges of diagnosis, only about 200 therapies have been developed for thousands of rare diseases.

Both Ms. Micallef of the Neurological Health Charities Canada and Dr. Innes of Orphanet expressed concern about some of the social effects that advances in genetic testing might have on individuals found to have a genetic predisposition to certain rare disorders. Specifically, they expressed concern that given the increased availability of genetic testing, individuals found to have certain genetic differences might experience discrimination on that basis.

E. Committee Observations and Recommendations

The Committee heard that Health Canada has recently taken valuable steps toward increasing our understanding of rare diseases and increasing access to treatments for individuals living with rare diseases. It heard that Canadian researchers are international leaders in some areas of research of particular importance to rare diseases, but that more innovation is needed in the areas of screening and treatment. Given the importance of

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154 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 2 May 2013, Meeting No. 85 (Dr. Durhane Wong-Rieger, President and Chief Executive Officer, Canadian Organization for Rare Disorders).

155 Ibid.

diagnosis to individuals living with rare diseases, the Committee believes that innovation in this area must be fostered.

Reflecting these findings, the Committee therefore recommends that:

14. **Health Canada, in addition to its support of Orphanet, participate in and contribute to international rare disease registries to facilitate international cooperation on the treatment of rare diseases.**

15. **Canadian Institutes for Health Research and the Public Health Agency of Canada, in collaboration with the Networks of Centres of Excellence, consider identifying clusters of rare disease research in Canada, and consider formalizing some of them as Centres of Excellence within the Network.**

16. **Health Canada consider whether it is necessary to establish a framework for non-pharmaceutical treatments such as medical devices used to treat rare diseases in the orphan drug framework or whether it is necessary to create a parallel framework for non-pharmaceutical treatments.**

CHAPTER 5: THE PREVENTION AND MANAGEMENT OF CHRONIC DISEASES

This chapter provides an overview of innovations in the prevention and management of chronic diseases, as well as particular challenges related to innovation in these areas. It examines how many new technologies can contribute to increased self-management of chronic illnesses and reduce risk factors in healthy or at-risk individuals. The chapter concludes with the Committee's observations and recommendations about supporting and promoting the use of these technologies by Canadians.

A. Chronic Diseases in Canada and the Role Technology Can Play in their Prevention and Management

The Committee heard that increasing numbers of Canadians are living with or at risk of developing chronic illnesses. Two thirds of deaths in Canada are caused by four chronic illnesses: cancer, diabetes, cardiovascular and chronic respiratory diseases.[156] Three out of five Canadians currently live with a chronic disease, and four out of five have at least one risk factor—including physical inactivity, unhealthy diet, smoking and being overweight or obese.[157] The PHAC estimates that the financial burden of chronic diseases in Canada is at least $190 billion annually.[158] Many people living with chronic illness, particularly the elderly, suffer from more than one chronic condition.[159]

Witnesses also discussed the growing problem of risk factors. For example, Dr. Peter Selby of the University of Toronto noted the societal shift that has resulted in a move away from physical labour to driving to exercise at gyms.[160] He also commented on the availability of low-cost high-calorie foods, high rates of nicotine and alcohol use, and high-stress, low-sleep lifestyles, all of which increase predisposition to chronic illness. He noted that high-risk behaviours are "infections within communities."

Many of the risk factors for chronic disease are modifiable, however.[161] Many witnesses before the Committee argued that technological innovations could be

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156 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 April 2013, Meeting No. 84 (Hon. Mary Collins, P.C., Chair, Chronic Disease Prevention Alliance of Canada).

157 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 23 April 2013, Meeting No. 82 (Ms. Kim Elmslie, Director General, Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada).

158 Ibid.

159 Ibid. (Ms. Heather Sherrard, Vice-President Clinical Services, University of Ottawa Heart Institute).

160 Ibid. (Dr. Peter Selby, Associate Professor, Family and Community Medicine, Psychiatry and Dalla Lana School of Public Health, University of Toronto, As an Individual).

161 Ibid. and House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 April 2013, Meeting No. 84 (Hon. Mary Collins, P.C., Chair, Chronic Disease Prevention Alliance of Canada).

particularly useful in modifying health behaviours to reduce the incidence of or to manage chronic illnesses. They pointed to society's increased reliance on the Internet, on smartphones, and on social media as an opportunity to create tools for individuals to prevent and manage chronic illness. The Committee heard that in 2010, 80% of Canadian households had Internet access, and two-thirds of households use the Internet to find health information.[162] Further, 48% of Canadians use smartphones and 70% have downloaded apps; a third of these apps relate to health and fitness.[163] Witnesses suggested that technological innovations can help healthy individuals to manage their risk factors, reducing the incidence of chronic illness.[164] Further, technology can help those living with chronic illnesses to manage their conditions, reducing expensive hospital admittance.[165]

B. Innovative Technologies to Prevent or Manage Chronic Diseases

The Committee heard from Ms. Kim Elmslie of the PHAC about a new initiative to prevent type 2 diabetes.[166] The program, called CANRISK, is a web-based assessment tool to identify individuals at risk of developing diabetes. CANRISK is also available as a mobile app. The aim of CANRISK is to identify people at risk for diabetes and to educate them about modifiable risk factors in order to prevent high-risk individuals from developing type 2 diabetes. Although the tool is widely available to the public on PHAC's website, CANRISK was rolled out in partnership with pharmacies so that pharmacists can help clients take the test, while educating and counselling clients about their risk factors and about making healthier choices in the process.

The Committee heard from Ms. Heather Sherrard, Vice-President Clinical Services with the University of Ottawa Heart Institute, about the e-health strategy the Heart Institute has implemented for its cardiac patients.[167] The first element of the strategy is telemedicine. Cardiologists in Ottawa are able to consult patients as far away as Nunavut using tools such as an electronic stethoscope that can be used to listen to heart sounds

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162 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 23 April 2013, Meeting No. 82 (Dr. Peter Selby, Associate Professor, Family and Community Medicine, Psychiatry and Dalla Lana School of Public Health, University of Toronto, As an Individual).

163 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 April 2013, Meeting No. 84 (Hon. Mary Collins, P.C., Chair, Chronic Disease Prevention Alliance of Canada).

164 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 23 April 2013, Meeting No. 82 (Dr. Peter Selby, Associate Professor, Family and Community Medicine, Psychiatry and Dalla Lana School of Public Health, University of Toronto, As an Individual), House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 April 2013, Meeting No. 84 (Hon. Mary Collins, P.C., Chair, Chronic Disease Prevention Alliance of Canada and Mr. Dale Friesen, Chief Executive Officer, Beagle Productions).

165 House of Commons Standing Committee on Health, Evidence, 1st Session, 41st Parliament, 23 April 2013, Meeting No. 82 (Ms. Heather Sherrard, Vice-President Clinical Services, University of Ottawa Heart Institute and Dr. Robyn Tamblyn, Scientific Director, Institute of Health Services and Policy Research, Canadian Institutes of Health Research).

166 Ibid. (Ms. Kim Elmslie, Director General, Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada).

167 Ibid. (Ms. Heather Sherrard, Vice-President Clinical Services, University of Ottawa Heart Institute).

remotely. The second component is a home-monitoring device that connects to patients' phone jacks, and can relay patients' vital signs to their care providers. The final element is an automated calling system developed by clinicians that asks patients questions their care providers would ask in a follow-up visit. Patients' responses are converted to text, which is then reviewed by nurses. If a nurse finds a problematic response, he or she follows up with the patient. Ms. Sherrard noted that the Heart Institute was able to save $340,000 in its first year of running this strategy.

Dr. Robyn Tamblyn of the CIHR described to the Committee several "catalyst grants" that funded projects that used innovative approaches to improve patient quality of life. For example, the CIHR funded a program at Toronto's Hospital for Sick Children that established a peer-to-peer mentoring system for children with juvenile arthritis, and a McGill-based cardiovascular risk e-health tool. In order for these small grants to be effective, Dr. Tamblyn argued, Canada needs "a high-functioning science and technology innovation system" with an alignment between industry, research and clinical care.

Dr. Richard Birtwhistle, Scientific Director of the Technology Evaluation in the Elderly Network described the Canadian Primary Care Sentinel Surveillance Network, which has been funded by PHAC since 2008.[168] The network includes 420 participant physicians who contribute data on almost half a million patients who have one of eight different chronic diseases, tracking information such as weights and blood pressures. The network facilitates disease monitoring, quality improvement and research, and allows for feedback to physicians on how they are managing their patients' illness.

The Committee heard from Dr. Saul Quint of INTERxVENT Canada, a business that provides products and services to health care professionals and patients based on behavioural learning theories to facilitate the adoption of healthy lifestyles.[169] INTERxVENT is a platform based on a self-reported health risk assessment supported by laboratory tests and biometric testing. The platform identifies users as low-, medium- or high-risk, and then develops individualized online self-help interventions. These interventions may include support for nutrition, weight management, physical activity, stress management, tobacco cessation, medication management, diabetes and depression, and may include the support of a health coach.

The Committee heard from Dr. Victor Ling, President of the Terry Fox Cancer Research Institute, which is a virtual institute with 55 member organizations, including all the major universities, cancer research centres and cancer hospitals across the country.[170] One of the Institute's initiatives was to find a means of early detection for lung cancer, which kills more people worldwide than breast, prostate and colon cancers combined. The Institute created a web-based assessment tool that asked about smoking behaviours

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168 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 25 April 2013, Meeting No. 83 (Dr. Richard Birtwhistle, Scientific Director, Technology Evaluation in the Elderly Network).

169 Ibid. (Dr. Saul Quint, Chief Executive Officer, INTERxVENT Canada, Interxvent).

170 Ibid. (Dr. Victor Ling, President and Scientific Director, Terry Fox Cancer Research Institute).

and other demographic variables that are correlated with the development of lung cancer. The assessment tool was able to detect early-stage lung cancer in 5% of patients before they developed symptoms, which was a three-fold improvement on comparable early assessment models based on medical interventions.

Dr. Ken Milne of the Gateway Rural Health Research Institute described an innovative approach to information dissemination to front-line rural physicians. The Institute developed "Just out of the Gate," or JOG, through which the Institute gathers up-to-date research, conducts an evidence-based review of the data, then podcasts the new information to rural physicians. It also validated an app, called the REALM, ("rapid estimate of adult literacy in medicine"). The app takes 10 seconds to evaluate a patient's health literacy, which can improve patient-physician interactions by allowing the physician to adapt the information he or she provides to a level the patient will understand.

Mr. Dale Friesen of Beagle Productions, a business that specializes in the design and development of web applications described "wellness accounts," which are created as part of an online community and allow users to track their health behaviours.[171] When a company makes this tool available to its employees, employees fill out questionnaires and health risk assessments, and have biometric data uploaded to their account. Employees can then set goals and track fitness, weight loss, nutrition, connect with a coach, and collect health reward points to be used in a health store. Users input and access data through their smartphones. There is easy access to exercise tips and recipes, and users are prompted with reminders if they have not logged in recently. There can be team challenges and leaderboards to encourage team building while adopting healthier lifestyles.

C. Some Advantages and Challenges of Using Technological Innovations to Prevent and Manage Chronic Diseases

Witnesses discussed advantages and challenges of using innovative technologies in preventing and managing chronic illness.

1. Reducing Geographic Barriers

The Committee heard that although estimates vary depending on the definition used, between one in five and nearly one in three Canadians lives in a rural area.[172] Individuals living in rural and remote areas suffer from higher rates of chronic illness than do urban residents, and they have lower life expectancies.[173] The Committee learned about the great potential for technological innovations to contribute to better access to care for rural and remote residents.

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171 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 April 2013, Meeting No. 84 (Mr. Dale Friesen, Chief Executive Officer, Beagle Productions).

172 Ibid.

173 Ibid. (Dr. Feng Chang, Chair, Rural Pharmacy, Gateway Rural Health Research Institute).

The University of Ottawa Heart Institute's strategy discussed earlier has provided a means for Canadians across the country to access the expertise of the Heart Institute. Patients are given home monitors that they simply ship back to the Heart Institute when their observation period is over.[174] Patients from remote locations can experience social isolation while receiving treatment at the Institute. The Institute's strategy helps reduce geographical barriers between family members when patients must be treated on-site by connecting families and patients through the same telemonitoring stations used for remote consultations.

As Dr. Robyn Tamblyn of CIHR noted, telehealth can be a very valuable tool for increasing access for individuals living in rural and remote areas, but even small geographical distances can be major barriers to effective care. She argued that even individuals living in major urban areas could receive enhanced care when their health care providers can monitor them at home, and patients with chronic illnesses would not have to make repeated trips to clinics and other care facilities.

2. Financial Barriers to Accessing Health Technologies

Many witnesses discussed Internet-based tools and smartphone apps that are used in the prevention or management of chronic diseases. While these may be readily available technologies for some individuals, there are costs associated with their use, which may, for some patients, render the technologies inaccessible. In some cases, as in the Ottawa Heart Institute's strategy, the cost savings associated with a particular technology may be so great that the health care provider can absorb the costs associated with any necessary devices meaning no direct cost to patients.[175]

As Dr. Ken Milne of the Gateway Rural Health Research Institute noted, some of the patients least likely to have easy access to smartphone and Internet-based solutions are those with lower socio-economic status who may have limited literacy, or limited health literacy, and who are often the most frequent users of hospital emergency department services. Dr. Robyn Tamblyn of CIHR suggested that in some cases, it may be more cost-effective in the longer term to subsidize technologies at the outset where patients cannot afford to invest themselves than to pay for patients' care as their health deteriorates. Dr. Peter Selby suggested that a way of addressing the "digital divide" or the discrepancy in access to Internet-based health technologies between individuals of different socio-economic status might be to increase access to these tools in public places such as libraries and health care centres.

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174 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 23 April 2013, Meeting No. 82 (Ms. Heather Sherrard, Vice-President Clinical Services, University of Ottawa Heart Institute).

175 Ibid.

3. Physical and Cognitive Barriers to Accessing Health Technologies

The Committee heard about the importance of ensuring that patients are able to use the technological innovations that are designed for them. For example, Ms. Sherrard of the Ottawa Heart Institute explained that some equipment the Institute had provided to monitor cardiac patients is presenting challenges to patients with arthritis who lack the necessary dexterity to use the equipment and find it painful to use. She also noted that in the automated calling platform the Institute uses, it is possible to slow down the questioning for patients with mild dementia to give them more time to answer. Dr. Feng Chang of the Gateway Rural Health Research Institute described challenges with health apps developed for seniors. Specifically, she said the volume on some of the apps is too low for individuals with hearing loss, and the navigation buttons that seemed self-explanatory to the developers are not intuitive for those seniors who are not familiar with common software programs.[176]

4. Scientific Validation for Self-Management Tools

The Committee heard from many witnesses about the wide array of self-management tools available to the public that could either promote healthy choices, thus reducing the risk of chronic illness, or that could help individuals with chronic illnesses monitor their condition. When Ms. Elmslie of PHAC described CANRISK, she noted that a critical aspect of the program is that the tool is scientifically validated. She argued that there should be a great deal more research done on the science underlying e-health apps used to help patients prevent or manage chronic diseases to be sure they do "more good than harm."

Similarly, the Ottawa Heart Institute tested the automated calling component of its strategy (described earlier) in a randomized controlled trial of 1200 patients, and found that individuals who received a call were statistically more likely to be on best practice medications and less likely to be readmitted after a year.[177]

Dr. Robyn Tamblyn of CIHR noted that it is important for government to be involved in the entire process of development from innovation through to evaluation in order to provide sound guidance on scientifically validated tools. The Honourable Mary Collins, Chair of the Chronic Disease Prevention Alliance of Canada also argued for quality control, and for government identification of scientifically valid information and tools. Dr. Feng Chang noted that this type of initiative has been undertaken in Europe in the form

176 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 April 2013, Meeting No. 84 (Dr. Feng Chang, Chair, Rural Pharmacy, Gateway Rural Health Research Institute).

177 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 23 April 2013, Meeting No. 82 (Ms. Heather Sherrard, Vice-President Clinical Services, University of Ottawa Heart Institute).

of the *European Directory of Health Apps (2012-2013),*[178] which identifies recommended apps for patients and for various health care professionals.

5. When to Refrain from Using Technology

Dr. Richard Birtwhistle of the Technology Evaluation in the Elderly Network reminded the Committee that although technological innovations can be very beneficial, in end of life care, the unwanted use of technology can negatively affect quality of life for both patients and their families, and can in fact prolong suffering. Dr. Birtwhistle explained that for seriously ill elderly patients, technological innovations are sometimes used to prolong life for individuals in a very poor state. He stressed the need for communication with health care providers about decision making surrounding the use of life-sustaining technologies.

D. Committee Observations and Recommendations

The Committee's study of the role of innovative technologies in the prevention and management of chronic diseases revealed that there is an abundance of technologies designed to support and encourage healthy behaviour among individuals whether they are healthy, at-risk, or living with chronic illnesses, but not all these technologies are equally effective. PHAC representatives told the Committee that it sees a role for the federal government in supporting and promoting the use of innovative technologies by identifying and scaling up best practices across Canadian jurisdictions.

Further, witnesses emphasized the importance of health literacy in preventing chronic illness. They suggested that investing in health literacy could result in Canadians making better lifestyle choices and being better equipped to make medical decisions with their health care providers, thus reducing their risk of developing chronic diseases.

Reflecting these findings, the Committee therefore recommends that:

17. The Public Health Agency of Canada and the Canadian Institutes for Health Research consider ways to facilitate the sharing of best practices among industry, researchers and clinicians with respect to technological innovations in chronic disease prevention and management.

18. Health Canada and the Public Health Agency of Canada continue to promote health literacy with a view to empowering patients to take steps to prevent and manage chronic illness.

178 *European Directory of Health Apps 2012–2013: A review by patient groups and empowered consumers, Patient View*, 2011–2012.

CHAPTER 6: MANAGING THE COSTS ASSOCIATED WITH THE ADOPTION OF TECHNOLOGICAL INNOVATIONS IN HEALTH CARE

The Committee's study showed that technological innovation has brought many benefits to health care delivery in terms of new ways of diagnosing, treating and understanding diseases. Furthermore, technological innovations in e-health and telehealth are improving access to health care for many Canadians, while reducing costs to health care systems. While witnesses saw investments in technological innovation as providing overall benefits to health care, the Committee also learned about the costs associated with the adoption of these innovations. This chapter focuses on the costs associated with the adoption of technological innovations in health care, as well as identifies ways to address these costs, as presented by the witnesses.

A. Overview of the Costs Associated with the Adoption of Technological Innovations in Health Care[179]

Witnesses provided the Committee with an overview of the direct costs associated with the adoption of different types of health technologies in their respective health care organizations. The Committee heard from Andrew Williams, President and Chief Executive Officer of the Huron Perth Healthcare Alliance that the adoption of MRI units, a common medical technology, cost $3.4 million for the purchase of the equipment and $800,000 per year in operating costs. He explained that his annual budget for information technology is $2.8 million and reflects 2.2% of the Alliance's total annual budget. He said that annual IT budgets for other hospitals in his region range between 1.8% and 5.8% of total budgets. He noted that for his group of rural hospitals to have the complete adoption of a mature EMR system, a further investment of $2 million would be necessary along with three years of planning.

Other witnesses highlighted the fact that there are also indirect costs associated with the adoption of technologies. Branden Shepitka, the lead for the implementation of EMRs in the Emergency Department of Health Sciences North, explained that his organization faced large infrastructure costs associated with the implementation of IT projects. For example, the emergency departments, when initially constructed, lacked Ethernet connections and power outlets for computer stations, which are now being installed at significant cost because much of this work has to occur during night-time hours so as not to disrupt patient care. Furthermore, he explained that an additional $2 to $3 million would be required to implement a wireless network so that health care providers could use hand-held devices. Carolyn McGregor, Canada Research Chair in Health Informatics at the University of Ontario Institute of Technology, also explained that IT

179 Unless otherwise noted, testimony provided in the section reflects the following document: House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 16 April 2013, Meeting No. 80.

budgets need to include funds to support clinicians and informaticians in integrating the new technologies into their work practices.

The Committee also heard from Dr. Steven Morgan, Associate Professor at the Centre for Health Services and Policy Research at the University of British Columbia, that pharmaceutical drugs represent one of the largest costs of health care systems today, larger than all the care provided by physicians.[180] According to the Canadian Institutes of Health Information (CIHI), pharmaceuticals accounted for 15.9% of total health care costs in 2012, amounting to $33 billion in total or $947 per patient.[181] In addition, Dr. Morgan also explained that CIHI data shows that pharmaceutical costs were the fastest growing component of health care costs between 1980 and 2005, growing almost eleven-fold.[182] Finally, he noted that as of 2010, per capita spending on pharmaceuticals in Canada exceeded the median of per capita spending in the seven countries used by the Patented Medicine Prices Review Board to monitor drug prices in Canada, by $280.[183]

B. How to Manage the Costs Associated with the Adoption of Health Technologies

1. Determining Value for Money

Witnesses stressed the importance of HTAs in providing policy makers with the information necessary to make decisions regarding the value for money of different health technologies. Witnesses applauded the work of the CADTH in this area, particularly the Common Drug Review, which evaluates the clinical and cost effectiveness of different pharmaceuticals and makes recommendations as to whether they should be covered by publicly funded drug coverage programs.[184]

One witness suggested that developing a stricter regulatory process for medical devices would also help determine value for money in this area, as well as eliminate unnecessary costs to the health care system in the utilization of these devices.[185] Dr. Pascal-A Vendittoli, from the Université de Montréal, whose research focuses on the clinical assessment of new implant technologies for hip replacements, explained that his research had found that some of the newer implants approved by Health Canada are much costlier than conventional implants, but have higher failure rates, resulting in poorer health outcomes for patients and higher costs to health systems. He believed that this problem could be addressed by stricter regulation by Health Canada, which would limit the

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180 House of Commons Standing Committee on Health, *Evidence,* 1st Session, 41st Parliament, 19 March, 2013, Meeting No. 79 (Dr. Steve Morgan, Associate Professor, University of British Columbia).

181 Canadian Institutes of Health Information (CIHI), Growth in Drug Spending Continues to Slow, 11 April 2013.

182 Ibid.

183 Ibid.

184 House of Commons Standing Committee on Health, *Evidence,* 1st Session, 41st Parliament, 19 March 2013, Meeting No. 79 (Dr. Steve Morgan, Associate Professor, University of British Columbia and Dr. Marc-André Gagnon, Assistant Professor, School of Public Policy and Administration, Carleton University).

185 House of Commons Standing Committee on Health, *Evidence,* 1st Session, 41st Parliament, 16 April 2013, Meeting No. 80. (Dr. Pascal-A Vendittoli, Professor of Surgery, Université de Montréal, As an Individual).

number of these devices on the market to those that are most clinically effective. He suggested that approval processes for medical devices should have similar data requirements as the approval processes for pharmaceuticals, including: pre-clinical trial data and additional tests and studies, such as preclinical tests, high precision metrics using small groups of patients, as well as randomized control trials. He also suggested that Health Canada establish a national registry for post-market approval surveillance of these devices.

He explained that this approach to the introduction of new technologies, called the "Stepwise Introduction of Innovation into Orthopedic Surgery" had been developed and implemented in Sweden and had successfully reduced the revision rate or the reoperation rate for patients with hip and knee implants in comparison to other countries, who had not introduced this strategy:

> In this first slide, if you compare the revision rate or the reoperation rate of patients in the in the U.S.A versus Sweden, you can see that the Swedish action taken on the introduction of new technology was very effective, and I would say in Europe there is a broad change to move forward with the evolution of new technology, including precision technology.[186]

The Committee notes that the testimony received from this witness contradicts earlier testimony, which focused on the challenges that small businesses face in navigating Health Canada's current medical devices regulations, as well as the costs associated with those regulations.

Finally, Dr. Doug Coyle, a Professor at the University of Ottawa, also explained that determining the value for money of health technologies should also take into account other health care services that may be more clinically and cost-effective than those produced by industry, such as physiotherapy, chiropractic services, exercise programs, home visits by public health nurses, respite services and mental health services.[187]

2. Managing the Costs of Pharmaceutical Drugs

Witnesses identified specific ways to help manage the costs of pharmaceuticals. The Committee heard cost savings could be realized through national bulk purchasing strategies. For example, the Committee heard from the Canadian Health Coalition that national bulk purchasing of plasma products had saved the Canadian Blood Services $160 million over three years.[188] Dr. Steven Morgan explained that a national strategy for bulk purchasing for pharmaceuticals would be necessary to negotiate lower prices for new specialized drugs that are expected to cost hundreds of thousands of dollars per

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186 Ibid.

187 Ibid. (Dr. Doug Coyle, Professor, University of Ottawa, As an Individual).

188 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 1 November 2012, Meeting No. 62 (Mr. Michael McBain, Canadian Health Care Coalition).

patient.[189] Dr. Marc-André Gagnon from Carleton University suggested that different types of drug pricing policies could be adopted, such as reference-based pricing, which establishes a base price for a certain category of pharmaceuticals based upon their therapeutic value, or value-based pricing which determines the price of pharmaceuticals based upon their ability to achieve specific patient outcomes.[190] Finally, some witnesses also suggested that the cost of medications could be addressed by examining the prescribing behaviour of physicians.[191] However, two witnesses argued that many of these strategies would not be as effective unless the federal government played a leadership role in managing pharmaceuticals, which could be achieved through a national framework for pharmaceutical management and/or the establishment of national universal public drug plan.[192]

3. Using Patient Modelling to Implement Technological Innovations[193]

Dr. Carolyn McGregor explained to the Committee that patient modelling could be used by health care organizations to implement electronic health information systems and other technologies in an efficient way. She explained that "patient journey modelling" uses business processes to create diagrams that show the path that a patient takes through the health care system, including what health care workers they see, what steps and procedures are performed and which technologies are needed or used to support their care. It allows health care organizations to examine how new technologies can be integrated with existing ones, as well as identify how to increase efficiencies and streamline processes to improve patient outcomes. The Committee heard that patient modelling had been successful in promoting the adoption of EMRs in two mental health service providers in Ontario: Ontario Shores in Whitby and Providence Care in Kingston.

C. Committee Observations and Recommendations

While the costs associated with technological innovation in health care were considered by witnesses to be investments in better health care delivery, they also believed that it is important to determine the value for money of different health technologies in order to make best use of public funds. HTAs were seen as of great value in this area, particularly in relation to pharmaceutical drugs. However, the Committee heard from one witness that there is a need for better evaluation and regulation of medical

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189 House of Commons Standing Committee on Health, *Evidence,* 1st Session, 41st Parliament, 19 March 2013, Meeting No. 79 (Dr. Steve Morgan, Associate Professor, University of British Columbia).

190 Ibid. (Dr. Marc-André Gagnon, Assistant Professor, School of Public Policy and Administration, Carleton University).

191 Ibid. and House of Commons Standing Committee on Health, *Evidence,* 1st Session, 41st Parliament, 1 November 2012, Meeting No. 62 (Mr. Michael McBain, Canadian Health Care Coalition).

192 House of Commons Standing Committee on Health, *Evidence,* 1st Session, 41st Parliament, 19 March 2013, Meeting No. 79 (Dr. Steve Morgan, Associate Professor, University of British Columbia) and House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 1 November 2012, Meeting No. 62 (Mr. Michael McBain, Canadian Health Care Coalition).

193 House of Commons Standing Committee on Health, *Evidence,* 1st Session, 41st Parliament, 16 April 2013, Meeting No. 80. (Dr. Carolyn McGregor, Professor, University of Ontario Institute of Technology).

devices and in particular implants for hip surgery, by Health Canada, which could also reduce costs associated with these devices. The Committee therefore recommends that:

19. **Health Canada review its requirements for the regulation of medical devices to ensure that it is receiving sufficient data that takes into account the short- and long-term health outcomes of patients.**

CHAPTER 7: PROMOTING TECHNOLOGICAL INNOVATION IN HEALTH CARE IN CANADA

This chapter focuses on identifying ways that the federal government could promote technological innovation in Canada, including funding research and development activities; addressing obstacles to commercialization by increasing access to venture capital and business expertise; and fostering collaboration among academic institutions, industry, governments, health care organizations, and patient stakeholders through public-private partnerships.

A. Research and Development

According to the Organisation for Economic Cooperation and Development's (OECD) 2002 *Frascati Manual*, Research and Development (R&D) consists of three forms of research: basic research, applied research and experimental developments.[194] The Committee heard from witnesses that in order to promote the development of new health technologies, it is important that the federal government maintain its funding for basic health research.[195] Basic research is defined by the *Frascati Manual* as the "experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view."[196] According to scientists appearing before the Committee, basic research is the source of the development of innovative health technologies, as they are derived from efforts to understand the basic laws of physics, chemistry and biology and apply them to important medical questions.[197] They explained that the development of their innovative drugs and devices had resulted from their basic research.[198] They further articulated that funding for basic research needed to come from public sources, as the

194 Organization for Economic Co-operation and Development, Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development, 6th edition, p. 30.

195 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 4 December 2012, Meeting No. 68 (Dr. Warren Chan, Professor, the University of Toronto, As an Individual, Dr. Normand Voyer, Professor, Université Laval, As an Individual, and Dr. Frank Plummer, Chief Science Officer, National Microbiology Laboratory, Public Health Agency of Canada) and House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 October 2012, Meeting No. 61 (Dr. Ravi Menon, Professor and Canada Research Chair, Robarts Research Institute, University of Western Ontario and Dr. Josef Hormes, Executive Director, Canadian Light Source).

196 Organization for Economic Co-operation and Development, *Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development*, 6th edition, p. 30.

197 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 October 2012, Meeting No. 61 (Dr. Ravi Menon, Professor and Canada Research Chair, Robarts Research Institute, University of Western Ontario and Dr. Josef Hormes, Executive Director, Canadian Light Source).

198 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 4 December, 2012, Meeting No. 68 (Dr. Normand Voyer, Professor, Université Laval, As an Individual) and House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 October 2012, Meeting No. 61 (Dr. Ravi Menon, Professor and Canada Research Chair, Robarts Research Institute, University of Western Ontario).

funding of basic research is often considered too risky for industry to invest in, as there may not be an immediate financial payoff from these efforts, as one witness noted: "Canadian venture capital companies will not take this risk. This is the role of government to seed innovation in the laboratory, even when you do not know what it will yield or when it will yield it."[199] Furthermore, the Committee heard that if basic research in Canada is funded by international companies, Canadian researchers could also lose their rights to commercialize their discoveries.[200]

The Committee heard that it is also important to foster applied research, as well as experimental development research, in order to promote innovation in Canada. Applied research is defined by the OECD's 2002 *Frascati Manual* as original investigation applied towards a specific objective or problem, while experimental development is the application of existing knowledge towards the production of new materials, products or devices, or processes or systems.[201] According to Mr. John Soloninka, President and Chief Executive Officer of the Health Technology Exchange, it is also necessary for federal research granting agencies, such as CIHR, to focus on supporting research that transforms basic scientific knowledge into something that can be used in clinical practice or sold as a product in order to receive possible returns on the public investments made in basic research, such as improved health outcomes for Canadians, economic growth, and savings to health care systems.[202]

The Committee's study revealed that it is necessary to provide incentives to Canadian academics to foster applied and experimental development research in Canada. A written submission provided by Dr. D. Lorne Tyrrell from the Canadian Academy of Health Sciences explained that there is some reluctance on the part of Canadian academics to focus on how to translate their discovery research into innovative applications, as the academics believe that they either lack the experience or knowledge necessary to do so and/or believe that innovation is secondary to basic research.[203] Consequently, the brief explained that there is a need for a cultural shift in the mindset of Canadian academics to focus on translating their research to realize commercial benefits.[204]

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199 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 October 2012, Meeting No. 61 (Dr. Ravi Menon, Professor and Canada Research Chair, Robarts Research Institute, University of Western Ontario).

200 Ibid.

201 Organization for Economic Co-operation and Development, *Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development*, 6th edition, p. 30.

202 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 7 February 2013, Meeting No. 72, (Mr. John Soloninka, President and Chief Executive Officer, Health Technology Exchange).

203 Dr. D. Lorne Tyrrell, Director of the Li Ka Shing Institute of Virology, Fellow of the Canadian Academy of Health Sciences, "House of Commons Standing Committee on Health Agenda: *Technological Innovation*," Brief submitted to the House of Commons Standing Committee on Health, May 2013.

204 Ibid.

Witnesses provided some recommendations in order to promote applied research and experimental development in Canada. They suggested that academics receive training and support to help them write patent applications, as well as have universities include patents as part of the criteria for tenure for professors.[205] The Committee also heard that academics face high patent application costs ranging from $10,000 for initial patents and up to $80,000 to file patents world-wide.[206] Similarly, other witnesses recommended that the Canada Research Chairs Program include "Canada Innovation Chairs" to recognize achievements in the commercialization of research.[207] Finally, Professor Adam Holbrook, Associate Director for the Centre for Policy Research on Science and Technology at Simon Fraser University also explained that there is a need for a common intellectual property regime in Canadian universities, as intellectual property regimes in academic institutions are inconsistent across the country.[208] Consequently, the Committee heard that industry is reluctant to partner with academic institutions on research and development projects.[209] He therefore recommended that federal research granting agencies develop national intellectual property guidelines that could be adopted voluntarily by universities.

B. Commercialization and Venture Capital

Commercialization is the means by which an idea or prototype is transformed into a market-ready product and is the core of the process by which an invention becomes a business innovation.[210] Witnesses identified ways that the federal government could promote the commercialization of health technologies, including increasing access to venture capital and business expertise and promoting collaborations among academic institutions, industry, governments and health care organizations through public-private partnerships.

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205 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 4 December 2012, Meeting No. 68 (Dr. Normand Voyer, Professor, Université Laval, As an Individual) and House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 October 2012, Meeting No. 61 (Dr. Donald Weaver, Professor, Dalhousie University, As an Individual).

206 Dr. D. Lorne Tyrrell, Director of the Li Ka Shing Institute of Virology, Fellow of the Canadian Academy of Health Sciences, "House of Commons Standing Committee on Health Agenda: *Technological Innovation*," Brief submitted to the House of Commons Standing Committee on Health, May 2013.

207 Dr. Geoff Fernie, Toronto Rehabilitation Institute, University Health Network, "Commercialization of Innovations via Small and Medium Sized Businesses," Brief submitted to the House of Commons Standing Committee on Health, 21 May 2013.

208 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 7 March 2013, Meeting No. 78 (Dr. Adam Holbrook, Associate Director for the Centre for Policy Research on Science and Technology, Simon Fraser University, As an Individual).

209 Ibid.

210 Government of Canada, *Innovation Canada: A Call to Action – Review of Federal Support to Research and Development – Expert Panel Report*, 2011.

1. Access to Venture Capital and Business Expertise

Witnesses identified access to venture capital and business expertise as one of the main challenges facing the commercialization of health technologies in Canada.[211] According to Mr. Paul Kirkconnell from the Business Development Bank of Canada (BDC), a federal Crown corporation, the amount of venture capital available in Canada declined over the past 10 years from a high of nearly $4 billion in the late 1990s to $1.5 billion in 2012, because of the global financial crisis.[212] The Committee heard that a shortage of start-up and seed-stage capital in the life sciences in Canada means that many innovative ideas remain in the laboratory.[213] Start-up or seed-stage capital is used to fund activities in the early stage of commercialization, such as applying for patents, proof-of-concept,[214] product development and initial marketing.[215] According to Dr. Ilse Treurnicht, Chief Executive Officer of MaRS Discovery District, seed-stage capital is critical because it brings the new product to a level where it becomes less risky to invest in and can therefore attract further investment from venture capitalists either in Canada or abroad.[216] She further noted that it is at the seed stage that governments typically step in because it is the most difficult stage, a stage which other witnesses referred to as "the valley of death".[217]

The Committee also heard from witnesses that once small companies pass the initial start-up stage, they continue to face challenges accessing venture capital as they

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211 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 7 February 2013, Meeting No. 72 (Dr. Ilse Treurnicht Chief Executive Officer of MaRS Discovery District and Mr. John Soloninka, President and Chief Executive Officer, Health Technology Exchange) and House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 October 2012, Meeting No. 61 (Dr. Donald Weaver, Professor, Dalhousie University, As an Individual and Dr. Ravi Menon, Professor and Canada Research Chair, Robarts Research Institute, University of Western Ontario) and Dr. D. Lorne Tyrrell, Director of the Li Ka Shing Institute of Virology, Fellow of the Canadian Academy of Health Sciences, "House of Commons Standing Committee on Health Agenda: *Technological Innovation*," Brief submitted to the House of Commons Standing Committee on Health, May 2013.

212 Mr. Paul Kirkconnell, Executive Vice-President, Venture Capital, Business Development Bank of Canada, "Speaking Remarks," Submitted to the House of Commons Standing Committee on Health, 21 May, 2013.

213 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 October 2012, Meeting No. 61 (Dr. Ravi Menon, Professor and Canada Research Chair, Robarts Research Institute, University of Western Ontario) and Dr. D. Lorne Tyrrell, Director of the Li Ka Shing Institute of Virology, Fellow of the Canadian Academy of Health Sciences, "House of Commons Standing Committee on Health Agenda: Technological Innovation," submitted to the House of Commons Standing Committee on Health, May 2013.

214 Proof-of-Concept refers to a demonstration of the real world viability of a product or service and can include the development of a prototype. Technopedia, What is Proof of Concept.

215 Government of Canada, *Innovation Canada: A Call to Action – Review of Federal Support to Research and Development – Expert Panel Report*, 2011.

216 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 7 February 2013, Meeting No. 72 (Dr. Ilse Treurnicht, Chief Executive Officer of MaRS Discovery District).

217 Dr. D. Lorne Tyrrell, Director of the Li Ka Shing Institute of Virology, Fellow of the Canadian Academy of Health Sciences, "House of Commons Standing Committee on Health Agenda: Technological Innovation," submitted to the House of Commons Standing Committee on Health, May 2013.

grow.[218] Consequently, they license their products to other companies outside the country, which often leads to a relocation of jobs and economic benefits of the innovation. For example, the Committee heard how Canadian researchers developed a micro CT scanner technology and established a company called EVS to commercialize their product. However, the researchers were unable to raise enough capital to grow the company resulting in it being sold to General Electric, which eventually sold it to another company, Gamma Medica Inc., which moved the company and its jobs to California.[219]

In addition to accessing venture capital, Dr. Treurnicht also explained that start-up companies require sophisticated business expertise to execute partnerships with large companies, deal with intellectual property issues, attract capital and have an understanding of and be able to translate a highly specialized science to the business community.[220] Mr. John Soloninka from Health Technology Exchange explained that in comparison to the United States, Canada lacks this type of management talent that has experience bringing companies through the commercialization process.[221] Therefore, these witnesses suggested it was necessary for governments to focus on training in this area, or provide opportunities to attract individuals with this talent to Canada by building collaborative partnerships focused on innovation and commercialization.

The Committee heard that the federal government was addressing these challenges in several ways. Mr. Kirkconnell from the BDC explained that his organization is providing financing opportunities for the commercialization of health technologies.[222] The Committee learned that BDC has an internal fund that provides direct funds to help new companies involved in health care innovation grow and find new markets. BDC also has a Strategic Investments and Initiatives team that helps mentor early stage entrepreneurs and a Canadian Technology Accelerator program that helps health care start-ups in Canada connect with health care companies in the United States. He further explained that BDC also helps develop venture capital in Canada by investing in funds managed by venture capitalist companies, which in turn invest those funds in Canadian start-up companies. In support of this aim, the Committee heard that the federal government announced the creation of the Venture Capital Action Plan, which will provide $400 million in funding to support private sector investments in early-stage risk capital, and to support the creation of large-scale venture capital funds led by the private sector.[223]

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218 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 October 2012, Meeting No. 61 (Dr. Ravi Menon, Professor and Canada Research Chair, Robarts Research Institute, University of Western Ontario).

219 Ibid.

220 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 7 February 2013, Meeting No. 72 (Dr. Ilse Treurnicht, Chief Executive Officer of MaRS Discovery District and Mr. John Soloninka, Chief Executive Officer, Health Technology Exchange).

221 Ibid. (Mr. John Soloninka, Chief Executive Officer, Health Technology Exchange).

222 Mr. Paul Kirkconnell, Executive Vice-President, Venture Capital, Business Development Bank of Canada, "Speaking Remarks," Submitted to the House of Commons Standing Committee on Health, 21 May 2013.

223 Ibid.

The Committee heard that $125 million of this fund would be devoted to the health care sector.

Witnesses also explained that the federal government provides support to health technology companies through a program run by the National Research Council Canada called the Industrial Research Assistance Program (IRAP),[224] which provides small- and medium-sized enterprises with technical and business advisory services, financial assistance, and networking and linkage services.[225] While witnesses very much valued IRAP, they also offered some suggestions for its improvement. Two witnesses recommended that IRAP develop expertise in evaluating health technologies.[226] One witness suggested IRAP consider providing funding to start-up companies for the clinical trials that they need to undertake to prove the clinical effectiveness of their products prior to regulation by Health Canada.[227]

Many witnesses also suggested that the federal government examine the feasibility of similar programs offered in the United States through the National Institutes of Health, including the Small Business Innovation Research Program and the Small Business Technology Transfer program.[228] These programs were seen by witnesses as being effective in supporting commercialization, because the programs focus on financing small companies in the more challenging seed or start-up stage.[229] These programs also promote the procurement of new health technologies by local health organizations.[230] Finally, witnesses also explained that the federal government could examine other options for financing small start-up companies, such as tax credits for academic institutions, hospitals and other investors supporting these projects.[231]

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224 For further information, see: NRC, "Industrial Research Assistance Program (IRAP)," http://www.nrc-cnrc.gc.ca/eng/irap/index.html.

225 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 30 October 2012, Meeting No. 61 (Dr. Weaver, Professor, Dalhousie University, As an Individual and Dr. Ravi Menon, Professor and Canada Research Chair, Robarts Research Institute, University of Western Ontario).

226 Ibid.

227 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 7 February 2013, Meeting No. 72 (Mr. John Soloninka, Chief Executive Officer, Health Technology Exchange).

228 Association of Canadian Academic Healthcare Organizations, "Remarks to the House of Commons Standing Committee on Health," Submitted to the House of Commons Standing Committee on Health, 21 May 2013.

229 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 7 February 2013, Meeting No. 72 (Dr. Ilse Treurnicht, Chief Executive Officer of MaRS Discovery District and Mr. John Soloninka, Chief Executive Officer, Health Technology Exchange).

230 Ibid.

231 Dr. Geoff Fernie, Toronto Rehabilitation Institute, University Health Network, "Commercialization of Innovations via Small and Medium Sized Businesses," Brief submitted to the House of Commons Standing Committee on Health, 21 May 2013.

2. Public-Private Partnerships

The Committee heard that the federal government could also promote the commercialization of health technologies by fostering collaboration among academic institutions, industry, health care organizations and governments. The Committee learned how different types of public-private partnerships in Canada are succeeding in promoting the commercialization of health research. For example, witnesses highlighted the MaRS Discovery District, which is a not-for-profit public-private partnership that is funded through the federal government's Centres of Excellence for Commercialization and Research .[232] It is a partnership consisting of 15 academic institutions, including research hospitals, that work together to create a pipeline of research discoveries that are commercially relevant and viable to partner with industry. MaRS provides start-up companies emerging from its pipeline with mentoring and business training and education. It also administers a seed-fund provided by the Government of Ontario to support these new companies. Since its beginning in 2008, MaRS has launched more than 20 new companies, one of which, Xangenic, has expanded after raising over $10 million in venture capital financing to develop point-of-care diagnostics for infectious diseases.[233]

The Committee heard about the University Health Network's Techna Institute, which focuses on developing new health technologies designed to meet the needs of health care organizations and health care practitioners by bringing together academic clinicians, engineers and industry.[234] Written submissions to the Committee also described the Centre for Drug Research and Development (CDRD), which is a national not-for-profit drug development and commercialization centre funded by the federal government that works with a national network of affiliated universities and teaching hospitals to identify Canada's most promising drug discoveries.[235] CDRD's Ventures Inc. (CVI), the Centre's commercial arm, funds these discoveries to the point of third party investment. CVI has raised $135 million since 2007 from both public and private sector partners in the pharmaceutical industry to advance projects towards commercialization.

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232 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 7 February 2013, Meeting No. 72 (Dr. Ilse Treurnicht, Chief Executive Officer of MaRS Discovery District and Mr. John Soloninka, Chief Executive Officer, Health Technology Exchange).

233 Dr. Daniel Muzyka, Council Member, Natural Sciences and Engineering Research Council of Canada (NSERC) and Mr. André Isabelle, Associate Vice-President, Networks of Centres of Excellence, "Moving New Health Technologies from the Lab to the Marketplace," Brief submitted to the House of Commons Standing Committee on Health, May 2013.

234 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 7 March 2013, Meeting No. 78 (Dr. David Jaffray, Head, Radiation Physics Department, Princess Margaret Cancer Centre).

235 Dr. Daniel Muzyka, Council Member, Natural Sciences and Engineering Research Council of Canada (NSERC) and Mr. André Isabelle, Associate Vice-President, Networks of Centres of Excellence, "Moving New Health Technologies from the Lab to the Marketplace," Brief submitted to the House of Commons Standing Committee on Health, May 2013 and Dr. D. Lorne Tyrrell, Director of the Li Ka Shing Institute of Virology, Fellow of the Canadian Academy of Health Sciences, "House of Commons Standing Committee on Health Agenda: Technological Innovation," submitted to the House of Commons Standing Committee on Health, May 2013.

Finally, several witnesses suggested that the federal government could also bring academic institutions, health organizations, health care providers, patients, governments and industry together on a much broader scale in multi-stakeholder partnerships to work together to address the common challenges facing health care systems across the country, such as chronic diseases and the aging of the population.[236] One witness, Dr. Pascale Lehoux, Canada Research Chair on Innovations in Health from the Université de Montréal, suggested that this collaboration could be achieved by the federal government establishing an intersectoral health innovation development body driven by the health portfolio, which could focus on creating better alignment between technological development done by industry and the needs of health care systems.

C. Committee Observations and Recommendations

The Committee's study identified several ways that the federal government could promote technological innovation in health care in Canada. Witnesses stressed the importance of continued federal funding for research and development activities. The Committee heard that it was important to foster applied research that has commercial application by focusing on intellectual property rights in academic institutions, including the development of standards in this area; training for academics in patent applications; the inclusion of patents in criteria for tenure; and addressing the costs academics face in filing patents. To promote the commercialization of health technologies, witnesses highlighted the importance of improving access to venture capital and business expertise. In addition, witnesses highlighted how public-private partnerships were successful in promoting the commercialization of health research in Canada. The Committee therefore recommends that:

20. The Government of Canada continue to fund research and development activities in order to promote technological innovation in health care in Canada.

21. The Government of Canada continue to fund not-for-profit public-private partnerships focused on the commercialization of health research through its Networks of Excellence of Canada Program.

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236 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 7 February 2013, Meeting No. 72 (Dr. Ilse Treurnicht, Chief Executive Officer of MaRS Discovery District) and House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 7 March 2013, Meeting No. 78 (Dr. Pascale Lehoux, Canada Research Chair on Innovations in Health, Université de Montréal).

PART TWO: OTHER INNOVATIONS IN HEALTH CARE

During the course of its study, the Committee received testimony from witnesses about other types of innovation occurring in health care delivery, as well as the training of health care professionals and health human resource planning. Part two summarizes this testimony and presents the Committee's findings in these areas.

A. INNOVATIONS IN HEALTH CARE DELIVERY

The Committee heard from witnesses that many innovations are occurring in health care delivery across Canada, as well as in some other jurisdictions, in three main areas: primary health care, acute care and public health. These innovative models of health care delivery and the Committee's observations and recommendations are presented in the sections below.

1. Innovation in the Delivery of Primary Care.

i. Multi-disciplinary Health Care Teams

The Committee heard that new models of primary health care are being established across the country. For example, with respect to multi-disciplinary health care teams delivering primary care,[237] the Committee learned about the Clinique multi-disciplinaire en santé at the Université du Québec à Trois-Rivières, which was established to provide students with multidisciplinary clinical training experiences. The clinic covers three disciplines, including occupational therapy, speech therapy and health care. The clinic provided students in these disciplines the opportunity to work in a clinical setting while being supervised by more experienced health practitioners and physicians. In addition, the Committee heard that the clinic was established to reflect and meet the needs of the local population, which included children from early childhood centres, schools and social paediatrics who often did not have access to occupational and speech therapy services.

The Committee heard from witnesses that multi-disciplinary teams and collaboration between health professionals in clinics has been found in some studies to improve quality of care, though some challenges remained, such as power struggles between different health professions.[238] They therefore recommended that the federal government support inter-professional training and education through targeted programs in collaboration with universities, as well as examine along with Canada Health Infoway

237 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 1 November 2012, Meeting No. 62 (Ms. Lyne Thomassin, Clinique multi-disciplinaire en santé, Université du Québec à Trois-Rivières).

238 Ibid. (Ms. Marie-Claude Prémont, Professor, National School of Public Administration).

Inc. how health information technology could be used to further enhance collaboration between health care providers.

ii. The Social Primary Care Model

The Committee also heard about innovative approaches for improving the health of vulnerable communities through the adoption of the "Social Primary Care Model." According to representatives from the B.C. Healthy Living Alliance, the Social Primary Care Model is a model that delivers health care to hard-to-reach and disadvantaged communities through the establishment of links between those communities and health care systems.[239] For example, the Social Primary Care Model embeds nurse practitioners in community settings, including schools, day cares, and community centres to act as a point of care contact between these communities and tertiary and specialist services. They also partner with Social Services Agencies/NGOs to work together to address social determinants, such as housing and food insecurity, that have an impact on the health of the community. Under the Social Primary Care Model, communities are also welcome to engage in discussions with health care providers to identify emerging health concerns, as well as ask questions and make suggestions.

The Committee heard that Dr. Judith Lynam, from the University of British Columbia School of Nursing, has conducted research evaluating this model and has found that it fosters access to health care for families facing many disadvantages and was succeeding in reaching people, including children with developmental and mental health challenges, whose health needs were not previously being addressed.[240] Dr. Lynam also found that these families were no longer going to emergency departments to receive primary care and an acute exacerbation of chronic illnesses were also being avoided, providing cost savings to the health care system.

Given the benefits of this health care model, representatives from the B.C. Healthy Living Alliance recommended that the federal government work with the provinces and territories to expand the model to other communities through the provision of research and practice grants.[241] Furthermore, they also recommended that the federal government identify best practices and lessons learned in the development and implementation of innovative primary care models across the country funded through its Health Innovation Fund, which was part of the 2004 Health Accord. According to these witnesses, an evaluation of different primary care models would help to promote their adoption across the country.

iii. The Patient's Medical Home

The Committee also heard about Dr. Christopher Fotti's Pritchard Farm Health Centre, which is a new family practice clinic that has nine family doctors with different

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239 Ibid. (Hon. Mary Collins, P.C., and Mr. Scott Macdonald, B.C. Healthy Living Alliance).

240 Ibid.

241 Ibid.

specialities.[242] Consequently, patients have access to physicians with different areas of expertise in one location. Moreover, the physicians themselves are able to consult both formally and informally with their colleagues on the spot. The clinic also has diagnostic services located next door, which are linked electronically to its computer systems. The Committee heard that some of the doctors working at the clinic also worked in acute care settings, which smoothed transitions for patients between primary and acute care. Furthermore, the group practice model meant that the clinic is able to offer same day and after hour appointments.

The Committee heard that the clinic had been established following a model developed by the College of Family Physicians of Canada called "The Patient's Medical Home."[243] According to the College of Family Physicians of Canada, this model is a family practice defined by its patients as the place they feel most comfortable to present and discuss their personal and family health and medical concerns.[244] It serves as a central hub for the timely provision and coordination of a broad range of health services provided by a team or network of providers, including nurses, physician assistants located in the same physical site or linked virtually through different sites in the community.

iv. Integrating Complementary and Conventional Medicine

The Committee heard about another model of care seeking to integrate complementary and conventional medicine within a community clinic setting.[245] Approximately 40% to 80% of cancer patients, particularly breast cancer patients, seek the services of complementary practitioners to improve their quality of life as they undergo conventional therapies such as chemotherapy and radiation. The Committee heard that the Ottawa Integrative Cancer Centre is a multidisciplinary community clinic that includes: naturopathic doctors, medical doctors, acupuncturists, physiotherapists, counsellors and a nutritionist that was established to provide treatment and support for patients undergoing conventional cancer treatments at the Ottawa Hospital Cancer Centre. These treatments and supports include facilitating post-operative healing and controlling the side effects associated with chemotherapy and radiation. Supported by the Ottawa Regional Cancer Centre, as well as CIHR, the Committee heard that the Ottawa Integrative Cancer Centre is also working with the Ottawa Hospital Research Institute to evaluate the benefits of complementary medicine in relation to cancer patient outcomes, including recurrence and mortality rates.

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242 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 29 November 2012, Meeting No. 67 (Dr. Christopher Fotti, As an Individual).

243 Ibid.

244 The College of Family Physicians of Canada, "A Vision for Canada: Family Practice: The Patient's Medical Home," September 2011. Submitted to the House of Commons Standing Committee on Health by Dr. Fotti, November 2012.

245 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 1 November 2012, Meeting No. 62 (Mr. Dugald Seely, Ottawa Integrative Cancer Centre).

v. Health Co-operatives[246]

Witnesses also highlighted the establishment of health co-operatives across Canada. The Committee heard that there are approximately 120 health cooperatives in Canada, which are located primarily in Quebec, but also in Manitoba, Saskatchewan, British Columbia, New Brunswick and Nova Scotia. Witnesses from the Conseil canadien de la coopération et de la mutualité explained that health care co-operatives are collective enterprises that provide infrastructure and resources for the provision of services, which promote, maintain and improve the health and living conditions of communities. Its members are involved in both the organization and management of these services. Members agree to fund the co-operative's operations through qualifying shares, annual contributions and donations. These witnesses explained that health co-operatives had been established to ensure that communities have on-going access to health care in their communities. Located in mostly rural and remote communities, 46% of health co-ops were established because the local community health clinic was closing, while 54% of new health co-ops were established to bring new services to the community, such as home care, telehealth and prevention services to targeted populations such as First Nations and Inuit communities. In order to promote the establishment of health co-ops across Canada, these witnesses recommended that the rules regarding contributions to co-operatives be clarified, as well as allow these contributions to be claimed as medical expenses.

2. Innovations in the Delivery of Acute Care

i. Use of Physician Assistants

The Committee also heard from witnesses about different efforts to improve the efficiency and performance of acute care settings. For example, surgery wait times for hip and knee surgeries are being addressed by the Concordia Joint Replacement Group by increasing the productivity of surgeons through the employment of physician assistants. The assistants help with the positioning, prepping, draping and closure during hip and knee surgeries.[247] The use of physician assistants frees up the surgeon earlier, in turn allowing the surgeons to begin surgery in an adjacent room that was already prepared for surgery by other physician assistants. The Committee heard that the employment of physician assistants has resulted in a 42% increase in the volume of surgeries and an associated drop in wait times from 44 weeks to 30 weeks. Dr. Rob Ballagh, a surgeon appearing before the Committee as an individual, also explained that the Canadian military is also using physician assistants, called physician extenders, who have specialized medic

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246 Unless otherwise noted, this section is based upon the following testimony: House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 14 February 2013, Meeting No. 74 (Ms. Brigitte Gagné, Executive Director and Mr. Michaël Béland, Conseil canadien de la coopération et de la mutualité).

247 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 29 November 2012, Meeting No. 67 (Dr. Eric Bohm, Associate Professor, Concordia Joint Replacement Group).

training and work under the supervision of physicians.[248] The use of physician extenders is helping to address the shortages of physicians in the military.[249]

ii. Adoption of Lean Approaches

The Committee heard that acute care settings are adopting "lean" practices to improve the efficiency and performance of acute care settings. Lean is defined as a "patient/client-focused approach to identifying and eliminating all non-value adding activities and reducing waste within an organization."[250] Value-adding activities are those the client/patient is willing to pay for, either directly or indirectly through taxes, as in the case of the health care system. "Lean" is a philosophy or mindset that has been borrowed from the manufacturing sector. For example, the Committee heard that in its adoption of "lean" thinking, St. Boniface Hospital had focused on narrowing its strategic priorities from 15 to 4 in order achieve better results in those areas.[251] The hospital holds multiple improvement events per month, in which frontline staff and managers get together to develop ways to solve a particular problem. These applications of "lean" thinking have increased patient satisfaction, increased the engagement of staff, as well as reduced its hospital standardized mortality ratio by 30%. The Committee heard that St. Boniface Hospital had succeeded in improving their financial performance by 1%, which resulted in $3 million worth of savings.

The Committee also heard that the Concordia Joint Replacement Group had also adopted "lean" thinking to improve hip fracture care by tracking where the delays in surgery were and identifying solutions to address bottle necks in the system.[252] These efforts have reduced surgery wait times for hip fracture patients to 1.8 days, the length of stay has decreased to 25 days and the in-hospital mortality ratio has declined to 5%. Because of the increases in efficiency and performance of acute care settings associated with the adoption of "lean" practices, one witness recommended that a learning centre for the use of "lean" thinking in health care be established in Canada for health care leaders. Another witness suggested that different hospitals or health regions could focus on developing models in their areas of expertise, such as chronic disease management or emergency department management, which could then be shared across jurisdictions. One witness identified the importance of tracking and measuring outcomes through the use of databases to both identify problems within the system, as well as ensure that changes in the system were having an impact.

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248 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 14 February 2013, Meeting No. 74 (Dr. Rob Ballagh, As an Individual).

249 Ibid.

250 Government of Saskatchewan, *Introduction to Lean*.

251 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 29 November 2012, Meeting No. 67, (Dr. Michel Tétreault, St. Boniface Hospital).

252 House of Commons Standing Committee on Health, *Evidence*,1st Session, 41st Parliament, 29 November 2012, Meeting No. 67 (Dr. Eric Bohm, Associate Professor, Concordia Joint Replacement Group).

iii. A Virtual Hospital Ward[253]

The Committee heard from Dr. Danyaal Raza from the Canadian Doctors for Medicare about a virtual ward project in Toronto that is allowing patients to receive hospital care and supervision at home. Patients who are at high risk for being readmitted to a hospital are virtually admitted into the hospital while they are at home. They are provided with around the clock care at home, which is similar to that found in a hospital. As virtually admitted patients, they are able to call their care team with any concerns until they are transitioned over to their regular doctor. This system helps keep patients physically out of the hospital, while connecting them to community care and preventing them from falling through the cracks. In order to promote these types of innovations in the delivery of care, Dr. Raza also recommended that the federal government play a leadership role by sharing best practices in new models of care. He further explained that this sharing could be done by establishing a national body that looks at innovation from a national perspective. He suggested that the Health Council of Canada, which is currently tracking some best practices in health care delivery through its innovation portal, could be given a broader mandate and funding to help identify and scale up best practices and innovations across the country.

iv. Out-of-Hospital Surgery Clinics[254]

Dr. Emad Guirguis from the Lakeview Surgery Centre described to the Committee how acute care could be delivered outside a hospital setting, including the performance of surgeries and general anesthetic procedures. Dr. Guirguis explained that his accredited facility provides services that are considered medically necessary services under the *Canada Health Act*, such as hernia operations and breast cancer surgery, as well as those that may not be covered, such as laparoscopic gastric banding surgery for persons who are obese. The Committee heard from Dr. Guirguis that some jurisdictions, including Ontario, are currently considering contracting-out some types of surgeries (that do not require patients to be fully hospitalized) to out-of-hospital surgery facilities, which could conduct them safely and efficiently and reduce pressures on hospital operating rooms.

v. Use of Funding Models to Improve Access to Care[255]

The Committee heard from Dr. Jason Sutherland from the Centre of Health Services and Policy Research at the University of British Columbia that adopting new models for the funding of health care delivery could create incentives for hospitals to improve access to care and decrease wait times for surgeries. The Committee heard that

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253 Unless otherwise noted, this section reflects the following testimony: House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 26 February 2013, Meeting No. 75 (Dr. Danyaal Raza, Board Member, Canadian Doctors for Medicare).

254 House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 28 February 2013, Meeting No. 76 (Dr. Emad Guirguis, Lake View Surgery Centre, As an Individual).

255 Ibid. (Dr. Jason Sutherland, Assistant Professor, Centre of Health Services and Policy Research, University of British Columbia, As an Individual).

British Columbia has begun to implement activity-based funding for elective procedures. Activity-based funding is funding that is provided to hospitals to target certain areas such as increasing the volume of elective surgeries in particular areas (e.g., cataract or knee surgery). Dr. Sutherland explained that Ontario is adopting a model that provides financial incentives to providers that are implementing evidence-based practice for the care of chronic conditions. Tying financial incentives to the quality of health care is known as quality-based procedures. The Committee also learned about bundle payment schemes being implemented in the United States, which focus on bundling payments for combined services offered by different health care settings, such as home and acute care, to promote seamless transitions between these different delivery systems for patients. In addition to calling for a national clearing house for best-practices in health care delivery, Dr. Sutherland also recommended that the Canadian Institute for Health Information develop data sets to evaluate innovations in the delivery of health care, in particular data sets that focus on patient outcomes. From his perspective, these data are necessary to evaluate innovations in health care delivery.

3. Innovations in Public Health[256]

The Committee also heard about an innovative public health strategy to address the HIV epidemic in Canada. According to research conducted by the B.C. Centre for Excellence in HIV/AIDS, the use of antiretroviral therapies, which are used in the treatment of HIV/AIDS, could be used to help prevent the transmission of the disease because they reduce the amount of the virus circulating in the blood to undetectable levels. The Committee heard that the use of antiretroviral therapies in the treatment of HIV/AIDS has reduced the number of new HIV infections in British Columbia by 40%. Similarly, the Centre also found that the treatment of mothers with antiretrovirals prevents the transmission of HIV to their babies by nearly 100%. Consequently, the Government of British Columbia has adopted a new strategy called “seek and treat,” which seeks to facilitate and normalize the testing of individuals for HIV, as well as provide them with antiretrovirals to prevent further spread of the disease. As a result of these efforts, the Committee heard that HIV morbidity and mortality have decreased in the province by more than 90% and the number of new HIV infections has been reduced by more than 66%. By reducing the number of new cases of HIV, this strategy is also providing cost savings to the health care system, as the average cost of HIV treatment per patient is $15,000. As the incidence of HIV is increasing rapidly in other parts of the country, including Manitoba, Saskatchewan and Newfoundland and Labrador, there is a need to adopt a national strategy focusing on HIV testing for the general population.

The Committee also heard from Dr. Thomas Kerr from the B.C. Centre for Excellence in HIV/AIDS that other public health measures could be adopted to address the HIV epidemic in Canada, including abstinence-based and harm reduction programs for

256 Unless otherwise noted, this section reflects testimony from: House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 29 November 2012, Meeting No. 67 (Dr. Julio Montaner, Director and Dr. Thomas Kerr, Director of the Urban Health Program, B.C. Centre for Excellence in HIV/AIDS) .

injection drug users, who represent the highest proportion of new cases of HIV/AIDS. The Committee heard that these programs have reduced the HIV infection rate among injection drug users in Vancouver from 19% to 1%.

4. Innovations in Health Care Delivery in other Jurisdictions[257]

In his appearance before the Committee, Mr. Ray Racette from the Canadian College of Health Leaders articulated that Canada could look to other jurisdictions to identify ways in which it could improve the overall efficiency and performance of its health care system. He suggested that Canada examine Sweden's health care model. He explained that the Swedish health care system prioritizes primary care; adopts lean practices to improve backlogs in hospitals; undertakes major efforts to promote care for the elderly in the home rather than in institutions; includes patient safety and quality in national priorities; and makes efforts to engage consumers in the health care system by providing them with choices. Furthermore, the Committee heard that Sweden's health care system also insures a broader basket of goods, including dental care for the young and elderly, home care and a national pharmacare program. In order to gain insight into health care delivery in another federal state, Mr. Racette suggested that Australia's health care model be examined, in particular its decision-making structure, which includes a Standing Council on Health which is made up of federal and state ministers of health and Health Ministers Advisory Committee, which works collaboratively to develop national health care priorities.

5. Committee Observations and Recommendations

The Committee's study revealed that many innovative models of health care delivery are occurring across the country, many of which focus on the collaboration among different health professionals, as well as the integration of different sectors of the health care system. Witnesses felt that the federal government has a role to play in identifying, evaluating and sharing best practices in health care delivery from both Canada and other jurisdictions. Based upon these observations, the Committee therefore recommends that:

22. The Government of Canada take note of the innovative models of health care delivery outlined in this section of the report.

257 Ibid. (Mr. Ray Racette, President and Chief Executive Officer, Canadian College of Health Leaders).

B. INNOVATIONS IN THE TRAINING OF HEALTH PROFESSIONALS

The Committee's study also examined the role of technological innovation in the training of health professionals. Witnesses highlighted how technological innovations are being used to train health professionals, as well as how technology could be used to plan and determine how many and which types of health professionals need to be trained to meet the needs of health care systems across Canada.

1. The Use of Technology in the Education and Training of Health Care Professionals[258]

The Committee heard that medical schools across the country are using technology in the training of physicians in several ways. Dr. Alireza Jalali, a medical doctor and professor at the University of Ottawa explained how he incorporates e-learning in the training of physicians, including web-based courses where lectures are posted on-line through podcasts and wikis. The use of e-learning tools means that students could access the lecture material outside of the classroom, allowing for classroom time to be used for hands on applications of the lectures. Dr. Jalali also explained that simulation technologies allow students to practice applying their skills on models rather than real patients. For example, he explained that high-fidelity mannequins have been created for this purpose, as well as virtual reality programs that simulate a hospital operating room. Finally, the Committee heard that educational curriculums in medical schools are also being adapted to reflect the realities of an e-health enabled environment.[259]

2. Technology and Health Human Resource Planning[260]

In their appearance before the Committee, representatives from the Association of Faculties of Medicine of Canada (AFMC) explained that in order for students to determine which area of medicine to study, it is necessary for them to have an understanding of which areas of medicine are most in demand, or are needed to meet the current and future health needs of Canadians. As a result of a lack of health human resources planning, many physicians were trained in fields where they cannot find employment or are currently under employed. In order to determine which types of health professionals need to be trained, the Committee heard that it is necessary to develop data and modelling tools to monitor trends. While some jurisdictions in Canada have been able to develop and utilize

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258 Unless otherwise noted, this section is based upon the following testimony: House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 5 February 2013, Meeting No. 71 (Dr. Alireza Jalali, Medical Doctor, As an Individual).

259 Ibid. (Mr. Irving Gold, Vice President, Government Relations and External Affairs, Association of Faculties of Medicine).

260 Unless otherwise noted, this section is based upon the following testimony: House of Commons Standing Committee on Health, *Evidence*, 1st Session, 41st Parliament, 5 February 2013 Meeting No. 71 (Mr. Irving Gold, Vice President, Government Relations and External Affairs, Association of Faculties of Medicine).

sophisticated health human resource data and modelling tools, other jurisdictions lack capacity in this area. Furthermore, as health care providers move across jurisdictions, it is necessary for provinces and territories to have an understanding of what is occurring in other jurisdictions. Consequently, the AFMC recommended that the federal government establish a national health human resources data and modelling centre, which could pool provincial and territorial health human resource data and identify and monitor trends in this area. An understanding of these trends would in turn allow jurisdictions to determine how many health professionals need to be trained and in what areas.

3. Committee Observations

Witnesses highlighted the use of technologies in medical education and training in Canada. The Committee heard that health human resources data analysis and modelling tools are also necessary to help jurisdictions across Canada to determine how many different types of health professionals need to be trained, as well as which skill sets are necessary to meet the current and future health needs of Canadians.

CONCLUSION

The Committee's study demonstrated how innovation is occurring across the health care sector from leadership in the use of telehealth and telerobotics in health care delivery to cutting-edge research in genomics and nanotechnology. The Committee learned that Canadian researchers are delving into the unknown to gain new knowledge about the human body in order to foster innovation in personalized medicine. The study also examined the challenges facing innovation, including the need to share best practices in health care delivery across the country so that these innovations do not remain mere pilot projects. The Committee also identified issues related to access to health care technologies and in particular, the costs of these new technologies, which could be prohibitive to both individuals and health care systems. Finally, the Committee's study focused on identifying ways that the federal government could promote innovation in health care, including facilitating the commercialization of health research and fostering collaboration between the health and industry sectors to address the key issues facing Canadian health care systems today, including the rise of chronic diseases and the aging of the population. The Committee believes that its findings and recommendations outlined in this report both highlight the great work of those driving innovation in the health care system, as well as identify how the federal government can continue to help lead the way in supporting these efforts.

LIST OF RECOMMENDATIONS

APPENDIX A
LIST OF WITNESSES

Organizations and Individuals	Date	Meeting
Canadian Agency for Drugs and Technologies in Health	2012/10/18	58
Brian O'Rourke, President and Chief Executive Officer		
Canadian Institutes of Health Research		
Alain Beaudet, President		
Department of Health		
Barbara Sabourin, Director General Therapeutic Products Directorate, Health Products and Food Branch		
Assembly of First Nations	2012/10/23	59
Jonathan Thompson, Director Health and Social Secretariat		
Centre for Global eHealth Innovation		
Joseph Cafazzo, Lead		
Department of Health		
Ernie Dal Grande, National Manager EHealth Program, Primary Health Care and Public Health, First Nations and Inuit Health Branch		
Kathy Langlois, Acting Assistant Deputy Minister Regional Operations, First Nations and Inuit Health Branch		
Manitoba eHealth Program		
Roger Girard, Chief Information Officer		
Canada Health Infoway	2012/10/25	60
Richard Alvarez, President and Chief Executive Officer		
Mike Sheridan, Chief Operating Officer		
Ontario Telemedicine Network		
Ed Brown, Chief Executive Officer		
Ottawa Hospital		
Glen Geiger, Chief Medical Information Officer		
University Health Network		
Peter Rossos, Chief Medical Information Officer		

Organizations and Individuals	Date	Meeting
University of British Columbia	2012/10/25	60
Kendall Ho, Director and Professor EHealth Strategy Office, Faculty of Medicine		
As an individual	2012/10/30	61
Donald Weaver, Professor Department of Medicine and Department of Chemistry, Dalhousie University		
Canadian Light Source		
Jeffrey Cutler, Director Industrial Science		
Josef Hormes, Executive Director		
University of Western Ontario		
Ravi Menon, Professor and Canada Research Chair Robarts Research Institute		
Canadian Health Coalition	2012/11/01	62
Michael McBane, National Coordinator		
Manitoba Chambers of Commerce		
Dale Lacombe, Chair Health Committee		
Ottawa Integrative Cancer Centre		
Dugald Seely, Executive Director		
Université de Montréal		
José Côté, Holder of the Research Chair and Professor Research Chair in Innovative Nursing Practices		
Diane Saulnier, Chair Coordinator Research Chair in Innovative Nursing Practices		
Université du Québec à Trois-Rivières		
Carole Lemire, Director Nursing department		
Lyne Thomassin, Coordinator Clinique multidisciplinaire en santé		
As an individual	2012/11/22	65
Margaret Webb, Regional Nurse		

Organizations and Individuals	Date	Meeting
BC Healthy Living Alliance	2012/11/22	65
Hon. Mary Collins P.C., Director Chair, Chronic Disease Prevention Alliance of Canada		
Scott McDonald, Chair Chief Executive Officer, BC Lung Association		
École nationale d'administration publique		
Marie-Claude Prémont, Full Professor		
Nassera Touati, Associate Professor		
Greater Saskatoon Chamber of Commerce		
Kent Smith-Windsor, Executive Director		
Ottawa Hospital		
Dale Potter, Senior Vice-President Strategy and Transformation		
As an individual	2012/11/29	67
Christopher Fotti, Doctor Pritchard Farm Health Centre		
British Columbia Centre for Excellence in HIV/AIDS		
Thomas Kerr, Director Urban Health Research Initiative		
Julio Montaner, Director		
Canadian College of Health Leaders		
Ray Racette, President and Chief Executive Officer		
St. Boniface Hospital		
Michel Tétreault, President and Chief Executive Officer		
University of Manitoba		
Eric Bohm, Associate Professor Concordia Joint Replacement Group		
As an individual	2012/12/04	68
Warren Chan, Professor University of Toronto		
Normand Voyer, Professor Department of Chemistry, Université Laval		
BC Cancer Agency		
Marco Marra, Director Genome Sciences Centre		
Public Health Agency of Canada		
Frank Plummer, Chief Science Officer Scientific Director General, National Microbiology Laboratory		

Organizations and Individuals	Date	Meeting
University of British Columbia	2012/12/04	68
David Huntsman, Professor of Pathology Medical Director, Centre for Translational and Applied Genomics; Director, OvCaRe		
As an individual	2012/12/06	69
Michael Jong, Professor Memorial University		
Dalhousie University		
Ivar Mendez, Professor of Neurosurgery, Anatomy and Neurobiology		
Nunatsiavut Government		
Gail Turner, Consultant Department of Health and Social Development		
As an individual	2013/02/05	71
Steven Denniss		
Alireza Jalali, Medical Doctor		
Association of Faculties of Medicine of Canada		
Irving Gold, Vice President Government Relations and External Affairs		
Steve Slade, Vice President Data and Analysis		
Health Technology Exchange	2013/02/07	72
John Soloninka, President and Chief Executive Officer		
MaRS Discovery District		
Ilse Treurnicht, Chief Executive Officer		
MEDEC - Canada's Medical Technology Companies		
Brian Lewis, President and Chief Executive Officer		
As an individual	2013/02/12	73
Scott Lear, Professor		
David Price, Chair Department of Family Medicine, McMaster University		
TELUS		
Michael Guerriere, Chief Medical Officer and Vice President Health Solutions		
Paul Lepage, President Health and Payment Solutions		

Organizations and Individuals	Date	Meeting
As an individual	2013/02/14	74
Rob Ballagh, Assistant Clinical Professor of Surgery, McMaster University, Adjunct Professor of Otolaryngology, University of Western Ontario		
Bradley Dibble, Cardiologist		
Conseil canadien de la coopération et de la mutualité		
Michaël Béland, Communications and Programs Manager		
Brigitte Gagné, Executive Director		
Canadian Doctors for Medicare	2013/02/26	75
Danyaal Raza, Board Member		
Public Health Association of BC		
Marjorie MacDonald, President		
As an individual	2013/02/28	76
Emad Guirguis, General and Cosmetic Surgeon Lakeview Surgery Centre		
Jason Sutherland, Assistant Professor Centre of Health Services and Policy Research, University of British Columbia		
Genome Canada	2013/03/05	77
Pierre Meulien, President and Chief Executive Officer		
Structural Genomics Consortium		
Aled Edwards, Director and Chief Executive Officer		
As an individual	2013/03/07	78
Jeffrey Hoch, Director Cancer Care Ontario		
Adam Holbrook, Associate Director Centre for Policy Research on Science and Technology, Simon Fraser University		
Pascale Lehoux, Researcher, Full Professor Department of Health Administration, Université de Montréal		
Princess Margaret Cancer Centre		
David Jaffray, Head Radiation Physics Department		
As an individual	2013/03/19	79
Marc-André Gagnon, Assistant Professor School of Public Policy and Administration, Carleton University		

Organizations and Individuals	Date	Meeting
As an individual	2013/03/19	79
Steven Morgan, Associate Professor Associate Director, Centre for Health Services and Policy Research, University of British Columbia		
Michael Rachlis		
As an individual	2013/04/16	80
Pascal-A Vendittoli, Professor of Surgery Funded Clinical Researcher		
Health Sciences North		
Branden Shepitka, Emergency Department Health Record Project Lead, Ramsey Lake Health Centre, Emergency Department		
Huron Perth Healthcare Alliance		
Andrew Williams, President and Chief Executive Officer		
University of Ontario Institute of Technology		
Carolyn McGregor, Canada Research Chair in Health Informatics Professor and Associate Dean of Research, Faculty of Business and IT		
University of Ottawa		
Doug Coyle, Professor Epidemiology and Community Medicine		
As an individual	2013/04/23	82
Peter Selby, Associate Professor Family and Community Medicine, Psychiatry and Dalla Lana School of Public Health, University of Toronto		
Canadian Institutes of Health Research		
Robyn Tamblyn, Scientific Director Institute of Health Services and Policy Research		
Public Health Agency of Canada		
Kim Elmslie, Director General Centre for Chronic Disease Prevention and Control		
University of Ottawa Heart Institute		
Heather Sherrard, Vice-President Clinical Services		
INTERxVENT Saul Quint, Chief Executive Officer INTERxVENT Canada	2013/04/25	83
Technology Evaluation in the Elderly Network		
Richard Birtwhistle, Scientific Director		
Terry Fox Cancer Research Institute		
Victor Ling, President and Scientific Director		

Organizations and Individuals	Date	Meeting
As an individual	2013/04/30	84
Cameron Norman, Principal, CENSE Research + Design, Adjunct Professor, Dalla Lana School of Public Health, University of Toronto		
Beagle Productions		
Dale Friesen, Chief Executive Officer		
Chronic Disease Prevention Alliance of Canada		
Hon. Mary Collins P.C., Chair		
Craig Larsen, Executive Director		
Gateway Rural Health Research Institute		
Feng Chang, Chair Rural Pharmacy		
Ken Milne, Chair Rural Medicine		
Canadian Organization for Rare Disorders	2013/05/02	85
Durhane Wong-Rieger, President and Chief Executive Officer		
Department of Health		
David K. Lee, Director Office of Legislative and Regulatory Modernization, Policy, Planning and International Affairs Directorate, Health Products and Food Branch		
Neurological Health Charities Canada Jacquie Micallef, Manager, Member Relations, Policy & Partnerships	2013/05/07	86
Orphanet Canada		
Allan Micheil Innes, National Coordinator		
Association of Canadian Academic Healthcare Organizations	2013/05/21	87
Chris Paige, Vice-President, Research, University Health Network		
Chris Power, President and Chief Executive Director of Capital Health, Halifax		
BIOTECANADA		
Andrew Casey, President and Chief Executive Officer		
Business Development Bank of Canada		
Paul Kirkconnell, Executive Vice-President Venture Capital, Montreal		
Norgen Biotek Corporation		
Yousef Haj-Ahmad, President and Chief Executive Officer		

Organizations and Individuals	Date	Meeting
Toronto Rehabilitation Institute - University Health Network	2013/05/21	87
Geoff Fernie, Institute Director Research		
Promise Xu, Junior Commercialization Officer		
As an individual	2013/04/30	88
Ian D. Brindle, Professor Brock University		
Albert Friesen		
D. Lorne Tyrrell, Professor and Director, Li Ka Shing Institute of Virology, University of Alberta		
Biosential Inc.		
Craig Hudson, President and Chief Executive Officer		

APPENDIX B
LIST OF BRIEFS

Organizations and Individuals

Assembly of First Nations

Association of Canadian Academic Healthcare Organizations

Beagle Productions

Canadian Academy of Health Sciences

Canadian Fabry Association

Canadian Federation of Nurses Unions

Conseil canadien de la coopération et de la mutualité

Gateway Rural Health Research Institute

Health Care Co-operatives Federation of Canada

Jong, Michael

Lehoux, Pascale

Natural Sciences and Engineering Research Council of Canada

Neurological Health Charities Canada

Ottawa Hospital

Selby, Peter

Terry Fox Cancer Research Institute

Université de Montréal

University of Western Ontario

REQUEST FOR GOVERNMENT RESPONSE

Pursuant to Standing Order 109, the Committee requests that the government table a comprehensive response to this Report.

A copy of the relevant *Minutes of Proceedings* (Meetings Nos. 58 to 62, 65, 67 to 69, 71 to 80 and 82 to 91) is tabled.

Respectfully submitted,

Joy Smith

Chair

Supplementary Opinion of the New Democratic Party of Canada

Libby Davies, Vancouver East; Djaouida Sellah, Saint-Bruno - Saint Hubert; Dany Morin, Chicoutimi-Le Fjord; and Matthew Kellway, Beaches-East York.

Innovation in our Public Health Care System

The New Democrat Members of the Standing Committee on Health are concerned that recommendations in the final report on *Technological Innovation in Health Care* do not reflect the depth of ideas shared by witnesses who testified before the Committee—particularly testimony on the need for strong federal government leadership, in working with the provinces and territories, to ensure equal access to comprehensive health and social care programs and health technologies for all Canadians. New Democrats believe that new and effective health care technologies and innovative practices must be introduced into our public health care system, so that all applicable patients can benefit from them.

The Committee's report excuses the lack of federal leadership in health care and minimizes the federal role. Witnesses identified the federal government as having an important role to play in providing health technologies equitably and effectively as well as expanding innovative primary care. Witnesses spoke to creating a national pharmacare program, establishing a national strategy for rare diseases, preventing genetic discrimination, expanding electronic health records, assisting Canadian researchers in marketing new technologies, and maintaining its funding for vital research and evaluation of health care technologies. Witnesses also asked the federal government to renew and expand the mandate of the Health Council of Canada to evaluate innovative practices and share best practices. Witnesses also suggested the

federal government take the lead in developing new national HIV/AIDS screening practices and expanding harm reduction programs. The New Democrat members of the Committee understand the importance of federal action on these issues, and recommend the following to promote innovation in public health care in Canada:

NDP Recommendations

1. The Government of Canada maintain its funding to Health Canada's eHealth Infostructure Program.

2. Canada Health Infoway Inc. focus its efforts on promoting the automation and integration of different sectors of the health care system, such as home care, mental health services, and long-term care, into Electronic Health Record Systems across Canada.

3. Health Canada, through its eHealth Infostructure Program, prioritize the expansion of broadband networks to remote and northern First Nations and Inuit communities.

4. The Government of Canada consider providing incentives to health care organizations to promote their adoption of clinically and cost-effective health care technologies developed in Canada.

5. Health Canada in collaboration with the Networks of Centres of Excellence identify clusters of rare disease research in Canada, and consider formalizing some of them as Centres of Excellence within the Network.

6. Health Canada, in collaboration with the provinces and territories, implement a national strategy for screening newborns for rare diseases, identifying best

practices, listing the diseases that may be detected through newborn screening, and updating this list as new tests become available.

7. Health Canada, in collaboration with the provinces and territories, establish national standards for the treatment of rare diseases.

8. The Government of Canada introduce legislation which would protect individuals from discrimination as a result of advances in genetic testing.

9. Health Canada conduct an assessment of whether it could include non-pharmaceutical treatments such as medical devices used to treat rare diseases in the orphan drug framework or whether it could create a parallel framework for non-pharmaceutical treatments.

10. The Public Agency of Canada create a program to facilitate sharing best practices among industry, researchers, and clinicians with respect to technological innovations in chronic disease prevention and management, and to consider how these innovations can be made accessible to Canadians.

11. Health Canada, in association with the Public Health Agency of Canada, develop a framework to evaluate health apps and other self-management tools targeted at the public, and develop a means of identifying and recommending scientifically validated tools to the Canadian public.

12. Health Canada, in association with the Public Health Agency of Canada, develop a public education campaign to increase health literacy with a view to empowering patients to take steps to prevent and manage chronic illness.

13. The Government of Canada work with the provincial and territorial governments to establish a pan-Canadian prescription drug coverage plan,

ensuring that all Canadians have access to equitable drug coverage and which includes a bulk purchasing component and improved drug safety measures.

14. Health Canada review its requirements for the regulation of medical devices to ensure that it is receiving sufficient data that takes into account the short and long-term health outcomes of patients, before their approval and introduction into the Canadian market.

15. The Government of Canada consider providing the Canadian Agency for Drugs and Technology in Health with additional funding to scale up its efforts in the evaluation of the clinical and cost effectiveness of medical devices.

16. The Government of Canada continue to fund research and development activities, and in particular maintain its funding levels for basic research, in order to promote technological innovation in health care in Canada.

17. The Canadian Institutes for Health Research, the Natural Sciences and Engineering Research Council of Canada, and the Social Sciences and Humanities Research Council of Canada work together to develop voluntary guidelines for the development of intellectual property policies by academic institutions.

18. The federal provincial and territorial governments reinstate funding for and continue the existing mandate of the Health Council of Canada and broaden the current mandate of the Health Council of Canada to focus on the promotion of innovation in health care delivery.

19. The Canadian Institute of Health Information work with health care organizations, provincial and territorial governments, and other stakeholders to

promote access to the data necessary to evaluate innovation in health care delivery in Canada.

20. The Government of Canada review innovative models of primary care, such as social primary care and consider ways to encourage this approach to benefit all Canadians.

21. The Pan-Canadian Public Health Network's Communicable and Infectious Disease Steering Committee evaluate whether there is a need to develop new guidelines for generalized testing for HIV, and that the Government of Canada work with the provinces and territories to develop British Columbia's successful 'seek and treat' strategy at the national level.

22. The Government of Canada review successful harm reduction strategies adopted in British Columbia, and work with the provinces and territories to adopt these strategies at a national level.

23. Health Canada examine whether the membership fees and contributions associated with health co-operatives comply with the Canada Health Act.

24. The Government of Canada consider collaborating with provincial and territorial governments in the development of a data and modelling centre to monitor trends in health human resources in Canada.

It's short-sighted to integrate technologies into our health care system while neglecting to ensure all Canadians can benefit from these innovations. We need now, more than ever, to ensure Canadians have equal access to strong primary services and that new technologies and innovations are also introduced equitably and effectively. The New Democratic Party, in accordance with the testimony heard from witnesses at

the Standing Committee on Health, urges the federal government to take action to strengthen our public health care across Canada.

Dissenting Report by the Liberal Party of Canada Health Critic
Hon. Dr. Hedy Fry, P.C., M.P.

The Liberal Party of Canada (LPC) presents this dissenting report. We agree with the text of the report per se, but think the Committee recommendations do not adequately reflect witness testimony. We are also concerned that Part II of the main report contains no recommendations.

The Committee broadened the scope of the study, calling in expert witnesses, to discuss innovations in health care delivery and the barriers and costs of implementing new technological innovations.

Witnesses made several recommendations, contained in the main report, that were not reflected in the Committee's recommendations. These pertained to federal leadership in the areas of technological innovation and innovation in health care delivery, and where collaboration and cooperation among levels of governments and other groups was necessary.

The LPC thinks the federal government has a leadership role to play in the development of policies, programs, and strategies that impact the health of all Canadians. This role, due to constitutional requirements, requires negotiations with provincial and territorial governments, regulatory authorities and health professional organizations. We do not accept that all health care delivery is only a provincial jurisdiction. The *Canada Health Act* and Medicare confirms this. The 2004 Health Accord, signed by all Premiers and the Prime Minister endorses a cooperative model. Innovation in health care delivery is impossible without jurisdictional flexibility. One notes that federal government is the fifth largest deliverer of health care, and fourth

largest purchaser of prescription drugs, to First Nations and Inuit communities, Corrections, and the Canadian Forces.

Witnesses outlined significant challenges associated with interoperability of Electronic Health Record (EHR) systems. Many jurisdictions had developed their own programs, but are unable to communicate with other EHR systems across Canada, creating a fragmented system. It was pointed out that hospitals needed to link with regional and province-wide EHRs, in line with Canada Health Infoway Inc.'s standards for interoperability.

REC 1. Canada Health Infoway Inc. promotes the interoperability, automation, and integration of different health care sectors into one Electronic Health Record System across Canada.

Witnesses were concerned over the lack of broadband networks, to access remote health care services in remote and rural First Nations and Inuit communities. Evidence shows Canadians in these areas face poor health outcomes and increased costs due to medical travel for care.

REC 2. Health Canada prioritize the expansion of broadband networks to remote and northern First Nations communities.

Witnesses stated that case-by-case determination regarding whether a new application of nanotechnology is a drug or medical device led to confusing regulations. They expressed concern that nanotechnology research is not a priority in Canada.

REC 3. Health Canada establish a regulatory framework for pharmaceuticals and medical devices that is responsive to developments in technology.

REC 4. CIHR establish a new institute of health research devoted to nanotechnology.

Witness stated many health care organizations lacked the fiscal capacity to implement newly-developed technologies.

REC 5. The Government of Canada provide incentives to health care organizations to adopt clinically and cost-effective technologies.

Witnesses noted, while Canada is a world leader in genetic research and 80% of rare diseases have a genetic basis, Canada lags behind other nations in developing rare disease treatments and genetic screening tests for newborns.

REC 6. Health Canada implement a national strategy for screening newborns for rare diseases, identifying best practices, diseases that may be detected, and updating this list as necessary.

REC 7. Health Canada, working with provinces/territories and health professional authorities, establish national standards for treatment of rare diseases.

Concerns were raised regarding Canadians' access to new and innovative technologies for prevention and management of chronic diseases, because of costs, literacy, or complexity.

REC 8. The Government of Canada create a program to share best practices among industry, researchers and clinicians with respect to technological innovations in chronic disease prevention and management and to consider ways to improve accessibility to all Canadians.

REC 9. The Government of Canada implement tax incentives for employers who implement e-health solutions for their employees.

REC 10. The Public Health Agency of Canada, develop a framework to evaluate public health apps and other self-management tools, and a means of identifying and validating their scientific accuracy.

Witnesses were concerned about the cost and availability of safe and effective prescription drugs and suggested the establishment of a National Pharmaceutical Strategy to realize cost savings and to evaluate different drug pricing policies, to ensure Canadians can afford the medically necessary medications they need.

REC 11. The Government of Canada, the provincial and territorial governments establish a pan-Canadian Pharmaceutical Strategy, as in the 2004 Accord.

We heard that basic research is at the core of, and stimulates other research and innovations in health care.

REC 12. The Government of Canada increase funding for basic research.

REC 13. CIHR, NSERC and SSHRCC work with provinces/territories and provincial academia to develop guidelines for the development of intellectual property policies.

Witnesses stressed evaluation and measuring of outcomes and agreed the Health Council of Canada should undertake that role.

REC 14. Federal government reinstate the Health Council of Canada and broaden its mandate to include the promotion of innovation in health care delivery and maintain the Innovation Portal beyond 2014 for use by health care providers, and policy makers of all jurisdictions in Canada.

REC 15. CIHI share data with health care organizations, provincial and territorial governments, for evaluation of innovative health care delivery, including primary care reform.

REC 16. The Pan-Canadian Public Health Network's Communicable and Infectious Disease Steering Committee evaluate British Columbia's "seek and treat" Highly Active Anti-*Retroviral Therapy (HAART) program's success and develop these as pan-Canadian guidelines.*

REC 17. PHAC review and promote successful harm reduction programs, (Vancouver's InSite) and work with provinces/territories, municipalities, communities and other authorities to establish Safe Consumption Sites.

REC 18. The Government of Canada resume collaboration with provincial and territorial governments, to develop a pan-Canadian Health Human Resources Strategy, as in the 2004 Accord.