SHIFTS IN GLOBAL HEALTH SERVICES TECHNOLOGY: ETHICAL CONSIDERATIONS FOR IMPLEMENTING HEALTH SENSORS

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Purpose

- Health sensors are increasingly being developed and implemented into various health service domains worldwide. The automatic generation and transmission of one's health information by sensors generates various implications for privacy, autonomy, and control of health information. This project aimed to identify and explore the ethical implication of these concerns to the use health sensors on differing global populations.

- To ascertain whether the uptake of certain health information transmitting sensors is contingent on the guarantee of privacy or not, and if yes, which ones.

Introduction

- A fundamental tenet of privacy is that individuals should have the ability to control when and how their personal information is collected, who collects their personal information, and how this information is used and disclosed.
- Canadians are protected by two federal privacy laws [1][2]
- Canada is an international leader in generating and applying new and emerging health sciences and technologies (HST) such as sensors.
- Sensors impact the meaning of, delivery of and ability to secure privacy [3-8].
- Sensors enable the move to quantified self(where people diagnose themselves) [9-12] and enable increasingly the person and the home to be the producer of health data, which then can be distribution to various locations and analyzed by the person or remotely.
- How Canadians especially health Clients perceive privacy and what privacy they desire impact the acceptance level and level of practice penetration of sensors

Methods

- Step 1: Literature Review of sensors applied to health applications searching Google and Google Scholar
- Step 2 underway: focus groups and one on one interviews of Calgarians and online survey of broad sample

Table 1c Google		Table 1d Google scholar	
Sensors 148,000,000	Health concepts and areas	Sensors 148,000,000	Sensors 2,000,000
Parliamentary Technology Assessment	604	Parliamentary Technology Assessment	17
Participatory Technology Assessment	2,050	Participatory Technology Assessment	20
Obsolescence	523,000	Obsolescence	5,790
Evidence based medicine	334,000	Evidence based medicine	1,180
participatory medicine'	1,570	participatory medicine'	8
personalized medicine	176,000	personalized medicine	1,140
Home care	1,150,000	Home care	4,870
self diagnostic	142,000	self diagnostic	1,710
Consumerism	384,000	Consumerism	1,120
Consume	5,930,000	Consume	52,500
Competitiveness	2,370,000	Competitiveness	16,100

Table 1a Google		Table 1b Google scholar	
Sensors 148,000,000	Health concepts and areas	Sensors 148,000,000	Sensors 2,000,000
Health	6,280,000	Health	578,000
Patient	19,800,000	Patient	149,000
Health Care	15,900,000	Health Care	39,700
Public Health	7,260,000	Public Health	33,800
Health Economics	92,500	Health Economics	755
Health Ethics	6,670	Health Ethics	67
Determinants of Health	1,520	Determinants of Health	401
Burden of Disease	1,530	Burden of Disease	1,530
Social Well being	28,500	Social Well being	772
Telehealth	141,000	Telehealth	2,230
e-Health	346,000	e-Health	3,340
Disability Adjusted life years	2,930	Disability Adjusted life years	188
Health Technology Assessment	15,100	Health Technology Assessment	284

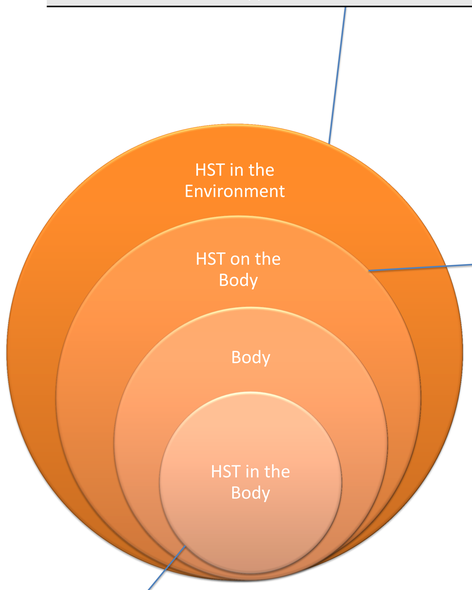

Table 3 Technology	Application
Mirror Cameras	Measure vital signs by examining how light reflects off the skin .
Video/USB Examination Devices	USB linked examination tools such as stethoscopes, otoscopes, dermoscopes, and spirometers, that allow examination information to be transmitted and evaluated from remote locations.
Active Daily Living Sensors	Sensors located in chairs, beds, and floors can help detect falls, extended absences, as well as inactivity and moisture.
Telehealth interface Units	Audio/Visual hubs which receive and store transmitted activity and health information data.
Endpoint Devices	Mobile robotic platforms that enable physician to be remotely present.

Table 4 Technology	Application
Brainwave Sensors (iBrain)	Head band with single brain wave seeking electrode. Could potentially be used to diagnose conditions such as Alzheimer's, autism, schizophrenia. Allows everyday people to monitor their brain activity.
Galvanic Skin Sensor	Measures stress levels through electrical conductivity of skin and alerts caretakers of fluctuations in stress.
Intrathecal Drug Delivery Systems	Devices that are programmed to automatically deliver pain medications.
Insulin Pumps	Devices which continually monitor glucose so that the patient can know his/her levels and can adjust their insulin rates according to food, physical activity or illness.
Life Shirt	Wearable system developed by Vivometrics, which uses ECG leads, posture sensors and respiratory sensors to record a patient's physiological, pulmonary and cardiac data during a patient's daily routine.
Pulse Oximeter	Measure pulse and blood oxygen levels. Wireless, wrist, handheld, and fingertip models exist.

Table 5 Technology	Application
Electrocardiography [ECoG]	Placed on the brain to identify areas of abnormal activity . Often used in the treatment of epileptic seizures.
Neurotransmitter Sensors	Chemical sensors on the brain- detect neurotransmitter release.
Brain Penetrating Electrode Array	Generates accurate data on brain activity allowing paralyzed people to control computer cursors and robotic communication.
Cochlear Implants	Can restore as sense of hearing in deaf and severely hard of hearing individuals
Intelligent Sensors (Activities of Daily Living)	Form a wireless body area network with a personal server that then allows wireless continuous monitoring of activities of daily living.
Brain Machine Interfaces	Implantable brain computer translates thoughts into computer commands (communication, movement etc.)
Artificial Hippocampus	Brain prosthesis that can monitor neural spikes and replicate to possibly restore and enhance memory.

Proposed Implications

Table 6. Neurotransmitter	Supposed to be involved in
Acetylcholine	Alzheimer's Disease
GABA	Specific phobias, obsessive compulsive disorders, and panic disorders
Dopamine	Schizophrenia, Attention Deficit/ Hyperactivity Disorder, Bipolar Disorder
Norepinephrine	Depression, Generalized Anxiety Disorder, Attention Deficit Disorder/Hyperactivity Disorder, Bipolar Disorder
Serotonin	Depression, Generalized Anxiety Disorder, Bipolar Disorder

Results

- Sensors are linked to various health discourses (table 1-2)
- Sensors within the body, on the body, and within the environment to collect and transmit health information are increasingly being developed and integrated into the healthcare sector (tables 3-6).
- Although the primary goals of these types of sensors are largely efficiency of information transfer and the safety of the individuals being cared for, these technologies are accompanied by a number of ethical issues.
- Ethical considerations for privacy and autonomy with the widespread implementation and use of this health tool largely center on global populations with varying levels of self-advocacy and visibility with global health policy domains, such as elderly and disabled populations. Privacy, autonomy, and control issues related to the wireless generation of health information however, extend beyond specific populations to overall consumer and health care provider utilization. In particular, the inability for individuals to control the generation of and access to sensitive health information potentially paves the path for social, medical, financial, and occupational discrimination based on third-party interpretation of information generated.

Future Steps

- Despite increased efficiency and other benefits of sensor integration into various healthcare sectors, future research into the appropriate use and regulation of this important health tool is necessary. Overall, it is necessary for global health policy to acknowledge and address concerns for privacy, control, autonomy, and discrimination generated by the implementation of health sensors into various health care facets.
- Development of a sensor acceptability index of a pilot set of health information transmitting sensors through focus groups and one on one interviews and an online survey.
- Evaluate possible social, ethical, and practical issues for the deployment of sensors stemming from the respondents views
- Evaluate what the impact could be on quality indicators of health, health care and health systems [13-15]

References
(1.) Treasury Board of Canada.2008. What is Privacy All About in Canada? Treasury Board of Canada http://www.tbs-sct.gc.ca/pgol-pged/piatp-pfefvp/course1/mod1/mod1-6_e.asp. Accessed 30 July 2011.
(2) Treasury Board of Canada.2008. So, what exactly is privacy? Treasury Board of Canada http://www.tbs-sct.gc.ca/pgol-pged/piatp-pfefvp/course1/mod1/mod1-2_e.asp. Accessed 30 July 2011.
3) Perera G, A Holbrook, L Thabane, G Foster, DJ Willison. 2011. Views on health information sharing and privacy from primary care practices using electronic medical records. International Journal of Medical Informatics 80(2):94-101.
4) hachak A, AR Jadad. 2010. Electronic Health Records in the Age of Social Networks and Global Telecommunications. JAMA 303(5):452.
(5) Rindfleisch TC. 1997. Privacy, information technology, and health care. Communications of the Acm 40(8):92-100.
(6) Gostin L. 1997. Health care information and the protection of personal privacy: ethical and legal considerations. Annals of Internal Medicine 127(8 Part 2):683.
7) Gostin LO, J Turek-Brezina, M Powers, R Kozloff, R Faden, DD Steinauer. 1993. Privacy and security of personal information in a new health care system. JAMA 270(20):2487.
(8) Blount M, VM Batra, AN Capella, MR Ebling, WF Jerome, SM Martin, et al. 2010. Remote health-care monitoring using Personal Care Connect. IBM Systems Journal 46(1):95-113.
(9) Swan M. 2009. Emerging patient-driven health care models: an examination of health social networks, consumer personalized medicine and quantified self-tracking. *International Journal of Environmental Research and Public Health* 6(2):492.
(10) Dvorsky G, Dv.2010. The quantified self: 6 tools to help you get started. Institute of Ethics and Emerging Techologies http://ieet.org/index.php/IEET/more/dvorsky20101106. Accessed 10 January 2011.
(11) Wolf G.2010. The quantified self. TED http://www.ted.com/talks/gary_wolf_the_quantified_self.html.
(12) Blaze Carlson K. The quantified self. The National Post 2010.
Health Quality Council of Alberta.2005. Alberta quality matrix for health of the Health Quality Council of Alberta. Health Quality Council of Alberta http://www.hqca.ca/assets/pdf/Matrix%20.pdf. Accessed 30 July 2011.
(13) Berwick DM. 2004. Crossing the quality chasm: Health care for the 21st Century. *Institute for Healthcare Improvement, San Francisco* .
(14) Canadian Institute of Health Information.2010. Health Indicators 2010. Canadian Institute for Health Information [CIHI] http://secure.cihi.ca/cihiweb/products/Healthindicators2010_en.pdf. Accessed 30 July 2011.
(15) Department of Economic and Social AffairsDivision for Social Policy and Development Secretariat of the Permanent Forum on Indigenous Issues.2010. State of the World's Indigenous Peoples. United Nations, Department of Economic and Social AffairsDivision for Social Policy and Development Secretariat of the Permanent Forum on Indigenous Issues http://www.un.org/esa/socdev/unpfii/documents/SOWIP_web.pdf.

This research is made possible through the generous support of...

We acknowledge the support of the Wolb-Pack

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Conseil de recherches en sciences humaines du Canada

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