

# Health versus Privacy: Sensor information trade-off: Development of a sensor acceptability index: Step 1

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## Purpose

- 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].

- The **wireless hacking** of a medical device, first demonstrated at the Black Hat 2011 conference in August, has been taken a step further. An **insulin pump** has been hacked and instructed to deliver a lethal dose [16].

- 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 distributed 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

Table 1c		Table 1d	
Google		Google scholar	
Sensors	Health concepts and areas	Sensors	Sensors
148,000,000		148,000,000	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		Table 1b	
Google		Google scholar	
Sensors	Health concepts and areas	Sensors	Sensors
148,000,000		148,000,000	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 (see introduction)	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.

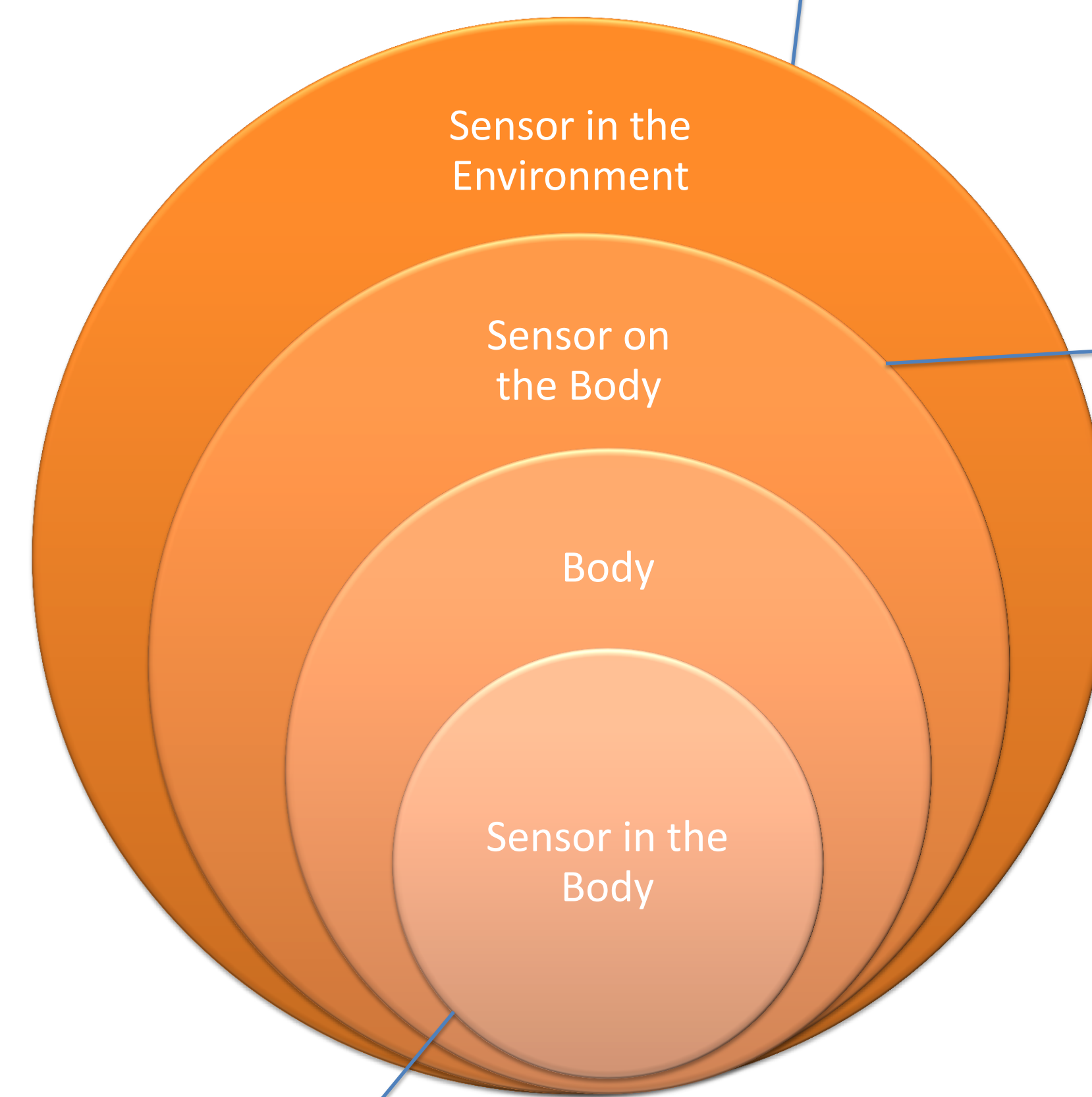


Table 5	Technology	Application
	Electrocardiography [ECOG]	Placed on the brain to identify areas of abnormal activity . Often used in the treatment of epileptic seizures.
	Neurotransmitter Sensors	Chemical sensors on the brain- detect neurotransmitter release.
	Brain Penetrating Electrode Array	Generates 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 sensors	Neurotransmitter suggested to be involved in
Acetylcholine sensor	Alzheimer's Disease
GABA sensor	Specific phobias, obsessive compulsive disorders, and panic disorders
Dopamine sensor	Schizophrenia, Attention Deficit/ Hyperactivity Disorder, Bipolar Disorder
Norepinephrine sensor	Depression, Generalized Anxiety Disorder, Attention Deficit Disorder/Hyperactivity Disorder, Bipolar Disorder
Serotonin sensor	Depression, Generalized Anxiety Disorder, Bipolar Disorder

## 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

## Results

- Sensors are linked to various health discourses (table 1-2)
- The authors have so far generated a list of more than a hundred different sensor linked health applications in three categories
- In the body
- On the body
- In the living environment (tables 3-6)

## Future Steps

- 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]

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