

Developing a Research Agenda to Support Sodium Reduction in Canada

Workshop Report

January 25 - 26, 2010
Toronto, Ontario



The Institute of Nutrition, Metabolism, and Diabetes (INMD)
The Institute of Circulatory and Respiratory Health (ICRH)



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I. EXECUTIVE SUMMARY

The following is a report of the Canadian Institutes of Health Research (CIHR), Institute of Nutrition, Metabolism, and Diabetes (INMD) and Institute of Circulatory and Respiratory Health (ICRH) Workshop: *Developing a Research Agenda to Support Sodium Reduction in Canada*.

The **objectives** of the meeting were to identify:

- strengths, gaps, and opportunities in **research capacity** in Canada for sodium reduction in the thematic areas of health, food science, knowledge-to-action, and in evaluation and monitoring;
- a **research agenda** for sodium reduction in Canada that will be incorporated into the report of Health Canada's Working Group on Sodium Reduction;
- opportunities for **international and global collaborations** for the Canadian research community in the context of Chronic Disease Prevention and Control;
- potential **research funders** to support the identified research agenda for sodium reduction in Canada.

Approximately 100 participants attended the workshop, including members of the research community and representatives from voluntary health organizations, government and the food industry, as well as international participants. Participants were invited to share knowledge and to work collaboratively to generate key research recommendations to advance knowledge in relation to sodium reduction and, ultimately, improve the health of Canadians.

The workshop focussed on the identification of research questions in the following four thematic areas:

- 1) Health and Human Physiology
- 2) Food Science and Food Technology
- 3) Knowledge-to-Action
- 4) Evaluation and Monitoring

These themes align with the work of the Working Group on Sodium Reduction, a multi-stakeholder group tasked with making sodium reduction recommendations to the Government of Canada. The Sodium Working Group's multi-pronged approach is based on:

- 1) Awareness and education
- 2) Research
- 3) Voluntary reduction of sodium in the food supply

THEME 1. HEALTH AND HUMAN PHYSIOLOGY

Research areas identified include:

1. Defining mechanisms underlying salt-induced health risks
2. Discovering biomarkers for salt and links to outcomes
3. Defining physiologic, immune, CNS and renal mechanisms controlling salt intake, distribution and excretion
4. Describing optimal sodium intakes in pregnancy and childhood with long-term impact on blood pressure and cardiovascular disease
5. Developing treatments to target salt intake and excretion
6. Defining the impact and risks of a low sodium diet, low serum sodium and low blood pressure
7. Developing focused and comprehensive research programs

THEME 2. FOOD SCIENCES AND FOOD TECHNOLOGY

Research areas identified include:

1. Identifying mechanism of salty taste perception
2. Describing food safety consequences of reducing sodium concentration
3. Evaluating the effects of other forms of sodium on blood pressure and other physiological functions
4. Defining how low sodium concentration can go technologically, with limited or no impact on existing food products
5. Developing greater coordination between food scientists and health researchers
6. Differentiating between needs (sodium is essential) and wants (higher sodium preferred)
7. Planning to avoid or mitigate unintended consequences of sodium reduction
8. Estimating impacts and implications of altered diets on consumption of sodium

THEME 3. KNOWLEDGE-TO-ACTION

Research areas identified include:

1. Evaluating effects of a voluntary approach to sodium reduction on price and health disparities
2. Describing real time monitoring of levels of sodium in food products and contribution to overall sodium intake
3. Developing information regarding the effectiveness of population interventions (especially for children)
4. Obtaining more data on broader interventions (focused on sodium alone versus total diet)
5. Developing effective policy options, and impact of various policies on different segments of the population, as well as the factors that drive policy decisions

THEME 4. EVALUATION AND MONITORING

Research areas identified include:

1. Monitoring and evaluating discussion focused on the need for nationally representative population-based 24-hour urine data
2. Assessing high risk groups (e.g., children and Aboriginal populations)
3. Defining medium-term indicators focused on surrogate outcomes (i.e., blood pressure, renal function measurements, and hypertension)
4. Identify gaps, including the need to address the lack of baseline data (particularly for vulnerable groups) and a need to assess the effectiveness of education and clinical interventions

CONCLUSIONS AND RECOMMENDATIONS:

The estimated benefits of dietary sodium reduction are considerable and warrant a public health approach to reduce sodium at the population level. A strong **portfolio of research** is an essential component of a national approach to reducing dietary sodium. The Canadian Institutes of Health Research Institute of Nutrition, Metabolism and Diabetes and Institute of Circulatory and Respiratory Health are pleased to provide leadership to catalyze a broad range of research including health, food science, knowledge-to-action and evaluation research to support sodium reduction in Canada.

Next steps will include **securing funds to implement calls for research proposals** in each of the four themes, which were identified and highlighted in this Workshop to support sodium reduction in Canada.

II. THE CONTEXT

WELCOME AND OPENING REMARKS

Dr. Philip M. Sherman, Workshop Chair
Scientific Director, Institute of Nutrition, Metabolism and Diabetes, CIHR

Dr. Sherman welcomed participants to the meeting and thanked everyone who was involved in making this event a success. He recognized workshop co-chair, Dr. Peter Liu, an expert in cardiovascular health and medicine. He noted the importance of bringing together a wide cross-section of leaders in Canada, to provide input for the development of ideas, research questions and proposals for a sodium reduction research agenda.



He thanked CIHR partners and the research sub-committee of the Sodium Working Group. The proceedings will be synthesized into a report which identifies research gaps and research questions and proposals. He asked participants to declare their conflicts-of-interest upfront, in the spirit of open dialogue and transparency.

Dr. Sherman spoke about developing a "made-in-Canada" research strategy, by identifying where there are research gaps and building on the evidence to pursue significant, value-added opportunities. He clarified that a Canadian perspective was paramount, while taking into account best practices and experiences from other countries and organizations. He also emphasized the valuable role of research in awareness-raising and education campaigns for reducing sodium reduction in the food system and the population.

Dr. Colin Carrie, M.P., Parliamentary Secretary to the Minister of Health



This presentation built on the January 25, 2010 letter from the Honourable Leona Aglukkaq, P.C., M.P., the Federal Minister of Health, that commended the Canadian Institutes of Health Research Institute of Nutrition, Metabolism and Diabetes (INMD) and Institute of Circulatory and Respiratory Health (ICRH) for their positive and productive effort and "leadership in bringing together researchers, food industry representatives and health policy makers to inform and support the work of Health Canada's Working Group on Sodium Reduction".

Dr. Carrie noted that sodium is a preservative that adds texture and flavour to foods, and is also a key part of the Canadian diet. He recognized the impact of sodium on high blood pressure, asking the conference participants to help the government "draft a to-do list to guide our research and ultimately our policy." He also made the following points:

- The Sodium Working group will help set targets, and focus efforts on education and awareness.

- Sodium reduction requires changing the habits of Canadians and information to help consumers to make healthy choices. There has to be a gradual, but significant, reduction in the Canadian diet.
- Canada's food industry needs time to find substitutes. Progress is occurring as food product manufacturers take steps to reduce sodium, and sodium ingredient information is reflected on nutrition labels.

Kimberly Elmslie, Director General, Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada



This presentation focused on the relationship between sodium intake, hypertension, and chronic disease. Ms. Elmslie observed that Canadians have a high sodium intake, and this has a major impact on cardiovascular disease – priorities for the Public Health Agency of Canada.

She challenged the workshop participants to identify "mission critical issues of the research agenda" and set the tone for the following two days of discussions, by focusing the sustainability of a sodium reduction trend and ways to proceed to achieve that goal. She noted

the importance of surveillance and monitoring activities; learning from prior public health challenges; coordinating inter-sectoral and cross-disciplinary public health efforts and linking knowledge, behaviour and activities aligned to the Pan-Canadian Healthy Living Strategy. Her priorities were to strengthen and reinforce positive outcomes by:

- Developing a knowledge base to support the modification of dietary efforts of Canadians (i.e., modeling studies)
- Understanding Canadian's knowledge and awareness about sodium reduction
- Identifying (in cooperation with the Sodium Working Group) the appropriate mix of interventions possible to achieve and sustain positive outcomes of dietary sodium reduction
- Identifying the constellation of Canadian and international collaborative teams required, including health researchers, food and behavioural scientists, and ensure stronger linkages and connectedness to government and stakeholders collaborating to advance the health of Canadians
- Working with other jurisdictions internationally to share information, data, and best practices
- Developing comprehensive evaluation, monitoring, and surveillance systems to measure sodium reduction and its effect on the health of Canadians (i.e. hypertension).

Dr. Hasan Hutchinson, Chair of the Multi-Stakeholder Working Group on Dietary Sodium Reduction and Director General of the Office of Nutrition Policy and Promotion, Health Canada



This presentation highlighted the tremendous health, economic, and societal costs involved in over-consumption of sodium. An 'entire-society' approach for reducing sodium intake is needed, and multiple stakeholders from the public, private, and academic sectors must contribute to develop a successful strategy and determine the critical research directions.

High blood pressure and cardiovascular disease are negative outcomes of high sodium intake. Dr. Hutchinson spoke of an example of economic modelling done whereby a reduction of 1,800 mg in sodium intake could decrease the prevalence of hypertension by 30%, resulting in over a million people not needing anti-hypertensive medication and an annual direct cost savings in the range of \$430 million.

It is estimated that Canadians ingest 3,400 mg of sodium per day, more than double the Adequate Intake level (this is a conservative estimate of sodium consumption). The Adequate Intake (AI) of sodium intake is 1,500 mg per day, and the Tolerable Upper Level of Intake (UL) is 2,300 mg per day. In Canada, 90% of men exceed the UL. More than three-quarters (77%) of sodium is contained in processed food and discretionary sources.

The Sodium Working Group is examining different ways to look at nutritional labelling, regulatory approvals, and education tools to be used to reduce sodium intake. A phased long-term approach is required to allow enough time for Canadians to adjust their palates to changed levels of sodium and to change their food intake patterns. A key interim goal is 2,300 mg by 2016 – with the first food category targets finalized by June 2010, and the second set of foods finalized by the end of 2010. The Working Group is also focusing on educating and informing Canadians of health consequences in order to influence their behaviour and decrease the amount of sodium consumed. Other points include:

- A change in the entire food supply is essential to make a difference in the total amount of sodium consumed by Canadians
- The change affects multiple stakeholders: government, researchers, consumer/NGOs, and the food and manufacturing industry
- Canada requires a long-term, multi-staged, three-prong approach, encompassing: (1) awareness and education; (2) research; and (3) voluntary reduction of sodium in the food supply.
- Research gaps have been identified, that with more information, could shed light on monitoring sodium intake in foods, altered food formulation, and the development of more effective strategies for behavioural change
- Next steps include finalizing the education strategy, followed by strategic implementation in coordination with governments, industry, and civil society
- Appropriate monitoring tools and evaluation plans are critical to develop and adapt the sodium reduction strategy

Dr. Peter Liu, Scientific Director, CIHR Institute of Circulatory and Respiratory Health, Co-Chair of the Research Sub-Committee of the Sodium Working Group.



Dr. Liu's presentation set the tone for the conference, by addressing the health benefits of sodium reduction, the opportunity to save lives, and reduce costs to the health care system. He noted that the conference was an opportunity to enrich the knowledge base by exploring the mechanisms by which sodium impacts on health, salt reduction in the food supply, the process of public education and engagement, and effective monitoring and impact evaluation strategies. Dr. Liu expressed his gratitude to the Research Subcommittee of the

Sodium Working Group, and shared his message to attendees that, by working together, the innovation-to-application process could be accelerated.

FACILITATOR REMARKS

ROUNDTABLE PARTICIPANT INTRODUCTIONS AND EXPECTATIONS

Facilitator Marc Valois outlined the Workshop Agenda, and then asked participants to introduce themselves at their respective tables and to share their expectations, setting the context for the themes to be discussed over the next two days: (1) Health and Human Physiology; (2) Food Science / Food Technology; and (3) Knowledge-to-Action.

He informed the group that three speakers in each of the breakout groups would help set up the discussions, and allow for the development of more targeted research questions to emerge. He reiterated the focus of Kim Elmslie's "mission critical agenda", challenging participants to focus on the critical research questions requiring attention. The focus for day two's discussion was on Evaluation and Monitoring, and more specifically on questions related to desired outcomes; measurement indicators; data gaps; and availability of indicator data.

Participant key expectations for the conference were to:

- Identify key research priorities
- Leave with a practical, implementable, and focused research agenda
- Identify an array of funding tools needed
- Discover how different groups and stakeholders can work together, and identify national and international opportunities for collaboration
- Learn from others in terms of experience, best practices, and tools
- Learn from other public health initiatives (i.e., seat belt legislation, blood alcohol) to accelerate progress and achieve desired outcomes.

III. PLENARY SPEAKERS

Dr. Lawrence J. Appel

Professor of Medicine, Epidemiology and International Health (Human Nutrition), John Hopkins University, Baltimore, Maryland, USA



Overview of research gaps and opportunities in the thematic areas of health, food science, knowledge to action and evaluation and monitoring

Dr. Appel provided a primer on salt (sodium chloride) and health, the US Institute of Medicine's Dietary Reference Intakes (DRIs), and research gaps and opportunities. He began by presenting the magnitude of the problem; worldwide, cardiovascular disease is the leading cause of death, and 62% of strokes and 49% of CHD events are attributed to elevated blood pressure. About 26% of adults worldwide have hypertension and, generally, systolic blood pressure rises with advancing age. There are differences in the prevalence of high blood pressure by age and race/ethnicity. It has been estimated that 32,000 heart attacks and 28,000 deaths in the United States each year could be prevented by a salt reduction of 1 g/day.

He reviewed the evidence used to determine the DRIs for sodium, as well as the factors associated with increased salt sensitivity. He noted that the concept of salt sensitivity is irrelevant given that vast scope of the elevated blood pressure and cardiovascular disease epidemics. The majority of US adults, 69%, would be considered "high risk" for developing hypertension, based on the 2005 U.S. Dietary Guidelines, and should be striving to meet the Adequate Intake (AI) for sodium intake of 1,500 mg sodium/day rather than the Upper Limit of 2,300 mg of sodium/day. Recent national goals for cardiovascular disease reduction released by the American Heart Association recommend a diet consistent with energy balance and the DASH-type eating plan, containing <1,500 mg of sodium per day.

Dr. Appel noted the DRI report on Water and Electrolytes includes a section on research gaps, and this provided a starting point for his comments related to research gaps and opportunities. He highlighted research gaps and opportunities related to health, food science, knowledge-to-action, and evaluation and monitoring.

Research Gaps and Opportunities - Health

- Influence of sodium intake during infancy and childhood on blood pressure later in life
- Main and interactive effects of sodium and potassium intake on the age-related rise in blood pressure
- Main and interactive effects of sodium and potassium intake on non- cardiovascular disease (CVD) outcomes: bone mineral density, osteoporosis, kidney disease progression, and gastric cancer
- Assessment and feasibility of a large-scale, long-term trial designed to determine impact of sodium reduction on CVD outcomes

IOM Recommendations on Salt Sensitivity as a Phenotype:

- Development of practical tools to define and better measure salt sensitivity
- Better characterization of salt sensitivity as a phenotype and determination of its relationship to cardiovascular outcomes
- Assessment of genetic and dietary factors that affect salt sensitivity

IOM Recommendations on Biomarkers:

- Assessment of the clinical relevance of sodium-induced changes in plasma renin activity
- Main and interactive effects of sodium and potassium intake on plasma renin activity
- Main and interactive effects of sodium and potassium intake on insulin resistance

Research Gaps and Opportunities in Food Science

IOM Recommendations on Implementation:

- Development of alternative processing technologies to reduce the sodium content of foods, with special emphasis on maintaining flavour, texture, consumer acceptability, safety, and low cost

Food Service Needs:

- Improved salt enhancers and replacers
- New methods (ingredients) to replace key functions of salt (e.g., reducing bitterness)
- Improved delivery systems that deliver same taste, but with reduced amount (e.g., alternative crystal structure, location of salt on products)
- Documenting minimal levels of sodium needed for safety and anticipated shelf life
- Testing new formulations to ensure safety while considering common mishandling issues

Research Gaps and Opportunities Related to Knowledge-to-Action (behavior)

- If sodium reduction is a passive process, how much active engagement, including education of the consumer, is needed, to achieve a lower sodium goal?
- Messages on reduced sodium could be bundled with other diet recommendations while ensuring that the messages still are effective
- Tension between reducing sodium preference and maintaining sodium preference while reducing sodium content
- Basic research on taste receptors and mechanisms of salt perception
- Development and modification of salt taste preferences across the lifespan, particularly in children
- Time course of change in sodium preference

Research Gaps and Opportunities: Evaluation and Monitoring

IOM Recommendations on Dietary Intake:

- Development of practical tools to measure intakes of sodium and potassium and to assess total body levels of sodium and potassium

- Sodium and potassium balance studies to provide estimates of electrolyte loss (sweat concentrations and total sweat loss) by physical activity level, climatic conditions, and dietary electrolyte intake in populations
- Sodium and potassium balance studies during pregnancy

Population Data:

- Current population intake
- Trends in population intake
- Sources of sodium: foods, location (home vs non-home) by demographic
- Types of sodium (sodium chloride vs sodium with another anion)

Food Data:

- Sodium intake in common foods
- Trends in sodium intake in those foods
- Early identification of new foods or processing with high sodium (e.g., flash frozen fish sprayed with brine, poultry injected with sodium at grocery stores)

Measurement Issues:

- Type of measurement (24-hr urine excretion for total sodium intake), 24-hr dietary recall for food source or detailed direct observation
- Individual and group variability; intra-individual variability, inter-individual variability may result in the need for several 24-hr urine collections to accurately classify individuals

Dr. Appel stated that the estimated benefits of salt reduction are substantial and warrant major public health efforts to reduce salt intake. Moreover, a robust portfolio of research, including basic, clinical, and applied research, should accompany public health efforts to reduce dietary sodium.

Lori Sheremeta

Research Associate, Faculty of Law, University of Alberta, National Institute of Nanotechnology



*Challenges around emerging technologies and the food supply:
Law, Ethics, and Policy*

Ms. Sheremeta's presentation highlighted the societal shift from traditional foods to fast-food and the implications of this shift on our approach to research, social policy, and regulation. She highlighted some of the recent media coverage related to dietary sodium, and the relevance of debates around tobacco regulation, public-private healthcare, and preventative medicine.

Salt is a preservative and also provides taste, aroma, and texture. Currently available substitutes are not as cost-effective or tasty as salt, and the food industry is reluctant to make change, yet alternatives are possible in the field of food and nanotechnology (i.e., making salt crystals smaller; developing 'salt missiles' which wrap an innocuous substance with salt). Nanotechnology is acceptable in the public interest if it takes place in high benefit areas; however, there is opposition to nanotechnology from groups opposed to globalization, corporate concentration (of intellectual property),

and people who are concerned about protecting bio- and cultural diversity, and preventing harm to animals, people, and the environment.

Other points included:

- There is increasing pressure from public action groups, protective of the public interest and focused on raising issues and alerting the public. These groups have been at the forefront of increasing pressure for corporate disclosure of sodium levels; although successful litigation lags behind
- Harm is a necessary precondition for regulation (i.e., regulation based on evidence)
- Preliminary steps are focused on voluntary guidelines
- Need for ethical inquiry into action and evaluating other domains for biomedical ethics, learning and best practices, and respecting public trust and individual autonomy

IV. HEALTH AND HUMAN PHYSIOLOGY

Dr. Jens Titze

Interdisciplinary Centre for Clinical Research Department of Nephrology & Hypertension, Nikolaus Fiebiger Centre for Molecular Medicine, University Clinic and Friedrich Alexander University of Erlangen-Nuremberg, Germany



Recent advances in the regulation of salt-dependent volume and blood pressure

Traditionally, blood pressure is thought to be regulated by the brain, blood vessels, and the kidneys. Dr. Titze identified other potential players in blood pressure regulation: subcutaneous lymphatics and macrophages. His research group showed that high salt diets in rats lead to interstitial hypertonic sodium accumulation in skin resulting in increased density and hyperplasia of the lymph capillary network. The mechanisms underlying these effects on lymphatics involve activation of tonicity-responsive enhancer binding protein (TonEBP) in mononuclear phagocyte system (MPS) cells infiltrating the interstitium of the skin. TonEBP binds the promoter of the gene encoding vascular endothelial growth factor-C (VEGF-C) and causes VEGF-C secretion by macrophages. His data show that TonEBP–VEGF-C signalling in MPS cells is a major determinant of extracellular volume and blood pressure homeostasis. Dr. Titze also showed findings indicating that human subjects with refractory hypertension have significantly higher VEGF-C concentrations in circulating plasma than do normotensive controls.

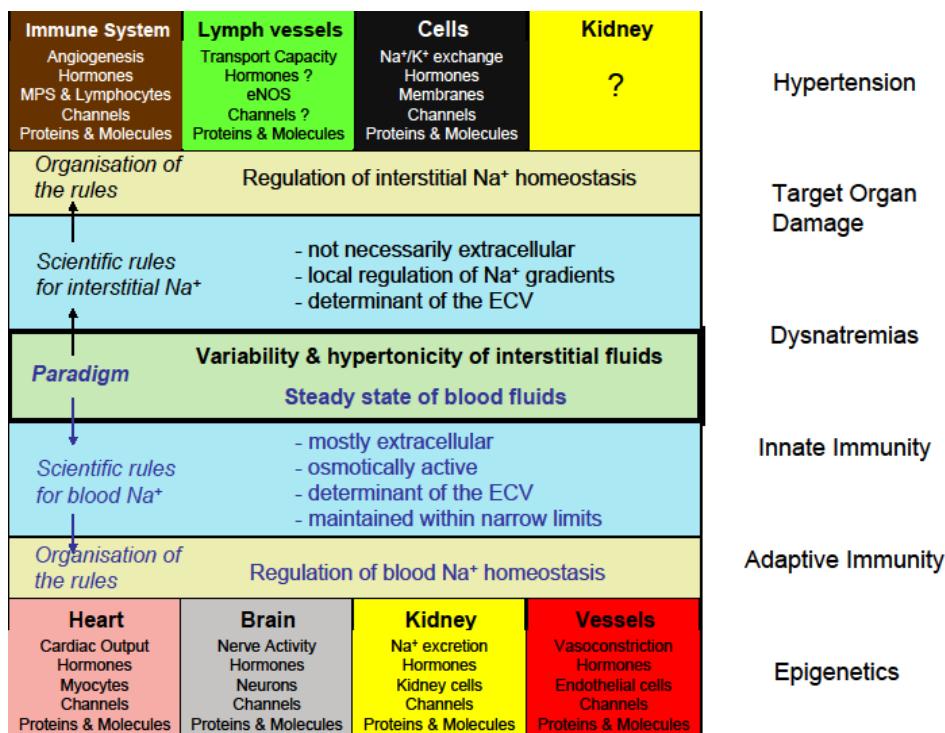


Image courtesy of Dr. Jens Titze University of Erlangen-Nuremberg, Germany

Traditional teaching involved a two-compartment model of interstitial electrolyte and body fluid homeostasis with iso-osmolality between the intra- and extracellular spaces and with no difference between fluid tonicity in the interstitium and in blood. Titze et al. have moved this prevailing view of the salt volume–blood pressure relationship from an isotonic two-compartment model to a dynamic three-compartment model. These studies indicate that uniquely stored sodium, the skin subcutaneous lymphatic vessels, and macrophages of the innate immune system all contribute to volume homeostasis and blood pressure control. Future challenges will be developing tools and applications to study the interactions between the skin interstitium and other organs, such as the kidney, brain, and the vasculature, that modulate blood pressure.

Dr. Norm Campbell

CIHR Chair in Hypertension, Prevention and Control



Clinical research and knowledge translation

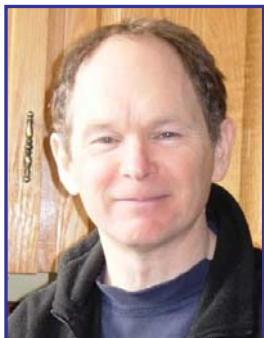
Dr. Campbell shared CIHR's definition of Knowledge Translation (KT) as a dynamic and iterative process that includes the synthesis, dissemination, exchange, and ethically sound application of knowledge to improve health, provide more effective health services and products, and strengthen the health care system. Defining research scope is critical to improving sustainable health outcomes and health services research projects. The Canadian cardiovascular disease community is capable of designing and conducting large, long-term, multi-centre, randomized controlled trials with hard clinical outcomes. While Canada is leader in KT theory, it has so far failed to apply KT concepts well.

There is sufficient clinical research data on the health risks of high dietary sodium to act to reduce dietary sodium, including the effects of sodium on blood pressure (and hypertension), on cardiovascular disease, blood vessels and the heart (in animal models), on renal calcium handling and markers of bone re-absorption, on thirst associated with increased caloric consumption, on inflammation of respiratory bronchioles (animal models), on gastric cancer (enhances carcinogens initiating and promoting gastric cancer in animal models and in epidemiology). Still, there is uncertainty related to the extent of impact of high sodium on non CVD in humans (i.e., on osteoporosis, asthma severity, frequency of renal stones, obesity, and other disease risks from in utero to death in humans).

There is a need for a sophisticated health economic models to assess and monitor the impact of sodium and interventions to reduce dietary sodium. For knowledge translation programs to be successful, the interventions usually need to be complex, multiple, consistent, and long-term. These interventions are testable in cluster randomized trials, but a cohort type observational design with continuous quality improvement is suited to national programs such as a sodium reduction effort.

Dr. Bruce Van Vliet

Professor of Cardiovascular and Renal Physiology, Memorial University



Early Exposures: Genetics of salt sensitivity and impact of early exposure to high sodium diets

Dr. Van Vliet shared a conceptual overview of "sodium induced risk", consisting of the impact of sodium on morbidity and mortality as a consequence of effects on blood pressure, effects on cardiovascular targets that are blood pressure independent, and effects on non-cardiovascular targets. The remainder of the presentation focused on the effects of sodium on blood pressure.

Acute salt sensitivity on blood pressure is reversible within a few days or weeks, and is the result of impairment in one or more of the many mechanisms/systems, renal and extra-renal, that ultimately impact on the regulation of renal sodium excretion. Salt sensitivity has a number of associates and causes. While simple, potent monogenetic forms of salt sensitivity have been identified, future research may reveal how small contributions from multiple genes can also cause acute salt sensitivity.

Progressive salt induced hypertension refers to the ability of sodium to cause a slow, age-dependent rise in blood pressure, and is distinct from acute salt sensitivity. The progressive increase in blood pressure has two components: a reversible component due to a progressive salt-induced increase in acute salt sensitivity, and an irreversible component due to a progressive and permanent resetting of blood pressure to higher levels. There are multiple contributing mechanisms, including the sympathetic nervous system, immune system and kidneys.

Accumulating evidence in rats suggests that the effect of dietary sodium on blood pressure begins during development, with high maternal salt intake during pregnancy and lactation programming the offspring for high blood pressure. Information on this subject is far from complete, and more research needs to be carried out to rigorously evaluate this phenomenon.

In summary, salt induced risk has multiple components, including acute salt sensitivity and progressive salt induced hypertension, and it is likely a lifelong phenomenon, starting prenatally and continuing with the evolution of blood pressure and acute salt sensitivity with increasing age.

V. FOOD SCIENCE AND FOOD TECHNOLOGY

Dr. Rickey Yada

Scientific Director, Advanced Foods and Materials Network, Networks of Centres of Excellence, Department of Food Science, University of Guelph



Food science challenges in sodium reduction: taste, preservation, texture, colour – what has been done in other jurisdictions? What can be done?

Dr. Yada shared the multiple challenges facing industry. Salt is commonly used for taste, flavour, preservation, colour, and other uses. For example, salt in cheese has many functions including preservation, protein hydration, and cooking. Salt in dough improves flavour, controls yeast fermentation, and strengthens gluten. Salt toppings can improve taste, and can be released either slowly or quickly. A variety of chemical leavening agents (e.g., sodium bicarbonate), processing aids (e.g., sodium metabisulfite), and emulsifiers (e.g., lecithin, mono- and diglycerides, sodium stearoyl lactate) are used in food processing.

He spoke about sodium reduction strategies including adaptation (i.e., a gradual reduction in salt intake); using different flavours, spices, herbs, and aroma compounds; and salt substitutes, such as mineral salts and maskers and other additives, to enhance saltiness.



An example of the various forms of sodium present in a typical kitchen.

Image courtesy of Dr. Rickey Yada,
University of Guelph

Dr. Jeffrey Farber

Director of the Bureau of Microbial Hazards, Food Directorate, Health Canada



Microbial issues and challenges associated with a sodium reduction in the food supply.

Dr. Farber spoke about the challenges of food safety in Canada.

Foodborne illness (e.g., *Listeria*, *Salmonella*, *Escherichia coli*) is a top-of-mind concern in Canada, with 11-13 million cases per year, and a cost of more than \$3 billion annually. With a dynamic and rapidly changing food supply, new issues are arising, including an aging population with increasing susceptibility, emerging foodborne pathogens and foodborne illness associated with foods that were once thought to not be associated with disease (e.g., produce, peanut butter, carrot juice).

Several methods either inactivate or inhibit growth (i.e., canning and cooking; the Big 5 (intrinsic): (pH, water activity, background microflora (i.e., lactic acid bacteria), natural food compounds that are inhibitory (carrots), food additives and the Big 2 (extrinsic): temperature (mesophilic, psychrotrophic), atmosphere (e.g., modified atmosphere packaging or MAP). It is known that salt inhibits the growth of pathogenic bacteria.



Sliced packaged meat which is in place and ready to be treated by a high-pressure processing machine

Image courtesy of Dr. Jeffrey Farber, Health Canada

Dr. Chor-San Khoo

VP, Global Nutrition and Health, Campbell Soup Company



Learning from Doing: The Campbell Soup Company Story

Dr. Khoo shared the challenge of sodium reduction from an industry perspective. Campbell's core business categories are soups and sauces, savory beverages, and baked products ($\frac{2}{3}$ liquid products). Sodium reduction is a global strategy for the company and a top priority is seeking solutions without sacrificing taste.

Demand has quadrupled for reduced sodium products (i.e., 25-50% reduction), with a future target of a 50% overall reduction in Canada. In soups, Campbell's has added lower sodium sea salt and proprietary flavours (to reduce sodium by 32% to 480 mg/serving). This has led to positive feedback, where 80% of consumers rated "As good as original"; and 65% claimed lower sodium brought them back to buying the brand.

Over the past 40 years, the company has learned that salt is multi-functional, even in taste (i.e., contributes to salty, sweet, bitter, sour, umami), and not all sodium salts act the same with respect to blood pressure. Human beings are able to perceive a difference in taste with as little as a 10% reduction in salt.

In terms of consumer communication, talking about sodium alone is not enough: people need assurances that safety, taste, and familiarity are not compromised. Possible research areas include: understanding salt taste mechanisms; palatability, taste, texture, influence on other taste modalities (i.e., hardwired, cooperative) influences on aroma, body of food; genetic factors; medication of a salt-loving behaviour; and safety of a 1,500 mg/day sodium diet.

VI. KNOWLEDGE-TO-ACTION

Dr. Charlene Elliott

Faculty of Communication and Culture, University of Calgary



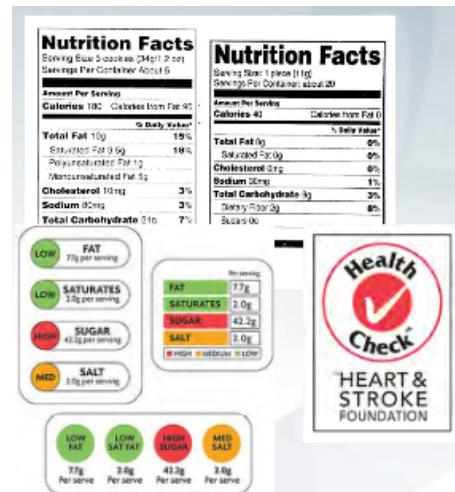
Product Packaging, Labelling and Marketing: Possibilities and Research Gaps

Dr. Elliott's talk examined the current state of knowledge regarding packaging and labelling, and suggested a number of research possibilities and gaps pertaining to the issue of product packaging, labelling and sodium.

An environmental scan of the academic research literature on packaging and labelling published in the last 8 years reveals that the predominant focus is on front-of-pack (FOP) and nutrition labelling. Product packaging should be brought on the radar of discussions pertaining to consumer purchasing habits, because other semiotic elements of the package also influence consumer perceptions.

Packaging appeals emphasizing "naturalness" or other desirable elements can prompt consumers to overlook undesirable aspects of processed foods (i.e., high sugar, high salt) and classify the foods as a whole as healthy. When referring to the label 57% of Canadians claim to "always or usually" read the label, focusing specifically on ingredient information, the best before date, and the Nutrition Facts table (in that order) (CCFN TNT 2009).

The relatively strong focus on the Nutrition Facts table as a source of information provides an opportunity to revisit how and what the label communicates. Because Nutrition Facts tables currently do not require standardized serving sizes for comparable foods, it is challenging to compare across the same category of products. One challenge facing the Sodium Working Group (SWG) is the problem of communicative abundance. That is, how does SWG make sodium stand out amidst the 12 other nutrients plus calories found on the Nutrition Facts table? There is equally the challenge of making it relevant in light of other consumer concerns regarding calories, trans fats and sugar content.



Potential conflict exists between systems designed to encourage consumption of healthier products and those designed to encourage consumption of healthy products.

Currently, the preferred system appears to be the standardized "traffic light labelling scheme" adopted by the UK, that works around a number of pitfalls by setting out threshold amounts for four key nutrients and working on a standardized amount of food. Lobstein and Davies' review suggests that this colour coding system has not only impacted shopper's choices, but also prompted retailers to reformulate products to achieve a healthier profile and,

Various forms of labels were created to attract consumers and influence their perception of products

Image courtesy of Lianne Vardy, Public Health Agency of Canada

consequently, a better colour code. Single score profiling also exists, but the real opportunities with these kinds of systems emerge with the consistent messaging communicated to consumers, emerging from a uniform approach and not based on varying, industry-defined criteria of what constitutes a "healthier choice."

Dr. Andrew Pipe

Chief of the Division of Prevention and Rehabilitation, University of Ottawa Heart Institute



Public health approaches to sodium reduction at the community level

Dr. Pipe provided an overview of the Champlain Cardiovascular Disease Prevention Network's Sodium Reduction Campaign. The goal of this campaign is to reduce the consumption of dietary sodium among the residents of the Champlain region (Ontario). Men and women 35-50 years of age are the primary target. The campaign strategy included a bilingual mass media campaign of TV, radio, print, web advertisements, public relations, and community engagement.

The focus was on processed foods and simple, quick, and easy tips to help consumers reduce sodium intake when shopping, preparing meals at home, or thinking about eating out (not menu decisions). The primary focus was light, quirky, and fun, and embedded in the campaign's tagline: "Cutting Sodium: It's pretty easy when you think about it," and slogans like "Give Your Head a Shake".

The mass media advertising elements were intended to tell consumers what to do to reduce their sodium and the public relations, media relations, and community engagement activities focus on why sodium is important. The goal of the ads is to identify foods or situations where there is potential for too much sodium; and then provide a quick, easy alternative. To date, more than 2,300 campaign ads have been posted on TV, radio, print, and web media. More than 52 news (editorial) stories have been either published or broadcast in news outlets across the Champlain region representing a reach of more than 4.2 million impressions.

An evaluation team has been created to try to measure the impact of the campaign, and baseline data collected using a 12-minute telephone-based interview. An evaluation plan has been developed, with implementation awaiting access to resources.

Lianne Vardy

Director, Chronic Disease Management, Division, Public Health Agency of Canada



International Action on Salt / Sodium Reduction: A Comparative Policy Analysis

Ms. Vardy indicated that the World Health Organization (WHO) has identified Eight Steps to Population Salt Reduction including: (1) organize support for change; (2) identify levels and primary sources of high salt intake; (3) set targets; (4) develop campaigns and engage partners; (5) raise consumer awareness; (6) apply easy to understand and clear labelling; (7) negotiate reduction levels with industry; and (8) monitor progress and continually evaluate.

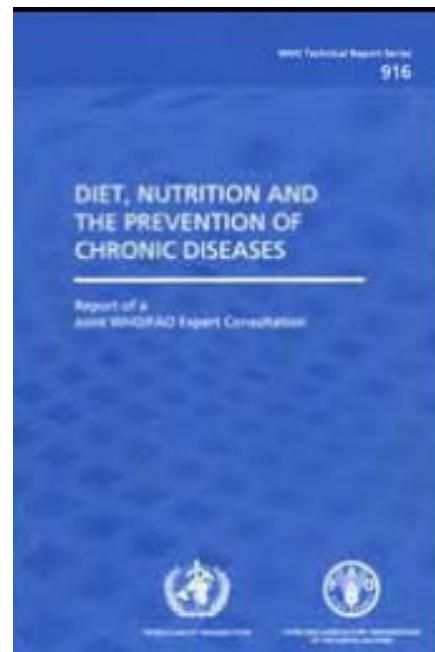
Many jurisdictions have undertaken salt reduction initiatives on a broad scale, which build on the WHO steps to Population Sodium Reduction. Since 2007, the European Union has had a clear decision to act on salt, and has set up national data collection and analysis. Actions also include developing reformulated products with industry and caterers, and monitoring salt content in food, individual intake levels and consumer awareness, and release of the First Monitoring Reports on the National Salt Initiatives in 2010.

The UK and Finland both have launched comprehensive salt reduction programs engaging a broad range of partners. These are broad-based consumer education and media campaigns delivered by government and non-governmental organizations (NGOs) with clear targets, ongoing monitoring, and documented impact on population salt intakes. Based on 24-hour urine collection, both jurisdictions have progressed towards achieving sodium targets. UK: 3,440 mg/day (2008) vs. 3,800 mg (2001); Finland: 3,300 mg/day (2002) vs. 5,000 mg/day (1980).

A number of South American countries also have set targets for sodium reduction, and the Pan American Health Organization (PAHO) is developing short, medium, and long-term goals for sodium reduction.

In 2007, the Australian Division of the World Action on Salt and Health (WASH) launched a "drop the salt" campaign and set targets for industry.

In the USA, there is mandatory reporting of sodium content and a voluntary approach to sodium reduction. The Institute of Medicine Report on Strategies to Reduce Sodium Intake is expected in April 2010. The New York City Department of Health and Mental Hygiene is coordinating a nationwide effort, The National Salt Reduction Initiative, to help food manufacturers and restaurants voluntarily reduce the amount of salt in their products. The goal is to reduce Americans' salt intake by 20% over five years. They have developed specific targets to help companies reduce the salt levels in 61 categories of packaged food and 25 classes of restaurant food.



The WHO established 8 steps to population salt reduction which lead to many countries developing their own salt reduction strategies.

Image courtesy of Lianne Vardy, Public Health Agency

In Canada, the Federal Minister of Health established multi-stakeholder Working Group on Dietary Sodium Reduction in 2007. The strategy focuses on consumer education, voluntary reductions in the food supply, and research, and its Strategy Report is due July 2010.

Lessons learned abroad include:

- Comprehensive, multi-pronged programs are effective in sodium reduction
- Sodium-specific campaigns are more effective than a generalized healthy eating approach
- Evidence of reduction of CVD events associated with sodium reduction
- Consumers will change behaviour if they understand and use food labelling
- Food supply - both processed foods and foods from restaurants - need to be major contributors to sodium reduction in order to achieve established goals.

VII. THE UK EXPERIENCE OF SODIUM REDUCTION

Alette Addison

Head of the Salt Reduction Strategy, UK Food Standards Agency



Evaluation of impact of United Kingdom voluntary approach to sodium reduction and consumer education

Ms. Addison indicated that the U.K. Food Standards Agency has been successful in engaging industry, major retailers, and NGOs in reducing sodium and reinforcing and amplifying the salt-reduction message. In the early part of this decade, there was considerable policy work on the development of a salt model that demonstrated the levels of salt reductions that would be needed to reach a 6g salt/day average population target (from an average intake of 9.5 g salt/day). This was reinforced by a campaign to reach out to manufacturers and consumer education campaign which included mascot 'Sid the Slug' and his tagline: "Too Much Sodium is Bad for Your Heart."

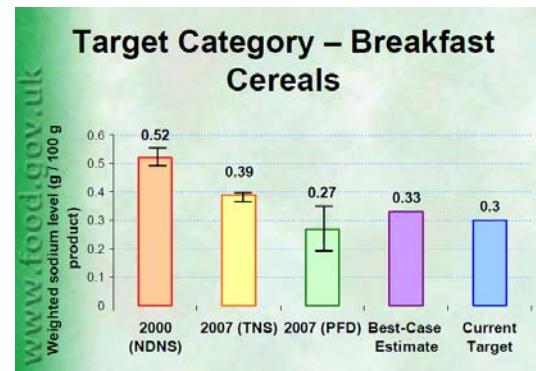
Ms. Addison shared the chronology of activities to reduce sodium in the U.K., as well as the effort to measure the contribution of different foods to sodium intake. These included: developing a Processed Food Data Bank; industry commitments and an industry self-reporting framework; and market labelling data. Over the course of the campaign, seventy food companies formally committed to reduce the salt content of their products and many others are using the voluntary salt reduction targets to guide their product reformulation. Initially, voluntary salt reduction targets were set for 85 food types. Good progress has been made in many sectors, including in bread, which has reduced its sales-weighted average salt content by ~35% and the breakfast cereal companies where a reduction of 45% has been observed.

The Agency purchased information from 130,000 food product labels and sales data (i.e., major companies, market share). These data enabled the team to identify sales-weighted averages of products which contribute the most to daily sodium intake. This led the team to engage manufacturers directly to discuss reducing the sodium content in foods.



Sid the Slug was created to increase consumer awareness of sodium intake

Image courtesy of Alette Addison, UK Food Standards Agency



Breakfast cereals in the UK have made a significant effort in reducing the salt content in their products

Image courtesy of Alette Addison, UK Food Standards Agency

Mascot 'Sid the Slug' helped increase awareness and further phases of the campaign focused on actions consumers could take to reduce their intake. The U.K. has seen an increase in the number of people checking food labels for salt content and claiming to make a special effort to cut down on the amount of salt in their diet.

Overall, there has been an average salt reduction of 0.9g per day at the population level. This equates to about a 9.5 % drop in average daily salt intake, from 9.5g of salt per day in 2001 to 8.6g of salt per day in 2008, based on urinary sodium analyses. The Agency has just published its next strategic plan which includes continued work on salt. Further voluntary salt reduction targets were published last year for achievement by 2012. However, the agency recognizes that as manufacturers progress in reformulating and rebalancing recipes it becomes more difficult and costly, which indicates that further progress toward the overall 6g target will remain challenging. In response to questions from the floor, the presenter made the following remarks:

- Monitoring levels of salt in the food supply is essential for success
- Consumer education was undertaken not simply as an opportunity to raise consumer awareness, but as part of the Agency's bargain with the industry to help promote lower salt products and provide incentives to manufacturers
- The Agency will be repurchasing marketing and sales data in 2011 which, alongside a further urinary sodium study, will be used to provide evidence of progress towards the 6g target
- Blood pressure data are also being collected, but it is recognized that it is difficult to attribute exclusively to efforts related to salt reduction in the diet
- EU harmonization – Work on a common framework for salt reduction has been taken forward by the European Commission; however, harmonizing action in 27 countries will be a challenge.

VIII. EVALUATION AND MONITORING

This session focused on summative evaluation and monitoring activities underpinning the successful outcomes of Canada's sodium research agenda

In preparation for the evaluation and monitoring breakout discussions, the following speakers set the context. After the conclusion of their formal presentations, the group divided into their respective themes and worked through a set of pre-identified questions.

Moderator – Dr. Nancy Edwards, Scientific Director, CIHR-Institute of Population and Public Health

Dr. Susan Barr

Professor of Nutrition, University of British Columbia



Considerations in monitoring sodium reduction at the population level

Dr. Barr reviewed issues and challenges in monitoring sodium reduction at the population level. She differentiated between assessing sodium intake at the individual versus the population level. She explained the sodium balance equation: intake (i.e., food and beverages) = losses (i.e., urine and sweat).

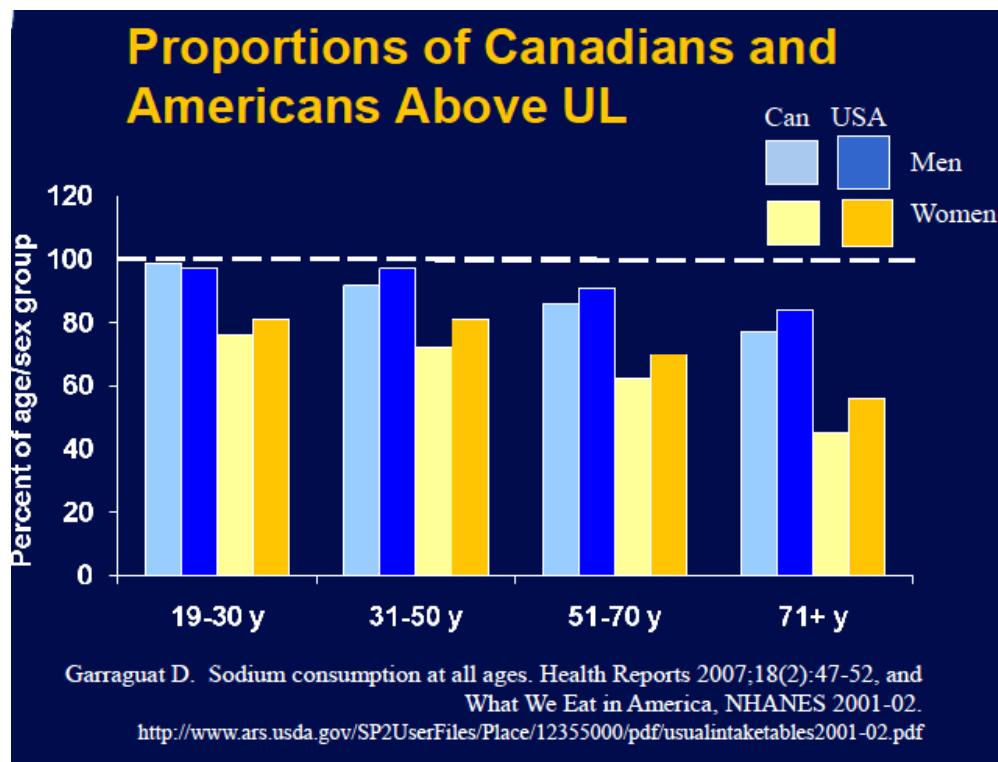
On the intake side, monitoring the sodium content of the food supply can assess manufacturers' adherence to sodium targets, but this measure does not necessarily provide information whether reduced intakes have been attained by the population. Conceivably, people could simply alter the types of foods they choose or the amount of salt they add to foods to compensate for sodium reductions in foods. Using either dietary recall or diet records provides important information on sources of sodium intake. However, under-reporting is common and it is difficult to capture salt added at the table or in cooking, leading to underestimates of true sodium intakes. Dr. Barr also shared challenges in using the Canadian Nutrient File (CNF) to estimate population intake levels of sodium. The CNF provides a composite value for sodium, but there is variation between different brands of products available in the Canadian marketplace. Furthermore, the CNF is only updated periodically. Thus, initiatives taken by manufacturers to reduce sodium content of foods may not be reflected in the database.

On the losses side, assessing sodium intake is measured by the "gold-standard" 24-hour urine collection method, which contains ~95% of sodium losses in non-sweating individuals. Challenges include: expensive to administer; burdensome to participants; and timing and completeness. There are different methods for urinary sodium assessment which have been used in various studies rather than 24-hour urinary sodium excretion, each with issues for validation, including: overnight, timed, and spot-urine. Issues for urine validation studies include: how long a period of time urine was collected for; time of day (spot urines); use of creatinine; influence of recent sodium intake; and differences between normal blood pressure and hypertensive individuals.

Dr. Barr also identified that monitoring the effectiveness of dietary sodium reduction using blood pressure as an outcome measure is problematic for a number of reasons. Although this is a key outcome variable of

sodium reduction initiatives, there are a number of factors other than sodium that affect blood pressure, including body weight, daily aerobic exercise, a diet rich in fruit and vegetables (the DASH diet), and a low consumption of alcoholic beverages. Changes in these variables could obscure the blood pressure effects related to changes in sodium intake. Also, large samples are needed to detect changes in blood pressure due to inherent variability in the measurement. She cited data from a systematic review by He and McGregor (2004), showing that reduction of urinary sodium by 1,150 mg/d (similar to what would occur if Canadians reduced average sodium intakes to the Upper Level of 2,300 mg/d) is associated with a reduction in systolic blood pressure of about 2 mm Hg in normotensive individuals and about 4 mm Hg in hypertensive persons. Greater reductions in intake (e.g., a decrease of about 1,840 mg/d, similar to reducing Canadians' intakes to the Adequate Intake of 1,500 mg/d for young adults) would lead to an average decrease in systolic blood pressure of >2 mm Hg in normotensive persons and about 6 mm Hg in those with hypertension .

Dr. Barr summed up by stating that a multivalent assessment approach is needed (i.e., food supply, population intake, urine sodium) to monitor sodium reduction at the population level; data are needed on intake from added salt; 24-hour urine collection would likely remain the gold standard for sodium intake assessment; and research is needed to determine whether timed or spot urine could provide informative data.



Americans and Canadians have similar proportions of population groups that figure above the Tolerable Upper Intake Level (UL)
Image courtesy of Dr. Susan Barr, University of British Columbia

Dr. Mary L'Abbé

Earle W. McHenry Professor and Chair, Nutritional Sciences, Faculty of Medicine, University of Toronto,
Co-Chair, Sodium Working Group



Food System Monitoring: How to measure changes in the food supply

Dr. L'Abbe spoke about data challenges regarding the sodium content in food, and the sources of information required for monitoring the food supply. There are considerable differences among different manufacturers of the same type of food and manufacturers have global differences for the same foods and products are reformulated. While UK data, for example, are highly valued, there is a need for 'made-in-Canada' information.

Sources of information include: the Canadian Nutrient File (CNF) (Canada's national reference food composition database); nutrition label data; company/restaurant websites; food analysis and analyzing composites of the "total diet". The CNF (<http://www.healthcanada.gc.ca/cnf>) includes:

- 143 food components described for over 5,500 foods
- Generic averages for certain food types
- Periodic updates since its inception in 1981
- Data sources: USDA Nutrient Databank data adjusted to reflect Canadian regulations (e.g., fortification; commodities industry, with HC advice regarding sampling; Canadian food manufacturers; Health Canada laboratories; Literature; and Recipe calculations)

A National Sodium Monitoring program needs to contain data for foods Canadians eat, focusing on the main sources of sodium in two sectors: (1) pre-packaged foods (i.e., which brands are most popular, using nutrition label values for sodium; and calculating sales weighted averages); and (2) monitoring the restaurant and food service sector. For the latter, there are particular challenges, including: large differences between different companies; only some companies have databases and websites; lack of nutrition labels; and unknown and highly variable portion sizes.

Data from the 2004 CCHS 2.2 Nutrition-focus was used to determine the contribution of foods to sodium intake of Canadians. It consisted of data from over 33,000 respondents of all ages from all provinces, excluding the three territories, and included a 24-hour recall on all respondents (self-reported), with a repeat recall done on a subset of respondents. Salt added in cooking or at the table was not recorded; nutrient intakes (sodium) were calculated using food intakes with sodium levels in foods in the CNF.

The Canadian approach to setting targets and monitoring uses two starting points: (1) UK FSA 2012 Targets, which were matched with Canadian foods reported in the CCHS 2.2. This modeling indicated that the total average per capita sodium reduction would bring the intake at, or close to, the UL at 2,300 mg per day for adults), and (2) Canadian market data:

Nutrition Facts	
Per 1 cup (264g)	
Amount	% Daily Value
Calories 260	
Fat 13g	20%
Saturated Fat 3g + Trans Fat 2g	25%
Cholesterol 30mg	
Sodium 660mg	28%
Carbohydrate 31g	10%
Fibre 0g	0%
Sugars 5g	
Protein 5g	
Vitamin A 4% • Vitamin C 2%	
Calcium 15% • Iron 4%	

*Image courtesy of Dr. Mary L'Abbé,
University of Toronto*

- The main food contributors of sodium for Canadians were determined using data from the 2004 CCHS 2.2.
- 2007 and 2008 Canadian Nielsen market volume data used to develop a sampling plan
- Preselected food labels were picked up or digitally photographed from various stores across Canada
- Nutrition Facts sodium information for individual products was used to estimate the average sodium content, range, and distribution of sodium levels in each food category.
- A first set of food categories (Group I foods) that contribute around 50 to 60% of sodium has been completed.

Data sources from restaurant and food services industry data sources do not have mandatory nutrition labelling and come from the Canadian Restaurant and Foodservices Association voluntary program of providing nutrition information on-line. Some information is provided by sampling and food analysis, and calculations from the CNF.

Dr. L'Abbe concluded that the food system is complex and it will be challenging to keep up with ongoing changes. A variety of complementary approaches are needed including: nutrition labels; company databases; calculations using company and CNF databases; and direct food analyses.

Dr. Anna Farmer

Community Nutrition, Department of Agriculture, Food and Nutritional Science and the Centre for Health Promotion Studies, University of Alberta



Consumer education and awareness: How to measure changes in consumer awareness, attitudes and behaviours

Dr. Farmer shared an ecological model and theories of behavioural change to provide the context for behavior change research. To provide an understanding of perceptions and motivations to reduce dietary sodium across different contexts through an ecological lens, she advised researchers to:

- Focus on studies that use mixed methods that include both qualitative and quantitative methods
- Research across settings and in multiple settings: layering intervention research
- Use behavioural theories that focus on perceptions and intentions
- Focus on not only what consumers say they do, but what they actually do (e.g., in restaurants and in grocery stores)
- Focus on understanding the perceptions and meaning of health from different cultural perspectives

Her research has found that Canadians are 'sodium-savvy' to a degree:

- Majority aware that canned or processed foods higher in sodium than other forms
- 75% agreed that "most sodium in a person's diet comes from processed or canned foods"
- Over 35% of those aged 18-24 years did not know sources of sodium in food
- Awareness of sodium in foods increased with age
- More than 85% of Canadians make the link with blood pressure and high sodium intake
- No variance across various regions of the country
- Sodium health beliefs do not differ significantly across demographics
- Most Canadians do not read the label for sodium content
- Young adults and families exercise fewer sodium reduction behaviors

Moderator's Summary

Moderator Dr. Nancy Edwards recognized the challenge in monitoring complex needs and interventions; the need for an adequate dose of intervention to ensure some measurable change, and that needs were diverse and complex.

IX. Identification of Research Gaps and Opportunities by Theme, as Identified by Workshop Participants

Summary of Small Group Discussions by Thematic Stream

Workshop participants were divided into three groups based on the Workshop themes:

1) health, 2) food science, and 3) knowledge-to-action. Each of the themes was introduced by three presenters who set the context for small roundtable discussions related to knowledge gaps. At the conclusion of the exercise, groups combined their results into one thematic group report for presentation to the plenary.

In addition to the context setting done by the presenters, the Facilitator asked participants at table groups consider the workshop objectives when identifying knowledge gaps and opportunities for research. The breakout room moderator guided participants to prioritize the research questions according to the following criteria:

- Which research questions are most promising in terms of advancing new knowledge?
- To what extent will this new knowledge provide an opportunity to inform food or health policy change and improve the health of Canadians?
- To what extent is this research feasible?
- Do we have the researcher capacity in Canada to address these research questions?
- Are there opportunities to build international or global research collaborations to address these questions?

The groups then completed a project proposal template in their table report booklets, and shared research project description results in plenary on Day 2.

THEME 1 – HEALTH AND HUMAN PHYSIOLOGY

RESEARCH AREAS IDENTIFIED INCLUDE:

- Exploring sodium influences during infancy and childhood, and throughout a child's life
- Examining main and interactive effects of sodium and potassium intake on the age-related rise in blood pressure (i.e., on average, a reduction in sodium intake leads to a decrease in blood pressure)
- Focusing on non-cardiovascular disease outcomes (i.e., bone mineral density, osteoporosis, kidney disease progression, gastric cancer) and feasibility of large-scale trials
- Researching potential adverse outcomes, including blood pressure related and BP unrelated adverse effects
- Developing recommendations on biomarkers (i.e., some people have advised against blood pressure reduction, because of changes in plasma renin activity)
- Conducting studies on sodium and potassium and insulin resistance

- Reduce current gaps in basic understanding of sodium physiology
- Huge opportunities for advancing knowledge in the field that will inform practice and policy

RESEARCH QUESTIONS:

1. Defining mechanisms underlying salt-induced risks
2. Discovering biomarkers for salt and links to outcomes
3. Defining physiologic, immune, neurologic, and renal mechanisms controlling salt intake, distribution, and excretion
4. Describing optimal sodium intakes in pregnancy and childhood, with potential for long-term impact on blood pressure and cardiovascular disease during adult life
5. Developing treatments to target salt intake and excretion
6. Defining the impact and risks of a low sodium diet, low serum sodium, and low blood pressure
7. Developing focused and comprehensive research programs

RESEARCH PROPOSALS:

1. BASIC MECHANISMS REGULATING SODIUM INTAKE, DISTRIBUTION, AND EXCRETION

- Advance knowledge on the basic mechanisms of plasticity of salt appetite, and peripheral and central sodium sensing in order to achieve effective behavioural strategies for intervention
- Develop tools to study recently recognized highly variable compartmentalization of sodium and the relevance to whole body sodium balance related to other nutrients and electrolytes
- Better understand the contribution of hemodynamic and non-hemodynamic, intra-renal, and extra-renal mechanisms determining sodium excretion

2. DEVELOPMENT OF TECHNOLOGY AND BIOMARKERS TO MEASURE SODIUM STATUS IN HEALTH AND DISEASE

- Encourage the formation of consortia (teams) bringing together basic, clinical ,and population health scientists; this could include MRI for measures of tissue sodium content and extra-renal control of sodium load
- Establish a prospective longitudinal study
- Create international collaborations (with NIH encouraged)

3. A) VOLUME INDEPENDENT EFFECTS OF SODIUM ON BLOOD PRESSURE

- Identify mechanisms by which sodium affects blood pressure through volume-independent pathways. For example:
 - Direct effects on cardiac and vascular function and structure
 - Indirect signalling pathways mediated by sodium
 - Mechanisms regulating osmotically active and inactive sodium pools

3. B) POTENTIAL ADVERSE EFFECTS OF SODIUM ON HEALTH

- Define the impact of high dietary sodium on:
 - Age-dependent changes in blood pressure
 - Asthma severity and frequency
 - Osteoporosis and bone mineral density
 - Calcium containing renal stones
 - Obesity
 - Gastric cancer

THEME 2 – FOOD SCIENCE

RESEARCH AREAS IDENTIFIED INCLUDE:

- Development of alternative processing technologies, emphasizing palatability, food texture, cost, safety, and improvements of salt substitutes or enhancers
- New methods to replace key functions of salt
- New delivery systems, delivering the same taste with a reduced amount, and new formulations
- Some innovations are proprietary and may not be publicly-available – there are competitive differences between industry and public health, and companies may not be willing to share new sodium formulations, considering them as Intellectual Property (IP)

RESEARCH GAPS AND OPPORTUNITIES:

- Defining mechanisms of salty taste perception
- Monitoring food safety consequences of reducing sodium concentration
- Evaluating the effects of other forms of sodium on BP and other physiological functions
- Defining how low sodium concentration can go technologically with limited, or no, impact on existing products
- Developing greater coordination between food scientists and health researchers
- Differentiating between needs (sodium is essential) from wants (higher sodium preferred)
- Planning to avoid or mitigate unintended consequences
- Estimating impacts and implications of altered diets on consumption of sodium

RESEARCH PROJECT PROPOSALS:

1. DEFINE THE LOWEST SODIUM CONCENTRATIONS THAT CAN BE ATTAINED WITHOUT ALTERING MAIN FOOD CHARACTERISTICS (FUNCTION)

Goal: Understand foundational knowledge on the role of salt in food systems (e.g. taste, hedonic, shelf-life, aroma, etc)

Scope: Target 3 food sectors including 3 food matrices (solid, semi-solid, liquid)

Type: Fundamental and applied research collaboration in food sciences through public-private partnerships

Resources: Multidisciplinary consortium-network approach at \$25M/5yrs (NCE model)

2. DETERMINE HOW TO REDUCE SODIUM LEVELS IN HARD CHEESES, PROCESSED MEATS AND POULTRY WITHOUT AFFECTING MICROBIAL SAFETY (SAFETY)

Goal: Reduce or eliminate sodium in these products while avoiding or mitigating unintended consequences

Scope: Investigate selected technologies to be used to reduce or eliminate sodium

Type: Applied microbial research through public-private collaborations, and synthesis research

Resources: Multidisciplinary team approach at \$4.5M over 3 years (model: CRDs, NSERC Strategic networks).

3. DEFINE THE PHYSIOLOGICAL MECHANISMS OF TASTE PERCEPTION AND SODIUM (TASTE)

Goal: To understand the physiological mechanisms of taste perception and sodium (receptors-signal pathways-effectors and responses)

Type: Collaboration between food industry, government and academia

Resources: Approx \$10M – as quickly as possible – seen as key to achieving 2016 targets

4. SHAPING A CANADIAN APPROACH TO COLLABORATIVE RESEARCH THAT CAN CONTRIBUTE TO THE GLOBAL PROBLEM OF SODIUM REDUCTION IN PROCESSED FOODS (FUNDING MECHANISMS)

Goal: Identify existing funding mechanisms to support the sodium reduction strategy that would also address the need for effective knowledge translation (e.g. NCE, CHRP, clusters and networks)

Scope: SWOT analysis of those mechanisms that will serve to shape the R&D strategy

Type: Environment scan (Canada and globally)

Resources: \$250K as a starting position (2-3 people, travel costs, networking /connecting / communicating, research support, etc.) - 6 months

THEME 3 – KNOWLEDGE-TO-ACTION

RESEARCH AREAS IDENTIFIED INCLUDE:

- Determining whether sodium reduction is a passive process and how much consumer engagement and education is necessary (i.e., 2,300mg/day is possible with less intervention, but more consumer engagement likely is required for moving from 2,300 mg to 1,500 mg/day)
- Establishing whether the sodium reduction message can be bundled with other healthy eating messages and diet recommendations and still be effective (i.e., collateral benefit)
- Supporting basic research on taste receptors, shifting of taste preferences across the lifespan to a lower sodium diet
- Assessing the extent to which people add sodium at the table, if sodium is reduced in food sources
- Monitoring changes in dietary and salt intake preferences over time

RESEARCH GAPS AND OPPORTUNITIES:

- Effects of voluntary approach on price and health disparities
- Real time monitoring of levels of sodium in products and contribution to overall sodium intake
- Lack of information regarding effectiveness of population interventions (especially for children)
- Need for more data on broader interventions (focused on sodium alone versus total diet)

RESEARCH QUESTIONS:

1. What are effective policy options, and for what segments of the population are they effective? What factors drive policy decisions? i.e., the recipe for success in policy adoption and implementation, (e.g. food taxation models, school food policy, best use of label information)
2. Is low sodium-specific messaging more effective than heart-healthy messaging to promote product reformulation, lower sodium intake and healthy eating?
3. How much sodium is contained in various brands of food? How has sodium in the food supply changed over time? What are the largest food sources of sodium in the Canadian diet based on the market share of various products?
4. What is population intake of sodium and how is it changing over time?
5. Continuously updated inventory of nutrition profiles of all foods (including sodium, other nutrients, and ingredients): \$500K 1st year, cheaper thereafter (if industry supplies data) + Nielsen market share data as needed

RESEARCH PROJECT PROPOSALS:

- Establish mechanisms for CIHR to partner with other federal research funders to commission intersectional research (i.e., policy, health science, agri-food supply, behavioural sciences, food science) to welcome and meaningfully peer-review research proposals to reduce sodium intake and to embrace the importance of an integrated approach to food, agriculture and health.
- Systematic review of food policies successfully applied in National settings to enhance population health benefit – focus on environment, making healthy choices the easy choices (i.e., environmental scan, review policies); <\$500K
- Beyond Sodium: Determining Incremental Impact of Healthy Dietary Practices on Blood Pressure and other Intermediate Outcomes
- What are the effective interventions for sodium reduction, and for whom, at the population level e.g., for children at different ages
- Allocation of research funds and publication of results must be mindful of concerns about political interference and commercial conflict of interest

X. Identification of Evaluation & Monitoring Outcomes and Indicators as Identified by Participants

The workshop facilitator invited participants from each thematic area to discuss the following in terms of evaluation and monitoring:

- What are some of the key outcomes that require measuring?
- What are the short, medium and long term indicators?
- What data needs to be collected at the baseline and over time to monitor changes?
- What are the existing data platforms that may be used to monitor changes?

THEME 1 – HEALTH AND HUMAN PHYSIOLOGY

KEY OUTCOMES

- Monitoring and evaluation on a population level; nationally representative data should be a focused assessment of high risk groups (i.e., children, aboriginals); based on 24-hour urine population data and other reliable biomarkers
- Validate readout for tissue, plasma, and extra renal
- Correlate data with blood pressure, osteoporosis
- Refine the science of taste perception, and circadian clock control
- Fetal programming, blood pressure, and sodium regulation

INDICATORS

- **Short-term:** population intake of sodium; 24-hour urine; dietary recall and food frequency; develop technology for sodium measurement in tissue; use MRI in collaboration with industry and food industry
- **Medium-term:** surrogate outcomes (i.e., blood pressure, renal function); Canadian Health Measures Survey; CCHS Survey – diagnoses of self-reported hypertension; IMS Database (pharmacy information on anti-hypertensive medication use)
- **Long-term:** hard outcomes (i.e., prevalence of heart attacks, hip fractures, mortality). Use of Canadian Institutes of Health Information (CIHI) and Statistics Canada data

DATA SETS

- Canadian and International cohorts; Quebec, Cartagena, Chicoutimi, and others
- Childhood Cohorts, Longitudinal Study of Aging, Cancer Cohort Study

GAPS IDENTIFIED

- Need to address quality of blood pressure measurement
- Need to evaluate the effectiveness of education and clinical interventions
- Limited resources; need to piggyback on other initiatives to save resources
- Lack of baseline data (and collection), particularly for vulnerable groups

- Need to put the patient first (i.e., decrease in food intake and identify any reductions in blood pressure and impacts arising)

THEME 2 – FOOD SCIENCE AND FOOD TECHNOLOGY

KEY OUTCOMES

- Reduction in sodium content and maintaining functional assets and consumer acceptability
- Identify the lowest levels in sodium content in processed food, safe level, including processing analysis for shelf life outcomes, distribution impacts and use of alternative, and substitute ingredients without compromise and unexpected outcomes
- Consider different food products or matrices (i.e., one sodium reduction strategy may not be suitable for another); need for strategy prioritization
- Engage the food science industry, through a series of workshops, to identify the key industry challenge related to sodium reduction and identify the foundational knowledge required
- Identify leaders and share success and failures (as a community of practice)
- Develop a sodium strategy and action plan

INDICATORS

- Short-term process changes (0-6 months): Need to establish a starting point and baseline, as many food processors have already started. Research activities: new successful sodium research proposals put forward; increasing number of food companies becoming involved in university and industry collaboration and funding
- Medium-term (7 months to 5 years): Develop and implement collaborative research projects (i.e., U.K. bread project), reduce propensity for project silos and duplication of effort and results; increase number of companies involved; increase number of university research chairs focusing on sodium; increase number of products, new ingredients and new technologies commercialized; and number of prototypes tested to reach specified targets
- Long-term impact (5+ years): Market changes for lower sodium food products (caveat: wide variation in individual products); what share / percentages do these products have of the total market; increase number of products introduced to the marketplace with low sodium levels; measure the number of research proposals funded through government R&D program and agencies (i.e., SRED, IRAP, specific industry sectors) and Statistics Canada and track quantitative and qualitative numbers.
 - Develop a firm comprehensive baseline (i.e., nutrition label analysis, and physical product measurements)
 - Develop a tracking mechanism for high use products and track consumer acceptance (i.e., is whole wheat bread more acceptable to the consumer with less sodium?)

DATA SETS

- Major brand marketers have this information
- Need for electronic databases, with data points such as sodium, trans fat; ECCNet

- Development of a salt reduction tool kit and making it open and available for others (i.e., transcending corporate IP concerns)
- Use ECCNet data or GS1 data, or changes in sodium production levels – 90% of the market should be the target, on sales weighted data (2016)

GAPS IDENTIFIED

- Knowledge about the lowest sodium levels one can go in bread and processed meat, yet maintain a safe product
- Lack of database of sodium-specific information (i.e., an accurate, reliable baseline data set that reflects the current marketplace)
- Need for a rapid method for sodium analysis
- Need for understanding by funding agencies for the merits of collaborative research approaches (i.e., reducing sodium in bread products)
- Need for better understanding of food science and its limitations (i.e., functional thresholds / product specific: food safety, quality and expectations; availability, taste, shelf-life)
- Need to engage and mobilize scientific researchers
- Collecting Canadian food service data

THEME 3 – KNOWLEDGE-TO-ACTION

KEY OUTCOMES

- Individual and institutional measurement and perspectives (i.e., blood pressure, cardiovascular outcomes, mortality outcomes, and an understanding of changes in the food supply)
- Different evaluation approaches (i.e., simple evaluation – have regulations changed to complex evaluation – how have nutrition standards in schools evolved)
- Importance of awareness and knowledge of salt (i.e., building on the lessons from the U.K. salt reduction campaign)
- Recognition of need for baseline data, and different strategies for different groups (i.e., regulation for children, and voluntary for adults; socio-economic status)
- Evaluation of policy and public reaction (i.e., policy development, voluntary vs. mandatory regulation)
- Improving evaluation and monitoring frequency (quarterly) and quality, measure national vs. sub-groups (quarterly), and then identify sub-group evaluation opportunities

INDICATORS

- Need for an overall logic model with short, medium, and long-term objectives for reducing dietary sodium intake in Canadians. Recommend a focus on demographics, including measuring outcomes in children, programming, and other modelling issues.
- Short-term (at different levels): measure changes in the food system, at graded levels; consumer behavior, education (restaurants), health professionals, and industry groups.

- Long-term: voluntary programming and arrangements to start. If substantive progress is not achieved within a given time frame, federal and provincial scrutiny may become more intrusive and, possibly, mandatory.

DATA SETS

- Several different databases currently available, but not yet comprehensive or focused on sodium reduction
- Pediatric Cohorts
- Canadian Community Health Survey (CCHS) – does not have current data
- Tomorrow Cancer Cohort – obtain sub-samples from 24-hour urines

GAPS IDENTIFIED

- The food supply is dynamic and rapidly changing. There is a need for a repository of information presented on nutrition labels that is centrally deposited, updated frequently, and publicly accessible
- Need to measure sodium levels and other nutrients in food as a support to the CCHS (60,000 foods in the food supply)
- A means to identify sodium content of specific brands
- Action as important as knowledge (research)

CONCLUDING COMMENTS:

Dr. Liu shared his perspective of the importance of linking a voluntary strategy on sodium reduction in the diet of Canadians to outcomes; in particular, linking blood pressure and sodium reduction to changes in taste, and food preferences as it changes in the population over time. He asked the group about the potential for accelerating the benefits of reducing sodium in the Canadian food supply, and also stated his sense of the most important research priorities:

- Developing an expert group to prioritize the end points, and to identify key baseline data in longitudinal Canadian cohort studies
- Taking advantage of data gathering possibilities in key cohorts
- Engaging the provinces, and their ability to enrich local sampling and sub-sampling
- Establishing relevant biomarker development and validation

XI. FINAL REMARKS AND NEXT STEPS

Dr. Peter Liu

Scientific Director, CIHR Institute of Circulatory and Respiratory Health, Co-Chair of the Research Sub-Committee of the Sodium Working Group.



Dr. Liu thanked participants for their tremendous cooperative spirit and engagement in the process. He shared his desire to go forward on the research agenda, informed by participants' ideas and input in the conference, and to prioritize the work to be done. He said there was a great deal of common interest and convergence, and many opportunities for collaboration, and that the research agenda would be rolled out in a multi-faceted, coordinated manner, and in coordination with international initiatives in many sectors (i.e., NGOs, academia, industry, the health sector, and government institutions).

He praised participants for integrating ideas for implementation into the ideas generated at the conference, and said that these would be included in the research component of the report to Health Canada as part of the Sodium Reduction strategy. This, in turn, would lead to funding opportunities for interdisciplinary research and uniquely address the multifaceted problem of sodium reduction in Canada, leading to timely priorities, outcomes and results. The priorities would also lead to request for research proposals (RFP's) in the coming months.



Dr. Liu then thanked the Sodium Working Group and the SWG Chair, Dr. Hasan Hutchinson, and all of the partners who contributed to developing the agenda for the workshop and provided financial support for the workshop.

Dr. Liu also thanked the CIHR Institute of Nutrition, Metabolism and Diabetes' Team – Scientific Director and workshop co-chair, Dr. Philip Sherman, INMD Assistant Directors Mary-Jo Makarchuk and Paul Belanger, and Vera Ndaba and Alexandra Novis – for their hard work in planning and delivering a successful workshop. In addition, he thanked Marc Valois for his skills in facilitating the workshop and bringing it to a successful conclusion.



APPENDIX A: MEETING AGENDA



DEVELOPING A RESEARCH AGENDA TO SUPPORT SODIUM REDUCTION IN CANADA

**January 25-26, 2010
Sheraton Gateway Hotel
Toronto, Ontario**

Monday January 25, 2010

10:00 - 10:40am Welcome, opening remarks, the context for sodium reduction

Dr. Philip Sherman - Workshop Chair
Scientific Director, CIHR Institute of Nutrition Metabolism and Diabetes

Dr. Colin Carrie, Parliamentary Secretary to the Minister of Health

Kimberly Elmslie, Director General, Centre for Chronic Disease Prevention and Control, Public Health Agency of Canada

Dr. Hasan Hutchinson, Chair of the Multi-Stakeholder Working Group on Dietary Sodium Reduction and Director General of the Office of Nutrition Policy and Promotion, Health Canada

Dr. Peter Liu, Scientific Director, CIHR Institute of Circulatory and Respiratory Health, Co-Chair of the Research Sub-Committee of the Sodium Working Group

10:40 - 11:00am FACILITATOR - Marc Valois
Roundtable participant introductions and expectations

11:05 - 11:50am PLENARY: Overview of research gaps and opportunities in the thematic areas of health, food science, knowledge-to-action and evaluation and monitoring

Dr. Lawrence Appel, Chair, Panel on Dietary Reference Intakes for Electrolytes and Water, Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Food and Nutrition Board, Institute of Medicine of the National Academies (2005)
Department of Medicine, Epidemiology, and International Health (Human Nutrition), Johns Hopkins University

11:50 - 12:15pm Challenges Around Emerging Technologies and the Food Supply: Law, Ethics and Policy

Lori Sheremeta, Research Associate, Faculty of Law, University of Alberta, National Institute of Nanotechnology

12:15 - 1:15 pm LUNCH

1:30 - 5:30pm	Breakout Sessions by Theme		
1:45 - 2:00pm	Theme 1 Health and Human Physiology <i>Recent advances in the regulation of salt-dependent volume and blood pressure</i> Dr. Jens Titze Interdisciplinary Centre for Clinical Research Department of Nephrology & Hypertension, Nikolaus Fiebiger Centre for Molecular Medicine, University Clinic and Friedrich Alexander University of Erlangen - Nuremberg, Germany	Theme 2 Food Science/Food Technology <i>Food science challenges in sodium reduction: taste, preservation, texture, colour - What has been done in other jurisdictions? What can be done?</i> Dr. Rickey Yada Scientific Director, Advanced Foods and Materials Network, Networks of Centres of Excellence, Department of Food Science, University of Guelph	Theme 3 Knowledge-to-Action <i>Product packaging, labelling and marketing: Possibilities and research gaps</i> Dr. Charlene Elliott Faculty of Communication and Culture, University of Calgary
2:00 - 2:15pm	Clinical research and knowledge translation Dr. Norm Campbell CIHR Chair in Hypertension Prevention and Control	<i>Microbial issues and challenges associated with a sodium reduction in the food supply</i> Dr. Jeff Farber Director of the Bureau of Microbial Hazards, Food Directorate, Health Canada	<i>Public health approaches to sodium reduction at the community and school-level</i> Dr. Andrew Pipe Chief of the Division of Prevention and Rehabilitation University of Ottawa Heart Institute
2:15 - 2:30pm	<i>Early exposures: The genetics of salt sensitivity and impact of early exposure to high sodium diets</i> Dr. Bruce Van Vliet Professor of Cardiovascular and Renal Physiology, Memorial University	<i>Learning from Doing: The Campbell Soup Company Story</i> Dr. Chor-San Khoo VP Global Nutrition and Health, Campbell Soup Company	<i>International Action of Salt/Sodium Reduction: A Comparative Policy Analysis</i> Lianne Vardy Director, Chronic Disease Management Division, Public Health Agency of Canada
2:30 - 5:30pm	Small group discussions to answer questions to be provided		
6:30 - 8:30pm	Dinner and Speaker		

Evaluation of impact of U.K. voluntary approach to sodium reduction and consumer education

Alette Addison, Head of the Salt Reduction Strategy, UK Food Standards Agency

Tuesday January 26, 2010

8:30 - 8:40am	Opening remarks from facilitator
8:40 - 10:15am	Three thematic groups report-back synopsis for discussion
10:15 - 10:30am	BREAK
10:30 - 11:30am	PLENARY: Evaluation & Monitoring of Sodium Reduction at the Population Level <ul style="list-style-type: none">❖ Considerations in monitoring sodium reduction at the population level<ul style="list-style-type: none">○ Susan Barr, Professor of Nutrition, University of British Columbia❖ Food system monitoring: How to measure changes in the food supply<ul style="list-style-type: none">○ Dr. Mary L'Abbé – Earle W. McHenry Professor and Chair, Nutritional Sciences, Faculty of Medicine, University of Toronto, Co-Chair the Sodium Working Group❖ Consumer education & awareness: How to measure changes in consumer awareness, attitudes and behaviors<ul style="list-style-type: none">○ Anna Farmer, Community Nutrition, Department of Agriculture, Food and Nutritional Science, University of Alberta
11:30 - 12:30pm	LUNCH
12:30 - 2:30pm	Small group breakout by thematic area
2:30 - 3:15pm	Report-back on evaluation and monitoring
3:15 - 3:30pm	Closing Remarks and Next Steps Dr. Peter Liu Scientific Director, CIHR Institute of Circulatory and Respiratory Health, Co-Chair of the Research Sub-Committee of the Sodium Working Group

APPENDIX B: PARTICIPANT LIST

PARTICIPANTS

Name	Affiliation
Michael Adams	Queen's University
Konstantinia Arvaniti	Health Canada Food Directorate
Oliver Baclic	Public Health Agency of Canada (PHAC)
Daniel-Georges Bichet	Nephrologist, Hôpital du Sacré Cœur de Montréal INMD, Institute Advisory Board member
Pierre Bilodeau	Director, Bio Industries Natural Sciences and Engineering Research Council (NSERC)
Mauricio Bobadilla	Director of Regulatory Affairs Sobeys Inc.
Branko Braam	Internist/nephrologist, Associate Professor of Medicine Adjunct Associate Professor of Physiology University of Alberta Hospital
Pierrette Buklis	Senior Manager, Health & Nutrition General Mills Canada
Jill Carman	Director, Consumer & Regulatory Affairs, Quality and Regulatory Operations General Mills Canada
Martha Carman	Director, Regional Product Development Canada Bread Company, Limited Maple Leaf Foods
Sean B. Cash	Department of Rural Economy, University of Alberta and Department of Consumer Science, University of Wisconsin
Kevin Cockell	Research Scientist Nutrient Metabolism Section of the Nutrition Research Division, Food Directorate at Health Canada. Adjunct Professor ,School of Dietetics and Human Nutrition, McGill University and Department of Biochemistry, Microbiology and Immunology, University of Ottawa
Jackie Crichton	Vice President Food Safety and Labelling Canadian Council of Grocery Distributors

Name	Affiliation
Will Cupples	Professor of Biology, Center for Biomed Research University of Victoria
Elaine De Grandpré	Manager, Dissemination and Outreach, Office of Nutrition Policy and Promotion Health Canada
Margaret de Groh	Manager, Risk Factors Unit and Senior Policy Analyst PHAC
Sameer Deshpande	Associate Professor, Marketing, Faculty of Management, Centre for Socially Responsible Marketing, University of Lethbridge
Erica Di Ruggiero	Associate Director, CIHR-Institute of Population and Public Health
Lisa Duizer	Department of Food Science University of Guelph, Assistant Professor
Nancy Edwards	Scientific Director, CIHR Institute of Population and Public Health, Professor, School of Nursing and Department of Epidemiology and Community Medicine, University of Ottawa
Ahmed El-Sohemy	Associate Professor, Department of Nutritional Sciences University of Toronto, Canada Research Chair in Nutrigenomics
Colin Farnum	Senior Director, Innovation and New Technology Maple Leaf Consumer Foods
Peter Fischer	Technical Advisor Sodium Working Group Bureau of Nutritional Sciences, Health Canada
Kevin A. Flanagan	McCain Foods Limited Director, Food Science Global Potato Process Technology Centre
Gregory G. Germino	Deputy Director, National Institute of Diabetes, Digestive and Kidney Diseases (NIDDK), National Institutes of Health
Katherine Gray-Donald	Canadian Society for Nutrition / McGill
Mitchell Halperin	University of Toronto, Faculty of Medicine Nephrology
David Hammond	Assistant Professor, Department of Health Studies University of Waterloo

Name	Affiliation
Rhona Hanning	Associate Professor, Department of Health Studies & Gerontology, University of Waterloo
Bill Jeffrey	Centre for Science in the Public Interest (CSPI)
Michel Joffres	Simon Fraser University, Faculty of Health Sciences
Janusz Kaczorowski	Professor & Research Director, Department of Family Practice, University of British Columbia; Director, Primary Care and Community Research, Child and Family Research Institute
Charmaine Kuran	Senior Policy Advisor Bureau of Nutritional Sciences, Nutrition Evaluation Division, Food Directorate, Health Canada
Heidi Liepold	Manager Chronic Disease Management Division Public Health Agency of Canada (PHAC)
David McInnes	President and CEO Canadian Agri-Food Policy Institute
Diana Mager	Assistant Professor, Clinical Nutrition Department of Agricultural, Food and Nutritional Science, Alberta Institute for Human Nutrition, University of Alberta
Doug Manuel	Senior Scientist, Ottawa Hospital Research Institute PHAC/CIHR Chair in Applied Public Health Sciences Senior Medical Advisor, Statistics Canada Associate Professor, Departments of Family Medicine and Epidemiology & Community Medicine, University of Ottawa Adjunct Scientist, Institute for Clinical Evaluative Sciences
Michèle Marcotte	Agriculture and Agri-Food Canada, Research Branch
Chantal Martineau	RD Manager, National Guidance Office of Nutrition Policy and Promotion, Health Canada
Lynn McIntyre	Professor and CIHR Chair in Gender and Health Dept. of Community Health Sciences, Faculty of Medicine, University of Calgary
Michele Meaney	Specification Coordinator, High Liner Foods Incorporated
Raik Meissner	Director, R&D Piller's , Piller Sausages & Delicatessens Ltd.

Name	Affiliation
Robert Merritt	Branch Chief & Supervisory Health Scientist, Epidemiology & Surveillance Branch (ESB) Division for Heart Disease & Stroke Prevention (DHDSP) National Center for Chronic Disease Prevention & Health Pro-motion (NCCDPHP) Centers for Disease Control & Prevention (CDC)
Howard Morrison	Senior Science Advisor Health Promotion and Chronic Disease Prevention Branch Public Health Agency of Canada
Didier Mouginot	Université Laval
Robert P. Nolan	Research Psychologist, Behavioural Cardiology Research Unit, University Health Network, University Health Network/Toronto General Research Institute; Assistant Professor, Institute of Medical Sciences, Department of Psychiatry , University of Toronto
Paul Paquin	Industrial services (Innovation) Institut des Nutra-ceutiques et des Aliments Fonctionnels (INAF) Université Laval
Alan Paulson	Dalhousie University
Linda Piazza	Director, Research Heart and Stroke Foundation of Canada
Ron Reaman	Vice President, Federal Canadian Restaurant and Foodservices Association
Dérick Rousseau	Department of Chemistry and Biology, Ryerson University
Stephen Samis	Director, Health Policy Heart and Stroke Foundation of Canada
Judy Sheeska	University of Guelph
Rita Suri	Assistant Professor, Kidney Clinical Research Unit, Univ. of Western Ontario, Nephrologist, London Health Sciences Center
Hiroshi Suzuki	University of Toronto, Faculty of Medicine, Dept of Physiology P.I. at the Center for Research in Neurodegenerative Diseases
Phyllis Tanaka	Food and Consumer Products of Canada
Valerie Tarasuk	University of Toronto, Nutritional Sciences

Name	Affiliation
Rhian Touyz	Kidney Research Centre, Ottawa Hospital Research Institute, University of Ottawa Canada Research Chair in Hypertension, Professor of Medicine, Senior Scientist
Susan J Whiting	Professor of Nutrition, College of Pharmacy and Nutrition University of Saskatchewan
Kevin Willis	Canadian Stroke Network
Wim Wolfs	Director, National Research Program The Kidney Foundation of Canada
Patti Wunsch	Senior Analyst and Advisor Agriculture and Agri-Food Canada