

CIHR-IMHA

**National Oral Health
Research Strategy**

2024 - 2030

(DRAFT)

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A. Message from the Scientific Director

To follow.

B. Land Acknowledgment

The launch event for the National Oral Health Research Strategy was held on March 29 and 30, 2023, on the traditional, unceded lands of the Anishinaabe Algonquin people. This National Oral Health Research Strategy document has contributions from across so-called Canada, on land that has been stewarded by Indigenous peoples for thousands of years. As you read this strategy, we would encourage you to reflect on the impact of systemic disadvantages in health, and to consider how person-centred approaches address identity-related inequalities in oral health in Indigenous peoples.

C. Introduction and Rationale

In many ways, for decades, our understanding of oral health and disease and our practice of oral health care have lagged behind other fields of health and health care. For instance, while a multitude of scientific evidence has demonstrated the benefits of fluoride in a range of formats to prevent and treat dental caries, this disease remains the most common non-communicable disease on the planet,¹ and surgical removal of diseased tissue and restoration of function and aesthetics remains the dominant focus of care.²

Furthermore, for many years, dental care has remained low on the political agenda in Canada and many parts of the world, seeing little policy and program development, clinical or workforce innovation and strategic research planning. In recent years however, there is increasing recognition by governments, health professionals and the public that treating oral disease is very expensive,^{3,4} with spending on dental care in Canada reaching \$16.4 billion in 2019,⁵ while inequalities in oral health remain significant and access to dental care is very difficult for many.⁶

In 2023 the WHO published its Global Oral Health Action Plan (GOHAP), including a range of measures to reduce the burden of oral disease globally and integrate oral health care into primary medical care and universal health care⁸

December 2023 the Canadian government announced the Canadian Dental Care Plan (CDCP)⁷

For the first time in 15 years the current, on-going Canadian Health Measures Survey (CHMS) includes clinical, biological, and self-report indicators of oral health⁹


The Canadian Government

has recently recognized the need to invest in the education and licensing of foreign trained health care professionals, including dentists, so the health care workforce can better address the needs of Canadians¹⁰.

In recent years, these increasing costs, inequalities in access to oral health care and lack of progress in addressing oral diseases have led to governments and international agencies taking significant action.

And on top of these significant Canadian and international policy developments, the world of science and research also speeds ahead. As examples, artificial intelligence (AI) is now being investigated and developed as a tool to aid both research and health care¹¹ and climate change is driving the search for more environmentally sustainable technologies and approaches to health care in Canada^{12,13} and internationally.¹⁴ In the world of oral health research, and particularly in Canada, we recognise emerging challenges such as the dramatic increase in oropharyngeal cancer incidence,¹⁵ the uptake of tobacco vaping,¹⁶ the large increase in numbers of frail elderly Canadians and the challenges this presents for health care,¹⁷ the contribution of Canadian dental care to anti-microbial resistance,^{18,19} as well as the need to develop safe sustainable replacements for amalgam,²⁰ among many other challenges and trends. We also urgently need to better understand how “oral health **is** health” and how the mouth may be the “canary in the mine” for a number of chronic diseases and so how to integrate oral health research and care with general health research and care. This covers better understanding how,

for instance, poverty and sugar cause oral and other chronic diseases and how we can intervene to prevent that happening, through to analysing the oral and gut microbiome and their relationship with inflammatory pathways and multiple manifestations of chronic disease.

 In short, the world is rapidly changing, presenting new challenges to add to existing ones, but also new policies and opportunities, making this inaugural Canadian National Oral Health Research Strategy (NOHRS) both necessary and timely. This NOHRS can help governments and decision-makers, funding agencies, researchers and their organizations, health care practitioners, the public and others to focus on emerging, priority issues for Canadian society, as well as innovative methodological and technological approaches to address them. The oral health research community in Canada is a small but dynamic group and this NOHRS can help expand its numbers and skills, as well as its integration with other health research and ultimately support improving [oral] health and reducing inequalities among people living in Canada.

D. Process

The National Oral Health Research Strategy (NOHRS) is a collaborative initiative led by the Canadian Institutes of Health Research (CIHR) Institute of Musculoskeletal Health and Arthritis (IMHA) under the leadership of Dr. Karim Khan, in partnership with various Canadian oral health professional organizations and research/academic institutions. The strategy was co-created by the oral health research community, health researchers from other disciplines, professional bodies, and patient and public partners.

March 2023
Launch Event,
Ottawa

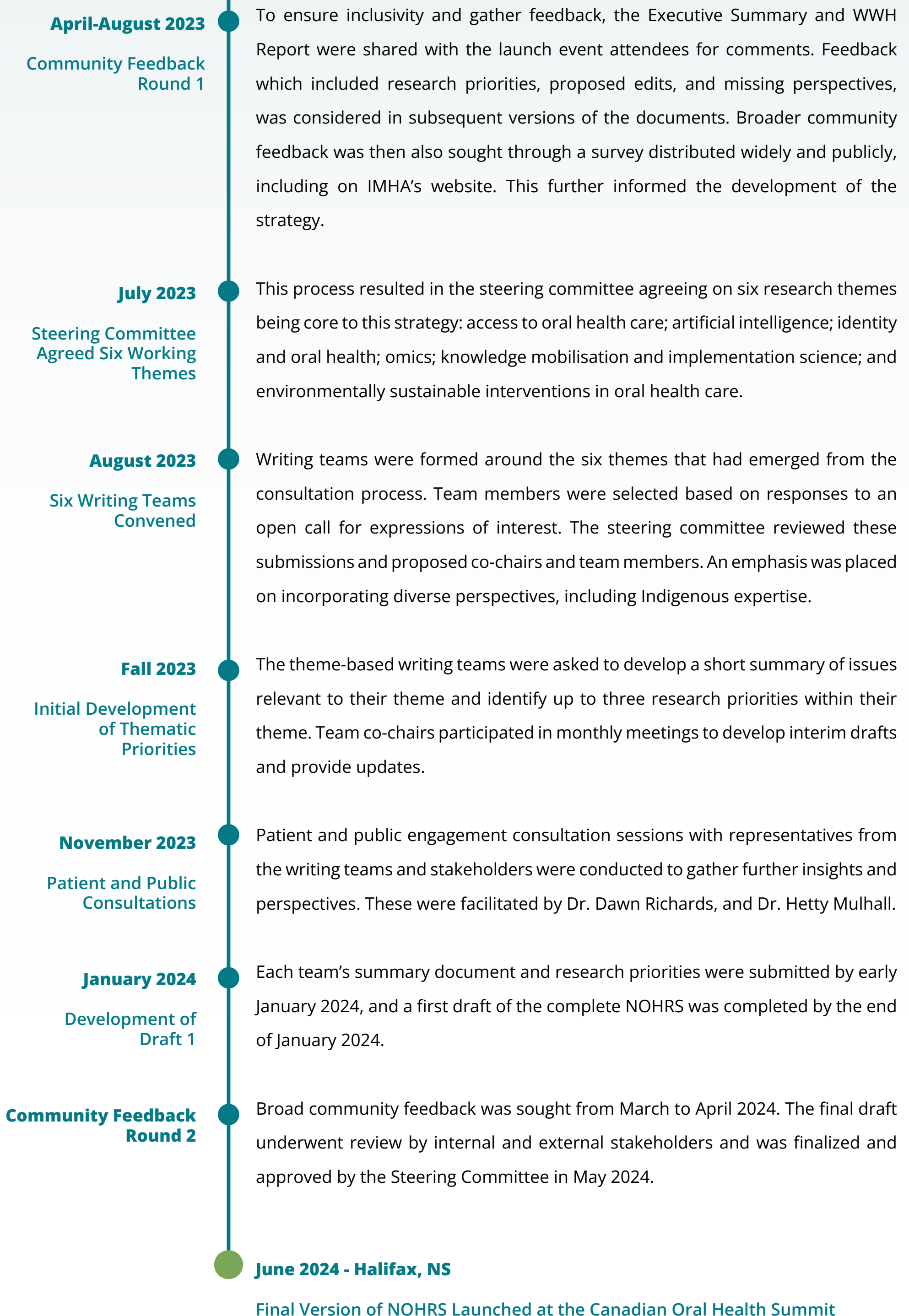


April 2023

To convene a broad community committed to better oral health and to discuss potential research themes and priorities. The planning committee comprised representatives from CIHR-IMHA, the Canadian Association for Dental Research (CADR), the Association of Canadian Faculties of Dentistry (ACFD), and the Network for Canadian Oral Health Research (NCOHR)

An open call for participation was shared through various channels, including the CIHR-IMHA website, e-blast, and social media. 70 participants engaged in sessions that set the scene for the development of NOHRS including patient and public partners, health researchers from various fields, and individuals experienced in working with diverse communities.

Chaired by Drs. Paul Allison and Leigha Rock. The committee comprised representatives from CIHR-IMHA, CADR, ACFD, NCOHR, and national oral health professional associations. Together with the IMHA team, the steering committee developed an Executive Summary and a “What We Heard” (WWH) Report, which summarized the discussions and proposed next steps from the launch event.



E. Guiding Principles

As we developed and then move forward with our strategic research plan, it is important that our work is grounded in principles that guide us. These guiding principles cover values and frameworks for us to think about as we perform the work driven by this plan. These guiding principles are as follows:



Equity, diversity, and inclusion – we want to include the most diverse range of people in our work, whatever their roles, whether they be community representatives, study participants, students, health professionals, decision-makers, researchers, or other stakeholders. We recognize that there are groups who have been marginalized from all elements of research and we will work to begin to address those inequities and exclusions.



Patient and community engagement – we want to include people who will use the results of our research, whether as members of the community, patients in hospital or community clinics, and/or their carers. We need their input at all stages of our research to guide us generating the best possible research projects.



Open science – we believe strongly in the principle of open science and will work to ensure that all elements of research (e.g., protocols, data, findings, and impacts) are accessible and used widely. We will adhere to the FAIR principles (findable, accessible, interoperable, and reproducible).²¹



Environmental sustainability – the European Regional Office of the WHO defined a vision for an environmentally sustainable health system as being a health system that improves, maintains, or restores health, while minimizing negative impacts on the environment and leveraging opportunities to restore and improve it, to the benefit of the health and well-being of current and future generations.¹⁴ We extend that definition to cover the research driven by this plan i.e. our research will aim to be environmentally sustainable.



Building excellent capacity – all elements of the work emerging from this plan will integrate the recruitment, training and retaining of excellent people and leaders so that the next generation is better placed to perform the work of this plan and future related work.



Collaboration – we all have experiential expertise and some of us have formal and informal training in a range of disciplines, fields, professions and other domains of knowledge relevant to health and research. We believe that it is essential to engage with people from a wide background of such experiences and expertise to enable the highest quality research.



Oral health is health – history has separated the mouth from the rest of the body, when in reality, the social determinants and pathological processes related to oral and general health are broadly the same. Furthermore, as outlined by the WHO's GOHAP, we need to integrate oral health care with general medical care.⁸ This principle of integrating the mouth with the rest of the body in all manifestations of research and health care will drive our work.

F. Strategic Priorities

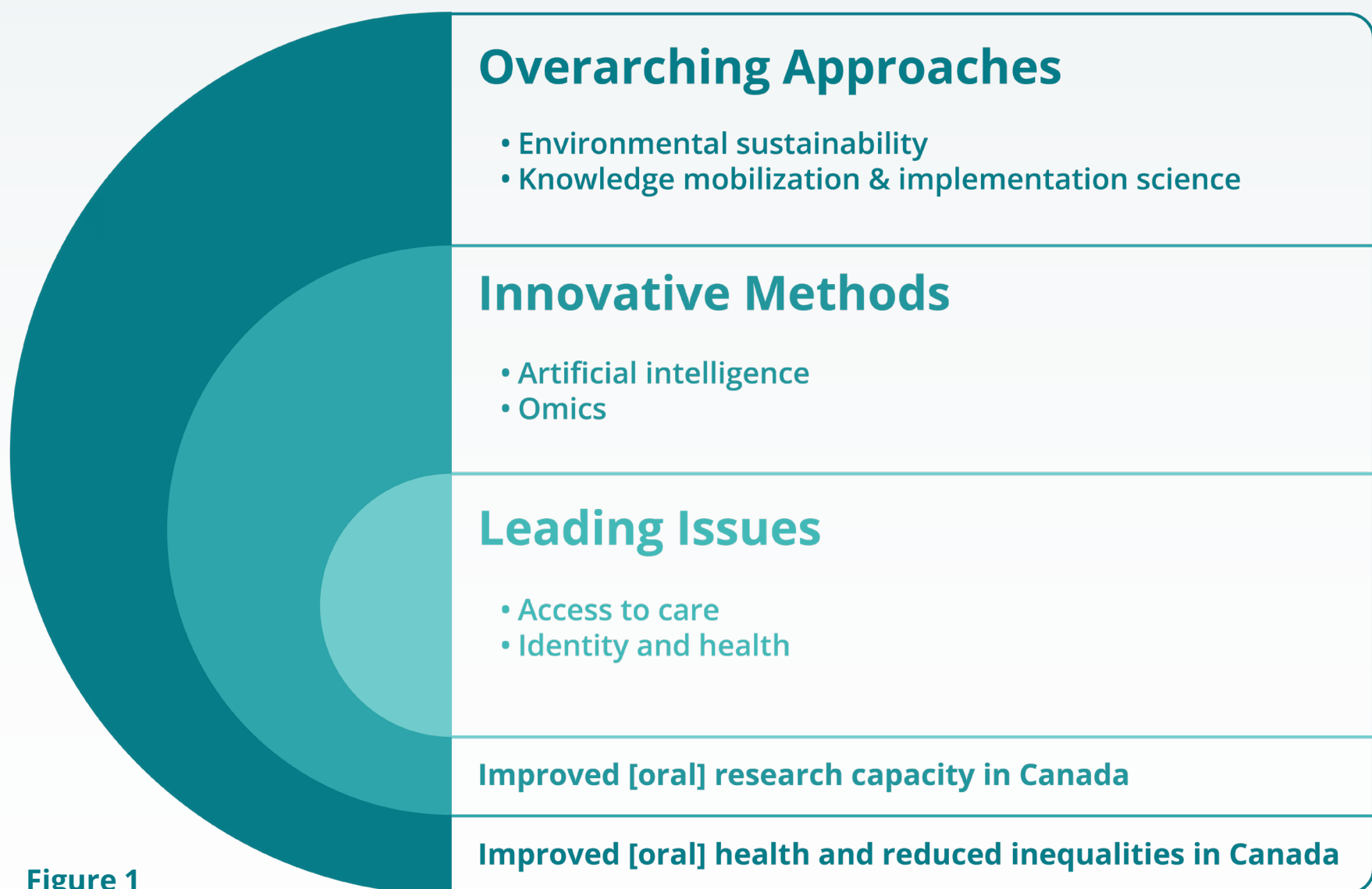


Figure 1

As described above, the broad consultation process to develop the NOHRS resulted in six themes emerging. Two of these (access to oral health care and identity and oral health) are core subjects for research; two of them (AI and omics) are emerging research methods and approaches; and two themes (knowledge mobilisation and implementation science (KM/IS) and environmentally sustainable interventions [ESI] in oral health care) are a combination of subject matter and research approach. With this third group of themes, we need to, for example, investigate and understand environmentally sustainable issues in oral health and care but also develop environmentally sustainable research methods and approaches, while similarly needing to understand and then develop appropriate mobilization and implementation strategies that span fundamental to applied science and beyond to improve [oral] health and reduce inequalities. We therefore envision a framework for this NOHRS with ESI and KM/IS as overarching approaches, AI and omics as innovative methods and access to care and identity and health as leading issues to address (see figure 1). With this framework in mind, we present the merging themes for the NOHRS below.

1. OVERARCHING APPROACHES

1.1 ENVIRONMENTALLY SUSTAINABLE TECHNOLOGIES AND INTERVENTIONS IN ORAL HEALTH CARE

The impact of human activity on planetary health is undeniable.²² There are a great number of issues that need attention, including a reconsideration of how we generate electricity and heat, produce food, manufacture and consume goods and services, and manage the land. Additionally, it is now common to recognize climate change

and environmental degradation as foundational to human health. The effects of planetary health on population health and individual wellbeing are clear in terms of “infectious diseases, non-communicable diseases, traumatic injuries, mental distress, and illness”.²³

The effects of health care on planetary health cannot be ignored either. It is estimated that health care contributes about five per cent of annual national carbon dioxide emissions.²⁴ The World Dental Federation and representatives from national dental associations and the dental industry have recognized that oral health care contributes as well.²⁵ For instance, a carbon footprint study of dentistry in England demonstrated that:

*“Examinations contributed the highest proportion to this footprint (27.1%) followed by scale and polish (13.4%) and amalgam/composite restorations (19.3%). From an emissions perspective, nearly 2/3 (64.5%) of emissions related to travel (staff and patient travel), 19% procurement (the products and services dental clinics buy) and 15.3% related to energy use”.*²⁶

As Duane, Fisher, Ashley, Saget, and Pasdeki-Clewer argue: “Healthcare systems need to fundamentally change to enable systems to deliver appropriate, affordable, and sustainable health care [and] [d]entistry needs to change on a practice-wide level and within the system of health care”.²⁷

Given this, research is needed in the area(s) of sustainable technologies and interventions in oral health care. Here, we define sustainability as “meeting the needs of the present without compromising the ability of future generations to meet their own needs”.²⁸ In turn, we believe that dentistry is sustainable or “green” when it is fiscally, socially, and ecologically responsible.

In short, oral health care needs to meet the demands of sustainability at the micro, meso, and macro levels, whether in its infection prevention and control regimes; reducing, reusing, recycling dental instruments, materials, and waste; minimizing unnecessary care; or better resource allocation to be more preventatively and equity oriented. With the above in mind, the following three key priorities can be used to inform a national oral health strategy on sustainability in oral health care:

a) Manufacturing existing or developing new dental materials and equipment that meet environmental sustainability definitions and standards. We need to develop, implement, and evaluate dental materials and equipment that are “green.” Examples include:

- Can we develop dental materials and equipment whose manufacturing process is less toxic and more energy efficient?
- Can we develop dental materials and equipment whose manufacture is cheaper, thus making dental care more affordable?
- Can dental materials and equipment be manufactured such that their by-products, parts, and/or packaging are reduced, reusable, and/or recyclable?
- Can dental materials and equipment be manufactured such that they last longer thus distributing manufacturing emissions over a longer time-period?

b) Dental clinic operational interventions are required that meet environmental sustainability needs. We need to develop, implement, and evaluate existing and new “green” operational interventions at the dental clinic level, which are safe, feasible, effective, and sustainable. Examples include:

- Can we develop safe alternatives to single use and plastic equipment, while continuing to uphold infection prevention and control standards?
- Can personal protective equipment and dental clinics’ solid waste more generally be reduced, reused, and/or recycled?
- Can clinic designs and capital infrastructure be made more energy efficient?
- Can teledentistry, artificial intelligence, and digital oral health technology more generally be leveraged to reduce dental clinics’ carbon footprint? As a baseline, what is the carbon footprint of a dental clinic?
- Can conservative dental treatment approaches be tested in comparison to traditional treatment options for their effectiveness and efficiency to promote minimally invasive dentistry, which ultimately has the potential to reduce dental clinics’ carbon footprint?

c) Oral health care system interventions that meet environmental sustainability needs. We need to develop, implement, and evaluate existing and new “green” system-wide interventions. Examples include:

- Can legislation, policy, and/or guidelines be created to drive sustainability in oral health care? As a baseline, what is the carbon footprint of Canada’s oral health care system nationally and sub-nationally?
- Can sustainability initiatives be evaluated through combined “health-economic-sustainability impact analyses,” and by “exploring (through quality research) the effectiveness of existing and alternative service delivery models [and] interventions that can drive change?”²⁵

1.2 KNOWLEDGE MOBILIZATION AND IMPLEMENTATION SCIENCE TO IMPROVE ORAL HEALTH AND ORAL HEALTH CARE

Advances in clinical, educational and population oral health research have significantly contributed to enhancing oral practices and public health.²⁹⁻³⁸ Despite this progress, the incorporation of research evidence into clinical practice, referred to as the evidence-to-practice or the know-do gap, is estimated to take an average of 17 years.³⁹ This gap has been further emphasized by the rapid emergence of new technologies and innovations in oral health practices, alongside recent changes in national and international oral health policies and recommendations.⁴⁰ In addition to the delay in benefiting patients and society at large, the evidence-to-practice gap has historically disproportionately affected marginalized populations, leading to increased health inequalities.⁴⁰ Therefore, there is an immediate need to promote the integration of scientific evidence into oral health practice and policy in order to strengthen oral health care systems⁴¹ and to ensure that knowledge users are aware of and can actively incorporate research findings into their decision-making. This can be facilitated through advancing knowledge mobilization (KM) and implementation science (IS) in oral health research.

KM encompasses the production and utilization of research results in a dynamic and iterative process that ultimately aims to benefit users and society, informing decisions about practices, programs, education, training and policies.⁴² KM is guided by the principles of patient/citizen engagement^{43,44} to ensure that knowledge development is relevant and useful for the diverse stakeholders. KM aims to get the right information to the

right people in the right format at the right time to influence decision-making.

Similarly, IS is the study of methods and strategies that facilitate the uptake of evidence-based or evidence-informed research findings into regular use to improve the quality of health services across multiple settings.⁴⁵ The integration of KM and IS into oral health research, collectively referred to in this document as KMIS, is crucial for addressing challenges and opportunities in oral health care and oral health care systems, including, but not limited to, the uptake of evidence-informed clinical practices and policies, the implementation of technological innovations including teledentistry, Artificial Intelligence, virtual reality, and environmentally sustainable oral health care.^{25,26,46,47} The overarching goal of KMIS in the context of oral health research is to ensure the systemic uptake of the best available evidence into routine oral health practices and systems, and to discontinue practices or policies that lack the support of current scientific evidence and/or those that are harmful to the environment. KMIS is thus integral to advancing research, practice, education, policy and the impact of Canadian oral health research.

The NOHRS underscores the importance of advancing KMIS in Canadian oral health research through three research priority areas:

a) Identifying the multi-level barriers and facilitators that influence the implementation of oral health innovations. Examples of relevant research questions are:

- What theories, models, and frameworks are recommended to guide and understand how resources, infrastructure and context, including economic and political factors, influence the implementation of oral health innovations?
- What individual and environmental factors influence the adoption, sustainability and scale-up of oral health innovations?

b) Evaluating KMIS strategies and outcome measures. Examples of relevant topics are:

- Prioritizing data sharing and embracing open science to facilitate the replication and validation of studies while ensuring that stakeholders can readily access research results
- How do we engage knowledge users, promote partnerships and incorporate KMIS considerations to maximize the success of adoption, sustainability, and scalability of interventions?
- How do we advocate for evidence-informed practices and policies on multiple fronts and engage policymakers and policy entrepreneurs to influence implementation?

c) Building capacity in KMIS research for oral health researchers, patients/families, community organizations, policymakers, oral health care providers and organizations. Examples include:

- Training the dental workforce in evidence-informed practices and critical appraisal of the scientific literature is crucial to foster the sustainability and the scale-up of oral health innovations.
- Future generations of researchers and clinicians should acquire competencies in KM and IS through incorporating KMIS concepts in dental education to achieve a workforce that is capable of understanding, implementing and educating patients on evidence-informed oral health innovations.⁴⁸

2. INNOVATIVE METHODS

2.1 ARTIFICIAL INTELLIGENCE AND ORAL HEALTH/ORAL HEALTH CARE

Artificial Intelligence (AI) is dedicated to creating intelligent machines capable of executing tasks that typically require human intelligence.⁴⁹ This innovative technology has seen substantial application across various sectors including in general healthcare and increasingly oral health.⁵⁰⁻⁵³ AI's integration into oral health is a revolutionary change that will transform dental care.^{54,55} AI-driven tools in dentistry are being rapidly adopted. Potential AI applications are extensive: assisting in creating dental prosthetics or refining orthodontic treatment plans, improving diagnosis of complex disorders, and streamlining the management of patient records and treatment histories.⁵⁶⁻⁵⁹ AI-driven virtual assistants will likely elevate patient engagement and education, enhancing adherence to treatment plans and preventive care measures.

The integration of AI in oral health care must be approached responsibly with a focus on sustainability, inclusivity, and human-centred design.⁶⁰⁻⁶² AI systems need to be developed with environmental considerations and the diverse needs and values of different patient populations in mind. Human-centred AI should augment rather than replace human expertise and assist the oral health system and its professionals. Regulatory bodies, including Health Canada, must ensure the safe and effective implementation of AI in oral health. Regulations must be developed to ensure that AI applications meet strict safety, accuracy, and ethical standards. Adherence to these regulations is essential for maintaining public trust and ensuring that AI is used to benefit both patients and practitioners.

The three research priorities to advance AI-readiness in oral health are:

a) Ensuring that the oral health field is AI-ready. AI-readiness refers to the state of preparedness to effectively utilize AI technologies. In addition to having access to the latest technology, readiness refers to researchers, clinicians, patients, regulators, and policy makers creating an environment where AI can be used effectively, responsibly, and ethically. Examples include:

- Establishing ethical and secure data collection practices
- Identifying and removing barriers to the standardization of AI-ready oral health data via federal, provincial, and territorial collaboration
- Developing sustainable and collaborative research networks and data infrastructures including open datasets for benchmarking
- Investing in AI literacy among diverse groups of interested people including researchers, clinicians, patients, and policy makers

b) Responsible development and rigorous evaluation of AI-based tools. AI is an evolving field that needs to serve humans ethically, transparently, accountably, and aligned with human values. Industry, researchers, regulators, and policy makers must work together to ensure the responsible development of AI-based tools.

Priority areas include:

- Responsible development of AI tools that integrates multimodal data (e.g., images, scans, patient records, smart sensors)

- Evaluation of ethical development and implementation of- and fairness in- AI based tools
- Evaluating equity, diversity, and inclusivity in development and implementation of AI tools
- Evaluations of privacy protection and information security in AI applications while adhering to standards of practice in healthcare (e.g., HIPA compliance)
- Enhancing human-AI collaboration via participatory designs in development and implementation

c) Implementation and measurement of the impact of the application of AI in oral health and in oral health care. Researchers will need to:

- Shift from data-centric to problem-centric research
- Develop and validate instruments to measure patient-oriented outcomes
- Evaluate uncertainty, causal reasoning, trustworthiness of AI-tools and its impact
- Implement and assess AI's impact on clinical workflow and acceptability

2.2 OMICS AND ORAL HEALTH

The objective of omics sciences is to identify, characterize, and quantify all biological molecules involved in the structure, function, and dynamics of a cell, tissue, or an organism. The power of omics approaches lies in the fact that they enable the generation of large unbiased datasets with millions of individual datapoints that can lead to the formulation of hypotheses and theories. The clinical utility of omics technologies is rapidly evolving to provide unprecedented, data-driven patient care. As a result, omics can provide a powerful and comprehensive approach to personalized patient care where patient-specific intervention and treatment options can be created. The oral cavity is particularly suitable for omics studies. It is easily accessible, allowing for non- or minimally invasive collection of biological materials. Cheek swabs, tissues excised during routine surgery or biopsy, extracted teeth, and saliva can all be used to characterize and improve oral and general health at both the individual (e.g., personalized medicine) and population levels. Saliva contains a diverse array of hormones, enzymes, antibodies and genetic materials that have been transferred from the bloodstream via various transfer mechanisms.⁶³ As a result, saliva, often called the “mirror of the body”⁶⁴⁻⁶⁶, has been used extensively to diagnose and monitor disease activity and progression in dentistry, medicine, and pharmacotherapy.⁶⁷⁻⁷⁰

The Canadian Health Measures Survey (CHMS)⁹ provides a special opportunity for oral health research using omics technologies. Researchers will be able to link physical measures and self-reported oral health data with biological specimens (including blood, urine, and saliva) that has been collected on a representative sample of people aged 1-79 years living independently in Canada.

The three strategic research priorities in omics and oral health are to:

a) Investment in the development of omics focused capacity and infrastructure. We need:

- A Canadian ‘Oral Health Repository’ of use to federal, provincial, and local governments, dental schools, and biomedical scientists. As clinically annotated biological specimens become molecularly characterized through individual publicly funded research projects, researchers, academic institutions, and government agencies need to work together to create a central atlas of multi-omics data which can be used by researchers from diverse disciplines and multiple institutions for secondary analysis to answer complex questions in

our ability to diagnosis, treat, and prevent disease.

- A coalition of government agencies, academic institutions, and hospital centers throughout Canada to identify emerging trends in Canadians' oral health via the use of omics and big data.
- Highly qualified personnel (HQP) training programs in the design, use and analysis of omics studies at the BSc, MSc, and PhD levels as well as short training courses for all levels of investigators to develop the necessary skills for the use of omics approaches in delivering precision patient care.

b) Prioritize research that aims to identify risks for disease and conditions at early, more treatable stages.

The development of omics tools can potentially create new tools that can provide diagnosis, prognosis (in some cases) and that guide treatment. Examples include:

- Developmental and structural disorders of the craniofacial complex (e.g., uncovered genes and molecules that may be involved in orofacial clefting, or to understand salivary molecular patterns in patients with enamel hypomineralization).
- Research that answers questions surrounding the human oral microbiome (e.g., how do oral bacteria, fungi and/or viruses link to chronic oral diseases and to systemic health?)
- Cancers (e.g., Can omics be used to identify potentially premalignant and malignant oral diseases and conditions at early, more treatable stages?)
- Connective tissue disorders. (e.g, Can omics be used in omics-based stratification for personalized therapeutic approaches in scleroderma or Sjögren's syndrome?).

c) Omics as an approach to addressing oral health diseases in priority populations. Canada has several vulnerable and priority populations that suffer a high burden of oral disease and inequalities. Omics technologies could contribute to understanding the biological variation that contributes to poorer oral health in these populations:

- Research that combines omics with AI approaches to leverage electronic health records and other types of existing data to investigate health disparities and advance health equity Prioritize Sex- and Gender-Based Analysis Plus (SGBA Plus) in omics research or that aim to identify potential sex differences in diseases

3. LEADING ISSUES

3.1 ACCESS TO ORAL HEALTH CARE

Access to oral health care in Canada is currently a major problem, particularly among a broad range of marginalized populations such as Indigenous peoples, people living and working with low incomes and those living and working with different abilities, those in rural and remote communities, seniors living at home or in long-term care facilities, infants, recent immigrants and refugees.^{6,71,72} A lack of any dental insurance coverage reported among 35% of Canadians in 2022 contributes to approximately 24% also reporting avoiding the dentist due to cost.⁷³ This clearly demonstrates that cost is an important barrier to dental care in Canada. Nevertheless, it is not the only barrier, with a broad range of other factors such as distance and transport, workforce and facility availability and acceptability, workforce training, accommodations for diverse clientele, including those

with disabilities, plus other factors contributing to poor access.⁷⁴ It is therefore very important to focus on developing and evaluating interventions to address these multiple barriers experienced by marginalized groups. This direction for research has greater impetus now, given the federal government's recent introduction of the CDCP⁷ as well as their focus on Canada's health care workforce,¹⁰ among other initiatives. With these observations in mind, the three priorities for research focusing on access to oral health care are as follows:

a) Evaluating of the development, implementation and impact of programs and policies addressing access to oral health care in Canada. Examples could include:

- Developing a collection of appropriate indicators of access to care and related concepts to be used in evaluations of a broad range of programs and policies
- Evaluating existing federal, provincial, territorial, municipal and other governmental dental care policies, and programs
- Evaluating the new Interim Canada Dental Benefit and the CDCP as it rolls out over the coming years

b) Developing and testing innovative approaches to providing oral health care for, particularly, marginalized groups facing challenges accessing such care. Examples of innovative approaches could include:

- Developing and evaluating the training, skills and care provision of a broader range of oral health care providers in settings that facilitate access to care for marginalized groups
- Evaluating the capacity of the workforce to address the oral health care needs of all people living in Canada, including marginalized groups
- Developing and evaluating strategies to recruit a more diverse workforce that can better address the oral health care needs of all people living in Canada
- Developing and evaluating the use of new and adapted technologies and interventions for the provision of oral health care among marginalized groups e.g., teledentistry, social prescription and health care navigators

c) Evaluating strategies that integrate oral health care with primary medical care. For example:

- Evaluate the incorporation of screening for oral health problems by oral and non-oral health care providers in preschool, schools, long-term care settings, primary care and other settings
- Evaluate preventive care (e.g., fluoride, fissure sealants, smoking cessation) delivery by oral and non-oral health care providers in preschool, schools, long-term care settings, primary care and other settings
- Evaluate the participation of oral health care providers in primary care teams, addressing a range of non-communicable diseases

3.2 BIOLOGICAL AND SOCIAL IDENTITIES AND HEALTH

Inequalities in oral health across the Canadian population have been well documented.^{6,75-77} Given this, the NOHRS has a significant focus on comprehending and tackling health inequalities linked to age, sex, gender and other identity indicators and how they are related to oral health. Research priorities in this theme aim to identify, understand, and address inequalities in oral health status and care, emphasizing the influence and interaction of various social and biological determinants of health and how using person-centered approaches and innovations to research and care can help reduce these inequalities. We want to understand how sex and

gender, race and ethnic culture, biological and social age and other biological and social indicators interact to determine oral health and inequalities in oral health. We recognize that it is important to investigate and understand oral health at every life stage, the interconnectivity of oral health and health, and of the role of improved care in promoting healthy aging for all Canadians. Furthermore, the need for population-based surveys with oral health data, as well as longitudinal cohort studies and research networks incorporating the collection of biological, physical, clinical, and self-report data including oral health indicators, are critical to addressing this theme's priorities. With these observations in mind, the three research priorities for this theme are as follows:

a) Investigating the identity-related determinants of inequalities in oral health and in the delivery of oral health care and focusing on equitable, person-centred solutions to address these identity-related determinants and population-based indicators. Examples of relevant research priorities are:

- Identifying how biological and social age, sex and gender and race and ethnic culture interact to determine oral health and care in those with addictions and/or mental health challenges
- Developing person-centred approaches to address identity-related inequalities in oral health in Indigenous peoples or newcomers
- Understanding how people with different mental, physical, social and other abilities experience oral health care with a view to ensuring equitable access
- Ensure that biological and social age, sex and gender, and race and ethnic culture are well incorporated into research proposals and that research participation is reflective of the diversity of Canada.

b) Investigating how biological and social identity indicators are inter-related as determinants of oral health across the life course. For example:

- How do infant and early childhood biology and experiences interact with sex and gender and race and ethnicity to determine oral health and non-communicable diseases in adulthood?
- How can poor oral health impact health and frailty in older adults?
- How does aging, frailty and settings where older people live, including community dwellings and institutions, interact to determine oral health and health?

c) Using a lifespan and life course approach across all identities to prevent and treat oral and craniofacial disease and dysfunction and to promote oral health and healthy aging. For example:

- What infant, childhood and adolescent interventions can prevent oral health-related problems in adults?
- What interventions can be used among infants, children and adolescents with inherited disorders to ensure they live socially fulfilling adulthoods?

G. Overarching Goals & Measures of Success

2026

Preparatory infrastructure

We will have created an 'Environmental Sustainability' training module that is widely available in the oral health research and broader health research, plus oral health care and broader health care communities.

2028

Infrastructure

We will have at least two training programs in place in the field of omics, AI, KM/IS or environmental sustainability as they relate to oral health.

We will have identified and created KM/IS frameworks that are used in oral health research proposals and projects, including:

- The use of standardized guidelines for reporting implementation studies.
- Knowledge dissemination and publication of research results in multiple languages and/or the language of the community where the research takes place, for example in Indigenous languages.

We will have established a KM/IS network of fundamental scientists, applied researchers, health professionals, community representatives, patients, decision makers that enhances knowledge mobilization and the implementation of the findings of oral health research.

All research in the field of oral health will address environmental sustainability issues in project/grant proposals and in reports of research work.

2030

Outputs

We will have the first trainees in place in Canadian research institutions (including universities, government and/or private sectors) practicing the skills they have learned in their respective training programs.

The KM/IS network will have helped specific examples of knowledge generated by research moving along the knowledge translation pathway towards improving the understanding of oral health and disease and/or improved oral health and oral health care.

We will have the infrastructure in place to have groups of researchers working with practitioners using AI to answer complex oral health research questions aimed at improving the oral health of Canadians.

We will have created access to multiple databases to enable researchers to address complex oral health questions.

We will have the infrastructure in place to have groups of researchers working with practitioners using omics to answer complex oral health research questions aimed at improving the oral health of Canadians.

We will have developed at least one biobank and supporting database.

.....and outcomes

There will be a practicing integrated KM/IS network that has contributed to improved oral health and/or improved oral health care.

Where applicable, we will be storing data of research findings in a public domain.

There will be specific examples of new environmentally sustainable materials, devices, practices, and policies in oral health care.

We will have research findings showing the economic and health benefits of strategies to improve access to oral health care for a range of groups.

Canadian researchers have contributed to a better understanding of the social and biological (e.g., sex and gender; race and ethnicity; biological and social aging) determinants and causes of health and disease.

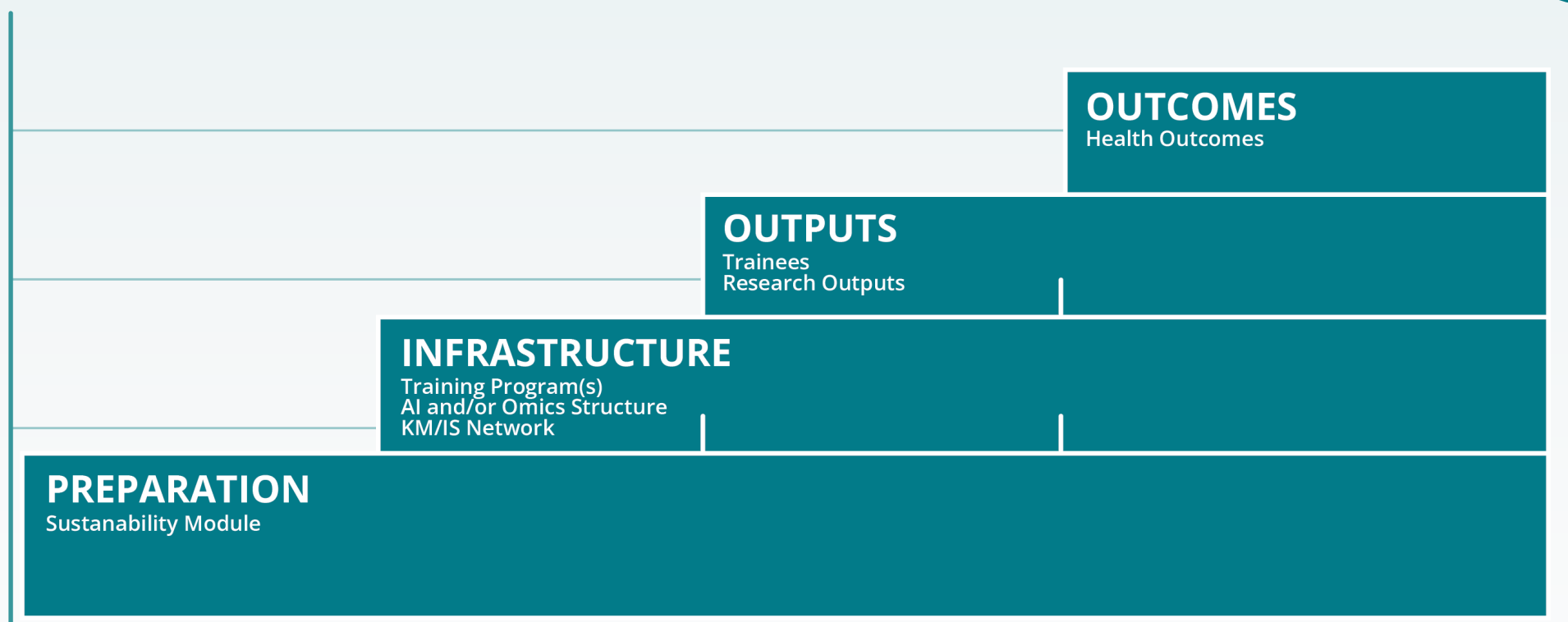
There will be a group of researchers working with practitioners developing implementing and using environmentally sustainable materials, devices, practices, and policies in oral health care in Canada.

2035

Outcomes

Our AI infrastructure has generated/led to/provided information that has demonstrated improved oral health of Canadians.

Our omics infrastructure has generated/led to/provided information that has demonstrated improved oral health of Canadians.



TIMELINE OVERVIEW FOR MEASURES OF SUCCESS

H. Moving Forward

As was mentioned in the rationale for this work, in Canada and internationally, there are currently a number of very significant health care and health research policy changes and challenges, as well as rapidly advancing science, making this NOHRS both timely and necessary to guide the Canadian oral health community forward. Above, we have outlined overarching goals and measures of success and linked them to a timeline, and it is important that the community acts on these items in an efficient and organized manner if we are to achieve these goals as outlined. The research community must be proactive, take the lead, get organized and move forward with this plan. To help those who decide to step forward and take the lead, we are proposing a “quick win” (i.e. a goal that can be achieved quickly and demonstrate we are moving forward), a “best buy” (i.e. a goal that can be achieved efficiently, making a strong impact with relatively few resources) and finally, a “game changer” (i.e. a goal that will completely change the way we work or look at the world). Our goals for these three categories are proposals, to stimulate the reflection on the way forward, but those who take the lead may decide to address different goals.



Quick wins

Our NOHRS will have been acknowledged and, where appropriate, adopted by all relevant research and health professional organizations

We will have created a sustainability training module that is widely available in the oral health research and broader health research, plus oral health care and broader health care communities.

* Best buy

We will have established a KM/IS network of fundamental scientists, applied researchers, health professionals, community representatives, patients, decision makers that enhances knowledge mobilization and the implementation of the findings of oral health research.

* Game changer

We will have at least two training programs in place in the field of omics, AI, KM/IS or sustainability as they relate to oral health.

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'ADDITIONAL COLLABORATORS AND LOGOS

TO FOLLOW IN THE NEXT DRAFT.'

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