

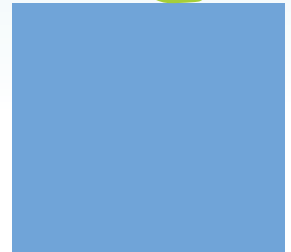
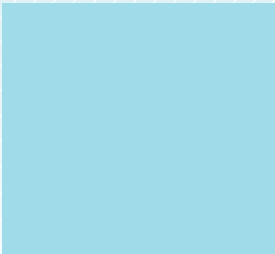
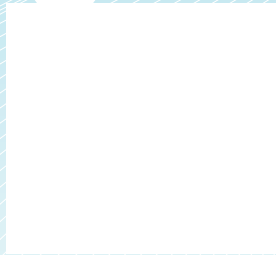


Public Health
Agency of Canada

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CHILDREN AND PHYSICAL ACTIVITY SCENARIOS PROJECT

Evidence-Based Visions of the Future



March 2011 | Population Health Assessment and Scenarios Team



**To promote and protect the health of Canadians through leadership,
partnership, innovation and action in public health.**

— Public Health Agency of Canada

Children and Physical Activity Scenarios Project: Evidence-Based Visions of the Future

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Table of Contents

Preface	iii	Cocoon Scenario Narrative	29
Executive Summary.....	1	No Child Left Inside Scenario Narrative	35
Introduction and Rationale.....	5	Smart Complex Scenario Narrative	41
The Issue.....	6	'Wild Card' Narratives: A Water Crisis	47
Phase I – Identifying Drivers and Trends.....	6	Phase V: Quantitative Modelling of Physical Activity Scenarios	51
Major Drivers of Activity	6	Introduction.....	51
Major Drivers of Inactivity	7	Exploring the Scenario Narratives Using a Monte Carlo Microsimulation Model ("Static Model").....	53
Wild Cards That May Influence Children's Physical Activity	7	Introduction.....	53
Phase II – Exploring Uncertainty	8	Methodology	53
Phase III: Scenario Logics.....	8	General Findings	56
Logic 1. Technology: The UltraWired to the Unplugged World.....	9	Conclusions	58
Logic 2. Community Involvement: Electronic Cottage to Community Cohesion.....	9	Exploring a 'Backlook Scenario' of 50 Years Past	59
Logic 3. Corporate Involvement: Market Driven Approaches to Multi-Sectoral Coalitions	10	Introduction.....	59
Logic 4. Public Sector Governance: Government Influence to Stewardship of Care	11	Methodology	59
Phase IV: Scenario Narratives	12	General Findings	61
Scenario Overviews.....	15	Conclusions and Suggested Future Work	62
À la Carte.....	15	Summary: Scenario Analysis and Public Health.....	63
Cocoon	16	Acknowledgements	64
No Child Left Inside	17	Project Sponsor	64
Smart Complex.....	18	Project Research Team	64
The Scenario Narratives.....	21	Research Support Team.....	64
Reading the Narratives	21	Modelling Team.....	64
À la Carte Scenario Narrative.....	21	Project Management Support Team	65
		Expert Advisors & Contributors.....	65
		References	68



Preface

In 2007 the Chief Public Health Officer initiated the Public Health Scenarios Development Project. The intent was to develop scenario expertise within the Public Health Agency of Canada as a means to assist with long-term strategic thinking around complex population and public health issues.

Planning through the use of scenarios can be used to great effect by private and public sectors within Canada and internationally to anticipate possible alternative futures and for strategizing in the context of uncertainty. Scenarios present *possible* futures in response to a defined issue or problem, and can be used to explore, debate and deliberate complex public health issues ranging from health outcomes to determinants of health. This approach is used to expand traditional decision making and planning horizons.

Scenarios can be described as sets of relevant and credible stories about the future (or the past), and can be used to learn about the integration of multiple perspectives or epistemologies. They combine experiential knowledge with scientific information, as well as integrate social and natural sciences. These plausible futures are not predictive, nor does this process define strategies. Instead, these resultant scenarios are more like hypotheses that ask “what if” in a disciplined way, forcing acknowledgement of new and unforeseen opportunities or challenges for an organisation. Scenarios are built on the foundation of exploring uncertainty and impact among many environments that influence an issue.

As one of a series of Public Health related scenarios to be developed by the Public Health Agency, the Children and Physical Activity Scenarios Project was designed to explore alternative physical activity futures among 5-12 year old children in Canada over the next 50 years.

Children and Physical Activity Scenarios Project: Evidence-Based Visions of the Future

Executive Summary

The Children and Physical Activity Scenarios Project was a multi-method exploration and analysis of alternative physical activity futures among 5-12 year old children in Canada over the next 50 years. Participation in physical activity by children was identified as appropriate for scenario development since the aetiology and consequences of the increasing rates of childhood sedentariness are highly complex, and comprehensive population health solutions remain elusive in spite of earnest individual and collective efforts.

This project was comprised of five phases. The first phase, 'Identifying Drivers and Trends' was a literature review to determine major drivers, and trends associated with children's activity and inactivity. Major drivers and trends explore what forces are impacting our current environment and what is coming on the horizon that may change those environments which may impact an issue¹. In order to capture a comprehensive and diverse range of influences on physical activity and inactivity in children, this project explored the social, technological, educational, emerging/reemerging conditions; environment (physical); population; political, economic, and regulatory environments to identify the major drivers and trends. This project identifies the key drivers of change shaping the wider context of physical activity in children.

The second phase, 'Exploring Uncertainty', involved interviews with 29 Canadian and international health, activity, education, technology, social science and built environment experts who were asked to articulate those drivers and trends associated with children's physical activity that had yet to be published in the scholarly literature, or were emerging in their fields.

The third phase, 'Scenario Logics', involved the identification of the logics or core relationships between the variability and uncertainties associated with major drivers of activity and inactivity as identified both through literature review and interviews. These logics were found to focus on i) soft and hard technology; ii) community involvement; iii) corporate involvement; and iv) public sector governance.

The fourth phase, 'Scenario Narratives', was the last of the predominantly qualitative components to this process. This phase involved developing and expanding the logics and their interrelationships into four plausible and distinct future scenarios of children's physical activity. These scenario narratives were entitled: 'À la Carte'; 'Cocoon'; 'No Child Left Inside'; and 'Smart Complex'.

In describing the four scenario narratives, we first encounter 'À la Carte', a Canadian society which is characterized by: daily dependence on "small 't'" technology; a mix of moderate cocooning and community cohesion; short-term multi-sectoral partnerships; and moderate government influence. This scenario attempted to reflect experts' concerns with the constraints that exist at the level of individual and family decision-making in the area of physical activity. Specifically, the constitution of 'choice' of activity and inactivity reflects the dynamic between societal, consumer and parental preferences and behaviours, and the external community and policy environment.

The 'Cocoon' scenario shows Canadians living in a society in which the pervading atmosphere is that of insularity, cautiousness, and fondness of the familiar. Cocooning, both socially and in the built environment, is associated with achieving personal and family security. However, the same behaviours preclude

neighbourhood interaction and inhibit a broader sense of community belonging. Government influence is strong, through physical activity monitoring and regulation, liberal tax incentives, and sponsored initiatives. These multiple efforts by government to provide a range of options to citizens is in keeping with a consumerist approach that privileges purchasing power and materialism.

In the scenario 'No Child Left Inside', Canadians live and work in a built environment that fosters children's physical and emotional well-being through a heightened connection with nature. This enables community cohesion through pedestrian- and all-ages friendly urban design, and where broad ecological protection is elicited through an emotional attachment to place. The most apparent social and political trends of this society include consumer-driven demands for healthy and organic products, strong and trusted government leadership in the areas of healthy and sustainable lifestyle, and genuine engagement in corporate good citizenship by private industry and not-for-profit organizations.

'Smart Complex' is a scenario in which Canadians are provided with opportunities for public engagement throughout the lifecourse through purposive urban design that includes a comprehensive school health model. The Smart Complex scenario is characterized by committed, strategic partnerships among diverse sectors and the use of built environment design properties to fulfil public health goals. This scenario was grounded in experts' concerns with Canada's aging demographics, the need for the maintenance of physical activity for all ages, and the necessity of broad-based coalitions to effectively address the education, health and social needs of future generations.

The fifth and final phase is a quantitative exploration of the potential impact on population health, setting parameters for selected major drivers that may change in specific environments. It is important to recognise that a limited number of variables can be explored in a quantitative setting, and thus outcomes will vary with the choice of variables and factors considered. Thus, these models can bring alternative perspectives to the consideration of plausible futures and specifically here to the four scenario narratives, but these outcomes will depend on the inherent assumptions of the modelling process and available data. This process involved the investigation of different forms of micro-simulation modelling to illustrate potential individual, population, and systems impacts related to physical activity and health. These techniques helped to quantify how the intensity and duration of physical activity in children might play itself out with regards to morbidity (Total Years Disabled) and mortality (Total Years Life Lost) chronic conditions such as ischemic heart diseases, stroke, hypertension, colon cancer, breast cancer, diabetes type II, and osteoporosis.

First, a Static Model approach was used to look at the implications of physical activity levels that would be suggested by the four scenario narratives presented in Phase IV. In this case, transition matrices were used to quantify comparisons in the relative levels of activity for children living within each of the four plausible futures. Children's activity levels were classified as 'inactive', 'low', 'moderate' and 'high' intensity on the basis of the Metabolic Equivalent of Task (MET)²⁻⁴. Hours per day spent at each of these four levels were estimated based on the description of the future worlds presented in the À la Carte, Cocoon, No Child Left Inside and Smart Complex narratives. The models were limited by the currently available data on physical activity, the outcomes considered (Life Expectancy and Mortality) and by a number of assumptions that were required for the modelling process. The potential impacts that were suggested through this type of modelling indicated that the cohort of children in the scenario depicted by No Child Left Inside had the highest life expectancy, and lowest mortality of the four narratives. Life expectancy and mortality due to levels of physical activity were similar for the Smart Complex and À La Carte scenarios. Finally, the Cocoon scenario produced the lowest life expectancy and highest mortality of the four narrative constructs used in

this modelling exploration. The modelling outcomes did suggest that an increase in both moderate and high intensity level activity has a positive effect on the health outcomes measured.

Secondly, a non-stochastic Compartmental Model was used to investigate what was described as a 'backlook' scenario in order to explore how the environment has changed in its impact on physical activity in children over the past 50 years. The question driving the modelling was posed as: "If Canadian children in 2000 have the same level of physical activity (PA) as those in the 1950s, to what extent would the health outcomes for these children change?" In response, models were created under the assumption that children in the 1950s could have had 10% to 25% higher levels of activity than children in 2000. In taking a cohort of 5 year old children in 2000 and carrying them forward 50 years with increases in their activity levels of 10% and 25% , general findings showed that this:

- decreased the overall morbidity rate by 145 to 374 cases per 100000 respectively,
- decreased the overall disability rate by 87 to 222 cases per 100000 respectively,
- decreased the overall mortality rates by 58 to 150 deaths per 100000 respectively,
- decreased the incidence of all diseases except osteoporosis; minimal reduction for breast cancer and colon cancer,
- decreased Total Years Disabled associated with the PA related diseases,
- increased Total Years Disabled overall (i.e., associated with both PA and non PA related diseases),
- decreased Total Years Life Lost associated with the PA related diseases,
- decreased Total Years Life Lost overall (i.e., associated with both PA and non PA related diseases).

These analyses suggest that if Canadians adopted the assumed physical activity levels of individuals who were 5-12 during the 1950s, there would be a decrease in disease morbidity, disability and mortality levels across all diseases under consideration in this study (related to physical activity/inactivity).

Scenarios provide public health planners and decision-makers with alternate visions of the future. These are designed to promote debate and visioning, and thereby elicit thoughtful planning for a range of possible, plausible outcomes. Effective, nimble responses founded on collaborative and diverse strategic thinking are the key to positive futures in public health. There is no paucity of information on public health issues, however there is a need to develop and support innovative processes such as scenario analysis that utilise, challenge, and engage a variety of stakeholders with a variety of perspectives at different levels both nationally and globally. Scenarios can support a role in both generating and testing strategies on specific issues in an organization⁵. Through the generating and testing of strategies, an organization can identify potential risks and further mitigation strategies⁵.



Introduction and Rationale

The Children and Physical Activity Scenarios Project was a multi-method exploration and analysis of alternative physical activity futures among 5-12 year old children in Canada over the next 50 years. The problem of inactivity among children was identified as appropriate for the scenario development approach since the aetiology and consequences of the increasing rates of childhood sedentariness are highly complex, and comprehensive population health solutions remain elusive in spite of earnest individual and collective efforts.

Scenarios provide public health planners and decision-makers with alternate visions of the future. These are designed to promote debate and visioning, and thereby elicit thoughtful planning for a range of possible, plausible outcomes. The process that was used for this project involved the use of both qualitative and quantitative methodologies in a five phase approach. Phase I, 'Identification of Drivers and Trends', involved an exhaustive scan of the health and social science literature to determine the major drivers and trends associated with physical activity and children. In Phase II, 'Exploring Uncertainty', the team conducted a broad

“Scenarios aim to stretch thinking about the future and widen the range of alternatives considered.”

Michael Porter, Competitive Strategy: Techniques for Industry and Competitor Analysis

range of qualitative interviews to engage a variety of experts in evidence-based visioning exercises of the factors that may influence physical activity among elementary school children now and in the future. Phase III, 'Scenario Logics', involved developing a set of logics, or core principles, based on synthesis of the literature review and interview outcomes and findings. Phase IV, 'Scenario Narratives', involved developing four evidence-based alternate future scenarios described in narrative form. Finally, Phase V was unique to the more traditional scenario analysis approach in that it involved a quantitative approach to illustrate the potential individual, population and systems impacts of the four future scenarios that we described, through development and application of micro-simulation models.

Throughout this project, the focus was on identifying the major drivers and trends associated with children's activity and inactivity in order to develop plausible and distinct storylines associated with the future in 25 and 50 years' time. Major drivers and trends explore what forces are impacting our current environment and what is coming on the horizon that may change those environments which may impact an issue¹. Trends are discernable, gradual patterns that slowly but pervasively cause change (eg. demographic shifts, decline in state sovereignty). Most stakeholders are relatively powerless to affect trends⁶. Major drivers are factors and uncertainties that create or drive change; they may be adapted by or strongly impact stakeholders, sometimes rapidly. These are areas that change from year to year and may be amenable to stakeholder actions and strategic choices by way of investments, new alignments, infrastructure, research and development and innovations⁶.

This report presents a scenario analysis of a public health issue of physical activity and children, detailing the qualitative and quantitative methods and outcomes. It begins with a brief explanation of our current understandings of physical activity levels among children in Canada. Next, the major drivers and trends of physical activity and inactivity identified in the extant literature are outlined. This is followed by exploring uncertainty and potential impacts through qualitative interviews with 29 local, national and international experts. The findings of the literature review and experts are then articulated in the section describing the scenario logics. These logics focused on i) soft and hard technology; ii) community involvement; iii) corporate involvement; and iv) public sector governance. Variabilities and uncertainties associated with each of these

logics were elaborated as continuums which we characterised by the following polarities: “The UltraWired to Unplugged World”; “Electronic Cottage to Community Cohesion”; “Market Driven to Multi-Sectoral Coalitions”; and “Short-term Planning to Stewardship of Care”. Logics provide the foundation for the scenario narratives. This report presents four plausible scenario narratives of children and physical activity through to the year 2060, entitled: ‘À la Carte’; ‘Cocoon’; ‘No Child Left Inside’; and ‘Smart Complex’. Concluding comments, based on the outcome and findings of this scenario analysis, consider the broader implications of scenarios for public health planning.

The Issue

As of 2009, only 13% of Canadian children and youth met national guidelines for physical activity^{7,8}. Childhood physical inactivity is associated with obesity and being overweight^{9,7}, as well as inferior physical and mental health^{10,11,12,13,14}. In contrast, engagement in physical activity is associated with children’s improved social and peer functioning^{15,16} and community integration^{17,15}. Recently, a small but encouraging increase in children’s physical activity has occurred^{7,18}. Still, much work remains to be done.

Phase I – Identifying Drivers and Trends

Public health scholars and policy makers understand children’s activity levels as a “paradox” of lifestyle¹⁹ in which children’s natural inclinations towards spontaneous movement and play meet with increasing obesity rates, less habitual activity, and an environment increasingly offering entertaining ‘sedentary alternatives’^{20, 21}. Consequently, efforts to increase children’s physical activity levels require paying close attention to the factors that foster movement, as well as those that inhibit it. For this reason, through consultation with an Expert Advisory Panel, the Scenario team examined factors associated with both activity and inactivity in order to understand the dynamics of increasing children’s physical activity levels on the whole.

To ensure a comprehensive range of activity and inactivity factors as possible was considered, the team adapted a commonly used scenario framework which guides the collection of evidence. Known as the ‘S-E-P-T’ framework (Social-Economic-Political-Technological)²² this was adapted for a public health application, and eventually became the ‘STEEPPER framework’: Social; Technological; Emerging/Re-emerging Conditions; Environment; Population; Political; Economic; and Regulatory. The STEEPPER framework ensured that the scenario team captured a wide diversity of influences on activity and inactivity at the local, national and global levels. In total, 14 major drivers associated with children’s physical activity were identified. These drivers are presented here as those related to either activity, or inactivity, among children.

Major Drivers of Activity

The eight major drivers of activity included:

- individual level factors such as children’s preferences^{7,23} and confidence levels^{24, 25};
- age-related developmental stages^{26,27};
- the development and appeal of youth-targeted active technology “exer-games” such as the Wii™ and ME2 pedometer, which combine physical and social activity^{7, 28, 29};

- participation in organized and unorganized sports^{30, 31};
- national, provincial, and municipal government initiatives³¹;
- the development and renewal of school-based interventions such as active learning and physical education curricula^{32, 33};
- after-hours community programming^{32, 33}; and
- grassroots movements which establish links between environmental and sustainability issues and health and activity³⁴.

Major Drivers of Inactivity

The six major drivers of inactivity included:

- individual level factors such as congenital or acquired disabilities³⁵, socio-economic status²⁶, and ethnicity and immigration status³⁰;
- cutbacks in existing physical education curricula³⁶, and the inability of many schools to meet provincial and federal physical education guidelines³⁷;
- sedentary screen and video technologies^{7, 38, 35, 39};
- barriers in the built environment^{40, 41, 42};
- reductions in the opportunities for active daily living including incidental movement⁴², active transportation^{7, 43}, and active leisure⁴⁴ by children and families; and
- social changes in the organization of families, including the working patterns of parents⁴⁵.

Wild Cards That May Influence Children's Physical Activity

In scenario analysis, drivers that are high impact, low probability events and situations that alter the fundamentals and lead to new actions, are identified as 'wild cards'⁶. These are the unpredictable but life altering events and situations that create new challenges and opportunities that most stakeholders have not considered or prepared for. Based on this description, four drivers that were considered to be wild cards associated with children's physical activity were identified:

- significant worsening of the economy^{46, 47};
- significant changes in global climate and associated environmental impacts⁴⁸;
- a water crisis⁴⁹; and
- a fossil fuel crisis⁵⁰.

Recent events suggest these may occur, yet their timing, extent, and implications for physical activity remain unclear. In some cases, the possible effects and outcomes of these wild cards for children's physical activity are highly troubling; in other cases, these may possibly be quite positive. For example, climate change is associated with volatile weather patterns, water scarcity, and high UV exposure that may individually or together restrict children's outdoor activities⁵¹. In contrast, consequences arising from a fuel crisis may exert some positive influence on higher uptake of active transportation such as public transportation and cycling. Since active transportation has been associated with increased physical activity, and improvements in community cohesiveness⁵⁰⁻⁵², these would potentially result in some beneficial outcomes.

Phase II – Exploring Uncertainty

The determination of the major drivers associated with children’s physical activity in Phase I led to the identification and subsequent interview of 29 youth, academic, government, and industry experts in physical activity and children. Experts hailed from Canada, the United States, and the Netherlands. Audio-recorded semi-structured telephone interviews lasted from 45-90 minutes in duration and were verbatim transcribed. Experts were interviewed in order to explicate the relationships between the variability and uncertainties associated with the STEEPPER-guided drivers of activity and inactivity, and to assist in understanding the implications upon Canadian society more generally. The interviews were designed to further the three fundamental principles of scenario planning on which the entire project was based: “multiple perspectives,” “outside-in thinking,” and “the long view”⁵³.

In scenario planning, multiple perspectives⁵³ are required to ensure that the final scenarios reflect the fullest range of social, economic, clinical and policy expertise that can be brought to bear upon an individual issue. Therefore, experts in this project represented a multiplicity of disciplines (e.g. health, urban planning, private industry, and youth leadership), activities (e.g. on-reserve First Nations outreach, direct clinical care, public policy) and scales (e.g. community-based physical activity research, international health initiatives) associated with physical activity.

Outside-in thinking refers to an external vantage point: that is, the consideration of factors in the contextual environment such as social values, geopolitics, and governance⁵³. These factors, and their interrelationships, are often overlooked in discussions of physical activity. Consequently, experts were asked to comment beyond their areas of specialty, to the broader socio-political environments of present day.

The long view looks beyond immediate concerns and conditions to ponder the future⁵³. Thus, experts were invited to envision the future of physical activity among Canadian children in 25 and 50 years time.

During the interviews, experts articulated critical considerations, threats and uncertainties related to children’s physical activity.

Phase III: Scenario Logics

In the third phase, the team analyzed jointly the literature associated with the fourteen identified drivers, as well as the interview data in order to determine the dimensions or polarity of uncertainty. These were used to identify the major uncertainties which ultimately formed the scenario logics. Scenario logics reveal the organizing principles or structures of experts’ beliefs about change, that is, both how the drivers develop and their uncertainties⁵⁴ in relation to an issue. In this project, four logics emerged that were associated with changes and uncertainty in children’s physical activity: i) soft and hard technology; ii) community involvement; iii) corporate involvement in amateur and competitive sport, physical education and community programming; and iv) public sector governance. When these logics were developed into full scenario narratives, the plausible combinations of changing environments were each flavoured with a distinct interpretation of the uncertainties and variabilities in the underlying drivers⁵⁴.

Whilst logics were jointly developed from the STEEPPER-guided literature reviews and the qualitative interviews, the following description of four logics specifically utilizes interview data to illuminate the range of variability and uncertainty associated with each of the four logics.

Logic 1. Technology: The UltraWired to the Unplugged World

The first logic concerned technology. Experts considered the variability and the uncertainty associated with extensive electronic communication and social networking, and the countervailing pressures of preferences associated with outdoors-focused and non-Internet play, leisure, and living environments. The logic reflected current and projected trends towards telework; home- and distance-learning; online and virtual engagement by adults and children; and child and adolescent cohort web-based skills and interests that make synchronous online social activity and avatar-play with peers highly desirable. Experts introduced the uncertainty of future preferences for natural and man-made outdoor environments to offer respite from technology, and to inspire an active, playful and personal engagement with the natural world.

“Kids don’t go outside. I think parents don’t necessarily want them outside in some cases. They may not feel that it’s safe to be outside and their entertainment isn’t outside any longer. It’s not down the street at the park with friends, it’s online, you know, instant messaging with friends. That’s “natural” to them....I think most people who are in policy-making positions right now look at the days when you used to be able to play in the streets till the street lights came on, and they want that back. We don’t live in that society anymore. ... It’s unrealistic.”

“I don’t see this idea that our public spaces become wired, so our public spaces will all have chips and so on and we’ll be able to interact. I see there being a reaction against it. I see there being a need to shut that off. ... but I would suspect that there’s going to be a cry for some of these spaces to actually be a place where you are tuning out from all of that electronic and having a break from all of that. ... and that tuning out is going to be part of our consciousness for public health.”

Interviewees

Logic 2. Community Involvement: Electronic Cottage to Community Cohesion

The second logic concerned children’s physical and social movements within, and connections to, their communities and neighbourhoods. Such movements and connections are a consequence of the broader relations between the built environment, technology, and the social organization of families, schools and work places. Experts queried the effects of families isolating themselves in “electronic cottages”¹ in their homes due to modern home-based conveniences, and ready access to entertainment and communication tools such as the telephone and internet.

“If we legislated screen use or electricity use to certain hours of the day... those types of things would have impact I think on the way we go about [increasing physical activity in children].”

“[People] are going to continue cocooning further inside their homes -- electronic cottages, ...No need to leave the home, no need to leave the recliner. Will people perceive ... streets to be safer so that we’ll see a resurgence of ball hockey because there’s fewer vehicles on the road?”

Interviewees

They were uncertain whether these trends would lead to negative changes such as increases in social isolation, and fears of “stranger-danger” and the dangerousness of public spaces. Conversely, experts speculated whether associated trends such as telework and teleschool would result in a reduction in the use of

¹ The Public Health Agency of Canada would like to thank Dr. Mark Tremblay for suggesting this term.

automobiles so that streets and cul-de-sacs would be safer for children’s travel and play, and the reduction in parental commuting time might foster more active family time.

“(T)echnology will continue to reduce the need to move, to use our body ... The notion of space is being redefined and movement is linked to the notion of space. Fifty years from now ... if we can start being able to transport ourselves miles without literally moving, and this is less and less fiction, what does it mean for physical activity?”

Interviewee

urban road closures to enable activities such as biking and walking. They spoke of the positive influence these initiatives have on family and personal health behaviours, role modelling of future health behaviours for children, and perceptions of safety of public spaces. Experts believed road closures and similar planning initiatives such as the creation of pocket parks and green corridors⁵⁷ provided evidence of the utility of urban design to promote close-knit and dynamic communities and improve children’s physical and social movements within the community.

Logic 3. Corporate Involvement: Market Driven Approaches to Multi-Sectoral Coalitions

The third logic concerned the degree and influence of corporate involvement associated with health and activity sectors such as amateur and competitive sports, physical education, and children’s community programming. Corporate involvement was viewed as ranging from single or partnered sponsorships to privatization and from organizations as diverse as traditional, not-for-profit and green corporations. Experts articulated the necessities

“...companies are fully aware of [the obesity epidemic] and would love to be able to be a part of the solution, not just the problem...(A)cross the board, you’ll be seeing more and more of that”

“...I think industry will drive [physical activity] because they want to sell stuff, and kids will drive it... getting their parents to buy stuff that their parents have never even heard of.”

“The bottom line is we’re not going to get anything done if we as governments are having to compete with opposing policies that undermine our efforts to do the right thing by children and youth as it concerns physical activity. ...if industry— video game and music industry—are not part of the solution, then they remain part of the problem.”

Interviewees

Experts identified the potential of the external built environment and community-capacity initiatives to establish a comprehensive school health model^{55,56} to improve community functioning, as well as the physical activity levels of individuals and families. Several experts commented on contemporary initiatives such as weekend

of a balance of influence in key sectors between corporate goals and practices (eg. profit-seeking; market expansion; viewing children as consumers) and broader societal goals of nurturing and guiding children’s physical and mental development. Positive models of corporate involvement included good corporate citizenship, as well as targeted coalitions among multiple partners across and beyond the physical activity sector.

It reflected experts’ significant concerns with the influence of corporate interests, and partnerships of different kinds. Experts articulated the necessities of: a balance of influence between the application and

imposition of traditional corporate goals and practices (eg. profit-seeking; market expansion; the grooming of children as consumers; sponsorship) and governance and regulation; targeted coalitions among multiple partners across and beyond the physical activity sector; and the development of good corporate citizenship.

Logic 4. Public Sector Governance: Government Influence to Stewardship of Care

The fourth logic concerned planning horizon endpoints associated with children’s physical activity. Experts noted that primary approaches to children’s physical inactivity are often single issue, project- or sector-specific, and piecemeal. Experts associated these approaches with responses that were more tailored than comprehensive in nature; that is, the amelioration of single issues through single approaches such as the choice by parents to address the complexity of children’s increasing obesity levels and sedentariness through prioritizing structured and supervised activities. Some experts believed that such piecemeal approaches would necessarily lead to negative personal, community and environmental consequences. These consequences, in turn, would initiate a radical philosophical and policy shift in Canadian society towards healthy living. Broadly conceived hypothesized outcomes included positive changes in personal and civic ecohealth behaviours including minimizing individual, family and corporate “ecological footprints”⁵⁸ or demand on resources, and social entrepreneurship. Ultimately, the end point of this philosophical shift would be a stewardship of care: a consciously enacted societal reorganization of energy consumption and environmental management, and an ever-present civic concern for the overall health and wellbeing of all community members. A diagrammatic representation of the four logics in the form of a summary matrix is found in Figure 1.

“...to survive as a society in the modern world, we have to collectively invest in human development. And that means creating urban environments that will promote physical activity as part of day-to-day life...”

“... we’ll have to densify (sic) in certain urban areas ... (to) recognize diversity in terms of the way in which kids want to engage with physical activity...”

Interviewee

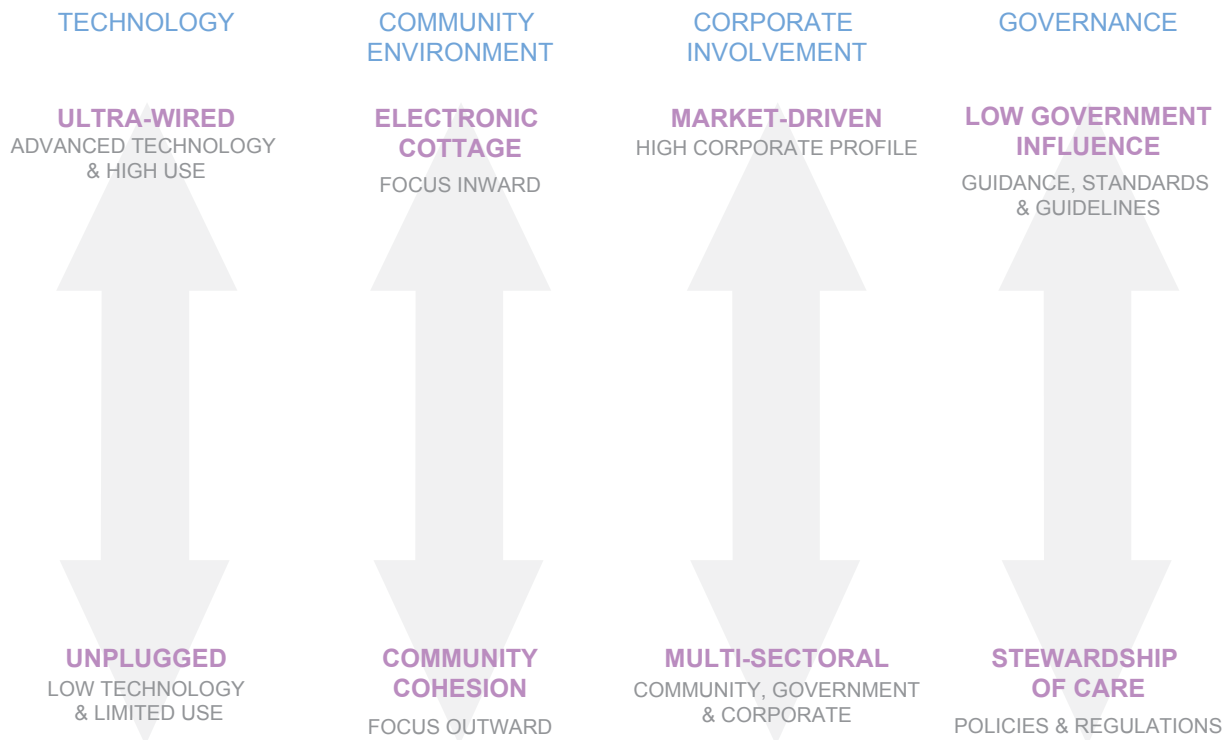


Figure 1. A diagrammatic representation of the four logics and their polarity in the form of a summary matrix.

Phase IV: Scenario Narratives

The fourth phase of the Children and Physical Activity Scenarios Project involved fully elaborating all four logics into scenario narratives, ensuring that the core features of plausibility associated with each logic was maintained, as well as articulating their points of interconnection. This resulted in the creation of distinct and unique scenario narratives that were reflective of various degrees or aspects of each of the four logics. The narratives reflect the critical uncertainties and how they may impact the changing dynamics of our environment.

The logics matrix (Figure 1) helped to position the most plausible permutations for developing the narratives; that is, we considered the likelihood of certain combinations, and dismissed the incompatibilities⁵⁹ between the four logics. To illustrate using software technology as an example, it was perceived as unlikely that strong regulation could co-exist with high market involvement, since the latter is generally perceived to be associated with low external regulation and monitoring of claims made by product makers⁷. Using this approach, four scenario narratives were developed entitled: ‘À la Carte’; ‘Cocoon’; ‘No Child Left Inside’; and ‘Smart Complex’ (Figure 2). The frameworks of these scenarios informed the development of the full narratives. Condensed descriptions of these four narratives (Figure 3) highlight the key aspects that underpinned the creation of the full scenarios.

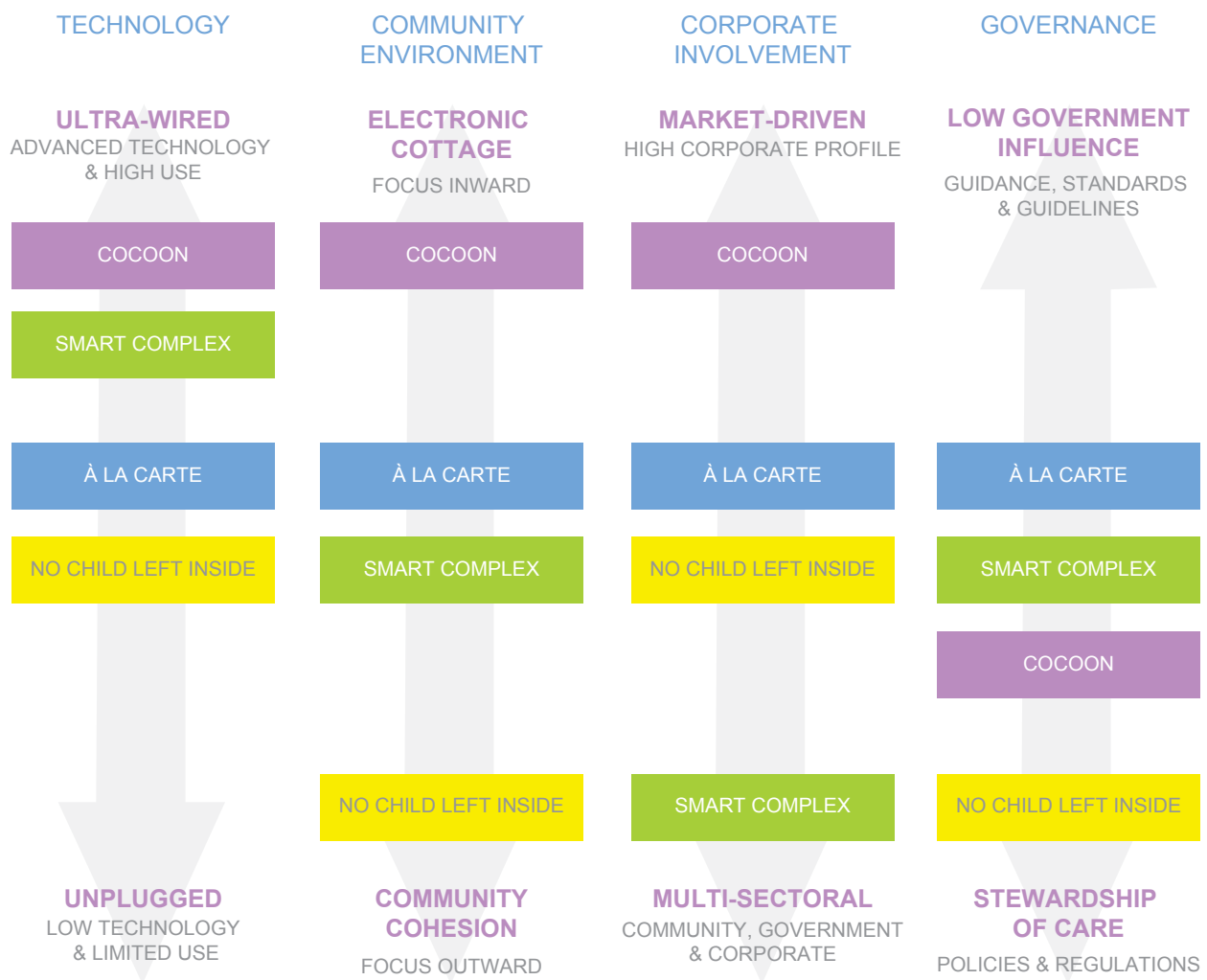


Figure 2. Development of the four scenario narratives using the logics matrix.

Narrative components drawn from the interviews and literature search (for example, comments on the organization of contemporary family life, or cohort characteristics) enabled the four scenarios to come alive with highly imaginative yet plausible detail. In keeping with established scenario practice, the four scenarios were written in such a way as to be structurally different, internally consistent, and challenging of conventional wisdom⁶⁰. In this way, story-telling combined with the best research evidence and expert opinion to present alternative futures of children and physical activity in Canada through to the year 2060.

Overviews for each scenario narrative are provided in the next section, followed by the scenario narratives themselves. The overviews describe the framework upon which the full narratives were created, enhanced with interviewee quotes that provide the reader with a sense of the diversity of opinion and perspectives that were collected throughout the analytic process.

The implication of changes in water availability due to global climate change was selected as a wild card that could be explored across all four scenarios. Short narratives were created for each, using research-supported implications of a water crisis (for example, high population movement and immigration; Canada-US relations; and international conflict)⁶¹ to demonstrate the diversity of possible impacts.

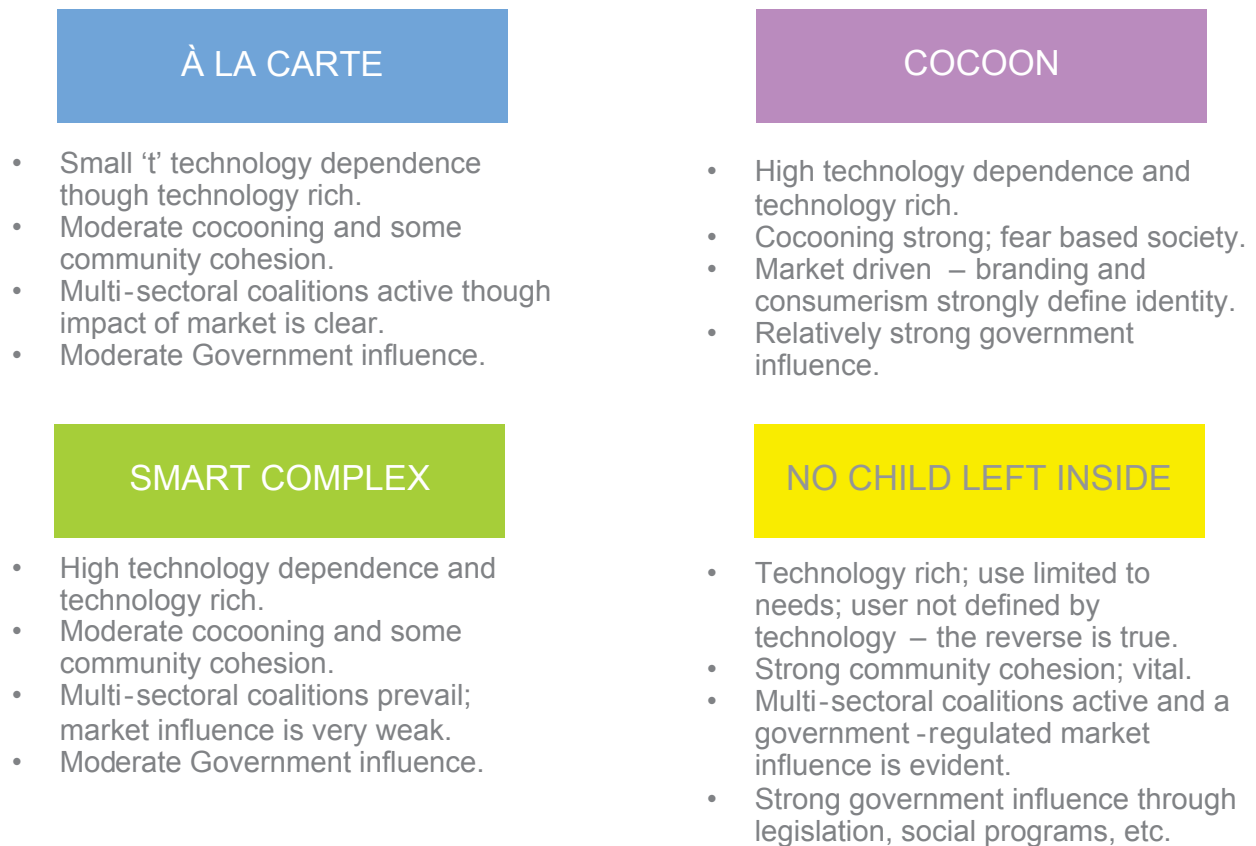


Figure 3. Key aspects describing the frameworks that were built upon the logics in developing the four scenario narratives.

Scenario Overviews

À la Carte

The À la Carte society is one of few extremes yet broad options. The population continues to seek and enjoy the benefits of ongoing developments in technology, yet desires to maintain social interactions and has a somewhat prudent involvement with the natural environment. As a result, moderate cocooning is balanced with evident community cohesiveness. Active multi-sectoral coalitions that support this society are often impacted by the corporate sector. Moderate government influence attempts to create a balance of the various needs – both globally and internally – but is showing an increasing reticence for funding. Changes in the social, built and natural environment present physical activity challenges that are addressed with multi-sectoral and technological salves from which individuals self-select based on individual and family preferences, social positioning and economic ability.

The À la Carte scenario is characterized by: daily dependence on “small ‘t’” technology; a mix of moderate cocooning and community cohesion; short-term multi-sectoral partnerships; and moderate government influence. The title is derived from a commonly-used term⁶² describing a restaurant menu that requires diners order, and pay for, items individually. While à la carte menus can be quite comprehensive, they still do offer a pre-determined set of options. Thus, the choice of food items is somewhat constrained although the belief is that the range of offerings will suffice to satisfy, or approximate, each diner’s distinct needs, tastes and moods at that meal. With this title, the scenario reflects experts’ concerns with the opportunities and constraints that exist at the level of individual and family decision-making in the area of physical activity. Specifically what emerges in this scenario is the constitution of “choice” of activity and inactivity which, in turn, reflects the dynamic between societal, consumer and parental preferences and behaviours, and what is provided or withheld by the external community and policy environment.

“I think we’ve lost the loyalty for more unstructured play. In our structured world where we’ve got two working parents and we’ve got schedules, we equate busy with active. We say, ‘Well my kid plays soccer, baseball,’” and we rhyme off all the things that our kids do in a week, but can these kids play on their own? How much time are they actually being active, or is that way less than the time they spend in the car being driven to and from all of these activities? Have we lost that joy of movement just for the sake of going outside and doing something?”

Interviewee

The scenario logic was drawn from literature review of consumerist approaches to health and social care and policy, and from experts’ comments regarding: the tensions between consumers’ increasing social dependence on communications technology and their continued social preferences for face-to-face interaction; present-day and forecasted medical and genetic advances which will offset illness consequences for those with financial means or access to third-party funded programs; the unique benefits offered by both short-term, targeted and ameliorative policy and programme planning and those offered through strategic broadly-based collaborations between government, health charities, and private industries; and consumers’ growing affinity for “green products” and their ability to assess – and reject – those industries which only appear “green” for profit-oriented purposes. Experts also focused on the full capitalisation of existing built structures (e.g. schools, community centres) under multi-use agreements to maximize community capacity. Aboriginal identity and self-governance, children’s mental health, and uniquely tailored educational models for children also figured prominently in experts’ visioning of individualized and self-organized futures.

Cocoon

Cocoon society is characterised by a population that is rich in technology and upon which there is a high dependency. The pervading atmosphere is that of a cautious, insular society where cocooning, both socially and in the built environment, is associated with achieving personal and family security. However, the same behaviours preclude neighbourhood interaction and inhibit a broader sense of community belonging. Society

“[People] are going to continue cocooning further inside their homes -- electronic cottages, if you will. So the need for the inconvenience of having to drive to anywhere diminishes...No need to leave the home, no need to leave the recliner. Will people perceive then the streets to be safer so that we’ll see a resurgence of ball hockey because there’s fewer vehicles on the road?”

Interviewee

is strongly market driven; branding and consumerism very much define identity. Government influence is strong, through physical activity monitoring and regulation, liberal tax incentives, and sponsored initiatives. Managing children’s physical and intellectual disabilities is seen as primarily a private responsibility but parents also find federal level support in

accessibility commitments to existing programs and services. These multiple efforts by government to provide a range of options to citizens is in keeping with a consumerist approach that privileges purchasing power and materialism. Personal privacy is no longer considered a social norm as it has become subsumed by the perceived need for citizen and government surveillance.

“The bottom line is we’re not going to get anything done if we as governments are having to compete with opposing policies that undermine our efforts to do the right thing by children and youth as it concerns physical activity. And so if industry—the video game industry and the music industry—are not part of the solution, then they remain part of the problem.”

Interviewee

The Cocoon scenario depicts a future in which physical activity is fostered and hindered by a mixture of private-public partnerships and relatively strong government regulatory involvement and control in the form of standards and policies. Primarily reactionary in thinking, the scenario arose from literature review of the social impacts of technology, and experts’

concerns with the social implications of citizens excessively “cocooning” in their homes due to dependencies on home-based conveniences including e-shopping, e-commerce and e-communication. It was suggested that cocooning would negatively impact social relationships in the wider community, leading to heightened anxieties regarding crime, ‘stranger-danger,’ and perceptions of risk in public and school environments. In such a context,

“ ... Will it be a sort of “Mad Max Beyond Thunderdome”² where everyone is cocooned inside their house; no one is outside except dangerous people, and so you certainly don’t want to go out there?”

Interviewee

societal and family actions, attitudes and responses would be increasingly litigious and fear-based. Effective and sustained monitoring, supervision, and control of external social and built environments would be viewed as key to achieving safety and

security. At the same time, experts believed that future educators and policy makers would make increasing use of the efficacy of free play, outdoor activity, and music-based movement to improve children’s mental health, academic focus, and social functioning with peers and other community members.

No Child Left Inside

No Child Left Inside describes a society characterized by strong beliefs in social equality, high civic engagement, environmental commitment and long-term sustainable policy and program planning. It also presents strong government influence and long-term multi-sectoral partnerships that support staunchly held individual and social beliefs regarding community participation and responsibility. Technology is highly advanced but used circumspectly as a tool to enhance, but not dominate, daily life. Recognizing that simply creating physically accessible environments does not ensure participation, a focus on social and environmental inclusiveness ensures full integration of children with disabilities or special needs. Health and fitness are regarded holistically.

“As a society, we are finally starting to look more seriously at environmental sustainability and tying that to health as well. ...a more environmentally sustainable lifestyle should include health and physical activity as part of that agenda.”

Interviewee

The No Child Left Inside scenario arose from STEEPPER-guided literature review and experts’ comments regarding the ability of “place-based” or built environment strategies to: enhance children’s health and physical and emotional well-being through connection with nature; foster community cohesion through pedestrian- and all-ages friendly urban design; and elicit an emotional attachment to place that would, in turn, lead to broad ecological protection. It was suggested that the environment and its link to the promotion of healthy communities could form a common reference point around which diverse government, industry, physical activity, grassroots and conservation sectors could mobilize sustained coalitions. The most likely trends that would influence a society which embodies an ethic of care would be consumer-driven demands for healthy and organic products, strong and trusted government leadership in the areas of healthy and sustainable lifestyle, and genuine engagement in corporate good citizenship by private industry and not-for-profit organizations.

“...We’re building a natural playground ... a hill, big trees, 30 foot pines and maples and service berries ... We’re digging up the asphalt... You look beside this space to the next one which is another school board ... Those kids get a completely paved and fenced in yard... and the kids from that space are sticking their fingers through between the bits of chain link fence to pull little chunks of mulch out to play with...that was their toy.”

Interviewee

Experts were deeply concerned about the current trends in the built environment such as the loss of traditional public play areas for children including streets (due to bylaw restrictions) and natural/wild spaces such as ravines or creeks (due to urbanization). Experts also identified problematic social trends such as parental fear of stranger-danger, as well as harms that might befall children as a consequence of natural and unpredictable events such as bee-stings and pollinating plants. Combined, these trends have created a contemporary environment in which children are most often provided supervised indoor-only play environments either in the home or in recreational facilities. This was believed by experts to delay the development of the personal autonomy of children, replace imaginative independent outdoor play with passive, technology-dependent indoor play, and strongly predict patterns of poor outdoor and environmental behaviour that children would one day model as adults and parents.

The scenario title, “No Child Left Inside” was taken from a growing international education movement of the same name. The movement, and the research evidence which supports it, recognizes the developmental, health and educational benefits that accrue to children as a result of learning and playing in natural settings⁵⁷.

The movement was sparked by the 2005 publication of “Last Child in the Woods: Saving Our Children from Nature Deficit Disorder”⁶³, which directly linked the lack of nature or ‘nature-deficit’ in the lives of today’s wired generation to the rising rates of childhood obesity, depression and attention disorders. As of March 2009, the US Congress was planning to consider the *No Child Left Inside Act*, a bill already approved by the House of Representatives. If passed, the Act would require schools to offer environmental education to students in kindergarten through grade 12, and provide federal grants to help schools fund outdoor education initiatives⁶⁴. At present, there is no equivalent Canadian government initiative that addresses the No Child Left Inside philosophy. However, not-for-profit and for-profit Canadian organizations have developed like-minded programs and products including “natural playgrounds”⁶⁵, and Canada’s first outdoor “forest pre-school”⁶⁶. Additionally, organizations in British Columbia, Alberta and Ontario have recently joined together to form the “Child and Nature Alliance”^{67, 68}. KidActive, a charitable organization member of the Child and Nature Alliance argues that it is in every child’s nature to choose activity over inactivity, and to choose active outdoor play - in particular - over indoor sedentary recreation⁶⁹. Further, as with the No Child Left Inside movement, the members of Canada’s Child and Nature Alliance believe that outdoor education is critical to children’s development of environmental caring.

“A walkable neighborhood is one where the child can actually go to the corner store, buy an ice cream in the summer and come back home before the ice cream melts.”

Interviewee

The built environment is a strong driver in this scenario. This refers to the nature and extent of the associations between the built environment (e.g. urban density, design, diversity, access and distance to public

transportation systems, and the mix of motorized, non-motorised and recreational spaces) and population levels of physical activity and quality of life related with health⁷⁰. The composition of the built environment links strongly to community cohesion, and can foster or inhibit feelings of comfort and belonging in community.

Smart Complex

“We have to also [have a] global consciousness of what there’s an opportunity to prevent some of the third world countries..., like China and India, from making the same mistakes we made...because basically they’re building cities for cars... [and] now we’re trying to backtrack and there’s no cheap solution for it.”

Interviewee

The Smart Complex scenario depicts a highly organized, technologically sophisticated society in which public health is predominantly fostered through principles of architectural design. In this scenario, the built environment deliberately enhances non-structured and incidental everyday physical activity, and encourages

structured activities for individuals with varied physical and cognitive competencies across the lifecourse.

“...the idea of ‘states and families being duty bearers’ in terms of creating opportunities for children to evolve according to their developing physical, social, emotional, language and cognitive capacities.”

Interviewee

The Smart Complex scenario was developed from literature review and experts’ belief in the capacity of urban design principles to fulfill public health goals, and the necessity for committed, strategic partnerships among diverse sectors in order to effectively do so.

A concern with the motivation for, and maintenance of, physical activity over the life course was also articulated. The scenario was also strongly grounded in experts’ support of the ‘comprehensive school health’

model. Many experts suggested that the comprehensive school health model was an effective mechanism to address the education, health and social needs of future generations; following an integrated approach to health promotion, it gives students numerous opportunities to observe and learn positive health attitudes and behaviours. This approach recognizes that many different factors affect the health and well-being of students, including the physical conditions of home, school and community; the availability and quality of health services; economic and social conditions; and the quality and impact of health promotion. In order to succeed, the comprehensive school health model depends on active partnership between and amongst multisectoral partners^{55,56}.

“The whole area of environmental neighbourhood development, and the geographers coming together with the physical activity specialists to try to design neighbourhoods and workplaces and schools that are more active, is crucial.”

Interviewee

The Scenario Narratives

Reading the Narratives

Each of the four scenario narratives are presented in the following format:

- i) the Background, which describes how the scenario narrative was constructed, including a description of the logics, major trends and drivers;
- ii) a set of plausible “National News Headlines” which introduce what are considered to be representative “national news headlines” that capture the essence of the scenario trends and drivers with events of interest characterising how things might have evolved over the time span considered (2015 – 2050);
- iii) the actual Scenario Narrative itself; and
- iv) a Summary which presents the reader with some thoughts on the potential future directions and related challenges and strengths of the scenario.

The section that follows provides a collection of short narratives that illustrate what might be seen in each of the four scenarios under one ‘wild card’: a water crisis.

À la Carte Scenario Narrative

Background

The À la Carte scenario is characterized by: daily dependence on “small ‘t’” technology, a mix of moderate cocooning and community cohesion; short-term multi-sectoral partnerships; and moderate government influence.

The scenario logic was drawn from experts’ comments regarding: dependence on communications technology which would lead to moderate cocooning and community cohesion; sophisticated medical and genetic advances; short-term, targeted and ameliorative policy and programme planning in the area of physical activity; strategic collaborations between government, health charities, and private industries (soft drinks, fast food, technology) on specific issues related to physical activity; and scepticism regarding industries appearing “green” for limited, strategic purposes. Experts also focused on the full maximization of existing built structures (e.g. schools, community centres) under ‘use agreements’ in order to capitalize on community capacity. Aboriginal health, children’s mental health and tailored educational models for children also figured prominently in these community centric futures.

The Scenario

Capturing the essence of the À la Carte scenario, an archival review of the E-CBC national news headlines is presented.

Archives of the E-CBC National Headlines: 2015 - 2050

- 2015 Quebec's Healthy Children: Province sees rewards of holistic family health program.
Two Ds for elementary school children: Depression and Diabetes
- 2020 East Coast tidal power plants rejuvenate, redefine Nova Scotia's population
U of T holds out as Ontario's other Unis go cyber
InVitro meats not just for wealthy. CowGro Co serves up burgers in PEI's Lunch4Munchkins program
- 2025 Government passes ban on gas-only fuelled vehicles in Canada
Saskatchewan under glass: massive wind-powered greenhouse developments overcoming drought and pests
20 Years Hence: Are we due for another Global Recession?
- 2030 Alberta seniors' association lauded for design of its 'Inter-Gen Safe2Saunter' children's walk and hike program
Water refugees overwhelm national immigration staging facility in Newfoundland
Vancouver's high rise farms now supply 60% of city supermarkets' produce
- 2040 Canadian population exceeds 40 million: 1 in 10 are 80+ years and going strong
Parties unite as Feds unveil "The 2920 Pledge" to improve children's health.
Canadians Golden at Nunavut's Summer Olympic Games

Choices, Checks and Balancing

In contrast to a period of relative wealth in the early part of the 21st Century, Canada experiences profound social and industrial upheavals in the years following the Great Global Recession period (2010-2017). Subsequent smaller economic downturns do little to return Canada to its former stability. As a result Canada is by 2050 an uncertain economic nation characterized by decreased state involvement in health and social care, marked social trends of individualism and personal choice, and the presence of clear health and socioeconomic inequalities.

Health practices and policy have been increasingly focused on genetic predispositions to diseases whilst underplaying non-medical determinants of health such as socio-economic and environmental factors. Yet research on how to treat genetic diseases lags behind, creating great demand by parents for identification services, selective abortions, disability insurance coverage and laws against the discriminatory use of genetic history. Genetic technology has eradicated functional obesity, yet poor mental health in children associated with "physical activity deficit" (PAD)⁷¹ and hypokinetic lifestyles persists⁷². Consequently the significant

role of physical activity in addressing childhood mental health has prompted the establishment of national guidelines, and activity-enriched curricula in elementary schools.

Decreasing government funding means that the physical activity sector in Canada is primarily market driven. With few exceptions, physical activity services and programs are funded through partnerships between the corporate sector and private not-for-profit foundations. Only basic levels of service or opportunities related to physical activity, for example, physical education in schools and municipal parks, are provided at no cost. User fees, strict means-tested subsidized programs, tax incentives, and employer-based private insurers provide alternate means of access within the fee-for-payment structure of the private consumer model of physical activity. Inequitable access based on individual and community socioeconomic capital persists.

Moderate government regulation aimed at improving children's overall health, combined with anti-globalism and green consumer movements provide the impetus for corporations to develop 'health- and eco-friendly' codes of conduct that benefit children's health. Yet profit, not ethics, provides the underpinning business rationale for even those companies considered "good corporate citizens," and consumers remain sceptical.

Government Influence and the 2920 Pledge

The monogenetic and polygenetic obesity that had earlier been a full-blown national public health crisis among elementary school aged children by 2015 were almost fully eradicated in that same age group by 2022. Eradication was achieved primarily through medical and transgenic interventions such as assistive reproductive technologies which de-selected embryos, genetic modification in common everyday foodstuffs which target hormones associated with appetite and carbohydrate conversion, and medical interventions such as liposection, and bariatric surgery including implantable gastric pacemakers which produce early satiety sensations for children with refractory obesity⁷³ Neurodevelopment disorders such as autism spectrum, attention deficit and hyperactivity disorder (ADHD) and sensory processing disorder (SPD)⁷⁴ and mental health problems (antisocial behaviour, depression and anxiety) are now the most prevalent health disorders in childhood. By 2036, suicide ranks as the second leading cause of death in children 8-10 years of age. Factors in the social environment such the cradle-to-grave consumer identity⁷⁵ as well as the modern convenience-oriented and hypokinetic lifestyle⁷² which leads to PAD syndrome, were identified as prime aetiological sources. Governments attempt to modulate the more negative effects of consumerism by limiting advertisements near areas where children congregate such as schools and playgrounds⁷⁶. Looking to the growing evidence of ineffectiveness of treatment versus preventive approaches to improving children's mental health, and consistent scientific evidence regarding the link between 60 minutes of daily physical activity and mental health ⁷⁷the federal government introduces "The 2920 Pledge"⁷⁸ in the 2040 Federal Budget. This is a national health standard that requires parents to voluntarily pledge to assist their children in logging 2920 hours of physical activity outside of school time over the eight years between ages 5 and 12, preferably aiming at 1 hour per day. Tax incentives, insurance deductions, savings on sports equipment and activity fees, and registered education savings plan contributions based on adherence to this pledge encourage participation.

Beginning at the gestational stage, pregnant women are socially pressured to attend prenatal yoga and pilates classes; this expectation is perceived as socially responsible, originating in research that finds maternal physical and mental health and fitness during pregnancy leads to healthy outcomes across the lifespan for the child. From birth to pre-school level, Parents-N-Tots exercise programs are closely monitored by the state and program providers must ensure that recognised physical fitness standards are achieved (eg. Cardiorespiratory

endurance, muscular strength and endurance, body composition and flexibility)^{78,79} in terms of infant/toddler motor development skills, left-right brain development, rhythm and balance, and cross-generational and peer interaction. These programs are intended to socialize children into habitual daily physical activity as a regular component of their day. Strong social messaging regarding the mood benefits of activity for children, as well as imputing the self-discipline and internal good character of those children and parents who maintain participation is heavily emphasized. Great importance is placed on the facility of physical activity to promote appropriate social conduct, to teach the principles of ‘fair play,’ and to improve individual and community mental health. Individuals are exhorted to view the care and maintenance of the physical body as visible indicators of positive self-care, buoyant mood, and personal resilience; characteristics of good citizenship and private responsibility.

Government accredited private and public programs for 5-12 year olds that are eligible for the 2920 Pledge tax breaks for parents must emphasize flexibility, strength training and technical skills intended to provide physical and psychosocial health benefits throughout the lifespan, as well as points of social reference with peers and adults. To capitalize on existing community capacity in low socioeconomic communities, and to remain in compliance with government regulations, most physical activity programs for children require only existing basic sport facilities and equipment, and the largest budgetary expenditures are on qualified staff.

The form and structure of physical activity is also heavily influenced by the presence of specific ethnic groups, specifically the increasing Aboriginal population and continued immigration⁸⁰. The increased sector of the corporate world that is now run by Aboriginals is a major funder of Aboriginal-focused activities such as enhancement of the functions of Friendship Centres. Recognizing the ongoing need for promoting and sustaining physical activity among Aboriginal children, these corporations heavily support the renovation of existing Friendship Centres to include state-of-the-art gymnasiums and pools, and the increased staffing of culturally sensitive recreational therapists and coaches. Integration with non-aboriginal children occurs during Heritage Canada sponsored day camps that teach Aboriginal games (handball, lacrosse, and quoits) and for older children hip-hop, and drum dancing classes. After-hour use agreements in communities additionally enhance the participation of local non-Aboriginal children by offering fee-for-use space for physical activities such as pilates, yoga, volley ball, indoor soccer, and handball.

The proportion of immigrants in Canada continues to rise; transition into Canada for recent immigrants (≤10 years’ residence in Canada) presents different challenges than those who have lived here for more than a decade. To encourage physical activity in the children of new Canadians, organized and unorganized sports are facilitated by the availability of culturally diverse and popular forms of exercise. Favoured structured activities for children include soccer, cricket, soft martial arts (aikido, tai chi chuan), meditation and yoga and dance (hip hop, reggaeton, bhangra, shumka). Inclusive policies that respect cultural differences include the provision of sex-segregated exercise areas and programs, and covered windows in gymnasiums and pools that facilitate the participation of girls needing to conform to modesty requirements.

Family and Community Life

A combination of lingering recessionary economic influences and burgeoning population stressors have supported the continued maintenance of federal government restrictions on the number of hours per work week, in turn prompting job sharing and 4 day work weeks. Strong social messaging encourages individuals to spend their ‘Spread-The-Wealth Day’ on fulfilling parental and community obligations. Parents in particular are encouraged to apply this day towards supporting the 2920 Pledge related activities,

for example, assisting with children’s active commuting, participating in and/or coaching organized and non-organized sports activities. High and dual income earners are most likely to take advantage of the 4 day work week to promote active lifestyle management. In contrast, lower-income earners and sole-support parents are more likely to use this day to work black market jobs, effectively decreasing active lifestyle modelling, and activity supervision and mentoring. Participation inequities in these lower-income families are exacerbated by financial barriers including user and entrance fees to facilities, and costs of sports equipment.

One legacy of the significant social anomie and individual isolation that plagued many Canadians during the Great Global Recession and afterwards is the ongoing social exhortations for families and individuals to increase outdoor participation as a means of effectively establishing heightened public safety and social calmness through “eyes on the street”⁸¹. Hence, morning, evening and weekend local-area peer-specific and intergenerational walking⁸², and in-line skating⁸³ groups are instituted for children, families and working and retired adults. These organized, facilitated groups are offered free or at nominal fee, and are often funded by crime prevention initiatives which tie the ‘socialize while you exercise’ activity groups into Nayborz R Us community watch programs. Similarly, urban regeneration plans incorporate daytime-only supervised fenced pocket parks⁸⁴ that are used for children’s, parkour, GPS-based hide-and-seek, bicycling, rollerblading, and skipping.

‘Community’ is not perceived to be associated with geographical neighbourhoods; proximal neighbours rarely know one another beyond face-recognition. Physical activity is supported by technology, with combinations of real-world and virtual activity. Since the majority of children attend large feeder schools with large catchment areas, scheduled play dates for younger children often consist of on-line virtual active turn-taking games such as Dance Dance Revolution with school chums. Older children and tweens ‘try on’ personalities through multiple persona avatars in competition-based active play with local and virtual peers. Individuals primarily establish and maintain social connections via on-line Google Groups[®] that have evolved from e-networks such as Craigslist[®], Twitter[®] and Youtube[®], and also through sports team fan attachments to non-local professional teams.

In most communities, recreation centres provide indoor free and fee-based services, yet outdoor access remains limited. General unease regarding children’s safety fuels urban regeneration plans that incorporate monitored daytime-use fenced pocket parks built on small reclaimed areas such as train corridors and abandoned building sites.

Multi-Sectoral Partnerships

During the period of 2015-2025, structured activities and health club memberships are increasingly popular. Economically disadvantaged families face increasing marginalization as physical activity and physical activity membership becomes a status symbol, and particular forms of physical activity become more socially desired than others. Social and economic disadvantage is not fully mitigated within publicly funded organizations such as the YMCA; bursaries are strictly means-tested, and “plus” memberships exist for those who can afford them in order to give the image of exclusivity by restricting public areas of the facility. International youth organization KidsCorp enjoys increased Canadian membership for boys and girls, and raises the international profile of physical activity and fitness by making personal fitness a merit badge requirement for the highest advancement rank. However, the KidsCorps’ short-term after-school modules designed to remove barriers to participation sets up a two tier system that additionally undermines the universality of status and incentive for physical activity by removing the merit badge program in economically disadvantaged areas, since awarded badges must be privately purchased.

Existing government programmes favour the social and political status quo so that interventions such as tax credits for privately purchased organized physical activity, tax breaks for seniors who participate as children's walking school bus monitors and publicly funded cartoons of "fitness superheroes" during children's television hours, do not increase existing inequalities but fail also to address them.

By 2036, the impact of decreasing state involvement in core funding to physical activity organizations leads to an increased role by corporations in the structure and delivery of physical activity-oriented programs for children within and outside of school hours. This creates a short-term progressive effect on physical activity levels between children from diverse socioeconomic communities as the poorer communities benefit most from the infusion of resources and technology. New media works as a pacing device, minimizing the differences among children from different schools and communities regardless of size and composition/training of physical activity educators/trainers and facilities. Yet by 2045 this proves limited due to challenges of sustainability such as continued corporate funding and interest, infrastructure maintenance, and rapidly obsolete technology. As well, the cultural homogenizing effect among communities is met with strenuous resistance by smaller anti-corporatisation groups who emphasize local, sustainable, green efforts designed to address the holistic aspects of children's physical activity and to emotionally attach children to their communities. To deal with consumer-backlash, companies return to the public relation strategies of good corporate citizenship once popular during the years of insensitive spending sprees during the government bailouts of the early years of the Great Global Recession. Corporations hone a 'health friendly' image associated with social equity, and inject funds into the community in return for advertising. By 2060, the physical activity sector is dominated by partnerships between the corporate sector and private not-for-profit foundations.

Tailored Schools

Upon entering school, active transportation, active learning, and targeted physical education curricula are designed to account for 60 minutes of activity per day within the school environment. Combined with the 2920 Pledge, this heightens the recognition that sustained behavioural changes in children related to physical activity are more likely assured when government incentives are coupled with institutional support.

'No Transport Zones' around schools, the distance at which children riding automobiles or passive transport are required to disembark and continue by active transportation to school, are established. School buses are required to stop 0.5 km away from the school; upon disembarking, children may walk, skateboard, or rollerblade or bike from the outer limit. Buses are also outfitted with bicycle racks that carry children's bikes in the front. Younger children are monitored along these walking routes by seniors who head the Walking Bus initiatives. Older children are free to proceed unassisted, given the safety associated with large groups of mostly supervised children moving at any one time. The No Transport Zone is also associated with reduced exposure to exhaust pollution near schools, and reduced risk of child injury⁸⁵.

Prior to school registration, children are administered standardized questionnaires which identify each child's attention and sensory processing profile, providing educators with information on children's vestibular and proprioceptive learning needs. Children are thus streamed into classrooms that are more activity permissive, and which may replace circle-time and line-ups with more active mechanism of classroom organization. For example, classrooms deploy proprioceptive stimulation techniques such as stand-up desks with swinging footrests⁸⁶, ball chairs, or the attachment of therabands to chair legs for children who fidget, weighted vests to increase deep pressure sensation, mini-study carrels to reduce visual distraction, headphones for auditory stimulation, and school-wide aromatherapy to increase concentration and decrease depression or agitation.

Accessibility is often viewed as an equipment-based and programmatic issue, and thus the inclusivity of children with disabilities is inadvertently undermined by inattention to peer and broader social issues.

Children are on healthy sensory diets [eg. thick shakes, chewy sandwiches, crunchy snacks] and provided with genetically modified, anti-caloric hard sour candies to increase concentration and energy during these activities⁸⁷. Fast food companies provide funding for playground and sport equipment in return for exclusivity to school cafeterias and vending machines. In recognition that overweight and sedentariness both contribute to poor health outcomes for children, governments require these companies to conform to regulations which restrict sodium, sugar and fat, and require they provide fruit and vegetable options.

Summary

À la Carte depicts a Canada that is coping but not as well as they could if they had had a more long-term vision in responding and reacting to the tapestry of social, political economic and environmental forces. By 2060 the population cannot help but recognise that technologies alone will not create a fit society, and certainly not future generations of physically fit individuals. The aging demographic with its longer life spans put a heavy load on the upcoming generations; managing and respecting their own health while responding to serious internal and global environmental challenges such as the water crisis, will be difficult in the coming decades. Whether government continues to play a less forceful role in this regard will depend partially on the public's perceptions of the efficacy and impact of its current relationships with corporations and non-governmental organisations.

Cocoon Scenario Narrative

Background

The Cocoon Scenario illustrates the possible future of increasing physical activity in elementary school children through a set of parameters that depict a mixture of private-public partnerships combined with relatively strong government regulatory involvement and control in the form of surveillance, standards, and bans. Primarily reactionary in thinking, the scenario arose from experts' concerns with the social implications of citizens excessively "cocooning²" in their homes due to dependencies on home-based conveniences including e-shopping, e-commerce and e-communication. It was suggested that cocooning would negatively impact social relationships in the wider community, leading to heightened anxieties regarding crime, 'stranger-danger,' and perceptions of risk in public and school environments. In such a context, societal and family actions, attitudes and responses would be increasingly litigious- and fear-based. Effective and sustained monitoring, supervision, and control of external social and built environments would be viewed as key to achieving safety and security. At the same time, experts believed that future educators and policy makers would make increasing use of the efficacy of free play, outdoor activity, and music-based movement to improve children's mental health, academic focus, and social functioning with peers and other community members.

²The Public Health Agency of Canada would like to thank Dr. Mark Tremblay for suggesting this term.

The Scenario

Capturing the essence of the Cocoon scenario, an archival review of the E-CBC national news headlines is presented.

Archives of the E-CBC National Headlines: 2015 - 2050

- 2015** Vancouver's Star-Studded Charity Gala raises \$10 million for Kids Mental Health and Gaming Addictions
 A new milestone: 400,000 immigrants admitted to Canada this year.
 Oceans Rising? Loss of Antarctic's Wilkins Ice Shelf speeds glaciers' move to the sea
- 2020** Calgary company creates weather-resistant PoppinBots for outdoor childcare
 Toronto in tatters and splatters: Mayor says costs of fixing water and wastewater infrastructure will create major deficit until at least 2030
- 2025** Skyrocketing cost of water forces province-wide closure of municipal pools in both Saskatchewan and Manitoba
 Crazy Christmas shoppers vie for new self-installable subcutaneous nano-telephones
 A step towards global peace: worldwide nuclear disarmament becomes a reality
 32% of all Canadian communities now tout optional E-schooling, Grades 3 to 8
- 2030** British Columbians love their 'bots. Average household has twice the national average number of electro-companions
- 2040** Canadian population exceeds 40 million: 1 in 10 are 80+ years old and going strong
 PHAC issues health alert: parents not heeding daily Vitamin D requirements for children
 Downsizing suburban-style: tips on retrofitting homes for multi-family use
- 2048** Olympics Watch: Outdated technology dashes medal hopes for Canadian Holo-ski team
 Thanksgiving bounty out of this world: Canada's Mars BioFarm supplies astronauts with fresh veg

Families and Community Living

By 2060, family homes are insular ultra-wired cocoons that function as “electronic cottages” supporting daily life activities such as banking, shopping, entertainment, and schooling. The connectivity they provide mostly precludes any need to venture outside. Outdoor streetscapes are uninviting and practically devoid of pedestrians which gives rise to palpable community unease that perpetuates fear of the external environment. In an attempt to diminish this fear, communities have instituted anti-vagrancy registries that wirelessly link to handheld SafeFace recognition devices. SafeFace listings can be programmed with ‘outdoor pass’ approval without which children and youth venturing outside are viewed with suspicion, due to public perceptions of the inherent propensity of unsupervised children to congregate, loiter and vandalize. Community members are exhorted through public media campaigns to report suspect or anti-social youth behaviour. Repeated on e-message billboards near schools and areas where children congregate is the slogan, “When you see them do something, say something”⁸⁸.

Transparent and Tele-Ed Schools

In efforts to address perceptions of an increasing prevalence of problem behaviours in children, including bullying, off-task disruption, and over- or unhealthy eating, both public and privately funded schools have been fitted with live-time web cameras. Known as “Transparent Schools,” the use of cameras enable school authorities and parents to track and control children’s movements, attendance, schoolwork habits and test scores, lunch-money spending, and degree of physical activity^{89,90}. Students are individually fitted with “HealthLync” bracelets that additionally facilitate the remote tracking of individual children throughout the school complex. The thin wrist bracelets also non-invasively record vital signs, glucose, medication, and cardio output. Bracelets are equipped with “intelligent ink”⁹¹ that glows traffic-light red, yellow and green depending on whether the child wearer remains within normal physiological limits and/or is engaged in appropriate activities. For example, should a child with Type 1 diabetes reach for a sugary snack at break time when blood sugar levels are high, the HealthLync bracelet rapidly blinks warning red, and immediately notifies school authorities and parents.

Beginning in grade 3, children are eligible to take courses via e-school, making tele-education a growing industry. Legal restrictions regarding the supervision of e-schooled children are strictly enforced by Truancy Officers. Remote human or robotic supervision is acceptable; consequently, many middle-class e-school parents join neighbourhood co-operatives which employ remote human Tele-Proctors to monitor live feed cameras in children’s homes, and are available to answer assignment-related questions. Parents of wealthier means purchase PoppinBots, child-sized childcare robots^{24,92} which continuously shadow children via pre-programmed GPS sensors in children’s clothing. PoppinBots verbally respond to children’s questions, assist with homework, and keep children amused and occupied through active indoor and outdoor play such as race-against-the-clock hide and find games. PoppinBots wirelessly link to parents’ workstations and to an off-site central monitoring service. As with children who attend Transparent Schools, the health and physical activity status of the e-schooled is monitored through HealthLync bracelets. At regular intervals throughout the learning day, both Tele-Proctors and PoppinBots prompt e-schoolers to engage in simple physical activity exercises such as stretching with therabands, leg splits, and jumping jacks.

Information recorded by the HealthLync bracelets of children’s participation in low-, moderate- and high-intensity activities is electronically transmitted onto each child’s Activity Compliance Record (ACR). The ACR conforms to evidence-based national child activity standards that require 60 minutes of daily activity, wherein the heart rate is raised by at least 25% higher than resting. The ACR is provided quarterly to parents. Should health or behaviour problems be clinically or legally established, the ACR is automatically forwarded to social service agencies, medical professionals, and to health insurers; no record of disclosure is required. The ACR becomes part of the child’s permanent academic record, and is utilized by high school and universities in evaluating the extracurricular and personal health behaviours of candidates for acceptance and scholarship. Should the ACR indicate satisfactory adherence to the national standards, parents are eligible for significant tax credits for organized fee-based physical and academic activities, Family Day passes to commercial parks, and snack chits at the behavioural modification stadiums known as PeerPlay Domes. Children who fall below the national standards are referred to in-school individual and family re-training workshops that stress the importance of personal and parental responsibility for positive health and activity behaviours in children. Wealthier parents hire privately paid physical activity coaches should their children lag behind national guidelines in order to avoid poor or failing personal health credit grades.

Environments of Play

At home, most children play indoors with active video gaming consoles that utilize vibrational therapy and electronic muscle stimulators which the gaming industry claims increase children's bone and muscle density. These claims are accepted by parents but not independently verified since the government has scaled back university research funding. International team gaming continues to be popular among elementary school children. The emphasis on e-games and e-entertainment decreases the social distance among children with disabilities and their normative peers since both groups spend a large proportion of their time similarly participating in computer games. Reptiles, birds and indoor-only cats provide urban and suburban children with animal companionship; in contrast, dog ownership has fallen sharply in those communities given the perceptions of dangers associated with venturing out-of-doors.

In 2048, the federal government creates PeerPlay Domes to respond to community concerns regarding the negative effects of home cocooning on children's social development, and skyrocketing rates of school transfers and litigation due to bullying and school massacres. PeerPlay Domes are behavior modification indoor play complexes designed to foster social responsibility, citizenship, and cooperation through physical activity. They are based on evidence-based research in peer ecology⁹³ that links pro-social impulse control, and peer compassionate behaviour and modelling with cooperative, unstructured play among children. At a ratio of 1 PeerPlay Dome per 10,000 children, PeerPlay Domes are transit-accessible, and funded by partnerships between government and private industry. Constructed of multi-functional sports floors that are anti-slip, low-emission with moveable rooms, PeerPlay Domes provide opportunity for active, co-operative activities that take into account motor-skill development stages, and which emphasize safety, strength, flexibility, endurance and balance. Younger children enjoy play spaces for active 'soft play' such as tunnels, slides, ball pools, hoops, and free dance, while older children engage in balance beam and obstacle course relays, in-line skating, skateboarding, team rock climbing, limbo and hip hop. Children who are not physically able to participate due to fine motor or large muscle control issues are provided opportunities for engaged free play which provoke particular developmental stimuli, for example dizziness, which underpin most play activities⁹⁴. As children enter each play space, the HealthLync bracelet records time of entry, and the level of difficulty and intensity associated with the physical activities being undertaken. Should younger children enter play areas with a difficulty rating beyond their motor skill levels, or without the requisite safety equipment, human or robot assistance gently but firmly redirect them towards safer play choices. The bracelets also record proximal and co-operative play, and glow green, amber and red to provide immediate feedback on appropriate co-operative play patterns including interaction between able-bodied children and their disabled peers which is strongly encouraged. Unintentionally, the forced co-play/co-operative practice creates significant environmental stressors for sensory-sensitive children who seek solitary play, and those who require more passive play opportunities to process new play experiences^{94,95}. The activities within PeerPlay Domes are low tech, free choice, and designed to be accomplished with peer guidance and little or no adult involvement or instruction. They are highly valued by parents as they provide safe, electronically monitored, and patrolled activity areas that promote active interdependent and uninterrupted freeplay thereby maximizing individual contributions towards each child's ACR. PeerPlay Domes also promote democratic and accessible activities as they have no entry fees, and children are provided with free safety equipment such as helmets and shin pads that bear company logos and pro-social statements. PeerPlay Domes are deliberate in presenting unplugged activities that would be novel to these 'ultra wired' children. The novelty attracts higher income children whose parents may otherwise have been disinterested in community share facilities.

Summary

The Cocoon depicts a Canada in which health- and communication-related technological advances have created a society in which childhood obesity has been eradicated, and individual dwellings operate as independent hubs for daily living including work, school, and leisure. Yet excessive individual and family cocooning has led to decaying community environments, and negatively impacted on childhood mental health and peer- and community functioning. The prognosis for the natural environment looks bleak with remarkably low levels of urban regeneration exacerbated by deteriorating water availability. A sense of responsibility for one's own self, health and welfare seems to have shifted well away from the individual and has been placed in the hands of government and corporations who provide innovative but short-term solutions. Children growing up in this world are imbued with the sense of a future that will continue to look to technologies to 'fix' their problems, be they physical, mental or environmental.

No Child Left Inside Scenario Narrative

Background

The No Child Left Inside scenario arose from experts' comments regarding the ability of "place-based" or built environment strategies to: enhance children's health and physical and emotional well-being through connection with nature; foster community cohesion through pedestrian- and all-ages friendly urban design; and, elicit an emotional attachment to place that would, in turn, lead to broad ecological protection. It was believed that the environment and its link to the promotion of healthy communities could form a common reference point around which diverse government, industry, physical activity, grassroots and conservation sectors could mobilize sustained coalitions. The most likely trends that would influence a society which embodies an ethic of care would be consumer preference for healthy and organic products, strong and trusted government leadership in the areas of healthy and sustainable lifestyle, and genuine engagement in corporate good citizenship by private industry and not-for-profit organizations.

Experts were deeply concerned about the current trends in the built environment such as the loss of traditional public play areas for children including streets (due to bylaw restrictions) and natural/wild spaces such as ravines or creeks (due to urbanization). Experts also identified problematic social trends such as parental fear of stranger-danger, as well as harms that might befall children as a consequence of natural and unpredictable things such as bees and bee-stings, pollinating plants. Combined, these trends have created an environment in which children are most often presented with supervised indoor-only play environments either in the home or in recreational facilities. This was believed by experts to delay the development of the personal autonomy of children, replace imaginative independent play with passive indoor technology, and strongly predict patterns of poor outdoor and environmental behaviour that children would one day model as adults and parents.

The scenario title, "No Child Left Inside" was taken from a growing international education movement of the same name. The movement, and the research evidence which supports it, recognizes the developmental, health and educational benefits that accrue to children as a result of learning and playing in natural settings⁹⁶. The movement was sparked by the 2005 publication of "Last Child in the Woods: Saving Our Children from Nature Deficit Disorder"⁶³, which directly linked the lack of nature or 'nature-deficit' in the lives of today's wired generation to the rising rates of childhood obesity, depression and attention disorders. As of March 2009, the US Congress was planning to consider the *No Child Left Inside Act*, a bill already approved by the House of Representatives. If passed, the Act would require schools to offer environmental education to students in kindergarten through grade 12, and provide federal grants to help schools fund outdoor education initiatives⁶⁴. At present, there is no equivalent Canadian government initiative that addresses the No Child Left Inside philosophy although for-profit and not-for-profit Canadian organizations have developed like-minded programs and products including "natural playgrounds"⁶⁵, and Canada's first outdoor "forest pre-school"⁶⁶.

The built environment is a strong driver in this scenario. The built environment refers to the nature and extent of the associations between the built environment (e.g. urban density, design, diversity, access and distance to public transportation systems, and the mix of motorized, non-motorised and recreational spaces) and population levels of physical activity and quality of life related with health⁷⁰. The composition of the built environment links strongly to community cohesion, and can foster or inhibit feelings of comfort and belonging in community.

The Scenario

Capturing the essence of the No Child Left Inside scenario, an archival review of the E-CBC national news headlines is presented.

Archives of the E-CBC National Headlines: 2015 - 2050

- 2015 Aboriginal leadership key in finalizing Ontario water stewardship legislation
Speak to the hand. Palm-sized simo-translator uses personal voice tonality for all world dialects
- 2020 China's trade embargo hits eco-dud countries where it hurts
VIA Rail celebrates inaugural voyage of high speed sensory-tech "Brain Train"
Is Health Canada doing enough to protect Canada personal genome database?
- 2030 Asia bound European tankers go North: Summertime ice free Arctic Ocean cheaper than Panama Canal route
Scientists really 'going green' with lab-based photosynthetic process
Health Canada approves EndoPharm internal drug auto-dispensers for use in children
- 2040 Canadian population exceeds 40 million: 1 in 10 is 80+ years old and going strong
Yukon receives World Biodiversity award celebrating 50 years of vigilant stewardship
- 2048 New Brunswick family selected worldwide for year-long sojourn on Earth2

Family and Community Life

Community life is largely defined by mutual interdependence and familiarity among immediate and distal neighbours due to shared community events and social projects, and sustainable environmental practices. Faith-based social justice movements have enjoyed a strong resurgence in popularity, and many individuals view community connection, non-violence, and environmental protection as important faith-related issues⁷⁵.

Socioeconomic disparities have considerably narrowed. In large part, social equity has been manifested by government redistribution mechanisms such as wage ceilings, progressive taxation, and a concerted effort to eradicate the stubborn problem of child poverty which plagued the country in the beginning decades of the 21st Century. The steadfastness of a strong government has been well received over the past few decades, as the population recognizes that despite the financial costs in high taxes, they and their future generations benefit from a solid standard of living defined by clear moral and ethical underpinnings.

Following mass multi-crop failure of genetically modified crops in 2038, and chromosomal abnormalities among cloned livestock that caused widespread public panic despite only a weak link to facial foetal deformities, governments implemented extremely stringent farming regulations. They limited agricultural cloning, mandated the labelling of all food containing legally defined genetic modifications, and re-invested in "old-style" small farming practices such as avoiding monocultures, encouraging biodiversity, and crop

diversity and rotation. Consumer demand further influenced the practices of food growers as companies that adopted the 'precautionary principle' before introducing new technologies enjoyed increasing market share.

By 2046, private corporations are believed by consumers to have a moral responsibility to ensure products and packaging leave a calculably small carbon footprint, and to contribute to a wellness lifestyle; corporations which do not live up to these ideals struggle to remain viable, most often unsuccessfully. Consumer pressure, not government regulation, has proven the most effective mechanism to curb the profit- rather than people-oriented practices of various private industries. Consequently, corporate waste reduction and recycling rates generally well-exceed the standards required by government regulation.

With declining birth rates dipping below death rates, Canada continues a downward non-replacement population trajectory. Children are a treasured and greatly indulged population, though a palpable pressure on these younger generations subjects them to a constant and vague type of stress. Intergenerational community activities and the establishment and maintenance of fictive kinship (behaving as if non-relatives are family) are common ways of childless families and singles to maintain involvement with children. Adults and seniors frequently engage in child-focused volunteer community service, for example, as Special Mentors. Special Mentors provide educational tutoring grounded in mentor expertise; most popular among children are re-gen fish hatchery specialists, e-toy programmers, and hologram zoo-keepers.

For leisure activities, most children are encouraged to play outdoors in unstructured activities and random play. 'Wild-erized' outdoor play areas are made accessible for physically disabled children through wheelchair- and prosthetic-friendly platforms and transfer stations for mounting and dismounting play equipment, while smellscape and sensory cues augment the environment context for children with cognitive issues or visual impairments. The intent remains to advance exploratory free play in natural environments, which runs counter to traditional perspectives on the importance of organized and institutional play opportunities for disabled children.

Children are contactable through GPS linked remote e-connection tags that easily attach to clothing, for example, to notify them of dinner time. Inside the home, children enjoy massively multiplayer online video games (MMOs) which promote gender equality, local sustainability and global good citizen practices, for example "SatNav Stewards"⁹⁷ and "ZenGen Dashboards" where children race each other to see who can beat the oil barons to get the best hypermileage⁹⁸. MMOs are considered an acceptable form of child activity but the emphasis remains on friendly co-operative games that encourage good global relations. The popularity of the In2Out versions of the MMO games of soccer, baseball, tennis and basketball are based on the appeal of being able to play these sports indoors and outdoors depending on weather and light availability. For tweens and teens, modern forms of Facebook®, Flickr® and Twitter® continue to be used to maintain connectivity with classmates, and organize social activities.

Body fluids are constantly monitored using the TopMeUp device that indicates when and how much water or rehydration product is required for optimal biological performance. TopMeUps can be adjusted for increased activities, in particular high performance athletic endeavours. Intelligent internal implants that constantly assess the body's pharmaceutical needs automatically meter out dosages of drugs as necessary. This innovation has provided a great sense of liberation, both mentally and physically.

Built Environment and Transportation

Recognizing the link between urban design and human behaviour, policy makers and community designers have strongly manipulated the built environment to have a positive effect on community social ties and mental health. Urban planners return to landscape-based urbanism⁹⁹ where urban renewal joins with ecologic regeneration and protectionism. Carefully planned wildlife corridors, small reforested park areas, walking trails, and bike paths form seamless streetscapes. These are built with the intent to promote incidental green exercise which is recognised to improve mental well-being among adults and children^{100,101}.

Municipal bylaws require developers to maximize urban density by building ‘up’ not ‘out’ in order to maximize housing stock, as well as appreciating the importance of increasing associated public and green space. New bylaws rescind previous bans on cul-de-sac street hockey, and regulate the provision of dedicated bike lanes on major roads and park paths. As well as weekend exclusion of vehicular traffic on many roads to allow for recreational biking, bylaws also restrict regular access to automobiles in certain parts of the community to ensure child pedestrian safety and address parental concerns⁷⁰. To shorten the proximity of food outlets to residential areas, zoning policies permit space constrained stores to have sidewalk displays of fruit and vegetable offerings, and additionally mandate the amount of shelf space that must be reserved for locally grown grains, and protein sources.

Private home ownership has rapidly dwindled; most families live in co-operatives that are characterized by solar panels, green roofs, cascading living interior plant walls, and divergent reclaimed water systems that provide recycled water for drinking, cleaning and wastewater. All new structures are equipped with a hydroponics room proportional in size to the expected occupancy needs for fresh vegetables. Governments have long recognised that good nutrition will decrease lifetime health costs and as such provide sizeable grants to retrofit older structures with these hydroponic gardens. The preponderance of solar panel sided homes provides ample feedback to the community energy grid, greatly decreasing the needs for fossil fuels. Major energy grids are fuelled by large wind turbine farms and tidal power stations predominantly on the East coast.

Partly out of habit and cost, people have the tendency to travel only within relatively small areas, favouring more proximate living. Government spending on road infrastructure has refocused on within-community surfaces, leaving highways in relative disrepair. Personal vehicle travel beyond community borders also involves tolls that go towards road and ‘environmental repair’. Travel for everyday errands is accomplished using planned community walkways and bike paths that lead to the community shopping centres – big and small. Larger urban centres are made up of multiple communities. Local transit options include hydrogen or solar powered buses with sky trains quite commonly seen in larger urban centres. Public transit commuting between cities is subsidized and comfortable on high speed hydrogen cell trains, which have been dubbed “BrainTrains” since they are now operated solely by artificial intelligence computers.

My School Colour is Green

Students demonstrate knowledge of the dynamic interrelationship among human health and well-being, the environment, and the economy. The emphasis is on producing a “green graduate”¹⁰², who is “ecoliterate” on issues including food sustainability. Being an “environmentally considerate” citizen is emphasized in social science classes which include lectures on “hypermiling”¹⁰³ for hybrid automobiles and how to positively influence the eco-behaviour of adults. Educators design curricula around the notion that direct experience

in the physical environment is the optimal learning environment, particular when enhanced by service to the community. The emphasis is on the use of project-based sustainability learning to lay a foundation for responsible, socially and physically active citizenship. As part of class projects, children restore the habitat of urban species, audit community landfill usage, and tend the school's edible flower and vegetable food gardens. These practices are believed linked to the establishment of healthy behaviour practices, and self-discipline on the part of children not to expose themselves or others to unnecessary health risks¹⁰⁴.

Educators view early elementary school years as the prime timing for activating healthy self- and eco-behaviours in children, with progression towards acquiring the behaviours in middle grades. By the senior elementary grades, children are believed mature enough to independently choose and maintain healthy habits, for example, to choose between sustainable transportation methods such as walking, bicycling or public transportation. "Waste-free" school lunches are mandatory; and must be composted and recyclable on the school site. Schools now operate year round so 'going to camp' in a semi-wilderness area is now integrated within the public school curriculum system. Each summer, the camp course provides a different age-appropriate focus that is based upon a physical activity— i.e. team play, leadership, civics, conservation, etc. Where it would be too environmentally intensive to take children to particular locations, or where facilities fail to seamlessly accommodate children's disabilities, virtual field trips replace physical field trips to aquariums, zoos, museums, libraries, and hospitals. These facilities are organized to offer virtual and holograph tours and programmes for students. Virtual field trips provide pupils with the opportunity to ask questions of experts in a range of environmentally-important subjects for which locally available community expertise is unavailable.

Gardens and native plants comprise school yard, including native plants, fruit trees, and other edibles to be used as an outdoor classroom. Children engage in active, outdoor learning, including geocaching in which children use GPS tools during field trips to locate, geotag and record specific information at the different locations¹⁰⁵. Green school design typically emphasize providing outdoor views, increasing daylight while eliminating glare, reduced indoor pollutants and lower energy costs⁷⁵. Green schools also use green roofs, which lower ambient air temperature and mitigate air pollution. Green schools were introduced in the early 2020s in the private school system, and found to reduce student absenteeism and improved student performance. By 2040, a two-tiered education system had fallen in disfavour, with parents overwhelming choosing to send children to publicly funded green schools on the belief that they signalled positive health and educational settings for all students, regardless of income or background.

Summary

The No Child Left Inside scenario depicts a Canada that is firmly grounded in a socially equitable and environmentally sustainable philosophy. Governments, industries, and educators work co-operatively to ensure citizen of all ages are provided with a healthy natural, built, and social environment in which to learn and prosper. Acceptance of progressive taxation, reduced rates of personal motorized travel, low personal rates of private home ownership, and rejection of genetically engineered crops and livestock represent the personal health and economic behaviours of citizens. Corporations and developers that fully embrace sustainable practices flourish in the market, guided by strong government leadership in the areas of resource and waste management, as well as urban design and zoning. A population cohort dwindling rapidly in numbers, children are highly valued as productive, reflexive and future guardians of society.

Smart Complex Scenario Narrative

Background

The Smart Complex Scenario was developed from experts' belief in the capacity of urban design principles to fulfill public health goals, and the necessity for committed, strategic partnerships among diverse sectors in order to effectively do so. A concern with the motivation for, and maintenance of, physical activity over the lifecourse was also articulated. The Scenario was also strongly grounded in experts' support of the 'comprehensive school health' model. Many experts suggested that the comprehensive school health model was an effective mechanism to address the education, health and social needs of future generations. The comprehensive school health model is an integrated approach to health promotion that gives students numerous opportunities to observe and learn positive health attitudes and behaviours. It recognizes that many different factors affect the health and well-being of students, including the physical condition of the home, school and community; the availability and quality of health services; economic and social conditions; and the quality and impact of health promotion. In order to succeed, the comprehensive school health model depends on active partnership among multisectoral partners^{55,56}.

The Scenario

Capturing the essence of the Smart Complex scenario, an archival review of the E-CBC national news headlines is presented.

Archives of the E-CBC National Headlines: 2015 - 2050

- 2015 Panniqtuuq Pride: Eco-activist Nunavut teens use win at Kite-skiing Worlds for heartfelt message
- 2017 Gadgets galore, but Japanese pavilion ‘blossoming’ solar trees wow crowds at Edmonton’s World’s Fair
- 2020 Capital’s Earth Day celebrations marred by extreme heat alert
 “Piétons seulement” in Québec City core as artists, engineers and architects co-host “Eco-Energie En Dehors” exhibition
 It’s all in a day’s work: Bay of Fundy Powerhouse and 100 billion tons of water
- 2030 Testing the Waters: OneOcean leaders’ vision for protecting remaining marine life
 GentleCare robots reduce nurses’ strain and patients’ pain
- 2036 Going DC! First ‘Deliberate Community’ completed in Manitoba as Winnipeg-DC residents settle in
- 2040 Our World Elder: PEI resident credits local potatoes for long healthy life at 132 years of age
 Are your kids active enough? New report decries SmartSchool monitoring methods
- 2045 Controversy surrounds contracting process for three new orbiting solar generators
 Left brain, right brain and the super athlete
- 2050 St John’s-DC Fish Farm tanks killing 10,000 plate-ready halibut

Strategic Stewardship: The Mayor, The Medic and The Manufacturer

Strong targeted partnerships between diverse sectors such as public works, transportation, education and industry have resulted in the creation of an eco-friendly, ultrawired, activity-focused city. Government incentives for programs and services that improve the health of all citizens, and the capacity for industries to thrive in a lucrative green economy foster and sustain co-operation between traditionally antipathetic partners. “Strategic stewardship” is the buzzword for this new spirit of coalition among organizations which might otherwise appear as strange bedfellows. Strategic stewardship has resulted in the design of a built environment that enhances integrated non-structured activity as well as encouraging organised activities across the lifecourse.

Most Deliberate Communities (“DC”) were designed in the late 2030’s after a decade of concerted visioning among multiple partners on how best to address eco-sustainability, public health, and lifecourse enhancement.

The underlying planning philosophy of Deliberate Communities was the enhancement of health and activity through built environment mechanisms such as the ‘5-to-8’³⁶ mixed-use design rule: urban design in which citizens of all ages can easily move between transit, shops and home within a five to eight minute walk.

The creation of DCs was aided by extensive incentive packages offered by Canada’s municipal, provincial and federal governments – market-based measures such as investment tax credits, reduced income tax liabilities over a specified period of time, property tax relief, and job creation grants¹⁰⁶ tied to stringent regulatory compliance. These market based measures promoted the development of a robust green economy in which products and services were tied to an overall program of public health.

Each DC is characterized by high density, multi-level and mixed-use wireless buildings powered by renewable energy sources and a largely decarbonised electricity mix (UK Renewable Energy Strategy: Consultation Document). ‘Sun Trees’, photovoltaic trees which produce energy and are designed to resemble large (now extinct) Sequoia trees^{107,108}, are planted alongside the shorter, genetically engineered ‘Sap Trees’ that provide overly-lush green canopy during summer months, yet quickly shed leaves when temperatures dip to maximize available solar radiation for streetscape energy grids. Buildings with on-site renewal energy technology such as biomass, hydropower, solar, wind and geothermal are networked to regional and national smart grids. Decentralized stand-alone energy sources power small personal devices¹⁰⁷ as well as the service robots which maintain city streets and electronically report problems to the larger public work centre for human response.

Price signals strongly steer consumer behaviour. Consumption patterns are influenced by levies and the ability to resell, at above market price, any unused solar power back to the grid for cash credit towards future power costs¹⁰⁹. Children are warned by the “Penny-Wise, Fuel Foolish” adage, a new twist on an old saying which focuses on not being overly careful on small issues and less than careful about big ones.

Nestled in the core of each Deliberate Community is the Smart Complex that forms the nerve center of civic life. Urban planners intended the centralized hub to foster the unique image and identity associated with the broader DC, and to provide the mechanisms for full civic inclusion via physical, social and cultural participation at every stage of a citizen’s life.

The Smart Complex

At the geographic and cultural core of a Deliberate Community exists the Smart Complex. Each Smart Complex consists of intergenerational Smart Schools (one per 2,000 population), a megasized MainGame Sport and Recreational Facility, and Cultural Coliseums comprised of theatre, museum and art rotundas. The Smart Complex also houses the Wellness Web that consists of several health facilities including long-term and palliative care centres, and Elder-Assistance Domiciles. These vertical supportive-housing domiciles, affectionately known as GrannyStax, are home to the socially revered centurions, known as “Elder Elders” (over 100 years of age), whose pride-of-place in the broader community is signalled by their placement in the Smart Complex, the hub of city life. GrannyStax are linked by overhead windowed tunnels to the intergenerational Smart Schools. Communal dining areas offer GrannyStax and Smart School residents’ age-tailored meals designed by trained chronobio dieticians. No buildings are more than a 15 minute walk from one another. The entire Smart Complex, including the intricate network of below and above ground freerail transportation system that joins the Smart Complex to the surrounding Deliberate Community is wirelessly, and tactically, surveilled. The intent is to ensure an ongoing live-time capture of the health habits, activities

and needs of the populace to feed back to the green industries who underwrite the Smart Complex. Visible cameras allow companies to further the social corporate agenda of the “next big green thing.” A commonly heard jingle is, “We Know What You Need Before You Do.”

Each Smart Complex is overseen by a Core Wellness Planning Board (CWPB). The mandate of the CWPB is to ensure each Complex furthers the relationships between green economy, public health, and corporate profit. Elected board members are drawn from a mix of sub-regional Deliberate Community Resident Associations and local green industries that border the Complex, multiple provincial ministries including Transportation, Environment, and Employment and Equity, and organizations that operate within the complex such as schools, recreational centres, food production services, and health and social services. Each Board additionally has 2 Citizen Consumer’s representatives drawn from local Youth and Elder Service User Groups. Citizen Consumer representatives are tasked with 2 way communication: organizing focus groups in order to flow consumer want information up to the Board, and disseminating CWPB decisions on new products and services back to the User Communities. The CWPB also receives e-submissions from lobbyists, special interest groups, and lone individuals.

Smart Schools

Smart Schools house an intergenerational population with a focus on the mental-physical balance and a lifespan education model that was popularized in the mid 2030s to maximize individual potential. A reversal of the decline in the numbers of elementary school children occurs in the 2020s due to a positive shift in the population-replacement ratios. Thus, by 2050, Smart Schools offer teaching to students from KinderCare age (3-5 years of age) through to Young Elders (70-80 years of age). Indeed, Young Elders tend to be over-represented in the school population since those who have been unsuccessful in launching ‘Encore Careers’ when reaching the age of mandatory retirement in either their first stage, or life careers, often return to school.

The widespread use of attention-focusing cognitive enhancing supplements drugs, as well as better understandings of neurobiology and individualized learning, has also facilitated the multi-age classroom. Long characterized as quick absorptive learners or ‘sponges’ but having short attention spans and requiring age-specific didactic pedagogy, children are now recognized as subject superlearners and offered accelerated, self-paced learner placement. Consequently, classes are grouped by Individual Knowledge Level (IKL) not age. An IKL II class in Ecoregulation may be comprised of a mix of what previous school systems would have termed grade 4s, grade 7s, and ‘mature students’.

During the school day, all learners intermittently join in intramural intergenerational sports. Health and activity breaks are viewed as productive for the physical, as well as providing physical activity-driven cognitive processing time perceived as key to the process of accelerated learning. To further facilitate the healthy body/healthy mind connection, each Smart School student receives a weekly individual electronic record that details current bodily performance, irregularities and milestones. Personalised feedback also addresses basic nutritional needs for individuals at particularly vulnerable developmental stages (for example, children, teens and Young Elders), providing free vitamin, mineral and protein supplements as required while at school.

Smart Schools are designed to facilitate before- and after-school care for learners considered too socially immature to remain unsupervised which is generally perceived to persist until the late teens. Culture-specific and physically active programming, such as Punjabi folk dances or Oceania virtual rowing, is generally

selected as outwith-school activities by children and youth. Groups of children and youth walk or bike to the MainGame Sport and Recreational facility in the Smart Complex to begin play and training in whatever physical activities they have chosen.

A weak link in the highly structured and group-focused regimens of the Smart Complex is reflected in overt criticisms that the needs of “Exceptionals” are inadequately met, where Exceptionals are children and adults who are classified as having special learning and activity needs associated with giftedness, illness or injury. Exceptionals are recognized, and often stigmatized, as expressing higher than average autonomy, spontaneity, or solitariness, qualities which are believed ill-suited to the smooth operation of surveilled networked hubs of activity.

Family Life

Most families have dizygotic opposite sex twins due to the increased use of fertility treatments to support the genetically engineered population-replacement “1 Boy 1 Girl” family. The average first time mother is in her late 30s. Viewed indulgently, children are often perceived to be in need of special treatment for longer periods of time than has historically been recognized. It is not uncommon for children to remain at home often into their early 30s, until the early establishment of their own careers. Parenting identity is strongly valued, and in large part, the ability to provide consumer goods – particularly those associated with health and physical activity - to offspring is perceived as a marker of good parenting. A mix of mechanical, virtual and outdoor family activities is emphasized. High-speed anti-crash solar-powered scooters, indoor active hologram exercise games, and outdoor bi-weekly Retro Challenges in the RezStack (the pet name given to the high-density living dwellings that most families live in), such as multiplayer ‘Twister’™ (a late 20th century game) to emphasize command-following and body flexibility, are common family pursuits. Most physical activities are intergenerational given the low numbers of children compared to adults, and increasingly, senior adults and the Elder Elders. Older children enjoy microblogging and podcasting, particularly when those activities are tied into active offline consumer-generated activities such as community hologram racing.

Face-to-face ‘high recreation’ such as theatre, concerts, or gallery going has enjoyed a recent resurgence in popularity, as families grow tired of widely available pre-programmed virtual tours that provide little individualized consumer experience that would enhance discourse with RezStax neighbours. The sensory cultural experience has additionally been recognized by parents as critical to enhancing children’s social capital, a valuable advantage in this competitive consumer society. Children’s exposure to the new hybridization of art forms and physical activity is particularly valued as it heralds high social distinction and simultaneously enhances right and left brain development.

Summary

The Smart Complex Scenario depicts a society consciously crafting an architectural approach for the health of its population and the environment it inhabits. Government plays a strong leadership role in defining this direction, but recognises the necessity of supportive multi-partner coalitions for the realization of this vision. Innovative and unexpected partnerships foster this eco-conscious, highly technological consumerist society. A common thread that is seen to weave throughout the evolution of a society strongly dependent on its constantly advancing technologies and innovations is the focus on physical and mental health. Children grow within a model that embraces a lifecourse that naturally emphasizes the importance of physical activity and education.

‘Wild Card’ Narratives: A Water Crisis

À la Carte Scenario: Water Commodities in a Changing Climate

The wild card, ‘water crisis’, is understood within a context of “water commodities in a changing climate.” Serious drought conditions, stringent water quotas, an increase in vector-borne diseases, and changing international perspectives on Canada’s traditional humanitarian reputation imbue this scenario.

Serious drought conditions persist in several Western provinces, contributing to strong federal conservation and provincial reallocation policies, and increased legal demarcation of Canada’s aquifers. By 2058, citizens across rural and urban Saskatchewan are resigned to stringent household water quotas and pay-per-litre public water readings with highly variable rates across the country. For these Canadians, rotating municipal dryouts are an expected part of community life. In-house water recycling and purification systems are commonplace, with domestic dwellings individually capable of recycling rainwater, kitchen and shower water, and recycling it for drinking water.

Global disapproval of Canada’s “historical national disinclination” to sign the UN Convention on Right to Water¹⁰, signals a changing view of Canada’s traditional humanitarian reputation. The absence of a unified international approach to water scarcity, which is exacerbated by Canada’s inaction on water rights, unintentionally worsens Canada’s water-related challenges. Unexpectedly high numbers of Syrian and Iraqi “water refugees” seek clemency in Canada when the diversion of the Tigris and Euphrates Rives devastates their countries’ fresh water supply.

Ultra-efficient vertical greenhouses have been ubiquitous in major urban centres since 2045 and are highly successful at providing fruits and vegetables for local populations. From 2055 onwards, many offer family-oriented “U-Pick” weekend programmes that provide year-round access to seasonal fruits and vegetables, combined with children’s activities. Certain levels can be rented for all-ages lawn-bowling and croquet on real grass.

2060 brings the amplification of un-regulated use and maintenance of household and community water cisterns, and with it comes worries of enhancing mosquito breeding grounds. Parents grow more concerned about allowing outdoor play activities and active transportation (biking, walking to school) due to continuing warming trends that facilitate vector-borne diseases such as Dengue Fever. Community spraying to kill mosquitoes similarly restricts outdoor play due to concerns of chemical exposure.

Cocoon Scenario: The Water Crisis and the Strength of Corporations and Market Influence

The implications of the water crisis and ability of the market to address the crisis provide the critical uncertainty in the Cocoon scenario. National decreases in available fresh water are reflected in export and trade, the transfer of costs to consumers, and federal restrictions.

By 2060, the partial privatization of water and wastewater services in Canada has led to public/private partnerships. Fresh water is viewed as a commodified, not a public good, and is exported in bulk by global trans-nationals for commercial purposes. Privatization has brought significant benefits such as the development of alternative technologies in the management of gray water and urban sewage such as waste stabilisation ponds and artificial wetlands. Yet, neither private nor government efforts to effectively increase

the fresh water supply to meet the demands of the burgeoning global population, such as the desalination of ocean waters, have been completely successful. International and national governments turn to water resource regulations to accommodate demand for drinking water, and fiscally conservative decision-makers influenced by free market think tanks increasingly turn to private water companies to manage, operate and update aging water infrastructures.

In Canada, impacts of water scarcity are reflected in food prices and availability. High costs of growing crops and raising livestock are transferred to consumers. The movement to water-conserving greenhouse farming across Canada strongly benefits the farmers in an increasingly moderate Arctic climate, allowing Inuit farmers to produce surplus fruits and vegetables for export. However, transportation expenses limits affordability of the northern produce.

In drought-stricken areas in Canada, social marketing campaigns promoting the importance of the individual as water eco-trendsetters prove woefully ineffective for broad-based sustainable water resource management. Consequently, the federal Canadian government institutes home No Faucet Days (NFDs), where for two days per week in each community, all private water supplies are turned off at source by the local Water Operations Control Centres. Water stress disproportionately impacts on low and middle income Canadians.

During the hot season, school boards attempt to accommodate on the one hand, poorly integrated multi-sectoral health messaging of the risks versus benefits of outdoor activity, and on the other, class action precedents regarding preventable outdoor UV and personal heat injury risks to children. Government and health charities contemporaneously message to schools and parents the increasing dangers of exposure to vectorborne insect diseases, and the importance of avoiding mosquito activity times (dawn and dusk). At the same time, educators are urged to capitalize on the psychosocial benefits to children of daily outdoor activity and the importance of strategies to prevent “Exertional Heat Illness” or EHI, such as the use of shade parks at non-peak UV and sunshine periods.

Year round popular activities include skating, curling and golf since all playing surfaces are made of artificial materials such as CryoL’Eau and AstroTurf and require neither water nor indoor cooling systems to operate. The vast majority of children have never experienced a backyard pool. The ability to swim has been lost to most urban children as all public indoor and outdoor community and wading pools were bricked over in 2040, in a move that was largely symbolic as most communities had long been unable to afford their upkeep and user fees were increasingly out of reach for all but the upper classes. Those privately owned pools that remain are viewed as markers of extreme conspicuous consumption.

No Child Left Inside Scenario: The Privilege of Water

The critical uncertainty of the water crisis is understood within a context of environmental policy, conservation by Aboriginal leaders, and international agreements. Citizens and governments alike view water of high value and as a public good.

The year 2015 marked the start of a period of aggressive environmental policy changes in Canada. The federal government toughened legislations around emissions, environmental fouling and instituted mandatory 'green technologies' as part of any new building or infrastructure. The actions of major world governments – both through education, policies and laws, have made it clear to their citizens that water is of high value and should be regarded as such. Ocean and lake traffic has been transformed – only small freighters that can operate using hydrogen fuel cells prevail for shipping.

These concerted efforts and focused technologies through to 2030 make a difference on the environment. By 2042 there are few lakes and streams in Canada that have any degree of industrial or chemical pollution and respectful recreational use is high. Government legislation combined with strong conservation efforts enforced by Aboriginal leaders have resulted in the successful clean up and protection of 80% of the watersheds associated with their lands.

Ski slopes in both Western and Eastern Canada have moved to mixed media relying on Mother Nature to provide real snow during cold months. Only limited water is available for snow-making to enhance or prolong snowy periods, which effectively decreases winter time 'natural skiing' activities. However, ski operators have focused their efforts on creating a thick base of artificial snow pellets for year-round ski fun. Although the slopes are necessarily smaller they are much more creative and particularly appeal to the snowboarders and trick skiers. Teen snow-biking clubs are popular, as are the Parasail ski-boarders, both sports having recently become Olympic events.

Smart Complex Scenario: A Visionary Watershed for Water & Health

The wild card of the water crisis is understood within this scenario as involving Ecohealth initiatives by governments and individuals, Arctic sovereignty and stewardship, water recovery and conservation efforts, and corporate farming practice changes.

Environmentalists' fears that Canada's fiscal struggles through late 2012 would drastically impede addressing the impending water crises would be unfounded. Indeed, a discernable shift in the federal government approach facilitates the passing of the vaunted National Water Strategy, celebrated as a truly egalitarian effort by the provinces, territories and Aboriginal groups. The subsequent impact on watersheds and water-related research activities regarding water security and quality continues to be recognised in 2050. Additionally, introspection during those difficult economic times effects a significant change in the population's attitudes regarding priorities and planning for the future. Arctic sovereignty issues heighten awareness of resource dependencies and the importance of strong legislation around stewardship. Child and youth activists around the world become a significant force, as they adeptly manipulate global multi-Emedia. The controversial 'Reduce Now or Die' campaign by Canada's leaders in the fashion industry seems to take on a life of its own with the 14-35 age cohort, despite concerned government efforts to restrain emotive messaging on water and resource usage.

Tentative successes in water recovery and conservation encourage actions and interactions with other eco-conscious global participants such as Scandinavia, India, China, Russia and the United States. By 2040, of the 53 major fishing nations that are represented in OneOcean, all but 3 agree and comply with the full ban on ocean fishing implemented in 2040. Not surprisingly, Canada's fish farms subsequently take up a whopping 30% of the underground SmartComplex farming areas by 2050.

Water and energy needs of the major robotic farming cooperatives continue to be reduced through technologies and the decreasing demand for beef, dairy, lamb and pork, by a highly vegetarian public. The vast underground hydroponic farms of the SmartComplexes that provide the bulk of the hubs' vegetative needs, also link with the SmartSchool swimming pools in the water recycling and reclamation loops. Above ground vertical farms are less water efficient, but offer more of the specialty items; most are closely linked to the SmartSchools to ensure that children can easily access green play space during inclement weather, as well as fresh fruits and vegetables for school meals and snacks. Companies rotate their sponsorship of vertical farm based soccer and field hockey tournaments to maximize use of these green fields and to obtain much desired advertising opportunities.

Phase V: Quantitative Modelling of Physical Activity Scenarios

Introduction

Expanding upon the qualitative focus of the traditional scenario analysis approach, Phase V presents the use of mathematical microsimulation modelling methodologies to give a quantitative perspective to plausible futures. Again, it is important to stress that this is not meant to be predictive; rather it simply helps to put some numerical parameters around plausible constructs of children's levels of physical activity in envisioned environments, and how these could portend various related health outcomes. Available data relevant to physical activity and health were collected; background research, expert consultations and literature reviews supported the methodologies and appropriateness of necessary assumptions.

Three approaches were undertaken, two of which were specific to questions regarding physical activity in children. The third methodology provided the modelling constructs based on adult physical activity data and will be used for future research regarding physical activity and obesity in children¹¹¹. Detailed technical reports for each of these three investigations were produced¹¹²⁻¹¹⁴ and released simultaneously with this report. Provided here are summaries of the two modelling exercises that related specifically to physical activity in children^{112, 113}.

The first of these approaches used micro simulation modelling applied to the four future environments as described by the narratives: *À la Carte*, *Cocoon*, *No Child Left Inside* and *Smart Complex* narratives. In each approach, somewhat different microsimulation modelling techniques were used in order to illustrate potential individual, population, and systems impacts related to physical activity and health, details of which are given in each subsection. Transition matrices were used to quantify comparisons in the relative levels of activity for children living within each of the four plausible futures. Children's activity levels were classified as 'inactive', 'low', 'moderate' and 'high' intensity on the basis of the Metabolic Equivalent of Task (MET) values found in the Compendium of Physical Activities². The average number of minutes that an 'average' child of 15 years of age would spend at each of these four levels over an 'average' 24-hour day were estimated based on the description of the four future worlds presented in the narratives. Comparative outcomes in the cohort of children in each of the narrative contexts were defined in terms of longevity and mortality.

Secondly, microsimulation modelling was used to investigate what was described as a 'backlook' scenario in order to explore how the environment has changed in its impact on physical activity in children over the past 50 years. The question driving the modelling was posed as: "If Canadian children in 2000 have the same level of physical activity (PA) of those in 1950s, to what extent would the health outcomes for these children changed?" This was described as a 'Backlook Scenario' and was investigated by using a non-stochastic compartmental model of the movement of morbidity, disability and mortality in a cohort of the Canadian population (specifically 5-12 year olds beginning in 2000 and ending in 2078) related to physical activity or non-physical activity. Models were created under the assumption that children in the 1950s could have had 10 to 25% higher levels of activity than a cohort of children in 2000. This year-2000 cohort of 5-12 year old children was thus 'carried forward' for 78 years with increases in their activity levels of 10 and 25%. These techniques helped to present estimates of how the intensity and duration of physical activity in children might play out with regards to chronic conditions such as ischemic heart diseases, stroke, hypertension, colon cancer, breast cancer, diabetes type II, and osteoporosis. Outcomes were variously expressed in terms of morbidity rates, Total Years Disabled, mortality rates and Total Years Life Lost.

Exploring the Scenario Narratives Using a Monte Carlo Microsimulation Model (“Static Model”)

Introduction

The goal of this project was to estimate the effects of projected activity levels based on the four narratives described previously (see Scenario Narratives: *À la Carte*, *Cocoon*, *No Child Left Inside* and *Smart Complex* for more information). This section provides a summary of the process and outcomes that are detailed in a comprehensive report¹¹² for this work.

Methodology

A Monte Carlo microsimulation model, identified as the ‘static model’, was created by Statistics Canada to estimate the impacts of Physical Activity (PA) on mortality and life expectancy in Canada³. Time use data obtained from the General Social Survey (GSS)^{115, 116} and from a 12 year follow-up to the 1981 Canada Fitness Survey (CFS)¹¹⁷ were used to estimate impacts on life expectancy and period mortality (two of the model outcome metrics). A representative set of 17,013 respondents was used. To investigate changes to life expectancy and period mortality given a reallocation of time in any of several physical activity levels, a physical activity transition matrix (PATM) was used. The model also used data from the Compendium of Physical Activities² and the NIH-AARP Diet and Health Study¹¹⁸. The former data were used to assign Metabolic Equivalent of Task (MET) to each of the 182 activities listed in the GSS. Model outcome metrics included period life expectancy and period mortality.

The static model allowed for the allocation of time use to different activities. Activities that were considered relevant to the focus on children’s physical activity were classified as either inactive, low intensity, moderate intensity or high intensity using the Compendium of Physical Activities. In all, 16 were labelled inactive (0-1.4 METs), 111 were labelled low intensity (1.5-2.9 METs), 21 were labelled moderate intensity (3-5 METs), and 10 were labelled as high intensity (>5 METs). A baseline of the average number of minutes per day spent in each activity level was established for the scenario narrative *À la Carte*.

A broad strokes discussion of the characterisation of time allocation for each of the scenarios is included below. These characterisations informed the Physical Activity Transition Matrices (PATM) which were created for each of the four qualitatively derived narratives of this project: *No Child Left Inside*, *Cocoon*, *Smart Complex* and *À La Carte*. The PATMs were used to compare each of the scenarios to the baseline (*À La Carte*), by defining how time is re-allocated to the different levels of activity (inactive, low, moderate and high intensity) depending on the narrative being considered.

Finally, a sensitivity analysis was done to assess the projected physical activity effects described as determined by the microsimulation models. Specifically, the goal was to determine if the results presented in that document were robust to changes in allocation of minutes within the constraints of each of the narratives.

³Statistics Canada, G. Rowe 2011

À La Carte

The À La Carte scenario is designed to reflect a scenario of what might happen should intervention not occur and our levels of physical activity not change. As such in this scenario, no time was transitioned. Children continue to not receive an adequate level of physical activity. An approximation of the curve used to demonstrate that the À La Carte scenario is presented in Figure 4. This scenario is assumed to be the most comparable of the four narratives to that of the current picture of physical activity in children in Canada. That is, for the purpose of this modelling exercise, À La Carte is assumed to represent a type of status quo.

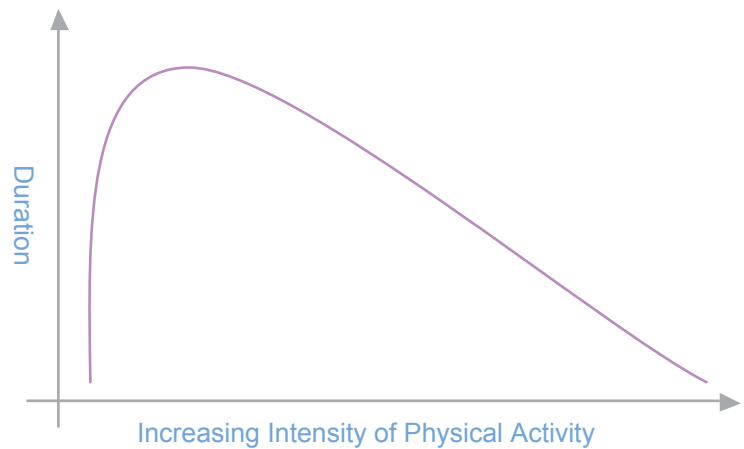


Figure 4. Characterisations of time allocation in low to high intensity activities in the *À La Carte* narrative.

Cocoon

The Cocoon scenario is characterised by a society where children spend most of their free time cocooning indoors and “plugged” in. Physical activity is recognized as important; however, the act of physical activity is therefore very deliberate. Scheduled physical activity time consists of high intensity physical activity in a safe, indoor environment. As such, the general trend used to demonstrate this increase in high intensity, deliberate physical activity and decrease in moderate intensity physical activity is a bimodal distribution. Time spent on particular activities was transitioned out of moderate intensity activities into low and high intensity activities, generating a bimodal distribution. An approximation of the curve used for the purposes of transitioning for Cocoon is found in Figure 5.

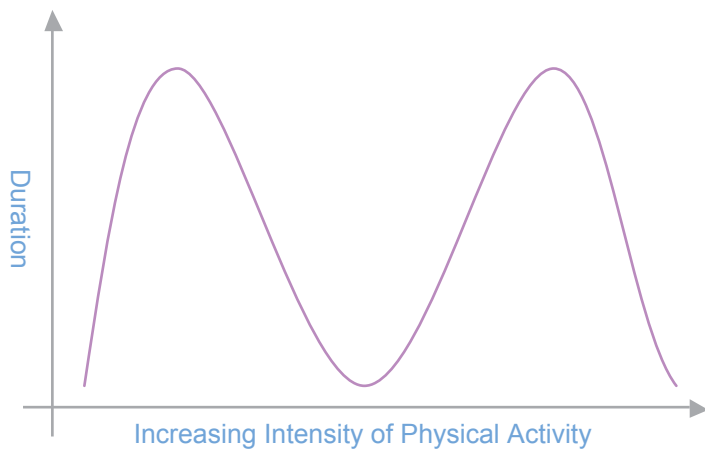


Figure 5. Characterisations of time allocation in low to high intensity activities in the *Cocoon* narrative.

No Child Left Inside

The No Child Left Inside scenario is characterised by societal changes that put more of an emphasis on children playing outside and making physical activity fun. Physical activity is not a chore, rather a by-product of an outdoor oriented lifestyle. As such, the general trend used to demonstrate this increase in moderate to high level physical activity that occurred as a result of the outdoor oriented lifestyle was a left skewed distribution. Time spent on particular activities was transitioned out of inactive and low intensity activities towards activities that involved moderate and high intensity physical activity. An approximation of the curve used for the purposes of transitioning for No Child Left Inside is shown in Figure 6.

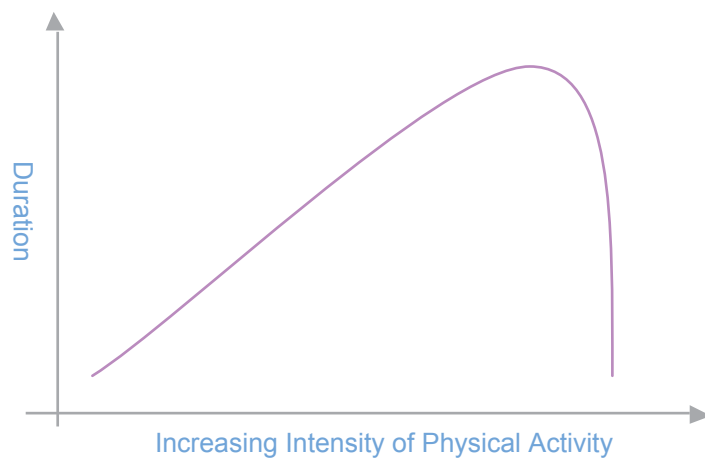


Figure 6. Characterisations of time allocation in low to high intensity activities in the *No Child Left Inside* narrative.

Smart Complex

The Smart Complex scenario is characterised by a society where the built environment is designed in such a way as to promote the use of manual forms of transportation, such as bicycling and walking. Physical activity is built into day to day lives and actions. As such, the general trend used to demonstrate this increase in moderate level physical activity that occurred as a result of the intelligently designed built environment was a symmetrical distribution. Time spent on particular activities was transitioned out of inactive and high intensity activities towards activities that clearly emphasize a moderate level of physical activity. An approximation of the curve used for the purposes of transitioning for Smart Complex is shown in Figure 7.

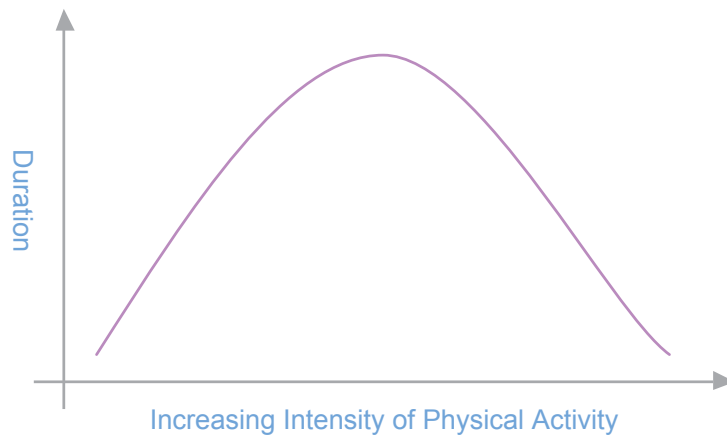


Figure 7. Characterisations of time allocation in low to high intensity activities in the *Smart Complex* narrative.

General Findings

As indicated previously, it is important to recognise that the results of this modelling exercise are very specific to the parameters considered, the outcomes chosen, the data used, and the assumptions made.

Based on the health metrics of *Life Expectancy* and *Mortality*, the results for the four scenarios emerged such that No Child Left Inside had the highest life expectancy and lowest mortality. Metrics for the cohorts of children in Smart Complex and À La Carte scenarios fell somewhere in between those in No Child Left Inside and those in Cocoon where the children ultimately had the lowest life expectancy and highest mortality of the four futures. As such, given the parameters and data that were available for this specific exercise, it would be expected that children in the No Child Left Inside scenario would enjoy the best health outcomes.

Ultimately what the overall results suggested were that an increase in moderate and high intensity level activity would have a positive effect on the health outcomes measured.

In general, while both No Child Left Inside and Smart Complex had increased life expectancy and decreased mortality compared to À La Carte, No Child Left Inside provided better results. This despite the fact that both transitioned approximately the same amount of time from inactivity and low intensity activity, to the higher levels of activity. Specifically, the No Child Left Inside scenario reallocates time from the lower intensity levels to both moderate and high intensity level activities. Smart Complex only transitions to the moderate intensity level. This seems to indicate that better health outcomes would be expected given a reallocation of time from inactivity and low intensity activity to a mix of moderate and high intensity activities. This argument may be strengthened by reviewing the estimated time spent sedentary between these scenarios. It appears that the benefits (in terms of the health metrics) of increasing both moderate and high intensity level activities offset the potential negative effects of an increased sedentary period.

Comparisons between À la Carte and Cocoon, No Child Left Inside and Smart Complex are shown (by gender) for the outcome of Life Expectancy (Figure 8) for the duration of the study period.

Projected Scenario Based Life Expectancy (Years) for 15+ Individuals, by Gender

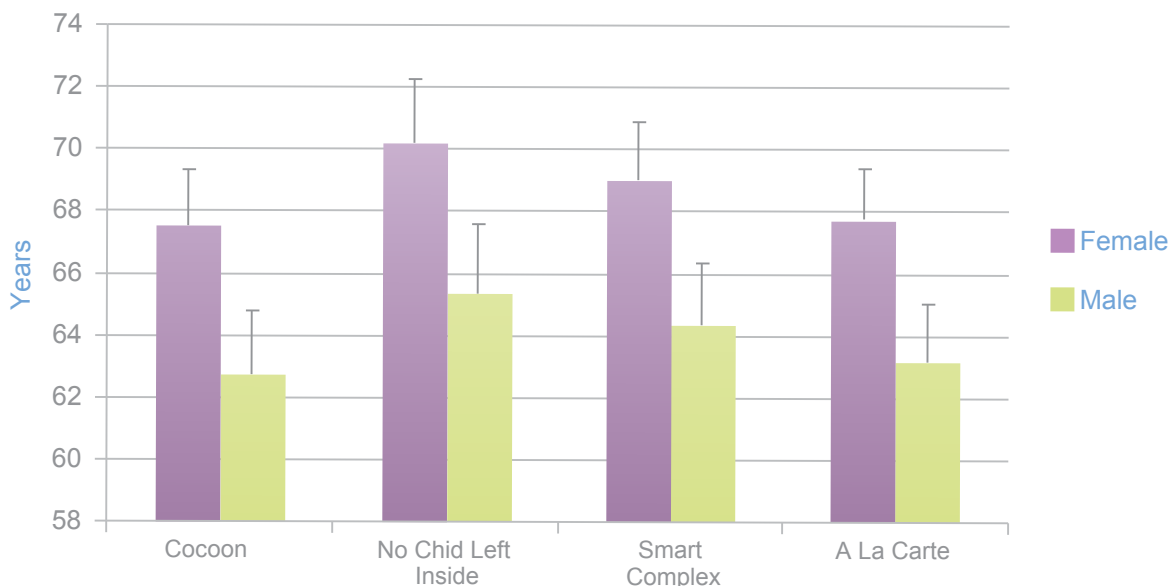


Figure 8. Scenario based life expectancy for individuals aged 15 years and older, by gender.

A depiction of sedentary hours versus Life Expectancy is provided in Figure 9. The plot suggests that as sedentary time was increased, there was a reduction in life expectancy.

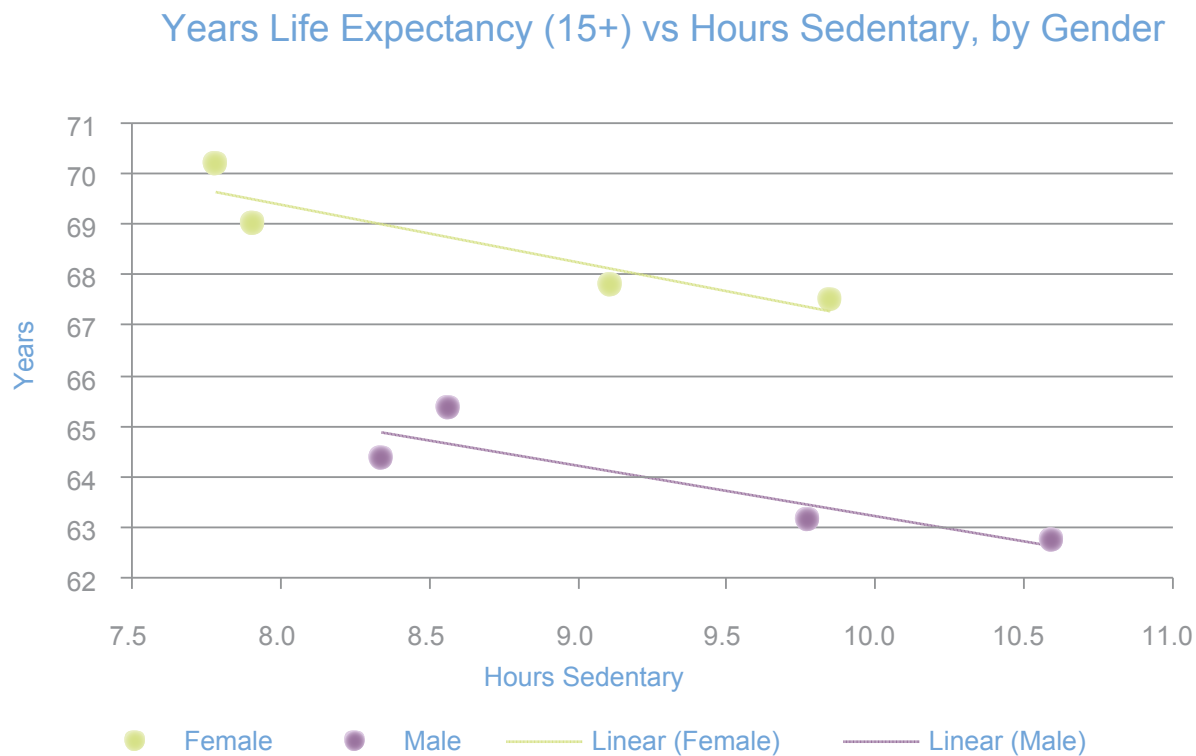


Figure 9. Overall results of the microsimulation, which show life expectancy versus hours sedentary, by gender.

In all scenarios, females had a higher life expectancy than males. However, the gap between males and females appeared to change based on the amount of time spent active (or inactive). Specifically, as inactivity levels increased, the difference in life expectancy between males and females decreased. Similarly, as activity levels were increased, the difference in life expectancy increased. This might suggest that increased activity has a larger impact on the life expectancy health metric for females than it does on males.

In all scenarios, females had a lower mortality than males. Since mortality and life expectancy are related metrics, it was not surprising to note that the difference in mortality between males and females varied based on activity or inactivity time. An increase of activity was shown to increase the gap between male and female mortality. Conversely, an increase of inactivity was shown to decrease the gap between male and female mortality. Again, it appears that increasing activity has a greater impact on the health metric for females than it does for males.

Life expectancy was shown to decrease as inactivity and low intensity activity time increased. Increasing moderate intensity and high intensity activity time was shown to increase life expectancy. Mortality increased as inactivity and low intensity activity time increased. However, increasing moderate and high intensity activity time was shown to decrease mortality.

The sensitivity analysis showed that the results remain consistent, in that the initial results are robust to changes in allocations based on the constraints of each of the narratives.

Conclusions

This exercise of exploring a quantitative application to compare the four scenario narratives, provided a useful perspective of these plausible futures, and importantly it also established a process for similar approaches using the static model with different permutations or constructs. The results of a sensitivity analysis applied to the process supported the robustness of the modelling.

For this particular study, increasing moderate and high intensity physical activity appears to decrease mortality and increase life expectancy for both genders.

There is a large difference in health outcomes (i.e., life expectancy and mortality) based on the scenario considered. From those reviewed, it is clear that the No Child Left Inside scenario offers the greatest rewards in terms of health outcomes. Additionally, this occurs without drastically reducing the sedentary hours observed for the status quo scenario (i.e., À La Carte). This may be an important consideration because much of sedentary time is captured during sleeping periods. Closely following No Child Left Inside was the Smart Complex scenario. While the health metrics are similar, a larger reduction in sedentary time is required to accomplish this.

The Cocoon scenario suggests the worst health outcomes. This scenario would be expected to see an increase in mortality for both genders, and a decrease in life expectancy and sedentary time is also increased.

In summary, the process of applying the static model to these narratives worked to great effect in allowing for a much broader vision of those plausible futures and how they can be compared in terms of more tangible health outcomes.

Exploring a ‘Backlook Scenario’ of 50 Years Past

Introduction

In this section another quantitative approach is explored in consideration of a ‘backlook’ physical activity scenario. Microsimulation modelling was used to investigate what was described as a ‘backlook’ scenario in order to explore how the environment has changed in its impact on physical activity in children over the past 50 years. The question driving the modelling was posed as: “Would any population health improvements be expected by children (aged 5-12) born in 2000 if they were to adopt the physical activity levels experienced by children in the 1950s?”.

In order to address this, a non-stochastic compartmental model was used to follow a synthetic population through time to illustrate the potential population impacts. To provide comparability, the model was designed with the basic assumption that only the level of physical activity would change. As in the previous section, one of the objectives of this exercise was to build an analytic tool that could model aspects of scenarios. By projecting different levels of physical activity envisioned in the scenarios onto a synthetic population and “aging” them through time, the impact of physical activity on health outcomes can be assessed. Quantitative outcomes of the modelling exercise are presented as: i) the number of cases of disease prevented; ii) the number of deaths prevented; iii) the increase in the number of years of life lived; and iv) the reduction in the number of years of life spent disabled.

Compartmental modelling, which involves dividing a population into one of several distinct subpopulations over time, will provide a “what if” quantitative examination of possible scenarios. The combined qualitative-quantitative approach is intended to assist further planning efforts by indicating potential quantifiable impacts of present policy and programme options on health outcomes. Although the model designed was employed to address the question as stated previously, the model could be used to quantitatively estimate outcomes from any scenario, given the projected effects of the policies involved in that scenario on changing the level of physical activity.

This section provides a summary of the process and outcomes that are detailed in a comprehensive report¹¹³ for this work.

Methodology

In order to answer the backlook question, the following process and objectives were followed:

1. Determine a set of diseases that are influenced by physical activity or inactivity (“PA related diseases”). Several chronic diseases that have been associated with physical inactivity include: ischemic heart diseases, stroke, hypertension, colon cancer, breast cancer, diabetes type II, and osteoporosis¹¹⁹. These 7 diseases were thus identified as the Physical Activity (PA) related diseases for this study. All other diseases were assumed to be unassociated with physical inactivity and were identified as the Non Physical Activity (NPA) related diseases.
2. Obtain disability and mortality probability estimates given morbidity due to one of the PA related diseases by scanning the available literature for incidence and/or prevalence rates of the PA related diseases.
3. Obtain rates of physical activity (or inactivity) for the 2000s age 5 to 12 cohort in order to provide the baseline physical activity data for the study, which was done by scanning the available literature.

4. Obtain rates of physical activity (or inactivity) for the 1950s age 5 to 12 cohort in order to modify the baseline physical activity data to mimic rates that would have been observed for the 1950s cohort, by scanning the available literature.
5. Develop a compartmental model to follow a population as it transitions from susceptible to disease, to PA and NPA related morbidity, disability, and mortality groups, based on the available data.
6. Compare the scenarios based on changes to morbidity, disability and mortality rates, total years of disabled life, and years of life lost.

A search for data specific to the physical activity levels for individuals born in the 1950s (for the cohort aged 5-12) was unsuccessful. This necessitated obtaining reliable data for physical activity in children as far back as was possible, as a basis to extrapolate further back to the 1950's. What was found were data from the Canadian Population Health Surveys, that specifically measured fitness, for children aged 15 to 19 in 1981¹²⁰.

These 1981 data were compared to the same measures of fitness for 2007-2009. At this point, it is necessary to detail a number of key assumptions that were required for this modelling exercise, either with regards to the data used, or for the modelling process itself.

A list of assumptions for this study is provided here:

- These data can be transformed such that they could be used to represent children aged 5-12 during the 1950s.
- The level of physical inactivity in different ages for this cohort remained constant.
- Measures of fitness were directly correlated to levels of physical inactivity. Thus, as physical inactivity increases, measures such as flexibility, and muscular strength were assumed to decrease, while measures such as BMI, waist circumference and skin folds would increase.
- The absolute relative change in fitness measures translated to a similar change in physical inactivity. The absolute relative change was then used to transform the current physical activity levels to reflect levels comparable to those (un)observed in the 1950s. Roughly, the data show changes of approximately 9 to 20% between the years of the study. To bring forward the physical activity rates from the 1950s, it was then necessary to find the appropriate relative increase to apply to the levels observed in 2000.
- All members within an age and gender subgroup had the same incidence rate of disease.
- The incidence rate of breast cancer for males of any age group was zero. Further, the incidence rates of hypertension, diabetes, breast cancer and colorectal cancer were assumed to be 0 for both genders aged less than 20 years.
- Since the data showed changes of approximately 9 to 20%, the baseline physical activity levels of 2000 would need to be modified by 10 to 25% in order to attain levels of physical activity that would have been observed in the 1950s.
- The relative risk of the diseases associated with physical inactivity was a biologic measure and would not change over time, thus we would be able to find the Population Attributable Risk (PAR) using the change in the prevalence of physical inactivity between the different scenarios.

Under these assumptions, two scenarios are explored; one which modified the baseline values by 10% and another which modified the baseline values by 25%. A non-stochastic compartmental model was created to model the movement of morbidity, disability and mortality in a cohort of the Canadian population (specifically 5-12 year olds beginning in 2000 and ending in 2078) related to physical activity (PA) or non-physical activity (NPA). These populations were used to estimate the cost of disease burden through time in order to act as a surrogate for health burden. Several compartments or groups were assumed, beginning

with the population of susceptible individuals, through to physical activity and non-physical activity related morbidity, disability and death.

Disease burden is a result of disability, morbidity, and mortality associated with the disease in question. Costs to the health care system associated with disease burden can be expressed using economic or life impact metrics. For this study, disease burden was measured using the life impact metrics identified as *Total Years Disabled* and *Total Years Life Lost*.

General Findings

With regards to the diseases being considered: coronary artery disease (CAD), stroke (ST), hypertension (HT), colon cancer (CC), breast cancer (BC), diabetes type II (DB), and osteoporosis (OS), a range of comparisons were made for:

- Disability Levels
- Mortality Levels
- Age and Gender Specific Morbidity Rates
- Age and Gender Specific Disability Rates
- Age and Gender Specific Mortality Rates
- Age and Gender Specific Total Years Disabled (TYD)
- Age and Gender Specific Total Years Life Lost (TYL)
- Disease Incidence Rates
- Disease Mortality Rates

Modelling results that were obtained when physical activity of the children in the 2000 cohort was increased by 10% and 25%, showed:

- A decrease in the overall morbidity rate by 145 to 374 cases per 100000 respectively
- A decrease in the overall disability rate by 87 to 222 cases per 100000 respectively
- A decrease in the overall mortality rates by 58 to 150 deaths per 100000 respectively
- A decrease in the incidence of all diseases except OS; minimal reduction for BC and CC
- A decrease in total years disabled (measured by TYD) associated with the PA related diseases
- Increases total years disabled (measured by TYD) overall (i.e., associated with both PA and NPA related diseases)
- A decrease in total years lost life (measured by TYL) associated with the PA related diseases
- A decrease in total years lost life (measured by TYL) overall (i.e., associated with both PA and NPA related diseases)

Conclusions and Suggested Future Work

These analyses suggest that if Canadians adopted the assumed physical activity levels of individuals who were 5-12 during the 1950s, there would be a decrease in disease morbidity, disability and mortality levels across all diseases under consideration in this study (related to physical activity/inactivity).

While we have successfully developed a compartmental model for reviewing the PA and NPA related morbidity, disability and mortality populations through time, ultimately using these to model associated health costs as a surrogate for health burden still depends on several key items that are currently outstanding. First, a Sensitivity Analysis to review the impact on costs given different parameter levels (i.e., transmission probabilities, relative risks, etc.) would be useful in order to identify any dynamic patterns that are not immediately evident given estimation via parameter point estimates. Second, in order to provide a better idea of the range of potential futures given estimation with parameter distributions (in place of point estimates), a fully stochastic differential compartmental model could be created. Finally, it would be of value to incorporate the findings of Statistics Canada research¹⁴ which projected physical activity levels for Canadians up until 2040, to estimate the burden of disease expected.

Summary: Scenario Analysis and Public Health

The Children and Physical Activity Scenarios Project has presented four scenario narratives that describe alternate possible futures of physical activity in children. *À la Carte*, *Cocoon*, *No Child Left Inside*, and *Smart Complex* highlight the value of scenario analysis to reflect the optimism, uncertainty and fears of seemingly incongruent perspectives on children's physical activity. This combination of literature review, expert interview, and analytically-driven narratives produced tangible, alternate visions of the future that will be of use by planners and decision-makers involved in tackling health issues facing today's and tomorrow's children.

The breadth, scope and variability of these scenarios highlights the value of qualitative evidence to inform visioning of credible public health futures. Recognizing that these scenarios are grounded in extensive research and diverse expert opinion gives them the credibility required for the use of these scenarios as tools for helping to address public health issues¹²¹.

Complementing this work with the quantitative micro simulation modelling provides another perspective that perhaps allows stakeholders more tangible constructs of health outcomes with which to envision and utilise the narratives for futures planning.

The scenarios support improved decision making by:

- presenting plausible hypotheses about the ways in which the external forces might evolve to impact an issue
- providing a tool to develop and test potential strategies;
- determine optimal public health positions around a variety of critical uncertainties; and
- question our response and action in a variety of plausible futures.

Scenarios provide a common platform that can quickly orient a variety of participants with a full range of perspectives, backgrounds and experiences, to the issue under examination. The scenario approach effectively prompts debate and further development in visualising, eliciting thoughtful planning for a range of possible and plausible outcomes.

Effective and nimble responses founded on collaborative strategic thinking are the key to positive futures in public health. There is no paucity of information on public health issues, however there is a need to develop and support innovative processes such as scenario analysis that utilise, challenge, and engage a variety of stakeholders at different levels both nationally and globally.

“We use scenario building to help us anticipate what the future may hold and prepare ourselves more effectively. We also believe it can inspire individuals and organizations to play a more active role in shaping a better future – for themselves, or even on a global scale”

*Ged Davis, Scenarios: An Explorers Guide
Shell International BV*

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