

Niagara Community Observatory

THE FUTURE OF NIAGARA'S HEALTH: Using a Life-Course Approach to Improve Well-being

The resilience and prosperity of a region fundamentally rests on the health and well-being of its residents. A region can boast having state-of-the-art physical and digital infrastructure, the blessings of geography, and the most talented workforce, yet suffer socioeconomic stagnation. Fully leveraging the potential of these assets presupposes that its residents are healthy, motivated, and engaged. Health and wellness are central to the quality and productivity of our lives, and ultimately, our happiness and fulfilment. In a similar vein, our health is a function of the circumstances surrounding our birth, growth, and aging, and ultimately determines our capacity to learn, live, and work.

Over a period of 18 months, staff at Niagara Region Public Health collected and analyzed more than 49,000 lines of data from sources that kept track of ambulance trips and emergency room visits, illnesses and injuries, and the main causes of death by age group. The goal is to use these numbers to answer one overriding question: What are the biggest health problems in Niagara? These data should then help to identify specific times across the lifespan at which targeted interventions are most likely to have an impact. Once this has been determined, decision-makers can use the information to investigate whether current policies, programs, and services align with these issues at the appropriate time and location.

This policy brief is an attempt to enrich public discourse and advance novel approaches to designing and implementing Niagara's public-health policy agenda. The discussion embraces a holistic life-course perspective that is strategic in its orientation, and comprehensive in its scope with respect to the planning, delivery, and monitoring of health care. This promotion of wellness, prevention of illness, early identification of problems, and equitable access to services would require an integrated regional platform. The analytical lens of this life-course perspective serves to challenge Niagara's institutional infrastructure to consider more synchronized and targeted approaches to addressing some of the perennial problems of public health in the region. Health and wellness is one of those cross-sectoral and transgenerational "wicked problems" that defy the departmental silos of conventional public policy platforms.

The Life-Course Perspective offers a new way of looking at health, not as disconnected stages unrelated to each other, but as an integrated continuum. It suggests that a complex interplay of biological, behavioral, psychological, social, and environmental factors contribute to health outcomes across the course of a person's life. It builds on social science and public health literature that suggests each life stage influences the next and that social, economic, and physical environments interacting across a life's course have a profound impact on the individual. (CityMatChR Org, ND).

Life-course theory (LCT), which underpins this perspective, is a conceptual framework that helps explain health and disease patterns – particularly health disparities – across populations and over time. LCT is population-focused, and firmly rooted in social determinants and social equity models (Fine, 2010).

It is based on four key concepts (Fine and Kotelchuck 2010).

1. Today's experiences and exposures affect tomorrow's health (Timeline);
2. Health trajectories are particularly affected during critical or sensitive periods which should not be missed (Timing);
3. Biologic, physical, and social environments strongly affect the capacity to be healthy (Environment); and
4. While genetics can offer both protection and risk factors, inequality in health reflects more than genetics and personal choice (Equity).

Life-Course and Health Trajectories

Health trajectories are the pathways that individuals follow from a health perspective. These pathways evolve over time, and the directions taken are dependent on, and shaped by, individual actions as well as by the circumstances and conditions that individuals experience throughout life (Hertzman & Power 2003). They are influenced by the relative number and magnitude of positive and negative factors such as biological, behavioral, physical, economic and social. These evolve and interact within and across life stages, ultimately resulting in the positive and negative health outcomes that each individual experiences in his or her lifetime. Trajectories are not linear but can be in a constant state of flux relative to different influences at different points in time (PHAC 2009, Halfon 2014).

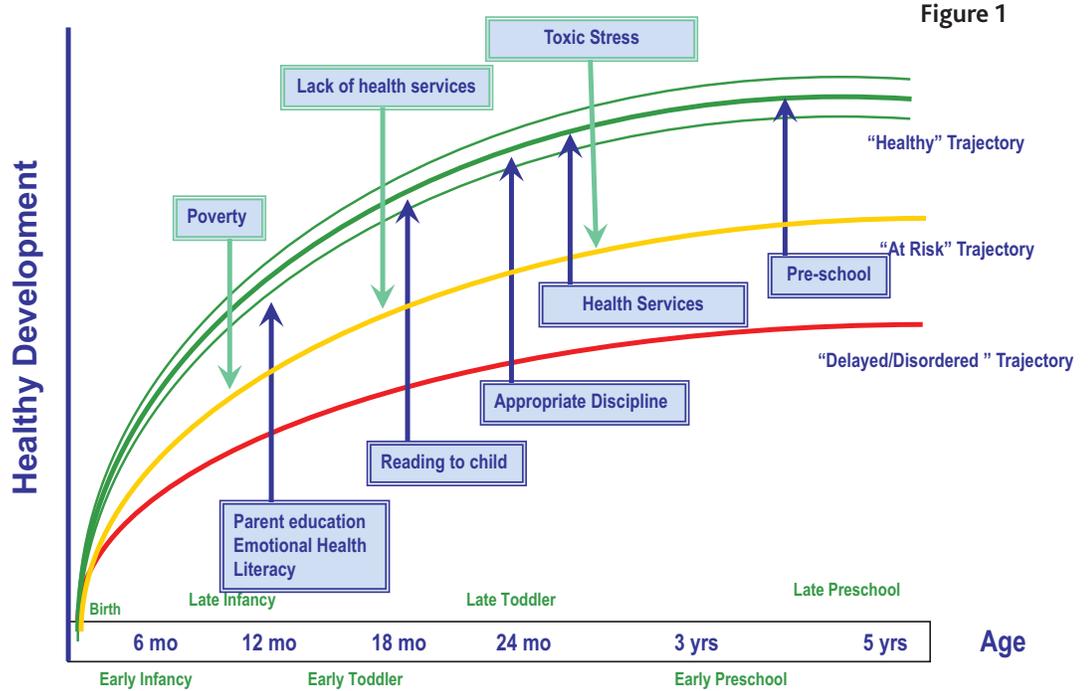
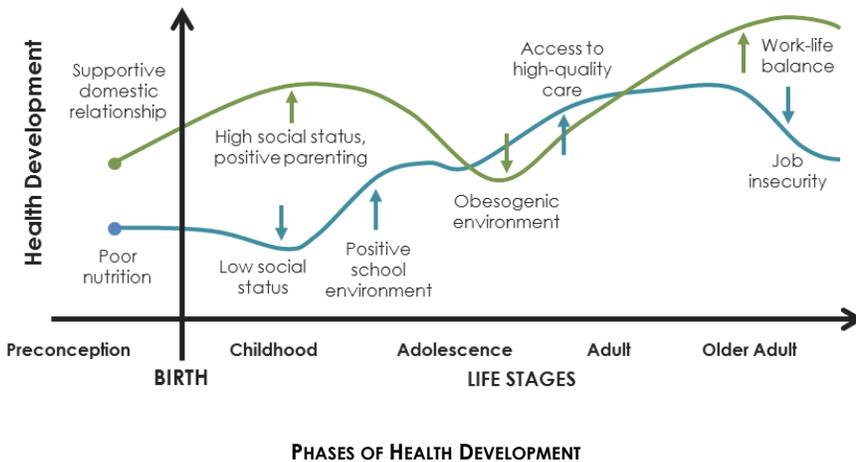


Figure 1

- 1 LATENT EFFECTS**
Experiences, particularly during sensitive periods, that influence health later in life.
- 2 PATHWAY EFFECTS**
Experiences that set people on certain health development trajectories.
- 3 CUMULATIVE EFFECTS**
Experiences that accumulate over time and manifests in health. A combination of latent and pathway effects.

Figure 2



Figures 1 and 2 reproduced with permission from Halfon, Larson, Lu, et al (2014 research paper, Figures 2a and 2b)

PHASES OF HEALTH DEVELOPMENT			
Generativity	Acquisition	Maintenance	Decline

Figure 1 illustrates how positive environmental factors, e.g. parent education, reading to a child, and appropriate discipline, can result in a positive shift in an individual's health trajectory, while negative factors, such as poverty and lack of health services, can shift the trajectory downwards.

Figure 2 compares the hypothetical health trajectories of two individuals exposed to a range of environmental influences on health. The figure illustrates the dynamic nature of "health": One individual starts life with low socio-economic status, but his health improves over time as he is exposed to a positive school environment and quality health care. A second individual starts life in a higher social stratum, but exposure to an obesogenic environment (prevalent factors that encourage obesity) results in his health trajectory falling below that of the first individual by early adulthood. Yet, better job security and work-life balance help to reverse the trajectories again by late adulthood.

What Protective and Risk Factors During the Life Course Affect Health Outcomes?

The Social Determinants of Health (SDOH)¹ as well as race and racism, health care, disease, stress, nutrition and weight, birth weight, and a range of behaviors are the key protective and risk factors that may affect health outcomes (Contra Costa Health Services, 2011).²

The Local Picture

The focus on Niagara's primary health issues using a life-course perspective is in support of Niagara Region Council's strategic priority of "Doing Business Differently".³ The life-course perspective is also a new way for Niagara Region Public Health (NRPH) to strategically use available data and be more goal-oriented and results-focused. It will help staff to determine which and when programs and services are offered in order to maximize impact on health outcomes across the lifespan. It will also lay the groundwork for provision of population health data to the Local Health Integration Network (LHIN) to support some of the goals of the Patient's First Act (2016).⁴

NRPH and Emergency Medical Services (EMS) have identified the top-10 overall Niagara-specific health issues and the major health issues for each of 11 different age groups across the life-course for both males and females. This was accomplished by analyzing more than 49,000 lines of data from multiple sources relative to the following categories: mortality rates, hospital discharges, infectious diseases, emergency department visits, EMS transports, chronic disease behaviors, and self-reported chronic disease.

Key Results by Age Group and Sex⁵

Childhood (0-9 years)

According to EMS transport data, children in this age group were most likely to be transported by ambulance to an emergency department (ED) for issues related to respiratory illness and seizures. ED admissions data on numbers and types of visits in general identified that falls, respiratory infections, wrist and hand injuries, and head injuries were the most common reasons for this age group to visit an ED.

Top-10 reasons why Niagara residents seek health services:

1. Cancer
2. Diabetes
3. Diseases and Infections of the Digestive System
4. Diseases of the Circulatory System
5. Injuries
6. Maternal/Reproduction
7. Mental Health
8. Poisonings
9. Respiratory Infections/Diseases
10. Sexually Transmitted Infections

¹ Social Determinants of Health are conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life (World Health Organization, 2018).

² LCT does have its critics. There is a heavy focus on maternal, child, and youth health and the great majority of initiatives appear to be embedded in children's health. This could be misinterpreted that it is difficult to change the health trajectory of older age groups. In turn, this may lessen the focus of programs, services, and policies regarding those older age groups. Therefore, more research needs to be done across all ages in order to place a greater emphasis on the concept that the development of health over a lifetime is an ongoing, interactive process and that pathways are changeable (Fine & Kotelchuck, 2010).

³ The objective of this strategic pillar aims to foster a strong internal foundation to drive continuous improvement efforts that has now been embedded in much of the organization within its programs and services. To adopt a continuous improvement lens, one needs to obtain data to establish priorities that address local contexts and support a healthy community.

⁴ The Act supports operational changes how care is planned, delivered, and monitored and establishes a formal linkage with Public Health Boards of Health and the Local Health Integration Network (LHIN). This ensures that Public Health expertise and access to data better informs community health planning and decision making.

⁵ There are limitations to our data: The top five are mainly outcome data. We had no influence on how the data was coded or entered (dependent on physicians, nurses etc.). The data examined only the most responsible diagnosis and not any secondary or tertiary diagnosis. Individuals may be double- or triple-counted (i.e. the same person who was admitted to ED, was then hospitalized and then died). We haven't analysed data from care homes/long-term care/institutional data/mental health data/PPYLL data. Some of the 'procedures' categories are too large and general, and cannot extract usable information.

Hospitalization discharge data identified that children were most likely to be admitted to a Niagara hospital with enteric symptoms (intestinal) and respiratory issues. Salmonellosis and campylobacter (infectious diseases of the small intestine) were the most frequently reported infectious disease to Public Health for children in this age group.

From a death perspective, a significant proportion of the data was not released (for children aged one to nine years) as the numbers were too small to report. However, congenital abnormalities (birth defects) were the main cause of death in babies in their first year.

Tweens and Teens (10-19 years)

Tweens and teens were most likely to be transported by EMS to ED for issues related to musculoskeletal trauma (broken bones, fractures) and behaviour/psychiatric reasons (especially girls). Overall more males than females visited an ED for injury-related complaints, especially in this age group. Emergency-visit data demonstrated that injuries were the main reasons for visiting an ED in Niagara and were mainly because of sporting injuries (struck by/struck against).

Mood (affective) disorders were the main reasons for hospital admittance, followed by labour-and-delivery complications, and diseases of the appendix. From a reportable infectious disease perspective, enterics were most frequently reported, followed by sexually transmitted infections (STIs), such as chlamydia and gonorrhea

The death rates for those aged 10-14 years were too small to report, while for those aged 15-19 years, transport accidents and intentional self-harm were the main reasons for mortality.

Emerging Adults (20-24 years)

Similar to the previous age-cohort, musculoskeletal trauma and behavior/psychiatric reasons were the most frequently reported reasons for EMS transports to emergency departments. ED visits were mainly related to injuries although digestive/abdominal symptoms and acute upper respiratory infections were also within the top five of this age group.

Hospital discharge data identified that labour-and-delivery complications followed by fetus-and-delivery problems, and diseases of the appendix were the main reasons for hospitalization (with more females being hospitalized than males).

STIs were most frequently reported for those (especially females) aged 20-24 years and this group had the highest number of STI cases in comparison to any other age group.

Transport accidents, accidental poisoning, and intentional self-harm were the main reasons for mortality.

Early Adulthood (25-44 years)

Most emergency transports in this age cohort were in relation to musculoskeletal and soft tissue pain (muscles/ligament damage), abdominal pain/gastro-intestinal problems, and for behavior and psychiatric reasons.

Digestive/abdominal symptoms were the main reason for ED visits in this age group, followed by injuries.

Labour-and-delivery complications, diseases of the appendix and gall, biliary tract and pancreatic disorders in early adults were the main reasons for hospitalization with more females than males hospitalized in Niagara in this age group.

STIs and blood-borne illnesses (hepatitis C) were the most frequently reported infectious disease followed by enteric diseases.

Mortality data shows accidental poisoning, intentional self-harm, and transport accidents were the top three reasons for deaths in this age group, followed by breast cancer, and ischaemic heart disease (IHD, diseases of the heart caused by insufficient blood supply to the myocardium).

Middle Adulthood (45-64 years)

The main reasons for EMS transport to hospital were due to general weakness, musculoskeletal and soft tissue pain, and chest pain to a lesser extent. The main reasons for admittance to ED were related to exam/investigation and circulator/respiratory signs and symptoms.

Hospital data demonstrate that heart disease in general (comprising of IHD, arthrosis, and other forms of heart disease) was the main reason for hospitalization.

Hepatitis C was prevalent across many age groups (especially in males) and is the No. 1 reportable infectious disease in Niagara residents aged 45-64 years.

Mortality rates in this age group demonstrate that IHD is the main reason for death followed by cancer (lung, breast, and colon cancers), and liver cirrhosis.

Seniors 1 (65–74 years)

Seniors in this age group were mainly transported by EMS to emergency departments for reasons related to general illness, respiratory distress, and musculoskeletal pain.

Admittance to ED was related to exams/investigation, followed by lens disorders (eyes), and circulatory/respiratory signs and symptoms. Main reasons for hospitalization were diseases of the heart (IHD, arthrosis), followed by complications of surgical and medical care, and intestinal diseases.

Enterics (campylobacteriosis, *C. difficile*, salmonellosis) are within the top-five most frequently reported infectious diseases.

The main mortality reasons were related to cancers, heart disease, and chronic lower respiratory infection.

Seniors 2 (75 years-plus)

The main reasons for EMS transports to emergency departments for this group were the same as for the previous age cohort: general illness, respiratory, and musculoskeletal pain. ED visits were linked to lens disorders, circulatory/respiratory signs and symptoms, heart disease, and general illness. Hospital discharge data demonstrates again that diseases of the heart were the main reason for hospitalization, although influenza and chronic lower

respiratory diseases were prevalent within this age group. In the oldest seniors (over 85 years), hip and thigh injuries were within the top-five reasons for hospitalization.

C. difficile, campylobacteriosis, enteritis, and *Streptococcus pneumoniae* were the most frequently reported infectious diseases in those over the age of 75.

Main mortality reasons were heart and cerebrovascular diseases, dementia, falls, and respiratory infections.

All Age Groups: Self-reported Behaviors and Conditions

Behaviors: All age groups reported poor dietary practices as indicated by poor fruit and vegetable consumption. Youth surveyed reported underage drinking, drug use, and cannabis use within their top-five while those over the age of 65 were most likely to be inactive during leisure time.

Conditions: Overweight and obesity were the most reported conditions across all age groups with anxiety and mood disorders being more prevalent in younger age groups.

How can we use this information?

Policies, programs, services, and initiatives can positively affect the health outcomes of residents and visitors to Niagara. By focusing efforts and resources on the top health issues facing Niagara, organizations and agencies within Niagara can work together to have a greater impact on the health and well-being of the community. By engaging with local partners, services can be coordinated and gaps in services addressed in collaboration. Over time, with a targeted strategy looking across the life-course, opportunities may be identified to potentially reduce the overall burden on the health-care system, including EMS transports. Prevention and management programs developed using a life-course perspective hold promise to deliver great health and wealth gains for individuals and communities as a whole in the future (Osler, 2006).

Niagara Region Public Health, using the life-course perspective, can provide services that provide safety nets and springboards for individuals during key life periods to alter life-course trajectories positively. These could be critical periods of growth and development (in-utero, early infancy, childhood, and adolescence), sensitive emotional/cognitive developmental periods (childhood and adolescence), or changes in one's life such as the diagnosis of a chronic disease, a death in a family, or the loss of a job. The above are just examples; the life-course perspective considers the impact of different exposures throughout the lifespan including adulthood and old age.

Table 1 TOP-FIVE REASONS FOR EMS TRANSPORTS TO NIAGARA HOSPITALS, BY AGE GROUP

	1	2	3	4	5
0<1 years	Respiratory Distress	Seizure/Postictal	General Illness/Weakness	Other Medical/Trauma	Newborn/ Neonatal
1-4 years	Seizure/ Postictal	General Illness/Weakness	Respiratory Distress	Soft Tissue Pain/ Trauma/Edema	Other Medical/Trauma
5-9 years	Musculoskeletal Trauma	Seizure/Postictal	Soft Tissue Pain/ Trauma/Edema	Behaviour/ Psychiatric	Respiratory Distress
10-14 years	Musculoskeletal Trauma	Behaviour/ Psychiatric	Soft Tissue Pain/ Trauma/Edema	Syncope	Seizure/Postictal
15-19 years	Musculoskeletal Trauma	Behaviour/ Psychiatric	Alcohol Intoxication	Soft Tissue Pain/ Trauma/Edema	Drug Overdose
20-24 years	Musculoskeletal Trauma	Behaviour/ Psychiatric	Abdominal Pain Not Yet Diagnosed	Soft Tissue Pain/ Trauma/Edema	Seizure/Postictal
25-44 years	Musculoskeletal Trauma	Abdominal Pain Not Yet Diagnosed	Behaviour/ Psychiatric	Soft Tissue Pain/ Trauma/Edema	GI Problems/Pain/ Vomiting/Nausea
45-64 years	General Illness/Weakness	Musculoskeletal Trauma	Abdominal Pain Not Yet Diagnosed	Soft Tissue Pain/ Trauma/Edema	Ischemic Chest Pain
65-74 years	General Illness/Weakness	Respiratory Distress	Musculoskeletal Trauma	Abdominal Pain Not Yet Diagnosed	GI Problems/Pain/ Vomiting/Nausea
75-84 years	General Illness/Weakness	Musculoskeletal Trauma	Respiratory Distress	GI Problems/Pain/ Vomiting/Nausea	Abdominal Pain Not Yet Diagnosed
85+ years	General Illness/Weakness	Musculoskeletal Trauma	Respiratory Distress	Soft Tissue Pain/ Trauma/Edema	GI Problems/Pain/ Vomiting/Nausea

Life-course Approach and Health Equity: What Does this Data Mean for Niagara?

The life-course approach focuses our attention on understanding the biggest health-related issues across the lifespan and to consider how to reposition programs, policies, and services to address these issues in order to have the largest impact on health and well-being. A further layer of equity considerations could then be applied. For example, how do the social determinants of health (SDOH) create vulnerability or resilience at each stage of life and for both males and females, in what geographic location, and across lifetimes and generations (Braveman 2014).

People don't live their lives by program or service. They live according to their stage of life. Therefore, the life-course approach to data helps us to identify the top issues across the age groups: What are people being diagnosed with? Why are they entering the hospital system? What is the primary cause for hospital admissions? Why are people dying in Niagara? The discussion concludes with a number of observations for consideration by policy actors, advocates, and community stakeholders:

1. Community stakeholder engagement will help validate the importance of the data, identify gaps, determine each partner's strength in addressing the issues, and set achievable outcomes. By setting targeted outcomes, strategies can be planned in collaboration with community partners to address the various health issues or risk factors. Programs and services should be based on the best available evidence of need, impact, and cost-effectiveness, and the principles of evidence-informed decision-making should underpin any policy, program, service or intervention.

2. The life-course perspective determines that the decisions you make and the experiences you have today, will have implications on your health tomorrow. If you are going to be focussing on the health of people over the age of 65 years, you need to look at those aged 50 and above to identify the behaviours, attitudes, biggest health and social issues, and trends to begin planning for the future. For example, the data demonstrates that currently two-thirds of Niagara residents aged 45 to 64 years are overweight or obese. As this condition is known to be associated with a multitude of chronic conditions such as diabetes, coronary heart disease, and asthma, as well as knee replacements; the life-course perspective identifies times at which targeted interventions may be especially effective to help reduce the burden on hospitals and clinics in 10 to 15 years as this particular age group nears 65 years old.

Another example is related to mental health. EMS transports and hospitalizations related to mental health appear in age groups as young as the five-to-nine-year-old and 10-to-14-year-old age groups in Niagara. Do enough agencies have interventions/programs/services at this time? Is there a gap? What more could we be doing in terms of both prevention and treatment to ensure that the future mental health of the Niagara population would benefit.

3. Understanding the life-course perspective creates opportunities to build upon protective factors and reduce risk factors. In this context, health-related policies can focus on building environments that support equitable, healthy, and thriving communities, and ensure that the broad array of protective and risk factors are addressed in an integrated, coordinated, and comprehensive manner (CCHS 2011).

4. A key element of a population health approach is the recognition that improving health outcomes is a shared responsibility within and across different sectors (e.g. government, education, business, social services, economic development, and health). The World Health Organization's strategy, "Health in All Policies", is promising for coordinating efforts to create healthy communities to meet the social, physical, economic, and spiritual needs of the population. Niagara's public health department and EMS could work with Niagara leaders across all public and private sectors to ensure that health is considered within all policies.

Conclusion

The life-course approach articulated in this brief is consistent with a prevailing model of public policy and management in Canada in which the boundaries within government departments, between government and other sectors (such as non-profit agencies and citizens) have become porous. This implies a regional institutional machinery that places emphasis on an open, holistic, long-term, and networked approach to health-service delivery. The life-course approach challenges stakeholders in Niagara's health-care policy domain - doctors, nurse practitioners, health-sector agencies and community-based agencies - to take a much longer time horizon in their models of program intervention. Central to this new thrust is the role of partnerships between core mental-health service agencies with mandates covering health care from the cradle to the grave. But it will also involve a greater engagement with community partners, including program end-users.

Health-care delivery in Niagara must consider holistic, longer-term, and networked models of public-service delivery. It must also construct credible alternatives to departmental silos that would address the perennial quagmires of narrowly constructed policy interventions based on the constrained mandates of individual agencies. This would also mean non-hierarchical health-service delivery structures and processes. Finally, it would require Niagara to articulate the full implications of residents as co-producers as well as service end-users of health programs.

REFERENCE LIST

- Asada Y. (2005). "A framework for measuring health inequity." *J Epidemiol Community Health*, 59: 7005.
- Braveman, Paula. (2014). "What is Health Equity: And How Does a Life-Course Approach Take Us Further Toward It?" *Maternal Child Health J*, 18:366–372.
- CityMatCH Org (ND). LifeCourse Toolbox. www.citymatch.org/lifecoursetoolbox. Accessed June 16, 2017.
- Contra Costa Health Services, Family, Maternal, and Child and Adolescent Health. (2005). *The Life Course Model and Maternal, Child and Adolescent Health: An Overview*.
- Contra Costa Health Services (April 2011) *Family, Maternal and Child Health Programs Life Course Initiative (California)* http://cchealth.org/lifecourse/pdf/lci_fact_sheet.pdf Accessed July 28, 2017.
- Fine A, and Kotelchuck M. (2010). "Rethinking MCH: The Life Course Model as an Organizing Framework." U.S. Maternal and Child Health Bureau <https://www.hrsa.gov/sites/default/files/ourstories/mchb75th/images/rethinkingmch.pdf>
- Forrest, C. B. and Riley, A. W. (2004). "Childhood Origins of Adult Health: A Basis for Life-Course Health Policy." *Health Affairs*, 23(5), 155–164.
- Galobardes, B., Lynch, J. W., and Smith, G. D. (2004). "Childhood Socioeconomic Circumstances and Cause-specific Mortality in Adulthood: Systematic Review and Interpretation." *Epidemiologic Reviews*, 26(1), 7–21.
- Halfon N, Larson K, Lu M, Tullis E and Russ S. (2014). "Lifecourse Health Development: Past, Present and Future." *Maternal Child Health*. 18:344 -356.
- Hertzman, C. and Power, C. (2003). "Health and Human Development: Understandings from Life-Course Research." *Developmental Neuropsychology*, 24(2&3), 719–744.
- Hosseinpour A, Bergen N, and Schlottheuber. (2015). "Promoting health equity: WHO health inequality monitoring at global and national levels," *Global Health Action*, 8: 29034.
- Lynch, J. and Davey Smith, G. (2005). "A Life Course Approach to Chronic Disease Epidemiology." *Annual Review of Public Health*, 26, 1–35.
- Mitchell, B. A. (2003). "Life course theory." *The International Encyclopedia of Marriage and Family Relationships*, 1051-1055.
- PHAC. (2009). Report: The State of Public Health in Canada 2009. Ch 2 The role of Public Health in Influencing the Lifecourse trajectory. <http://www.phac-aspc.gc.ca/cphorsphc-respcacsp/2009/fr-rc/cphorsphc-respcacsp05-eng.php>. Accessed June 16, 2017.
- World Health Organization. (2018). Social Determinants of Health. http://www.who.int/social_determinants/en/ . Accessed Jan. 9, 2018.

The Niagara Community Observatory is a local public policy think-tank at Brock University in St. Catharines, ON.

More information on our office and an electronic version of this policy brief can be found at: www.brocku.ca/nco

