

SHIFT

**Enhancing the Health of Ontarians:
A Call to Action for Preconception
Health Promotion & Care**



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//ONTARIO Public Health Association//

The Ontario Public Health Association (OPHA) is a member-based, not-for-profit association that has established a strong record of success as the voice of Public Health in Ontario. The Association provides leadership on issues affecting the public's health and strengthens the impact of those who are active in public and community health throughout Ontario. OPHA has nine active workgroups that focus on particular public health issues. The Reproductive Health Workgroup is one whose membership is interested in promoting reproductive health within Ontario, including promotion and support of preconception health. The workgroup's vision includes having systems and policies in place to achieve optimal reproductive health for all, with a mission to advocate for policies and supportive environments that improve reproductive health outcomes.

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//List of Acronyms//

- alPha – Association of Local Public Health Agencies
- APHEO – Association of Public Health Epidemiologists In Ontario
- BMI – Body Mass Index
- BORN – Better Outcomes Registry and Network
- BSRC – Best Start Resource Centre
- CDC – Centers for Disease Control and Prevention
- CIHI – Canadian Institute for Health Information
- CPNP – Canada Prenatal Nutrition Program
- EMR – Electronic Medical Record
- FASD – Fetal Alcohol Spectrum Disorder
- HBHC – Healthy Babies Healthy Children
- HCP – Health Care Provider
- IOM – Institute of Medicine and the National Research Council
- IUGR – Intrauterine Growth Restriction
- LGBTQ - Lesbian, Gay, Bisexual, Transgender, and Queer
- NTD – Neural Tube Defect
- OAR – Ontario Antenatal Record
- OPHA – Ontario Public Health Association
- OPHS – Ontario Public Health Standards
- PCC – Preventive Care Checklist Form ©
- PCH – Preconception Health
- PHAC – Public Health Agency of Canada
- PHO – Public Health Ontario
- RHO – Rainbow Health Ontario
- RLP – Reproductive Life Plan
- SOGC – Society of Obstetricians and Gynaecologists of Canada

Preconception Health

Preconception health refers to the health of all individuals during their reproductive years, regardless of gender identity, gender expression or sexual orientation. It is an approach that promotes healthy fertility and focuses on actions that individuals can take to reduce risks, promote healthy lifestyles, and increase readiness for pregnancy, whether or not they plan to have children one day. A comprehensive approach includes actions on an individual, community and population level to promote preconception health.

EXECUTIVE SUMMARY



Despite universal access to high quality prenatal care and advances in medicine, adverse perinatal outcomes persist in Ontario. Although strong public health programs that use a life-course perspective exist, “they do not guarantee that women enter pregnancy in good health” [1]. There is growing evidence that preconception health (PCH) can improve maternal and child health outcomes, both in the short- and long-term [1,2]. In light of this, the Ontario Public Health Association (OPHA) Reproductive Health Workgroup has developed this position paper to advocate for coordinated and comprehensive action in the area of PCH in Ontario. Our aim is to shift public and political awareness and understanding of reproductive health to include PCH. This document will review the evidence that supports the need to shift attention to PCH, while examining promising current strategies, exploring existing gaps and challenges in the area, and lastly, outlining a set of concrete action steps to move a PCH agenda in Ontario forward.

PCH refers to the health of all individuals during their reproductive years, regardless of gender identity, gender expression or sexual orientation. It is an approach that promotes healthy fertility and focuses on actions that individuals can take to reduce risks, promote healthy lifestyles, and increase readiness for pregnancy, whether or not they plan to have children one day. Experts agree that in order to improve birth outcomes, which have reached a plateau in recent years, it is imperative to intervene before pregnancy [3]. Many of the maternal and paternal risk factors for poor birth outcomes, such as lifestyle behaviours, are modifiable in the preconception period [4,5,6]. In fact, research has shown that PCH has positive impacts on many reproductive health outcomes and is cost effective for specific interventions, such as folic acid supplementation and diabetes care [7,8]. While it is not an exhaustive list, PCH can:

- prevent preterm births;
- improve birth weight;
- prevent congenital anomalies, including neural tube defects;
- reduce infant mortality;
- reduce maternal mortality [1].

Although some progress has been made in the area of PCH in recent years, a comprehensive approach and a standardized framework with specific guidelines are absent both provincially and federally. In Ontario, although PCH promotion is mandated under the Ontario Public Health Standards [9], there is no standardized program for public health units to follow, leaving each health unit responsible for prioritizing resources and developing and delivering programming based on their own local need. In clinical care settings, standards are fragmented and guidance and supports to integrate PCH care into practice are often lacking leading to inconsistent and incomplete care across jurisdictions and institutions [10]. Given that nearly 50% of pregnancies are unplanned [11], every health care provider (HCP) contact with individuals of reproductive age provides a key opportunity to

explore and discuss PCH topics such as healthy eating, physical activity, immunization status, reproductive life planning, substance use, chronic medical conditions, and exposure to environmental toxins [12]. Addressing these issues at the first prenatal appointment, as is often the case, is too late.

While the importance of PCH is clear, the most effective strategy for delivering services is currently unknown. Current evidence supports strategies such as public awareness campaigns, reproductive life plans, PCH care integration, and HCP outreach; however, more research is needed to determine effectiveness. Given the limited research on PCH strategies, examining effective approaches from other reproductive and public health programming is warranted. Furthermore, it is important to explore innovative ways to develop and deliver programming that moves beyond traditional individual level interventions, such as behavior change, to programming that focuses on broader community and system level interventions, such as socio-environmental changes, realignment of services and healthy public policies.

There are several major gaps and challenges which hamper effective implementation of a PCH agenda in Ontario, including lack of consistent and ongoing data monitoring, limited research and evaluation, lack of public and political awareness, limited diversity of target audiences (e.g., men, adolescents, LGBTQ, HCPs), and limited resources. Addressing the gaps and challenges will be essential for shifting the focus to encompass PCH in Ontario.

In ensuring optimal health for Ontarians, it is also essential to broaden the window of reproductive health practices to include PCH. To ensure a comprehensive approach to mobilizing this shift the following key actions must be activated:

- **Interdisciplinary collaboration** is needed to mobilize and support PCH in Ontario. Convening an intersectoral, interdisciplinary provincial PCH committee to lead the coordination of efforts and innovation across Ontario is recommended.
- **Integration** of PCH at multiple levels and in diverse settings is needed. This includes integrating interventions and key messages into public health and primary health care with all individuals of reproductive age (including men, and regardless of gender identity, gender expression or sexual orientation), developing standardized training and education for practicing HCPs as well as students in health related programs, and utilizing a variety of health promotion strategies to support individuals and communities to achieve optimal PCH.
- **Innovation** is needed to deliver PCH programming that moves beyond traditional modes of delivery and harnesses the power and reach of social media. Investment needs to be made in e-strategies and other innovative methods to work with partners and engage the public.
- **Inquiry** is needed through targeted, timely, and systematic data gathering, monitoring, research and evaluation. There are significant gaps in data and a lack of research in the area of PCH, especially from a Canadian perspective and in acknowledgement of Canadian realities. Facilitating the development of a comprehensive core indicator system and establishing a provincial repository where information on PCH programming and best practices can be stored and examined will aid service providers and practitioners in implementing effective programming on local and provincial levels.

In addressing these key action areas, it will be critical to apply a health equity lens and address the social determinants of health to complement the individual level focus of current PCH programming and ensure universality and accessibility of PCH.

PURPOSE & SCOPE



Despite universal access to high quality prenatal care and advances in medicine, adverse perinatal outcomes persist in Ontario. Although strong public health programs that use a life-course perspective exist, “they do not guarantee that women enter pregnancy in good health” [1]. There is growing evidence that preconception care – care before pregnancy – can improve maternal and child health outcomes, both in the short- and long-term [1,2]. In addition, as part of a life-course approach to public health programming, preconception care can bring health benefits to all individuals of reproductive age¹, regardless of whether or not they plan to become parents [13].

In Ontario, although preconception health (PCH) promotion is mandated under the Ontario Public Health Standards [9], there is no standardized program for public health units to follow, leaving each health unit responsible for prioritizing resources and developing and delivering programming based on their own local need. In clinical settings, standards are fragmented and guidance and supports to integrate preconception care into practice are lacking. Furthermore, there are no provincial programs for PCH delivery through health care providers (HCPs) [14]. As a result, PCH has not entered mainstream public awareness or routine practice with HCPs in Ontario [14].

In light of this the Ontario Public Health Association (OPHA) Reproductive Health Workgroup has developed this position paper to advocate for coordinated and comprehensive action in the area of PCH in Ontario. Our aim is to shift public and political awareness and understanding of reproductive health to include PCH. This document will review evidence that supports the need to shift attention to PCH, while examining promising current strategies, exploring existing gaps and challenges in the area, and lastly, outlining a set of concrete action steps to move a PCH agenda in Ontario forward. Increased attention worldwide is being directed to this area. It is our hope that this position paper will highlight the importance of establishing a PCH framework for Ontario and provide a foundation to assist and guide the province in harnessing the current momentum.

1. It is imperative that preconception health programming is inclusive to all individuals of reproductive age, regardless of gender identity, gender expression, or sexual orientation. Throughout this paper, we refer to “all individuals of reproductive age” as an inclusive term.

INTRODUCTION



What is preconception health?

Preconception health refers to the health of all individuals during their reproductive years, regardless of gender identity, gender expression or sexual orientation. It is an approach that promotes healthy fertility and focuses on actions that individuals can take to reduce risks, promote healthy lifestyles, and increase readiness for pregnancy, whether or not they plan to have children one day. A comprehensive approach includes actions on an individual, community and population level to promote preconception health.

Although preconception includes “all individuals”, strategies addressing preconception have typically focused on the ‘heterosexual woman’s’ needs [4]. Limited work, including programming, research and data collection, has been done on males or the Lesbian, Gay, Bisexual, Transgender, and Queer (LGBTQ) population; however, it is critical that PCH care, programming and policy shifts to be more inclusive of diversity. Inclusion of partners in PCH promotion is of utmost importance as they are affected by and contribute to many health issues and risk factors that influence maternal and child health, such as sexually transmitted infections, smoking, partner violence, substance use, immunization status, stress, and environmental exposures (see Appendix A). As a result, preconception initiatives must reach all individuals to ensure that they are healthy in their own right and promote the health of mothers and newborns [15].

PCH not only addresses health before a first pregnancy, but also the interval between pregnancies, referred to as interconception. Experiences from a previous pregnancy can identify areas that could benefit from intervention prior to a subsequent pregnancy, for example addressing maternal health issues such as diabetes and obesity (including excess gestational weight gain and postpartum weight loss), and reflecting on previous birth outcomes, such as preterm birth and congenital anomalies. It also provides an opportunity to assess for perinatal mood disorders, immunization status and discuss breastfeeding in preparation for future pregnancies.

A brief history of preconception health

It has been over thirty years since the concept of preconception was introduced [16]. However, it has only been in the last eight years that PCH has been receiving more attention from researchers, policy makers and HCPs. The establishment of the Preconception Care Work Group and the Select Panel on

Preconception Care by the Centers for Disease Control and Prevention (CDC) in 2006 was a major milestone for PCH. Assembled leaders and practitioners from various fields including primary care, research, policy, public health, and education, identified consistent terminology, critically reviewed research, and developed a strategy for advancing PCH in the United States [17].

A significant outcome to emerge was the release of a seminal report entitled “Recommendations to Improve Preconception Health and Health Care – United States: A Report of the CDC/ATSDR Preconception Care Work Group and the Select Panel on Preconception Care” [17]. The report made 10 overall recommendations for PCH and care within the United States; some of which may not be relevant to Canada:

- 1. Individual Responsibility Across the Lifespan** – All individuals of reproductive age should be encouraged to have a plan for reproductive life (e.g., whether and when to have children);
- 2. Consumer Awareness** – Increase public awareness of PCH behaviours and services;
- 3. Preventive Visits** – As part of routine care, provide risk assessment and health promotion services to all women of reproductive years to reduce reproductive risk and improve birth outcomes;
- 4. Interventions for Identified Risks** – Increase the proportion of women who receive intervention for identified risks;
- 5. Interconception Care** – Use the period between pregnancies to provide assessment and intervention to women who had a previous pregnancy that ended in an adverse outcome;
- 6. Pre-pregnancy Check-Up** – As part of maternity care, offer one visit to couples and persons planning a pregnancy;
- 7. Health Insurance Coverage for Women with Low Incomes** – Increase public and private health insurance coverage for preconception and interconception services;
- 8. Public Health Programs and Strategies** – Integrate preconception services into existing local public health and related programs;
- 9. Research** – Increase the evidence-base and promote the use of evidence in PCH;
- 10. Monitoring Improvements** - Maximize public health surveillance and related research mechanisms to improve PCH [17].

It also included a specific action plan for moving a PCH agenda forward.

Since 2006, there have been significant strides in promoting PCH, particularly in the United States. Although these recent efforts have helped to advance preconception research, intervention development and public awareness, Canadian efforts have been modest. In Ontario, a more comprehensive approach is needed - one which includes attention to policy and consideration to reframing health promotion and health care. Giving consideration to efforts beyond the province’s borders may provide some insight on how to fully integrate PCH into reproductive health promotion and clinical care. Below are key examples of global, national and provincial developments in the area of preconception; however, this is not an exhaustive list.

Global developments

The World Health Organization’s (WHO) “Born Too Soon: The Global Action Report on Preterm Birth” [15] identifies that everyone has a role to play in reducing preterm birth. The document recognizes preconception as a key period to effect change to the preterm birth rate. It proposes actions for policy, programs and research by all partners – from governments and policy makers, to healthcare workers and their associations, to academics and researchers, and the business community and civil society [15]. In follow-up to the Born Too Soon recommendations, WHO convened a meeting of experts to develop a global consensus on preconception care to reduce maternal and childhood mortality and morbidity [13]. The report chronicles detailed conversations regarding definitions, next steps and a ‘menu of interventions’ for categorizing the “health problems, problem behaviours and risk factors that contribute to maternal and childhood mortality and morbidity in thirteen domains, evidence-based interventions to address them and mechanisms of delivering them” [13].

CDC’s work since 2006 has been impressive and it has helped to better address and integrate PCH within the United States. Following the release of their report, the CDC assembled leaders and practitioners from various fields to form the Preconception Health and Health Care Steering Committee. To ensure a comprehensive approach the steering committee formed five workgroups to address different facets of PCH: clinical, public health, consumer, policy and finance, and surveillance and research [18].



The increased attention to PCH has resulted in more research and scholarly publications. The American Journal of Health Promotion [19] focused an entire issue on effective strategies for promoting PCH. Articles include positioning the message dependent on the audience and effective strategies in a variety of environments. In 2008, the American Journal of Obstetricians and Gynecology [20] also devoted its entire publication to preconception health. Articles addressed the importance of integrating preconception into clinical care and highlighted the key components of preconception care, including the quality of evidence to support clinical interventions.

National developments

In Canada, although there has not been the same attention or focus on PCH as in the United States, there has been some notable work on a national level. Motherisk [21] is a program at The Hospital for Sick Children that provides evidence-based counselling to women and HCPs across Canada on healthy pregnancy and breastfeeding. In a 2013 update, Motherisk addressed the need for preconception care, noting that “if pregnancies are planned, many potential risks ... can be identified and managed preemptively, thus enhancing maternal and child health” [5]. Twelve evidence-based preconception intervention categories were highlighted for women of reproductive age, as outlined in table 1.

While this update addresses a number of PCH interventions, some opportune interventions are lacking, notably screening, treatment and prevention of STIs, including HIV/AIDS in individual and sexual partners [22]; planning and prevention of unintended pregnancies [23]; promotion of optimal birth spacing [22]; and utilization of contact with an individual to provide health education [24,25].



Table 1: Preconception Health Interventions [5]

1. Eat a well-balanced diet	7. Reduce stress
2. Exercise regularly	8. Manage chronic medical conditions
3. Cease smoking	9. Identify and treat women at risk of severe morning sickness
4. Avoid alcohol intake	10. Maintain a healthy weight
5. Cease illicit drug use	11. Take multivitamins with folic acid
6. Reduce environmental toxin exposure	12. Get vaccinated

The Society of Obstetricians and Gynaecologists of Canada (SOGC) has incorporated select PCH recommendations within a number of their clinical practice guidelines, a sampling of which include: Alcohol Use and Pregnancy Consensus Clinical Guidelines [26]; Obesity in Pregnancy [27]; Diagnosis, Evaluation and Management of the Hypertensive Disorders of Pregnancy [28]; Rubella in Pregnancy [29]; and Teratogenicity Associated with Pre-Existing and Gestational Diabetes [30]. In addition to practice guidelines, SOGC partnered with the Best Start Resource Centre (BSRC) to develop a Canadian prenatal resource called “Healthy Beginnings” which includes information from preconception to birth² [31]. While these are initial steps, the PCH messages are limited and fragmented and a specific PCH guideline is needed to support integration of care into practice.

Despite the work of Motherisk and SOGC on a national stage, there has been an absence of federal leadership in the area of PCH. Developing a vision, framework, guidelines and seminal documents are necessary to move a PCH agenda forward in a systematic and comprehensive manner. Bialystok et al’s [10] article calls for the development of national guidelines, recommending “preconception care and education be incorporated into school curricula and the workplace, delivered through the media, and offered through community-based agencies”. Furthermore, Bialystok et al [10] notes that from a clinical care perspective “national leadership to foster collaborative development of authoritative guidelines and goals could reduce existing confusion and encourage more comprehensive and consistent application of preconception care, setting the stage for a more integrated approach”. This vision could also extend beyond care alone to include health promotion as well.

2. This resource will no longer be available in print form as of 2015. Information from the “Healthy Beginnings” resource will be available on the SOGC website.

Provincial developments

Alberta has been the only province to date to develop a PCH agenda, releasing their 'Preconception Health Framework' in 2007 [2]. The framework identifies that "despite advances in medical science, universal access to health services and high quality prenatal care, rates of adverse perinatal outcomes persist and some problems are increasing" [2]. With this in mind, the document sets out a preconception health framework with three key strategies as an avenue to impact this concern:

1. Promote Public Awareness and Knowledge;
2. Build Capacity to Provide PCH Services;
3. Champion PCH Supporting Environments.

Unfortunately, the Alberta framework has not been implemented in its entirety but has been used as a backgrounder and guide for many Alberta initiatives.

While no formal PCH framework has been developed to date in Ontario, there has been growing attention on the issue. For example, the Healthy Kids Panel released a report entitled "No Time to Wait: The Healthy Kids Strategy" [32]. The report acknowledged PCH, stating that "Ontario's public health system must develop guidelines and tools that the public health system, primary care provider and the education system will use to deliver a coordinated education program for all young women in Ontario of childbearing age and their partners". Two relevant recommendations included:

- "Educating women of childbearing age about the impact of their health and weight on their own well-being and on the health and well-being of their children",
- "Enhance primary and obstetrical care to include a standard pre-pregnancy health check and wellness visit for women planning a pregnancy and their partners".

BSRC has been a provincial leader in promoting PCH and developing related professional and public resources. In 2009, BSRC released three PCH documents detailing the realities in Ontario:

1. Awareness and Behaviours [117];
2. Public Health Initiatives [14];
3. Physician Practices [216].

A sampling of other BSRC initiatives include the Health Before Pregnancy website³, a resource for dads⁴, a report examining the issue of obesity during the preconception and prenatal periods [33], and a Reproductive Life Plan⁵ for youth.

Despite promising work occurring in the area of PCH, a comprehensive provincial approach and framework with specific guidelines is absent. Although the Healthy Kids Panel report [32] provided a refreshing perspective for promoting the health of children, further integration of PCH parameters is needed and a call for provincial leadership and coordination in this area is required.

3. www.healthbeforepregnancy.ca

4. www.beststart.org/resources/preconception/men_health_bro_2012.pdf

5. http://www.beststart.org/resources/preconception/MLMP_14MY01_Final.pdf

MAKING THE CASE



Healthy birth outcomes contribute to the foundation for healthy children and families [34]. Conversely, poor birth outcomes have the potential to create detrimental lifelong growth and developmental outcomes for children and can also lead to higher costs and strains on families and society [34]. For example, the estimated average neonatal hospital costs for babies less than 2,500g (low birth weight) in Canada ranges from \$4,600.00 - \$117,800.00, compared to \$950.00 for the cost of a baby who weighs more than 2,500g [35].

Traditionally, reproductive health programming in public health has focused on prenatal and postpartum services, such as in-class and online prenatal classes, the Canada Prenatal Nutrition Program (CPNP), and the Healthy Babies Healthy Children (HBHC) Program. Despite such programming, advances in medical science and quality prenatal care, poor birth outcomes continue to be a national and provincial concern [2,36]. Adverse perinatal outcomes, such as moderate and late preterm births (32 to <37 weeks gestation), are increasing and are associated with the trend to delay childbearing, which has resulted in a rise in reproductive assistance and multiple births [37,38]. Experts agree that in order to improve pregnancy outcomes, which have reached a plateau in recent years, it is imperative to intervene before pregnancy to educate, screen, modify and manage health conditions and risk factors to promote optimal maternal and infant health outcomes [3].

Unfortunately, providing care to individuals from a preconception lens is not routine. Clinical care standards supporting PCH care are fragmented leading to inconsistent and incomplete PCH care in many jurisdictions and institutions [10]. Typically, a women's first visit to a HCP regarding pregnancy does not occur until the end of the first trimester of pregnancy. By this time, an important opportunity for intervention to reduce maternal and infant mortality and morbidity risk factors has been missed, since the critical period for fetal development has already occurred. In addition, nearly 50% of pregnancies are unplanned, creating yet another missed opportunity for interventions [11]. In acknowledgement of this, Moos et al [12] states that every HCP contact with individuals of reproductive age provides a key opportunity to explore and discuss PCH topics such as healthy eating, physical activity, immunization status, substance use and reproductive life planning (including birth spacing, contraceptive use, and the prevention of unplanned pregnancies). To wait for the first prenatal appointment is too late. This sentiment is echoed in the Healthy Kids Panel report [32] and MAINPRO® CME Improving the Odds: Healthy Child Development toolkit [39] which both endorse recommendations to bring attention to the period before pregnancy.

Demonstrating the cost effectiveness of PCH is an important part of making the case for public health investment. Like many other areas of public health, there is limited economic evaluation of PCH care [7, 8]. There have been analyses showing the financial benefits of specific preconception care interventions, such as folic acid supplementation [40] and diabetes care [41]. Herman et al [41] found a cost savings of \$34,000 USD per participant in a diabetes care program based on reductions in length of maternal hospital

stays and neonatal Neonatal Intensive Care Unit (NICU) admissions compared to women who did not participate in the program. However, Salihu et al [7] argue that more comprehensive economic analyses needs to be conducted, specifically calling for comparative effective research, an approach that helps to identify the most effective interventions in real world settings with acceptable costs to society. The economic benefits of preconception care intervention can also be drawn from examining the costs of health issues that can be identified, treated or prevented before pregnancy. For example, the cost to society of HIV/AIDS and other STIs are enormous [42]. The Canadian AIDS Society estimates that HIV/AIDS is costing Canadians \$1.3 million for every new diagnosis, when taking into consideration the lifetime economic losses associated with the impact of HIV/AIDS on quality of life (\$380,000/person), health care costs (\$250,000/person) and labour productivity (\$670,000/person) [43]. HIV/AIDS can have serious implications during pregnancy. However, proper management before conception can significantly improve maternal and child outcomes, such as prevention of vertical transmission, providing significant long-term cost savings to society.

To further understand the benefit of shifting our attention to PCH, it is important to highlight current data on some well recognized reproductive health indicators, including preterm birth, birth weight, congenital anomalies, infant mortality, and maternal mortality. While it is not an exhaustive list, its intention is to draw attention on the detrimental impact of some of these indicators on maternal and infant health to further support our call to action.

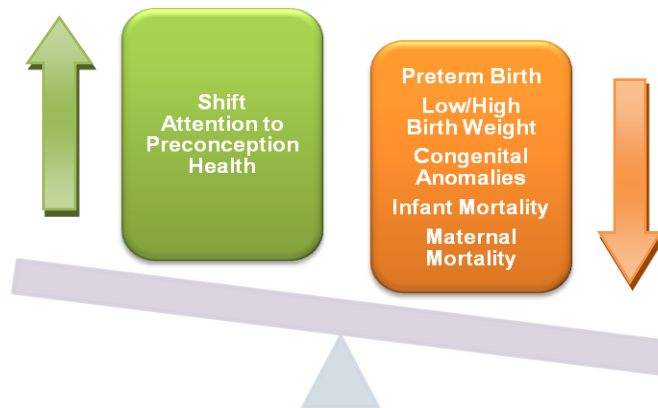


Figure 1: Preconception health impact on selective reproductive health indicators

Preterm birth

According to the Born Too Soon Executive Summary Group, globally 15 million babies are born preterm⁶ each year and the rates are increasing in almost all countries [15]. Furthermore, over 1 million children die annually due to the complications of preterm birth and many that survive face a lifetime of disability, including learning, vision, and hearing disabilities [15]. Globally, preterm birth is the leading cause of newborn deaths (babies in the first four weeks of life) and the second leading cause of death in children under five (after pneumonia) [15].

The Canadian Institute for Health Information (CIHI), reports that 7.9% of babies born in a Canadian hospital between 2010 and 2011 were preterm, while provincially the preterm rate was 8.1% in Ontario – the second highest provincial rate following Alberta at 8.6%⁷ [46]. The preterm birth rate is the percentage of all live births that occur before 37 completed weeks of gestation [45,46]. In Canada, the preterm birth

6. Preterm is defined as babies born alive before 37 weeks of pregnancy are completed. Preterm babies can be categorized based on their gestational age at birth: extremely preterm (<28 weeks); very preterm (28 to <32 weeks); moderate to late preterm (32 to <37 weeks) [78].

7. Although Alberta has the highest rate of preterm births in 2012 (8.6%), their rate has decreased since 2005 (9.1%) [2].

rate has been increasing and has been identified as the leading cause of neonatal and infant mortality [47].

Preterm birth occurs for many reasons – some of them unknown. However, strong associations have been found between preterm birth and multiple pregnancies, maternal diabetes, maternal hypertension, and previous preterm deliveries, while other associations include maternal age (less than 20 or greater than 35 years), a woman's first delivery (primiparous birth), single marital status, smoking, illicit drug use, maternal stress, pre-pregnancy weight (underweight, overweight or obese), low or excessive gestational weight gain, and race/ethnicity [45]. As cited in the CDC Select Panel report, there is also evidence to support that women with low income who experienced “reduced overall health status (including poorer physical and emotional health)” one month prior to becoming pregnant were at greater risk of preterm labour [17].

It is imperative that there is an investment in prevention through PCH. The Born Too Soon Executive Summary Group further supports this investment and shift in attention by stating that “family planning, and increased empowerment of women, especially adolescents, plus improved quality of care before, between and during pregnancy can help to reduce preterm birth rates [and] strategic investments in innovation and research are required to accelerate progress” [15].

Birth weight

Birth weight is one of the most significant indicators of an infant's chances of survival, health and development [94]; both low and high birth weights are of concern and have long-term health implications. The CIHI, reports that 6.1% of babies born in a Canadian hospital between 2010 and 2011 had a low birth weight, while provincially the rate was 6.6% in Ontario [46]. The low birth weight rate is defined by CIHI as any live birth weighing between 500-2,499 grams⁸. However, it must be recognized that APHEO's and PHAC's definition of low birth weight differs from CIHI in that it includes any live birth weighing less than 2,500 grams [47,48]. Unfortunately, a consistent definition of low birth weight is not adhered to by various organizations thus impacting the interpretation of statistics within our country.

According to APHEO, “low birth weight may be associated with premature birth or slow growth of the fetus or both, but each issue has different public health implications” [48]. Furthermore, low birth weight and preterm birth are often associated in terms of their significant link to infant mortality and morbidity [17]. For example,

8. It is worth noting that low birth weight is ideally considered within the context of gestational age, and that there are other relevant birth weight indicators, including very low birth weight rate (VLBW), extremely low birth weight rate (ELBW), small for gestational age (SGA), and large for gestational age (LGA) – however for the purpose of this paper, the focus remained on low birth weight [48].



there is growing evidence to demonstrate that low birth weight can lead to a wide range of deleterious health and developmental problems both in childhood and later in life, such as diabetes [50], hypertension, ischemic heart disease, stroke, malignancies, osteoarthritis, and dementia [30]. Such findings suggest the impact of in-utero developmental conditions, such as under or malnutrition, on the future health of the infant [50] and emphasize the need for effective primary prevention before conception occurs.

Growing attention has also been drawn to high birth weights, defined as a birth weight of 4,500 grams or more [49], due to the link to intermediate and long-term health problems, including childbirth complications as well as child and adult morbidity and mortality [50,51,52,53]. High birth weight can increase risk for type 2 diabetes, asthma, hypertension, breast cancer, and childhood leukemia [50, 52]. New evidence suggests that high birth weight increases risk of being overweight [50] or obese [33,100] later on in life in life.

Birth weight is affected by many factors, including maternal age, birth spacing, multiple births, gestational age, parity, lifestyle factors (e.g., smoking), weight gain, intrauterine infection, diabetes, genetic factors, and more [36]. A growing amount of research also points to the links between birth weight and social determinants of health, such as race, income, and physical and social environments [53,54].

Congenital anomalies

Congenital anomalies, also known as birth defects or congenital malformations, are “abnormalities that are present at birth, even if not diagnosed until months or years later” [55]. In Canada, about “1 in 25 infants is diagnosed yearly with one or more congenital anomalies” [55]. They are a leading cause of infant death, second only to preterm birth [55,56]. Six significant categories of congenital anomalies in Canada include: Down syndrome (trisomy 21), congenital heart defects, neural tube defects, orofacial clefts, musculoskeletal anomalies (including limb deficiency defects), and gastroschisis [55,57]. The most severe and fatal congenital anomalies include anencephaly, trisomies 13 and 18, and severe congenital heart defects [58].

The congenital anomalies rate is the number of live births and stillbirths identified as having at least one congenital anomaly, per 10,000 live births and stillbirths [57]. In 2009, for every 10,000 live births and stillbirths that occurred in Ontario, 386.1 babies were born with a congenital anomaly [57]. It is suspected that the rate of congenital anomalies is under reported due to certain conditions not being diagnosed after birth, and due to pregnancies terminated as a result of prenatal screening and diagnosis [55,57].

The majority of congenital anomalies (40% - 60%) are from unknown causes [57]. General known causes include: genetic conditions, infections, chronic diseases, pharmaceutical drugs, recreational drugs, and environmental risks [55]. The following highlights some of this information.

Genetic conditions such as chromosomal and Mendelian inherited disorders are known to cause congenital anomalies including Down syndrome. For instance, advanced maternal age is reported to be the “most significant established risk factor for Down syndrome” [55]. Attention to late paternal age should also be considered, especially regarding the “increased risks for de novo genetic mutations” [55].

Infections commonly associated with congenital anomalies include: rubella, cytomegalovirus, varicella and toxoplasmosis [58]. According to Public Health Agency of Canada, “cytomegalovirus and toxoplasmosis are now the most common known infectious teratogens” [55]. Sexually transmitted infections, such as

chlamydia, gonorrhea, syphilis, and human immunodeficiency virus can also be associated with birth defects if left untreated [55].

Chronic diseases commonly known to increase the risk of congenital anomalies include: maternal obesity, hypertension, diabetes, and thyroid disease [55]. A number of these chronic conditions “may co-exist and all increase in prevalence with advanced maternal age” [55]. For example, maternal obesity has been associated with “neural tube defects, congenital heart defects, orofacial clefts, hydrocephalus, anorectal atresia and limb reduction abnormalities”. Diabetes has been associated with an increased risk for spontaneous abortions, fetal growth abnormalities and for the child developing “obesity, diabetes, and attention disorder”. Thyroid disease has been linked to birth defects such as “congenital heart disease, hydrocephaly, hypospadias and isolated anorectal atresia” [55].

Pharmaceutical drugs commonly associated with congenital anomalies include: folic acid antagonists (e.g., Methotrexate), anticonvulsants/anti-epileptics (e.g., Dilantin), coumarin derivatives (e.g., Warfarin), angiotensin-converting enzyme inhibitors/antihypertensives (e.g., Ramipril), and retinoids (e.g., Accutane) [55,58].

Furthermore, recreational drugs, maternal smoking, and environmental risks have also been associated with congenital anomalies. For example, some recreational drugs have been associated with “gastroschisis and neuroblastoma,” maternal smoking has been associated with an “increased risk of defects of the cardiovascular, orofacial clefts, musculoskeletal and gastrointestinal systems,” and environmental risks such as living “near industrial sites or socioeconomically deprived areas” (e.g., landfill sites) have been linked to birth defects and some types of cancers [55].

However, the most widely used drug known to cause adverse fetal effects is alcohol [58]. A woman’s alcohol consumption in pregnancy can cause fetal harm, specifically fetal alcohol spectrum disorder (FASD) [26]. FASD is the leading known cause of preventable birth defects and developmental disability among Canadian children [59]. Approximately 9 in every 1,000 babies born in Canada are affected by FASD [59]. According to the Canadian Maternity Experiences Survey, 10.5% of pregnant women continue to drink during pregnancy; with binge drinking reported in 11% of women prior to realizing they were pregnant [60]. Addressing the issue of alcohol consumption before conception is critical. Given that almost half of all pregnancies are unintended [26] and that 62.4% of women of reproductive age report alcohol use during the three months prior to pregnancy [61], prevention of FASD requires education in the preconception period. The SOGC has published “Alcohol Use and Pregnancy Consensus Clinical Guidelines” to help physicians address the issue of alcohol use during pregnancy and supports a PCH approach [26].

Overall, primary prevention is key in reducing the burden of all types of known congenital anomalies. Public health initiatives to prevent or reduce exposures to all well documented risk factors should be strengthened [55].

“Laying the foundation for a lifetime of good health begins even before babies are conceived, and continues through the first months of life. We must provide the support young women need to maintain their own health and start their babies on the path to health” - Government of Ontario (Healthy Kids Panel) [32].

Neural tube defects and folic acid supplementation

One of the congenital anomalies with ongoing attention is neural tube defects (NTDs). NTDs occur when the baby's spinal cord, skull, or brain does not develop normally, resulting in the neural tube (which develops into the brain and spinal cord) failing to close properly [62]. Examples of NTDs are "spina bifida (the spine or its covering stick outside of the body), anencephaly (absence of part of the brain), and encephalocele (part of the brain grows outside the skull)" [62].

The NTD rate is the number of live and stillbirths in which the infant has a neural tube defect, per 10,000 live and stillbirths. In 2009, for every 10,000 live and stillbirths that occurred in Ontario, 4.2 babies had a neural tube defect [57]. NTDs are extremely costly to society - the direct health care costs for children with spina bifida in Canada is \$1.7 million per year [63]. This does not reflect the lost economic potential related to spina bifida or the psychosocial costs of spina bifida on children and their families.

While there is some evidence that NTDs are decreasing due to folic acid supplementation, (Canada mandated the fortification of all white flour and pasta products in 1998), it does not eliminate them completely [64]. The consumption of a daily multivitamin that contains 0.4-1.0 mg of folic acid for all women of reproductive age is therefore recommended to reduce the risk of having a baby with a NTD [65]. A higher daily dose of up to 5 mg of folic acid may be suggested by a HCP for women with increased risk factors for NTDs, such as obesity, diabetes, and epilepsy [62]. Yi et al [40] have demonstrated that the economic benefits of prevention of NTDs with folic acid supplementation far outweigh the costs. An emerging issue is the increasing number of individuals avoiding fortified wheat containing products and adopting a gluten-free diet, either by choice or for medical reasons, such as celiac disease. It is estimated that celiac disease affects approximately 1% of Canadians [66]. Women, who adopt a gluten-free diet, are not benefiting from fortified products and may be at risk of inadequate folate intake, thereby further emphasizing the need for supplementation [67].

According to Health Canada, two thirds of NTDs could be prevented if all women of reproductive age took a multivitamin containing folic acid daily [58]. However, it is important to note that accessing or following through with folic acid supplementation recommendations may be a challenge or barrier for some women, particularly those with disabilities, low education, and those from low socio-economic status. Interestingly, the Canadian Community Health Survey in 2011 reported from 2007 to 2010 that only 50.4% of women who had been pregnant in the last five years had taken folic acid before they knew they were pregnant [158]. These results highlight the importance of enhancing public awareness about NTDs and the importance of taking a multivitamin with folic acid in the preconception period as a prevention strategy for women, especially those with increased risk factors.

Infant mortality

The most alarming birth outcome is infant mortality. The infant mortality rate is the total number of deaths of live born infants 364 days of age or younger, per 1,000 live births [68]. The infant mortality rate is considered an indicator of population health and well-being [69]. High infant mortality rates within a community are an indication of poor social and economic conditions, such as low levels of education and limited access and equity in health service availability [70,71]. Infant mortality rates are reported to be higher among multiple births and births to women over 35 years of age [72,73]. In 2011, Canada had an infant mortality rate of 4.8 infants per 1,000 live births. Ontario's infant mortality rate was slightly lower than the national average with 4.6 infants per 1,000 live births [74].

Although Canada has dramatically decreased its infant mortality rate over the past few decades, other countries have done significantly better. More specifically, Canada had the second highest rate of infant mortality among seventeen peer countries, while Japan, Sweden and Finland had the lowest rates respectively [75]. According to the Conference Board of Canada [75], the greater number of low birth weight and preterm babies, coupled with the discrepancies among countries in defining “live births”, could be contributing to Canada’s higher rate of infant mortality.



Maternal mortality

The maternal mortality rate is the total number of maternal deaths (occurring during pregnancy, childbirth or within 42 days after delivery or termination of pregnancy) divided by the number of deliveries per 100,000 delivered [76]. Similar to the infant mortality rate, the maternal mortality rate is an indicator of the health of the community and health equity disparities.

Compared to many parts of the world, Canada is a safe place to have a baby, demonstrated by relatively low and stable rates of maternal mortality. However, a WHO report [78] highlighted that Canada’s maternal mortality rate rose from 6 to 11 per 100,000 births between 1990 and 2013 [77]. More analysis is required to determine the exact reason for the increase in rates, but experts suggest that rising chronic health issues, such as obesity and diabetes, as well as delaying childbearing could be contributors [78]. Shifting focus to preconception health messaging and interventions may provide opportunities to impact these confounders. In the case of diabetes, research and guidelines demonstrate a clear need to address diabetes in the preconception period [30,79,80].

Emerging trends

In addition to the well-researched risk factors discussed above, there are several newer issues that also highlight the need for intervention prior to conception. Some of these include advanced maternal age, obesity, and mental health.

Advanced maternal age

The population of women giving birth who are 35 years or older (also referred to as women of advanced maternal age) is growing. According to CIHI [81], “almost one in every five births in Canada is to a woman age 35 or over”. More specifically, this rate has “increased from 15% in 1998 to 18% in 2007” with a projection that this rate will continue to rise [81].

This growing trend has important implications on preconception health interventions due to the impacts on fertility as well as maternal and infant health outcomes. In women, fertility begins to decline in the early 30’s and continues to drop as a woman’s age increases. Health Canada [218] reports that 77% of

women at age 35 are physiologically able to become pregnant, while at age 40, this decreases to 53%. Although men do not experience a similar decline in their fertility, remaining fertile into their 60's and 70's, concerns about the quality and quantity of older men's sperm exists [82,218].

Compared to women under the age of 35, women of advanced maternal age are more likely to have pre-existing medical conditions, such as hypertension, diabetes, cancer and arthritis, which may impact their fertility and also increase risk to the developing fetus once pregnant [55,83]. During pregnancy the development of conditions such as diabetes, hypertension, pre-eclampsia, and placenta previa are more common among women over 35 years [84,85,86,87] and at birth there is a higher risk for requiring a Caesarean section [88,92]. A recent WHO report [78] also suggests that advanced maternal age could possibly be one contributor to the rise in maternal mortality rate in Canada.

Babies born to women of advanced maternal age are at increased risk of congenital anomalies, chromosomal and non-chromosomal abnormalities, preterm birth, low birth weight, small for gestational age, and intrauterine growth restriction (IUGR) [86,87,89,90,91]. To address this current trend and to assist women in making an informed choice in their reproductive plan, it is recommended that women be well informed regarding the impact of age on fertility and birth outcomes.

Obesity

Another issue receiving considerable attention is maternal obesity. Several key documents have highlighted the importance of optimizing maternal pre-pregnancy body weight [32,33,94]. The Institute of Medicine and the National Research Council [94] and Health Canada [65] recommend women enter pregnancy with a Body Mass Index (BMI) of 18.5-24.9. According to the Canadian Community Health Survey in 2012, 39.1% of women of reproductive age (18 to 49 years) in Ontario were obese or overweight [49]. Being underweight, overweight or obese before conception has been linked to chronic medical conditions and reproductive, pregnancy and birth related complications [33,94]. For example, maternal obesity has been linked to "neural tube defects, selected forms of congenital heart disease, cleft lip, cleft palate, anorectal atresia, hydrocephalus, and limb reduction deficiencies" [55]. These harms are magnified with gaining excess gestational weight during pregnancy. Given this, Health Canada [65], SOGC [27], and the Institute of Medicine [94] recommends "offering preconceptional services, such as counseling on diet and physical activity as well as access to contraception, to all overweight or obese women to help them reach a healthy weight before conceiving".

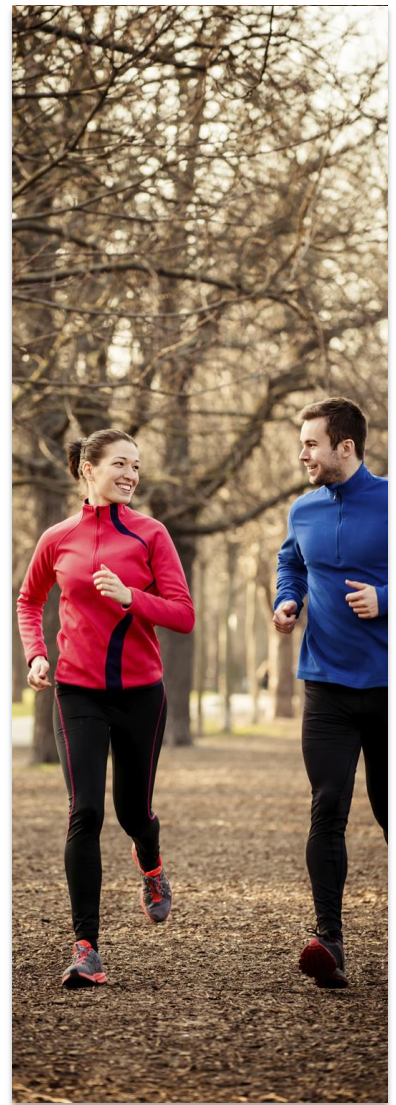
Increasingly during pregnancy, women are gaining more weight than recommended by gestational weight gain guidelines, posing additional risks to maternal and fetal health [33]. Over 50% of women in the overweight and obese BMI category gain in excess of the gestational weight gain guidelines [95], putting them at risk for postpartum weight retention. Consequently this may put women in a higher BMI category for subsequent pregnancies. Furthermore, the increased risks associated with excess gestational weight gain include: preeclampsia, gestational diabetes, gestational hypertension, Caesarean section, small or large for gestational age babies, and overweight/obesity in childhood [27,94,97,98,99,100].

Interestingly, attention has also been directed to the link between parental obesity and childhood obesity [32,33]. Given the links between pregnancy weight gain and child health, a recent study suggested that preventing maternal overnutrition, overweight and/or diabetes during pregnancy could be a promising strategy for preventing childhood obesity [50].

Mental health

The importance of mental health before pregnancy is becoming increasingly evident. A recent study found that women who reported poor mental health before pregnancy were 40% more likely to have a pregnancy complication, almost 50% more likely to have a non-live birth, and nearly twice as likely to deliver a low birth weight infant [101]. Once pregnant, mental illness can affect a mother's functional status including her decision making capacity, which may impair her ability to obtain prenatal care and avoid dangerous behaviours [102,103]. Women with poor mental health, such as depression, may be more likely to use substances, such as alcohol, nicotine, and illicit drugs before and during pregnancy [102,104,105,106]. In addition, severe depression can increase the risk of self-harm, psychosis, and impulsive and harmful behaviours that can affect pregnancy [102,107].

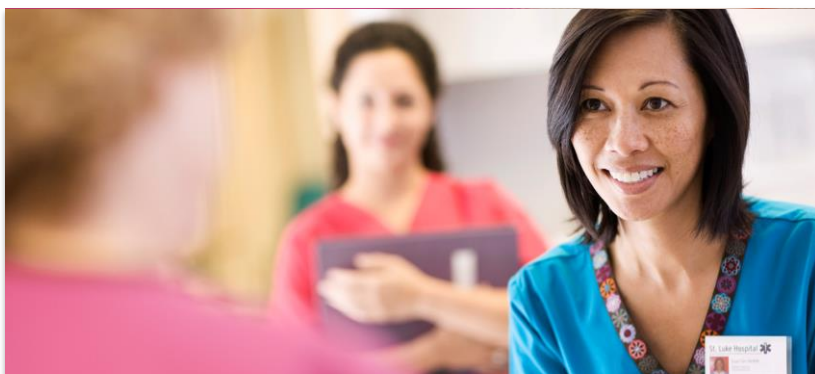
LGBTQ women may also be predisposed to perinatal depression due to issues related to social support, the couple relationship, and legal and policy barriers [109,175]. Challenges due to difficulty conceiving and heterosexism within the fertility system were also identified as having emotional consequences to lesbian and bisexual women trying to conceive [109]. The family context of lesbian and bisexual women differs from that of heterosexual women and fertility services may not be reflective of these differences. Issues such as the language used on forms, accepting the relationship of the sperm donor (i.e. may not be a sexual/intimate partner), and who, in a same-sex woman relationship, plans to be the biological mother are facets that differ from heterosexual care [109,110]. Such findings emphasize the importance of intervening prior to pregnancy to address and improve mental health and functioning.



Preconception counselling and risk assessment can provide an opportunity to review and modify medication use if necessary. Although most commonly used antidepressants are not major teratogens and are safe to consume during pregnancy, some women discontinue the use of antidepressants during pregnancy due to fear of harming their babies [111,112]. Since the sudden discontinuation of antidepressants can cause women to experience “discontinuation of symptoms or re-emergence of the primary psychiatric disorder” [108,112], it is important to educate women of reproductive age with mental health issues about the safety and efficacy of taking antidepressants during pregnancy.

In summary, there are multiple risk factors for poor birth outcomes including preterm birth, low birth weight, congenital anomalies (such as neural tube defects), and infant and maternal mortality. New evidence highlights that maternal obesity, advanced age and mental health may also contribute to poor outcomes. Many of these risk factors are modifiable in the preconception period and should be addressed by HCPs. Recognizing that it takes multiple attempts to affect change in health behaviours, it is important for health professionals to identify and provide interventions related to these risk factors for all individuals throughout the reproductive years. For a detailed review of specific preconception risk factors and strategies to address them, please refer to Appendix A.

CURRENT STRATEGIES



While the importance of PCH is clear, the most effective strategy for delivering services is currently unknown. A review by Shannon et al [113] identified primary care as the most common method of PCH service delivery; however, the authors also concluded that there is no consensus on the best way to deliver PCH and argued that multiple strategies acting synergistically may best facilitate service delivery. Furthermore, Mitchell and Verbiest [114] note that strategies to address PCH from both health promotion and clinical intervention levels are challenging because of the high number of unplanned pregnancies and the number of issues that should be addressed in the preconception period (e.g., lifestyle, screenings and vaccinations, chronic disease management). However, it is important that PCH strategies be delivered on both community and clinical levels to maximize reach [13].

In the absence of a standardized provincial or national framework, critically examining and using current evidence is necessary to inform the programming for PCH. A recent literature review by Wellington-Dufferin-Guelph Public Health Unit (WDGPH) explored health promotion strategies for increasing PCH awareness and behaviour change [115]. While not a systematic review, four strategies were recommended: public awareness campaigns, reproductive life plans, PCH visits, and HCP outreach. These strategies, along with emerging initiatives in the area of innovation and technology, will be critically examined in this section.

Public awareness campaigns

Raising public awareness of PCH is well supported by the literature as an important and popular strategy [17,114,115]. Various health communication campaigns have been developed in Ontario on both local and provincial levels, such as the 2013 “What’s Your Plan?”⁹ campaign by Toronto Public Health and the BSRC 2005 “Is there a Baby in your Future? Plan for it”¹⁰ campaign. Often campaigns include both web and print-based approaches, with an increasing number of campaigns exclusively using the web and social media to promote messaging. WDGPH [44] surveyed 26 of the 36 Ontario public health units and found that the development and implementation of community campaigns and website information was common. Unfortunately, the majority of strategies only targeted women. Mitchell and Verbiest [114] note that often preconception campaigns focus on single health topics for women of reproductive age (e.g., folic acid supplementation, avoiding alcohol intake); however, the current challenge is to determine how best to communicate the breadth of preconception topics and target more diverse audiences, such as men, adolescents and LGBTQ. The authors argue that communication campaigns need to “effectively bundle and deliver a PCH ‘package’ to consumers in a way that resonates with them and motivates them to take action” [114]. Furthermore, to date, most strategies and messages have targeted individuals,

9. http://www.toronto.ca/health/pregnancy/before_pregnancy.htm#tab_1

10. <http://www.healthbeforepregnancy.ca/future.htm>

leveraging heavily from chronic disease prevention programming, such as healthy eating and lifestyle messaging. However, it is important that PCH also employ strategies that target community and system level changes to shift the onus from the individual to the broader community [13].

Some additional challenges with existing PCH campaigns are that target audiences vary and messages may not be clear [116]. This can hinder message uptake and ultimately impact desired outcomes, such as behaviour change. Furthermore, limited evaluation has been conducted on campaigns, restricting the ability to determine the effectiveness of such strategies in achieving outcomes or in their ability to reach the intended audience [114].

Mitchell et al [116] argue that PCH could benefit from brand development to ensure consistent messaging and ensure clients know what to ask and care providers know what to provide in terms of education. For example, the “Show Your Love”¹¹ campaign developed by CDC in 2013 is a model of such branding.

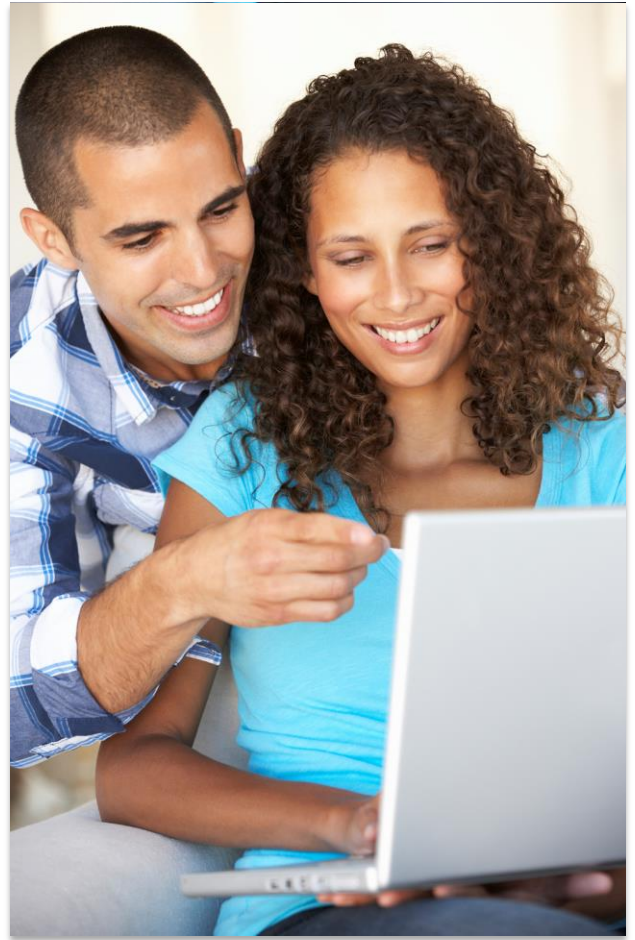
While awareness raising is an important and popular strategy, there is a growing call from organizations and researchers to move beyond communication campaigns [114]. A report by BSRC stated that: “we have moved beyond the need for generic campaigns that promote the importance of preconception health for women” [117]. Instead, the report highlights the need for additional services to strengthen PCH in Ontario, such as focusing on specific preconception risks and what individuals can do to improve their health before conception, such as taking folic acid, stopping substance use, adjusting medications, addressing pre-existing medical conditions, updating immunizations, and considering risks in home and workplace environments [117]. While there is a need for more public awareness of PCH in Ontario, addressing common gaps as described above and evaluating existing campaigns to assess their effectiveness should be considered before future implementation.



11. <http://www.cdc.gov/preconception/showyourlove/>

Reproductive life plans

Increasing awareness about reproductive life plans (RLP) is identified in the literature as an important and effective strategy [12,115]. A RLP is a tool that can be used by individuals to assist in developing personal goals as to whether (or not), when and how to have children [118]. RLPs are also strongly supported by the CDC [17] and can be used by HCPs as a communication tool regarding contraception and PCH care with clients [119]. A Swedish randomized control trial found that RLPs were an effective tool in promoting reproductive health among women [120]. Ultimately, RLPs should be initiated in the early reproductive health years for the greatest impact. However, given the growing rate of advanced maternal and paternal age in Canada, a RLP may also be utilized to increase awareness of the implications of delaying childbearing. Plans have also been tailored to specific high-risk populations, such as youth and marginalized women [121], and research has shown that they are useful in a range of settings (e.g., community, clinical care, schools). There is growing interest in using a RLP as a tool for promoting PCH in Ontario. As a result, BSRC collaborated with several Ontario Public Health Units to develop and release a RLP for youth [122].



Preconception health care integration

HCPs are in a unique and trusted position to deliver PCH messages. Interestingly, two Ontario surveys of individuals of reproductive age clearly identified HCPs as the most effective and preferred source of preconception information [117,220]. Clinical care settings provide a promising context for PCH service delivery. In Canada, 83% of women and 70% of men ages 18-64 years reported consultation with their physician annually [123]. Integrating PCH care into every contact between a HCP and an individual of reproductive age is well supported in the research [3,4,113,115,124]. Such an approach argues that PCH should be a process and integrated into on-going dialogue between the HCP and client, and not a single purposeful visit. Integrating preconception assessment, intervention and education into every clinical contact enables both planners and non-planners to be reached. This approach has led to the “Every Woman, Every Time” campaign¹² in the United States, however such models depend heavily on the motivation and knowledge of the HCP to focus on PCH issues. The annual physical and Pap test may be considered opportune times to provide PCH care, however in Ontario annual physicals are no longer recommended and guidelines regarding Pap tests have changed to every three years. This change could be construed as a barrier to providing PCH care, however if PCH care is to be integrated into every contact, as the evidence suggests, the current model may simply prove as an opportunity to realign our thinking and shift it to explore other avenues for integration such as utilization of specific tools.

12. http://www.everywomanalifornia.org/content_display.cfm?contentID=359&categoriesID=120&CFID=33569

The National Preconception/Interconception Care Clinical Toolkit [125], designed as a “one stop” resource for HCPs, is an example of such a tool. Posing one simple question “Are you hoping to become pregnant in the next year?” [125,219] will help to individualize further assessment, intervention and health promotion messaging to best meet the overall and reproductive health needs of clients. In order to be more inclusive, this question could be modified to “Would you like to have a child in the next one to two years?” Taylor and James [126] note that, “preconception counselling should not be limited to only a discussion of ways to optimize pregnancy outcome and prevent unintended pregnancy, but also provide a way to address other preventive health concerns”.

Based on the recommendation for integrating PCH interventions into every HCP contact with women of reproductive age, the World Health Organization [13] identified the following evidence-based interventions:

- Prevention of pregnancy in adolescence;
- Prevention of unintended pregnancies;
- Promotion of birth spacing;
- Optimizing pre-pregnancy weight;
- Promotion of healthy nutrition including supplementation/food fortification, such as folic acid intake;
- Promotion of vaccination of children and adolescents.

Furthermore, services for women with special risk factors that increase the risk for preterm birth include:

- Screening for, diagnosis and management of mental health disorders and prevention of intimate partner violence;
- Prevention and treatment of sexually transmitted infections (STIs), including HIV/AIDS;
- Promotion of tobacco use cessation and restriction of exposure to second hand smoke;
- Screening for, diagnosis and management of chronic diseases, including diabetes and hypertension [13].

As more research becomes available on paternal factors and their links to birth and child health outcomes, preconception interventions for men of reproductive age will need to be developed.

Currently in Canada, a PCH care screening tool has not yet been developed; however, in Ontario an opportunity to develop such a resource is currently being explored by the Ministry of Health and Long-Term Care (MOHTLC). Ideally a PCH specific tool would be most beneficial; however, if a specific PCH tool does not become a reality in Ontario, it may be worthwhile to explore other preventive health care checklists that include PCH content. The Greig Health Record (for children and adolescents aged 6 – 17 years) and Preventive Care Checklist Form© (for adults) are both validated, easy-to-use, and evidence-based tools that are endorsed by the College of Family Physicians of Canada [127,128]. Although these tools are currently available for use by HCPs in Ontario, it is not known to what extent they are put into practice. While these tools are not PCH specific, they do incorporate many preconception health topics, such as substance use, folic acid supplementation, and STI screening. Furthermore, an implementation process, which meets billing requirements [129], already exists for both tools. Expansion to include integration of an opening question as previously discussed and shifting the current focus to include a PCH context may be a worthwhile consideration.

HCPs are a trusted source for providing health education over time. They have the opportunity to share information during the interconception period to impact future pregnancies and chronic disease prevention later in life. Recognizing this, the CDC Select Panel [17] outlined the importance of interconception counselling as a strategy to help individuals reflect on a previous pregnancy and birth outcome and to address risk factors before a subsequent pregnancy. For example, discussing postpartum weight loss may also be an opportunity for healthy weight, exercise and nutrition counselling. It is therefore imperative to empower midwives, obstetricians, physicians, nurses, dietitians and other allied health professionals as appropriate to provide evidence-based interventions to women and families during the interconception period, particularly those who have had a previous adverse pregnancy outcome (e.g., low birth weight). Starting risk assessments and interventions early in the postpartum period can be an effective and efficient way to deliver care given the intensity and routine of postpartum follow-up with HCPs. Recognizing this, the American Congress of Obstetricians and Gynecologists, District IX and the March of Dimes developed the Interconception Care Project for California, with an aim “to improve and promote the interconception health of women by maximizing care provided during the postpartum visit” [130]. As part of the project, 21 algorithms were developed to guide risk assessment, management and counseling during the postpartum and interconception periods.

Currently in Ontario an interconception specific screening tool does not exist. However, the Ontario Antenatal Record¹³ (OAR) is a routine follow-up tool that guides Ontario physicians and midwives in their care through both the prenatal and postpartum periods. Some interconception content is covered in the postnatal visit section, such as birth outcomes, Rubella immunization and tobacco use. The tool also encourages HCPs to address emotional challenges, folic acid, contraception, relationship concerns, social support, family violence, and advice regarding future pregnancies and risks. While the current OAR form contains limited interconception messaging, an opportunity to enhance the tool with a PCH lens may be worth exploring.

Health care provider outreach

Despite HCPs being the preferred and trusted source of information [117,220], there is no standardized preconception care education program for physicians, nurses or allied health professionals in Ontario. In the United States, PCH education modules have been developed for nurses [131], physicians and midwives [125]. Training related to preconception care is critical to ensure providers have the knowledge and resources to deliver evidence-based interventions and messages. Lack of training and time are frequently cited as barriers to physicians providing preconception care [113,132]. A 2009 Best Start survey found that 97% of HCPs agreed that preconception care is important, but only 78% indicated that they provided preconception care on a daily or weekly basis, only 64% provided PCH check-ups and 25% displayed educational information [216]. The survey also found that physicians were more likely to provide preconception care to women than men and, the



13. <https://ocfp.on.ca/docs/default-source>

authors concluded that physicians may be missing key opportunities to provide preconception care [216]. It is important to note that currently there is no direct reimbursement for integrating PCH into all contacts with clients of reproductive age in Ontario. Whether to establish a billing code for such interactions or to tackle compensation in other ways, such as modifying the existing Greig Health Record and Preventive Care Checklist Form© to integrate more PCH messaging, should be explored with the HCP community.

Specific preconception care clinics have been established in Europe and in the United States as a strategy to overcome provider time and training barriers. However, such models will only reach those motivated to plan a pregnancy. Providing outreach to all HCPs will help to integrate PCH messages at every health and wellness visit [133]. Such an approach can allow physicians, nurses and other health professionals to play a role in risk screening, intervention and education [133]. The importance of both physicians and nurses in delivering PCH interventions and promoting messages is emphasized in the literature [115,133]. BSRC [117] notes that “HCP strategies should be considered in order to strengthen available preconception care services”.

Innovation and technology

The use of health information technology as a tool presents new opportunities to improve and expand PCH strategies [13,134]. Recognizing this, the WHO [13] highlighted the need to “explore and document innovative ways to deliver preconception care outside the traditional maternal and child health programs”. Such technology may help to overcome barriers experienced in delivering preconception care, such as provider time and knowledge, as well as increasing accessibility to client populations who primarily access health information online. In 2012, 84% of Ontarians aged 16 or over used the Internet for personal use from any location [135]. Fifty eight percent accessed the Internet via a wireless handheld device, such as a cell phone or tablet [135]. Canadians aged 16 to 24 were most likely to use a wireless handheld device to connect to the Internet [135]. Globally, there are 665 million daily active Facebook users and 200 million monthly active Twitter users [136]. These numbers are impressive and demonstrate the need to explore and invest in e-strategies.

Recognizing this trend, an online patient-centered program called the Gabby Preconception Care System has been developed in the United States [134]. The Gabby system helps to screen for and address preconception risks, assess readiness for behaviour change, and provide health education. While still in the development stage, early pilot data suggests users find the Gabby system useful, easy to use, reliable, and trustworthy [134]; however, further research is needed to determine effectiveness on promoting awareness and behaviour change.





While mobile device technology has not been extensively used to date in PCH, it has been successfully used in several innovative prenatal health promotion programs, such as Text4baby¹⁴, the M+B 2B app¹⁵, and the interactive Healthy Weight Gain During Pregnancy website¹⁶ and Twitter feed. Text4baby is a free program where subscribers receive timely text messages about pregnancy, baby care and parenting. Reminders of upcoming appointments can also be activated. This initiative was made possible through public and private partnerships. Text4baby is reaching women of low socio economic status and of those who enrolled over 39% were in their first trimester [137]. Users demonstrate increasing health knowledge and preparedness, improved appointment attendance and found the program assisted in facilitating interaction with HCPs and improving access to health services [137].

The M+B 2B app developed by Niagara Public Health is a free tool that incorporates credible, easy to use, evidence-based information beginning with tools for planning a pregnancy through to birth [217]. Some interconception content is also included. The app also complies with the Baby-Friendly Initiative guidelines. Although the app directs individuals to Niagara Region specific resources, as of May 2014, it had been downloaded in 112 countries.

The Institute of Medicine and the National Research Council launched an interactive website and social media campaign around healthy weights before, during and after pregnancy [96]. The website helps users calculate their BMI and encourages women to enter pregnancy with a healthy body weight. It also allows users to calculate the recommended amount of weight to gain in pregnancy based on their BMI and engage a virtual avatar in finding answers about healthy weight gain in pregnancy. In addition to more traditional print media strategies, the campaign also launched a Twitter discussion around weight gain and pregnancy. Further examination of these mobile strategies is important to see if they could be effective for disseminating PCH information.

While the evidence on PCH promotion and care delivery is limited, promising strategies are currently being utilized. It is important to note that the above discussion was not exhaustive and there are other strategies being used that were not discussed in this section, such as use of peer educators [133,138], and should be examined as more research is available. Although the need to shift the balance of attention from the prenatal period to preconception remains paramount, it is apparent that more research is needed to evaluate the effectiveness of the various strategies currently being utilized and to remain receptive to new innovations ahead. It is critical to ensure that strategies target diverse audiences, including women, men, adolescents, LGBTQ, and HCPs, and that access and equity issues be considered.

14. <https://text4baby.org/>

15. http://www.niagararegion.ca/living/health_wellness/pregnancy/baby_app.aspx

16. <http://resources.iom.edu/Pregnancy/WhatToGain.html#>

GAPS & CHALLENGES



There are several major gaps and challenges which hamper effective implementation of a PCH agenda in Ontario, including lack of consistent and ongoing data monitoring, limited research and evaluation, lack of political and public awareness, limited diversity of target audiences, and limited resources.

Data monitoring

One of the major challenges in discussing PCH is the lack of consistent use and ongoing monitoring of relevant public health indicators in Ontario and elsewhere. Public Health Ontario (PHO) acknowledges “the health of our population is dependent on the health of our ... ‘children’, yet Ontario lacks a coordinated population health assessment and surveillance system to monitor our success” [139]. Recognizing this, the Association of Public Health Epidemiologists In Ontario (APHEO) Core Indicators Work Group, in collaboration with PHO, reviewed the availability of various public health indicators in Ontario, including those related to PCH [140]. Among the many gaps found, data and indicators related to PCH were significant. In 2012, the only provincial indicator available was folic acid supplementation. Although progress has happened in this area, when taking into consideration the expanse of factors encompassed by PCH, it quickly becomes evident that more data are required to inform and guide PCH planning and programming in Ontario. A number of indicators were identified as being in development or to be created in the near future, such as adult body mass index. However, many indicators, such as number of women in reproductive years, are still missing. Table 2 outlines data and indicators that would assist in data monitoring and evaluation related to PCH in Ontario.

The table illustrates that numerous data gaps exist and that the indicators and data being sought are focused on the woman. As previously discussed, PCH must encompass all individuals. Data gathering must extend beyond the female to also include broader sociodemographic indicators, such as race, income, gender identity, gender expression and sexual orientation. The value of comprehensive core indicators can be seen in the CDC report entitled “Morbidity and Mortality Weekly Report (MMWR) Core State Preconception Health Indicators” [215].

Table 2: Indicator and data gaps for preconception health in Ontario [140,141]

Indicator gaps		Data gaps
<i>Indicators under development or under construction</i>	<i>Indicators not yet developed</i>	
Adult Body Mass Index	Number of reproductive aged women who have a family physician	Use of fertility treatments among women of reproductive age
Vegetable and Fruit Consumption	Ethnicity of reproductive aged women	Multi-vitamin intake (including folic acid) among women of reproductive age
Self-Perceived Life Stress	Number of reproductive aged women	Alcohol/drug use
Heavy Drinking Episodes	Geographic distribution of reproductive aged women	Awareness of community services
Leisure-Time Physical Activity	Sexually transmitted infection rates among women of reproductive age	Environmental toxins exposure
Self-Perceived Work Stress	Alcohol consumption among women of reproductive age	Family violence
Smoking Status	Oral health	History, screening, testing
Smoke-free Homes	Maternal health conditions	Nutrition
Non-Smoker Second-hand Smoke Exposure		Physical activity
		Preparation for breastfeeding
		Primary care provider of pregnant women
Number of Sexual Partners		Work and home environment
		Transition of parenthood

Research and evaluation

In addition to data and indicator gaps, there are also significant gaps in the area of PCH research and evaluation. The CDC’s Select Panel highlighted the need to “increase the evidence-base for preconception health and promote use of evidence in delivering preconception health” [17]. While increased research has been published over the last eight years, limited information on general PCH and effective interventions still remains, particularly regarding those that are community-based and from a health promotion perspective as highlighted in the previous section [17,113,142]. As previously mentioned, more economic evaluations identifying cost-effective interventions and implementation strategies are needed in PCH. Furthermore, the majority of research and evaluation currently available has been conducted outside of Canada. As momentum grows in Ontario, it will be important for initiatives implemented on local or provincial levels to be evaluated and documented to ensure the evidence-base continues to expand and reflect the needs and realities of Canadian PCH work.

Another significant research and programming gap is the predominant focus on individual level interventions. To date, most PCH programming and research has taken a behavioural approach, focusing on changes at an individual level. There is a need to shift the focus from an individual’s responsibility for PCH to

a broader socio-environmental approach whereby responsibility also lies on community and system levels. Additional research and intervention development driven from this lens would help to gain a greater understanding of how to affect change from community and system levels and provide an opportunity to explore the PCH impact of various important social determinants of health, such as race, income, social connectedness, employment and air quality. Women in Canada experience more adverse social determinants of health than men [143], which can contribute to poor birth outcomes, such as preterm birth and birth weight [17]. Furthermore, Shannon et al [113] note that evidence-based strategies for reaching particular groups, such as women with unplanned pregnancies, remain a “conceptual challenge”.

Political and public awareness

With gaps in data and research, it is not surprising that there is also a lack of political and public awareness regarding PCH. Political awareness and support is necessary to shift the reproductive health continuum to include PCH. While there has been growing awareness of PCH in recent provincial reports, there is limited political support for PCH in Ontario. While reproductive health is prominently represented on both the Ministry of Health and Long-Term Care and Ministry of Children and Youth Services websites and resources, information on PCH is lacking. Shifting the messaging to health before pregnancy would be beneficial.

While research has shown that women of reproductive age are aware of the importance of improving their health before pregnancy, gaps have been identified in knowledge related to specific modifiable risk factors and strategies to overcome them [14,144,145]. Furthermore, Ontario specific data from the BSRC [117] survey of women and men in reproductive years revealed gaps in understanding about a man’s health and contribution to the health of a pregnancy and baby. This is not surprising given that most health strategies to date have primarily targeted women. While identifying and reducing maternal risk factors before pregnancy is critical, paternal risk factors also exist and can be addressed through primary and secondary prevention efforts. In fact, WHO [13] recommends that boys and men should be encouraged to become active partners in preconception care. Despite this recognition, there are few initiatives that target or include men, and specific risk assessment, screening and education interventions for HCPs to use with male clients are missing. Including men of reproductive age in preconception initiatives is critical to truly enhance pregnancy outcomes.

Target audience diversity

Men are not the only group who require more focused attention; initiatives to date have rarely been tailored to LGBTQ communities. In particular, there appears to be no published studies examining “the satisfaction of Canadian lesbian and bisexual women with health and social services related to preconception and the perinatal period” [110]. LGBTQ populations seeking insemination, pregnancy and parenting services may have different needs from heterosexual populations. Part of the challenge in designing accessible and inclusive PCH promotion and clinical care services is the lack of research and data on LGBTQ reproductive health issues more generally. Rainbow Health Ontario (RHO) notes that Canadian researchers interested in studying LGBTQ health issues are faced with a number of challenges ranging from limited funding and methodological issues [147]. Furthermore, recruitment of LGBTQ individuals can be challenging due to discomfort in disclosing their sexual orientation or gender identity leading to many studies with small sample sizes. It is also worthwhile to note that lesbians experience increased rates of smoking, alcohol use and obesity, yet demonstrate lower rates of accessing health care services [110]. Concern with discrimination and lack of cultural competency may influence the extent to which lesbian and bisexual mothers access interconception care [110]. To help address this issue, the Association of

Ontario Midwives has developed tip sheets in providing care to lesbian, bisexual, and queer women [148] and for trans men and all "trans masculine spectrum" clients [149]. Developing strategies that specifically target diverse groups will help to shift and normalize the discussion of PCH and overall reproductive health fostering informed decision making and reproductive life planning among all individuals.

Resources

Finally, the current Public Health systems structure, funding and human resources to support PCH initiatives have also hindered implementation. While PCH is mandated in the Ontario Public Health Standards [9] under the Reproductive Health component of the Family Health Program standards, these standards are not specific and local health units must prioritize PCH programming and allocate resources accordingly. In addition, the information on PCH within the Reproductive Health Guidance document is limited [34]. Given the breadth and scope of Family Health programming in Ontario, PCH initiatives must compete for limited resources. Without strong advocates who can champion the importance of local PCH programming, staffing and resource allotments to PCH may be lacking.

As previously highlighted, ensuring that health professionals have the training to develop and deliver PCH initiatives is critical and often a barrier. This extends not just to public health settings but also primary care. For clinical settings, the lack of OHIP billing codes may be a barrier to providing PCH assessment and intervention at every clinical contact with individuals of reproductive age. Shifting priorities to ensure that PCH also receives adequate financial and human resources will be essential to ensuring effective and consistent implementation. Furthermore, ensuring effective collaboration between public and primary health care will be essential in implementing PCH initiatives, an ongoing struggle of the health care systems [150].

PCH is often a missed starting point when conceptualizing reproductive health programming on an operation and systems level. Within the "Public Health Sector Strategic Plan Framework" [151], it is stated that a life course approach is needed. The need for improvement of maternal, child and youth and senior's health is highlighted within the framework, however PCH is absent. To meet the strategic plan's mission to "protect and promote the health of all people in Ontario through the delivery of quality public health programs and services, effective partnerships, and a focus on health equity" a shift in focus to PCH is needed to truly fulfill the recognition of the need for a life course approach [151].



SHIFTING INTO ACTION



In ensuring optimal health for Ontarians, it is essential to broaden the scope of reproductive health practices to include PCH. The PCH platform itself must also be broadened. To truly be effective, PCH must encompass the following guiding principles:

- Preconception health is an important time to promote and protect healthy fertility and focus on reduction of risks, promotion of healthy lifestyles and increasing readiness for pregnancy, whether or not individuals plan to have children one day.
- To fully support reproductive health, attention must be shifted to the preconception period, including interconception.
- PCH must be a universal approach and encompass both health promotion and health care strategies.
- PCH includes all individuals of reproductive age, regardless of gender identity, gender expression or sexual orientation.
- PCH promotion and care includes individuals of reproductive age both planning and not planning to have children one day.
- Supporting efforts to enhance PCH will have an effect on lifelong health.
- A comprehensive approach to PCH is necessary; including advocacy, awareness raising, skills development, reorientation of health services and policy development strategies delivered at the individual, community and population levels.
- A multi-sectoral, interdisciplinary approach which is collaborative is necessary to achieve momentum in the area of PCH.
- Enhancement and building upon existing structures and initiatives is preferred.

To ensure a comprehensive approach to mobilizing this shift the following key actions must be activated: interdisciplinary collaboration, integration, innovation, and inquiry.

Interdisciplinary collaboration

Collaboration across a range of sectors is needed to enhance and support the duality of PCH – health promotion and its clinical component [15]. It is recognized that diverse partnerships are required to affect overall change since “health is bigger than health care, so the public health sector’s efforts to promote health must be bigger than the health sector” [152]. Motivating and inviting leaders and practitioners from various fields will enhance the momentum currently being seen in small pockets across the province. Although it is acknowledged that HCPs play a significant role in providing preconception care [5,12,17,115,

153], broadening collaborative partnerships will bring a new richness to the conversation. Examining effective strategies to develop and support collaboration between public and primary care will be essential [150]. In supporting dialogue amongst varied disciplines and levels, action to reduce the significant gaps in data monitoring, research and evaluation will be achieved. This broadened approach will also support the universality of PCH.

Collaborative partnerships could include, but certainly are not limited to:

- HCPs and their respective governing bodies and associations, such as physicians, nurse practitioners, midwives, nurses, pharmacists, dietitians, and physiotherapists;
- Government, such as Ministry of Health and Long-Term Care, Ministry of Children and Youth Services, and Ministry of Education;
- Research and best practice affiliates, such as Better Outcomes Registry and Network (BORN), APHEO, Public Health Ontario, and Registered Nurses Association of Ontario;
- Non-profit agencies, such as Health Nexus, the Lung Association, Heart and Stroke Foundation and Canadian Diabetes Association, Active Healthy Kids Canada, and ParticipACTION;
- Networks attentive to improving family health, such as HC Link;
- The private sector, such as media based businesses.

Ensuring partners apply an access and equity lens to actions will be critical to protecting the universality and accessibility of PCH. Exploring meaningful ways to engage the public in this process may further strengthen this approach.

To support a collaborative approach, we recommend convening an intersectoral, interdisciplinary provincial committee to lead the coordination of PCH efforts and innovation across the province. In recognition of the vast scope of PCH, it would be recommended to parcel the tasks of the provincial committee similar to that of the CDC Preconception Health and Health Care Steering Committee. The coordinating body may wish to address:

- The development of a provincial PCH platform where clear guidelines are set and consistent definitions are developed;
- The development of policies supportive of moving the PCH agenda forward including examining financial and resource opportunities as well as the ability to repurpose current funding;
- The development of recommendations directing ongoing research to address gaps highlighted earlier in this report as well as assembly of evidence-informed literature, tracking of current trends and emerging issues in a centralized location;
- The unique needs of primary HCPs and other regulated health professionals as it relates to PCH;
- Public health coordination at the population health level. Providing guidance to Ontario's 36 health departments to meet each community's unique needs;
- Reaching out to Ontario Early Years Centres, schools and additional neighbourhood hubs;
- The need for institutional change by advocating for measures to address the social determinants of health, including access to affordable housing, income supports including nutritional subsidies for women and families, and increased access to higher education. This approach will complement the individual level focus of current PCH programming and yield further health benefits across the lifespan, as well as improve maternal and infant outcomes.

Integration

PCH has a broad footprint. With the establishment of a centralized coordinating body, a comprehensive approach to PCH will set the stage for a more integrated approach to PCH. It is important to expand recommendations to encompass all individuals of reproductive age, including all gender identities, gender expressions and sexual orientations, and all those planning and not planning a pregnancy. Integrating diverse preconception voices into programming, reports, policies and systems is key. Developing and delivering PCH public awareness and education campaigns that target all individuals of reproductive age in Ontario would help to address the gaps cited earlier. While some campaigns have locally been developed and delivered in Ontario, a large coordinated campaign would help promote consistent messaging and ensure brand development. An example of this could involve expanding the “What’s Your Plan?” campaign by Toronto Public Health into a provincial e-resource highlighting the services unique to each community within Ontario. Captions such as “What’s Your Plan Thunder Bay?” or “What’s Your Plan Region of Waterloo?” would help to direct individuals to their local services. The “What’s Your Plan?” campaign has generated interest from other Ontario health units as well as the BSRC, indicating that there may be receptivity to moving this campaign to a more comprehensive approach.

However, education and awareness raising is only a single component of a comprehensive approach. Incorporation of a wide variety of health promotion strategies must be realized. These strategies may include, but not limited to, skills development, creating supportive environments, realignment of health care services and establishing policies in support of affecting a shift at all levels.

Realignment of services is addressed by the Healthy Kids Panel [32] where it is recommended to “include a standard pre-pregnancy health check and wellness visit for women planning a pregnancy and their partners”. The effectiveness of this approach is hindered by the need for the individual to anticipate or have the intention of becoming pregnant and realizing the benefit of seeking health care prior to pregnancy. Given the large proportion of the population who do not plan a pregnancy, a call for integration of preconception principals into wellness visits is recommended. By “promoting wellness at every visit, providers maximize the opportunity to impact the health and wellbeing” of individuals “and potentially ensuring a higher level of wellness for those who are planning a pregnancy, as well as those who find themselves with an unintended pregnancy” [154].



To fully support this shift in health care a number of parameters must be mobilized.

1. Standardized education needs to be developed, supported and integrated into health related curriculums for health professional students as well as on-going training promoted with practicing HCPs.
2. Preconception/interconception health key messages and action steps need to be integrated into electronic documentation utilized by HCPs within the clinic, hospital, community and home settings. Consideration must go beyond settings where interactions with the physician/nurse practitioner/midwife occur and include settings where programs, such as HBHC and CPNP, take place.
3. Policy supporting full integration within the primary care domain such as considering the usefulness of a PCH billing code, incentives built into code bonuses, or integration into existing tools to address funding challenges. Policy alleviating time constraints may also be of benefit.
4. Development of provincial tools to support health care professionals; both for the health care professional and for the public. Useful tools that could be utilized:
 - a. A Reproductive Life Plan that incorporates the life course perspective into PCH. As previously noted, the BSRC lead the development of such a tool for the youth population. A similar tool reflective of adult population needs would be a valuable compliment.
 - b. A revision to the comprehensive BSRC “Health Before Pregnancy” website intended for public use.
 - c. Consistent PCH key messages. BSRC currently is leading an initiative to create prenatal education key messages for service providers which will include PCH.
 - d. Explore developing a PCH specific screening tool or revise existing screening tools currently in use such as the Greig Health Record, PCC and OAR to incorporate a PCH/interconception lens.
 - e. Creation of a HCP toolkit to assist with the incorporation of preconception health into practice.

Adoption of such tools on a provincial level would assist to solidify a united provincial approach and integration of these tools into health care services, community programs and education systems would promote consistent messaging.

Although not examined in detail in this report, consideration of how to engage the education system and integrate PCH messages within the elementary, secondary and post secondary education systems warrants attention.

Innovation

It has been demonstrated that although momentum is gaining in the area of PCH, the possible benefits that could be gained from this shift in focus have not been realized. A new approach is needed: one that explores new ways to work with partners and engage the public in an effort to build bridges and support a continuum of care. WHO [13] identified the need to explore innovative ways to deliver PCH programming. The growth of social media and use of the Internet to access health information underscores the need for program planners and decision makers to invest in e-strategies. However, the health field in general has been slow to harness the power and reach of social media [136]. Exploring prenatal health e-practices, such as the previously discussed Text4Baby and M+B 2B app, may provide insight on potential innovative solutions for PCH. Furthermore, an Ontario specific texting program which meets the needs of individuals,

reflective of their stage of life, could act as a reminder of general healthy lifestyle practices, a review of their reproductive life plan as well as linkages to their community for support as needed. Partnerships with key stakeholders and integration of key messages that resonate at various stages could lead to the development of a valuable tool for the public.

Innovative constructs are also needed for service providers delivering PCH programming. The most common barrier verbalized by HCPs in BSRC's 2009 survey was "My patients do not discuss pregnancy planning with me". Time was an additional barrier. The challenge becomes providing PCH messages in a seamless, efficient manner that automatically engages and does not wait for the public to request it. E-health documentation tools integrated directly into all patient contacts may address this challenge. Such an approach would not only ease adoption of PCH care, it would also enhance data gathering and in turn provide insight into needs for further research. Dubey et al. [129] and Shojania et al. [155] identified that utilization of creative tools and health information technology such as electronic reminders to deliver preventive care services can support improved care. A system that electronically identifies an individual's age within the preconception period can also prompt the provider to ask a few simple screening questions, such as "Do you plan to have a child in the next 1 – 2 years?".

Although not specifically a PCH e-tool, one project currently underway employing the potential advantages of electronic documentation is a partnership between BORN Ontario and eHealth Ontario in the integration of the OAR prenatal best-practice clinical guidelines into Electronic Medical Record (EMR) systems [156]. It is believed that integration of these guidelines into EMRs could "enhance a number of care practices including diabetes screening ... and lifestyle counselling". Although the OAR is primarily prenatally focused, a shift to enhancing the postnatal visit and discussion topics sections in the OAR 2 would appear to be a good fit for the current work underway and benefit women during the interconception period. Furthermore, exploring the inclusion of more interconception topics specifically would also be an opportunity to further support positive reproductive health outcomes.

Innovation is also needed to develop more effective strategies for promoting and facilitating access to folic acid supplement prior to pregnancy. As noted in the Neural Tube Defects and Folic Acid Supplementation section, two thirds of NTDs could be prevented if women adhered to folic acid consumption guidelines. However, accessing or following through on recommendations may be a challenge or barrier for some women, particularly those with disabilities, low education, and those from low socio-economic status. Dietitians of Canada developed a call for universal access to supplements [157]. An innovative solution is needed to ensure accessibility for all.

Inquiry

Promoting PCH and developing a comprehensive system, necessitates acknowledgement of the significant gaps in data and the lack of research in the area. As discussed in the Gaps and Challenges section, the lack of information in this area demands a shift in focus to targeted, timely and systematic data gathering, monitoring, research and evaluation. Harnessing current opportunities within existing structures such as PHO's Locally Driven Collaborative Projects, as well as engaging academia, and utilizing and encouraging coordination between existing relevant data bases is strongly recommended. Furthermore, consideration of additional indicators for development, not highlighted in APHEO's list of gaps found in table 2, is advised. Indicators such as mental health status of women in their reproductive years, immunization status and pregnancy intendedness may prove to be beneficial. As well, inclusion of indicators and data reflective of all individuals, beyond women only, would provide a more comprehensive picture of the current state of PCH. Where APHEO currently identifies indicators for "women in their reproductive

years”, this could be expanded to all individuals of reproductive age regardless of gender identity, gender expression or sexual orientation.

PHO [139] acknowledges that the province lacks a coordinated system to monitor health as it pertains to infants, children and youth. PHO [139] identifies 10 recommendations pertaining to the measurement of health in Ontario children ages birth to 19, as outlined in table 3. The recommendations in this comprehensive report aim to address indicator gaps and develop an approach for ongoing population health assessment and surveillance.

Table 3: Recommendations for Health Measurement of Children in Ontario [139]

1. Report on available indicators	6. Evaluate indicators outside of OPHS
2. Expand core indicators	7. Identify indicators for measuring health disparities
3. Enhance data sources	8. Determine indicator subsets
4. Address major OPHS indicator gaps	9. Renew and revisit indicators
5. Assess minor OPHS indicator gaps	10. Advance a coordinated system

The above recommendation categories are broad and could be easily adapted as a guideline in addressing the inadequacies in core indicators and data for PCH. Furthermore, completion of a comprehensive report similar to PHO measurement of child health for PCH would aid in further understanding the needs in this area.

The province would benefit in playing a leadership role to facilitate the development of a comprehensive PCH core indicator system and engage/consult a variety of stakeholders to ensure the system is relevant and useful. Examining the experiences of CDC in developing their indicator system is recommended.

Lastly, establishing a provincial repository where information on PCH data, programming and best practices is more accessible is crucial. Provincial data reported by regions will aid service providers in creating targeted local strategies and will enable ongoing surveillance and monitoring of data and trends. Specific data will also assist in advocating for new initiative supports. The creation of a database detailing PCH strategies, and on-going research and statistics will support practitioner decision making regarding which services and supports will best meet their local community needs as well as provincial needs.

//Recommendations//

1. Establish an intersectoral, interdisciplinary provincial coordinating committee to lead PCH efforts and innovation in Ontario.
2. Engage a diversity of partners extending beyond the health sector, including research and best practice affiliates, non-profit and private sector stakeholders, to address the universality of PCH.
3. Ensure PCH concepts and principles are integrated into current systems, including public health, primary care and education.
4. Support the realignment of health services to support all individuals of reproductive age whether or not planning a pregnancy.
5. Develop policies and tools to support integration into existing services.
6. Invest in e-strategies to support seamless integration of PCH parameters into delivery of care and which in turn support data gathering and research.
7. Move beyond traditional modes of communication and service delivery and harness the power and reach of social media.
8. Complete a comprehensive assessment of PCH indicators, including existing gaps, and explore ways to integrate these indicators into current assessment and surveillance systems.
9. Create an accessible repository to house information on PCH research, programming and best practices in Ontario.
10. Submit a Locally Driven Collaborative Project to gain further insight into PCH needs.

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Appendix A

Preconception Risk Factors

The purpose of this appendix is to provide a quick summary of some of the evidence reviewed for this paper. It highlights some key documents and is not a comprehensive or exhaustive list of preconception health issues or recommendations. This summary is not meant to replace any practice guidelines or documents currently in place.

Alcohol & Substance Use (see Tobacco Use below)

Effects

When under the influence of alcohol, individuals are less likely to adopt safe sex practices and there is an increase in unintended pregnancies [26,159,221].

Alcohol use in pregnancy is the cause of Fetal Alcohol Spectrum Disorder (FASD), a permanent developmental disability [5,26,160,161].

Alcohol and substance use increases the risk of preterm birth, low birth weight and small for gestational age babies, placental abruption and intrauterine growth restriction [5,162,163].

Heavy alcohol consumption and street drugs can cause fertility problems including impotence, alterations in sperm quality for men and disrupted menstrual and ovulation cycles for women [159,162].

Recommendations

Screen¹⁷ all individuals of reproductive age, for at-risk alcohol consumption and drug misuse [26,160,161,163].

Identify at-risk drinking and drug misuse before pregnancy, to allow time to address substance misuse [5,26].

Particular attention should be made to women of advanced maternal age and young women as they may be more at-risk for alcohol use during pregnancy [164].

Provide consistent messaging that abstinence from alcohol and substances is the safest choice for those who are or may become pregnant [26,161,165,166].

Using a harm reduction approach, counsel all sexually active individuals of reproductive age who use alcohol and/or other substances, to make informed decisions regarding alcohol and substance use and to consistently use an effective form of contraception [159,162].

There is no confirmed safe amount of alcohol use during any stage of a pregnancy [26].

17. There are many different effective screening tools related to alcohol use, some intended for specific ages or populations; however none have been tested for preconception health specifically. The T-ACE screen was the first validated screening questionnaire for risky drinking developed for pregnant women.

Body Weight

Effects

Starting a pregnancy underweight, overweight or obese can negatively affect maternal and fetal health. As pre-pregnancy Body Mass Index (BMI) increases, the risk of infertility and complications during pregnancy also increases [13,33,65,167,168].

Adverse outcomes associated with maternal BMI in the overweight or obese category include gestational diabetes, gestational hypertension, excessive gestational weight gain, miscarriage, stillbirth, Caesarean section, wound infections, preterm delivery, neural tube defects, child obesity, maternal diabetes, hypertensive and thromboembolic disease [27,33,167].

Evidence shows that women who are physically fit before pregnancy have fewer aches and pains during pregnancy and feel they have more energy during their pregnancies [5,169].

Male obesity negatively impacts fertility, sperm quantity and quality [170,171].

Recommendations

Educate women of reproductive age about the impact of their health and weight on their own well-being and on the health and well-being of their children [32].

Advise overweight and obese women of the increased risk of congenital abnormalities and screen appropriately [27,55].

Educate and support individuals to reach a healthy body weight prior to a pregnancy occurring [27,65].

Inform all individuals to aim for at least 30 minutes of moderate exercise (that makes you sweat), five days a week, to enjoy long-term good health [5,172].

Inform men of potential impact of weight on fertility and their own well-being. Encourage men to set goals and develop a plan to reach a healthy weight [6].

Emotional Health & Stress

Effects

Poor preconception mental health is a significant risk factor for pregnancy complications and low birth weight babies [101].

Maternal depression during pregnancy is associated with increased odds for premature delivery and decreased breastfeeding initiation [173].

Women who have experienced perinatal mood disorder (PMD) during pregnancy or in the postpartum period have a greater risk of experiencing PMD in subsequent pregnancies [174,175].

Psychosocial factors such as socioeconomic status, work status, marital status, level of education, access to prenatal care, substance abuse, ethnicity, cultural background, and quality of relationships with partners and parents have been identified as determinants of stress during pregnancy [61,176,177].

High levels of stress may delay conception, impact the ability to conceive and has been linked to adverse pregnancy outcomes [5,176,178,179].

Women with psychosocial stress are also at risk for participation in high risk behaviours. Women with high risk behaviours before pregnancy are more likely to continue them during pregnancy and less likely to access prenatal care [102].

Emotional Health & Stress (cont.)

Effects

Evidence supports the association between prenatal stress and infection and inflammation during pregnancy which can lead to low birth weight, preterm birth, and additional adverse outcomes or pregnancy complications [61,177,178].

Intimate partner violence as a child or adolescent increases the risk of violence during pregnancy [176]. Women who experience preconception or prenatal violence are 30% less likely to have adequate prenatal care. Abuse can escalate in pregnancy [13,180].

Recommendations

Promote interventions that improve the emotional health of women and reduce stress before conception to reduce the risk including perinatal mood disorders. Intervention may include group counseling, development of coping and economic skills [5,179,181,182].

HCPs should include queries about violence in the behavioural health assessment of new patients, at annual preventive visits, as a part of prenatal care and in response to symptoms or conditions associated with abuse [13,183].

Environmental Toxins

Effects

There are substances in the everyday environment which are known to be harmful and interfere with the endocrine system, affecting fertility and reproductive outcomes for men and women [184,185,186].

Interference with hormone action during critical periods of fetal development can cause irreversible and delayed effects that do not become evident until later in life [187,188].

Environmental toxins (e.g., air pollutants, heavy metals, organic solvents, pesticides) may increase the risk of low birth weight, intrauterine growth restriction, preterm birth, and birth defects [189,190].

Recommendations

Encourage all individuals of reproductive age to investigate and review the harmful substances in their home and workplace environments so that they can adopt prevention strategies before conceiving [186].

Medical Conditions & Genetic Risks

Effects

Some medical conditions (e.g., diabetes, hypertension, thyroid disease), undiagnosed, untreated, or poorly controlled, can be associated with adverse fetal outcomes [5,191,192].

Men and women with pre-existing medical conditions are commonly prescribed medications. Some medications can pose risk to fertility (e.g., affect sperm count and quality), can affect sperm count and quality, and are contraindicated during pregnancy (e.g., increase risk for congenital anomalies). Sometimes, the risk of not taking medication during pregnancy may be more serious than the potential risk associated with taking the medication [6,193].

Recommendations

Investigate family history of genetic disorders such as muscular dystrophy, hemophilia, cystic fibrosis, fragile X syndrome, congenital heart disease, phenylketonuria, dwarfism, sickle cell anemia, and Tay-Sachs disease to increase understanding of possible genetic risk and lead to enhanced pregnancy outcomes [191].

Individuals should have a full medical examination to ensure chronic conditions are under control before conceiving. This should include exploring use of medications known to be safe for a fetus [5,191].

Encourage individuals to speak with a genetic counsellor if they have a family history of genetic disorders [191].

Oral Health

Effects

Dental caries and other oral diseases are common in women of reproductive age (>80% of women aged 20-39 years) [191,194].

Pregnant women with periodontal disease, which is a preventable and treatable condition, may have higher risk of delivering a preterm or low birth weight baby [195,196,197].

A mother with recent tooth decay can transmit the caries causing bacteria to the child [197,198,199,200].

Although not directly linked to fertility or birth outcomes, oral health in males contributes positively to physical, mental and social well-being and should be encouraged [198].

Recommendations

Encourage individuals of reproductive age to visit their dental care professional for regular care to prevent chronic conditions and maintain oral health before pregnancy [197,201].

Sexually Transmitted Infections (STI)

Effects

Some types of STIs, including HIV, can cause infertility in men and women, adverse pregnancy outcomes including preterm and low birth weight babies, transmission of the infection to fetus/infant, stillbirth or physical and developmental disabilities [202,203,204,205].

Recommendations

Incorporate STI prevention as part of routine patient care. Screen for and treat STIs early to prevent adverse outcomes to fertility, pregnancy and fetal health [13,202,204].

Particular attention should be given to teens as they have the highest rates of STIs among young people [203,204,205].

Tobacco Use

Effects

Women who smoke are more likely to experience reduced fertility as tobacco use can influence conception delay, ovarian function, tubal function, and uterine receptiveness [5,206,207,208].

Smoking in males is associated with erectile dysfunction, low sperm counts, poor motility, altered sperm quality which can lead to failed embryo implantation and adverse birth outcomes including low birth weight [206,207,208,209].

Nicotine exposure during pregnancy contributes to adverse birth outcomes, such as ectopic pregnancy, miscarriage, preterm birth and stillbirth [163,196,206,208].

Smoking in early pregnancy is linked to orofacial clefts in infants, and evidence suggests that smoking could be associated with certain other birth defects [207].

Exposure to second-hand tobacco smoke has been causally linked to cancer, respiratory, cardiovascular diseases, and to adverse effects on the health of infants and children [163,207].

Tobacco Use (cont.)

Recommendations

Provide routine screening of tobacco use for all individuals. Minimal interventions, of 1-3 minutes, are effective and should be offered to every tobacco user¹⁸.

Quit attempts before conception provide an opportunity for women to use nicotine replacement therapies without concern for a developing fetus [13,163,208].

Educate all non-smokers about harms associated with second-hand smoke and harmful effects on pregnant women and unborn children [13,163].

Vaccine Preventable Diseases

Effects

Infection by certain vaccine preventable diseases in women can cause serious birth defects or fetal death [211].

For rubella and varicella, the syndromes affecting the fetus and infants are most common when a non-immune woman is exposed to the virus during pregnancy, with the greatest risk to the fetus being in the first trimester [212].

Attaining immunity prior to pregnancy accounts for fewer complications related to the illnesses and provides passive immunity for the baby [212,213].

Communicable disease infection of males prior to conception can affect fertility e.g., a common complication of mumps is orchitis, inflammation of the testicles [214].

Recommendations

Provide routine immunity assessment and vaccination, if necessary, to individuals of reproductive age [213].

Women should be advised to avoid pregnancy for at least 28 days after live vaccinations since these vaccines cross the placenta and there is a theoretical risk to the fetus [212,213].

Ensure partners and household contacts to a pregnant woman have up to date immunizations [214].

18. The Ask, Advise, Assess, Assist and Arrange approach is recommended for routine screening [210]

General health status and life satisfaction

1. Reported good, very good or excellent health

Social determinants of health

2. Reported having a high school education/GED or greater

Health care

3. Reported currently having some type of healthcare coverage
4. Reported having had healthcare coverage during the month before pregnancy
5. Reported having had a routine checkup in the past year
6. Reported having had a postpartum checkup
7. Reported having had their teeth cleaned during the 12 months before pregnancy
8. Reported having had a Papanicolaou test within the past 3 years
9. Reported having received preconception counseling about healthy lifestyle behaviors and prevention strategies from a healthcare provider before pregnancy on at least five of 11 healthy lifestyle behaviors and prevention strategies before pregnancy

Reproductive health and family planning

10. Reported that their previous live birth was more than 3 weeks before the due date (among multiparous women)
11. Reported having had experienced a miscarriage, fetal death or stillbirth death or stillbirth in the 12 months before getting pregnant with their most recent live born infant
12. Reported most recent pregnancy resulting in a live birth was unintended (unwanted or wanted later)
13. Reported that they were not trying to get pregnant at the time of conception and neither they nor their husbands or partners were doing anything to keep from getting pregnant
14. Reported that they or their husbands or partners were currently doing something to keep from getting pregnant
15. Reported that they used fertility drugs or received any medical procedures from a doctor, nurse, or other health-care worker to help them get pregnant (among women who were trying to get pregnant at the time of conception)

Tobacco and alcohol use

16. Reported that they currently smoke everyday or some days
17. Reported that they smoked cigarettes during the 3 months before pregnancy
18. Reported that smoking is currently allowed in their home (current second hand smoke exposure)
19. Reported that they participated in binge drinking on at least one occasion in the past month
20. Reported that they drank any amount of alcohol during the 3 months before pregnancy
21. Reported that they participated in binge drinking during the 3 months before pregnancy

Nutrition and physical activity

22. Reported that they consume fruits and vegetables at least five times per day
 23. Overweight: Body Mass Index (BMI) 25.0–29.9
 24. Overweight: percentage of women with a pre-pregnancy BMI 25.0–29.9
 25. Obesity: percentage of women with a BMI ≥ 30
 26. Obesity: percentage of women with a pre-pregnancy BMI ≥ 30
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-
27. Reported that they took a multivitamin, prenatal vitamin or a folic acid supplement everyday of the month before pregnancy
 28. Reported that they participate in enough moderate and/or vigorous physical activity in a usual week to meet the recommended levels of physical activity
-

Mental health

29. Reported that their mental health was not good for at least 14 out of the past 30 days
 30. Reported that they visited a healthcare provider to be checked or treated for anxiety or depression during the 12 months before pregnancy
 31. Reported that they experienced depression symptoms after pregnancy
-

Emotional and social support

32. Reported that they were physically abused by their partner during the 12 months before pregnancy
 33. Reported that they always or usually get adequate social and emotional support they need
 34. Reported that they had ≥ 3 of 5 types of social support available to them after delivering their baby
-

Chronic conditions

35. Reported that they had ever been told by a healthcare provider that they had diabetes (not including gestational diabetes)
 36. Reported that before their most recent pregnancy they had ever been told by a healthcare provider that they had Type I or Type II diabetes
 37. Reported that they had ever been told by a health-care provider that they had hypertension (not including hypertension during pregnancy)
 38. Reported that they had hypertension during the 3 months before their most recent pregnancy
 39. Reported that they currently have asthma
-

Infections

40. Reported that they received an influenza vaccination within the past year
-