

**Prenatal Health is Public Health: Best Practices for Prenatal Health
Program Design, Implementation and Evaluation**

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Abstract

Prenatal health programs and public health promotion provide strategies to mitigate modifiable risks to pregnancy. Women marginalized by race/ethnicity, disability, sexual identity, socioeconomic status, immigration, Francophone and Indigenous status experience barriers to prenatal service access. Multijurisdictional program evaluations were conducted to review prenatal health promotion, design, implementation and evaluation strategies for Canadian government-hosted websites, prenatal e-classes and international prenatal guidance documents. Gaps were noted in prenatal content targeted to non-Anglophone, immigrant, Indigenous and disabled women and LGBTQ communities. I recommend that prenatal program best practices consist of evidence-based, theoretical foundations which recognize the diverse interacting determinants of health across the lifespan. Intersectoral collaborations and integration of public health into primary care facilitates delivery of accessible, inclusive, woman-centred services. These best practices are anticipated to help harmonize prenatal programs across communities, which optimize maternal-child health and children's long-term health outcomes.

Résumé

Les programmes prénataux et ceux faisant la promotion de la santé publique utilisent certaines stratégies afin d'atténuer les risques reliés à la grossesse. Les femmes marginalisées par leur identité ethno- raciale ou sexuelle, par un handicap, ou par leur statut socioéconomique, migratoire, francophone ou autochtone peuvent être confrontées à des obstacles en matière d'accès aux services prénataux. Sont présentées ici des évaluations multi-juridictionnelles du contenu des programmes de promotion de la santé prénatale des sites gouvernementaux canadiens, des cours prénataux en ligne et des guides prénataux internationaux. Certaines lacunes ont été observées dans le contenu ciblant des populations non-anglophones, immigrantes, autochtones, handicapées et LGBTQ. Nous recommandons que les bonnes pratiques en termes de programme prénatal soient appuyées sur des faits et sur des bases théoriques reconnaissant les interactions entre les déterminants de la santé au cours de la vie. Les collaborations intersectorielles et l'intégration de la santé publique dans les soins primaires facilitent la prestation de services accessibles, inclusifs et centrés sur les femmes. Idéalement, ces bonnes pratiques devraient aider à harmoniser les programmes prénataux à travers diverses communautés, ayant pour bénéfice d'améliorer les conséquences sur la santé maternelle et infantile à long terme.

Preface

This thesis consists of two research articles, for which I am primary author. My contributions to both research studies, guided by Dr. Karen P. Phillips, involved identification of prenatal programs and guidance documents for evaluation, creation of evaluation grids and conducting program evaluations and analysis of results. Rowan Terrell, a student in the Undergraduate Research Opportunity Program, assisted in the evaluation of government-hosted websites and prenatal e-classes. Dr. Phillips assisted in website, e-class and prenatal guidance document evaluations.

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Table of Contents

Abstract	ii
Résumé	iii
Preface	iv
Acknowledgments	v
Table of Contents	vi
List of Figures and Boxes	ix
List of Tables	x
List of Abbreviations	xi
Chapter 1:	
Introduction and Literature Review	1
Thesis Research Summary	1
Prenatal Health promotion	1
Prenatal Health Influences.....	2
<i>A Public Health Approach to Prenatal Health Promotion</i>	2
<i>Modifiable Prenatal Health Risks</i>	2
Maternal and Child Health Status in Canada.....	5
<i>Populations at-Risk for Adverse Pregnancy Outcomes</i>	6
Prenatal Health Information Channels	9
Mechanisms for Prenatal Health Promotion.....	9
<i>Formal vs. Informal Prenatal Health Promotion</i>	9
<i>Passive vs. Active Uptake of Prenatal Health Promotion</i>	10
<i>Models for Prenatal Education</i>	12
<i>Health Care Provider Services</i>	13
<i>Health Awareness Campaigns</i>	14
<i>The Internet and Mobile Applications</i>	15
Barriers to Prenatal Health Promotion Access.....	17
A Multijurisdictional Approach to Prenatal Health	20
<i>Canadian Health System Organization</i>	20
<i>United States Health System Organization</i>	21
<i>Australian Health System Organization</i>	22
<i>U.K. (England, Scotland) Health System Organization</i>	22
<i>Ireland Health System Organization</i>	23
Thesis Objectives	23

Chapter 2:	
Methodology	25
General Methodology.....	25
<i>Program Planning, Implementation and Evaluation</i>	25
<i>Environmental Scans</i>	26
Multijurisdictional Approach.....	26
Sampling and Program Evaluation Grids.....	27
Study 1: <i>Best practices for online Canadian prenatal health promotion: A public health approach</i>	27
1.1 <i>Government-hosted Websites</i>	27
1.2 <i>Prenatal e-classes</i>	28
1.3 <i>Study 1. Program Evaluation Grids</i>	28
Study 2: <i>Best practices for the design, implementation and evaluation of prenatal health programs</i>	33
2.1 <i>Prenatal Health Guidance Documents</i>	33
2.2 <i>Study 2. Program Evaluation Grids</i>	34
2.3 <i>Developing a Framework for Best Practices</i>	36
Data Analysis.....	37
Chapter 3:	
Study 1 Manuscript Submitted and Accepted to the Journal <i>Women and Birth</i> (Publication In Press)	
Best practices for online Canadian prenatal health promotion: A public health approach.....	38
Chapter 4:	
Study 2 Manuscript Submitted to the <i>Maternal and Child Health Journal</i>	
Best Practices for the Design, Implementation and Evaluation of Prenatal Health Programs.....	72
Chapter 5:	
Case Study: Does online Canadian prenatal health promotion reflect the inclusivity and accessibility principles described by Canadian prenatal health guidance documents?	101
Canadian Government-Hosted Websites	101
Women Living with Disabilities and LGBTQ Communities.....	102
Immigrant Women.....	105
Indigenous Women.....	107
Low Socioeconomic Status and Teen Women.....	110
Francophone Women.....	112

Ontario Public Health-Affiliated e-Classes	114
A Health Equity Lens for Prenatal Health Promotion	115
Conclusion	115
Chapter 6:	
Discussion of Prenatal Health Programs	117
Prenatal Health Program Components	117
Indicators for Program Success.....	117
Population Reach Through Evidence and Theoretical Approaches.....	118
<i>Evidence-Based Approaches and Public Trust</i>	119
<i>Interdisciplinary Approach to Prenatal Service Access</i>	119
<i>Behaviour Change Theories & Development of Self-Efficacy</i>	120
Prenatal Services Centred Around Women.....	124
<i>Women and Sexual and Reproductive Health Rights</i>	124
<i>Woman-Centred vs. Family-Centred</i>	125
Public Health Program Evaluations	126
Lessons Learned from Sexual and Reproductive Health Programs.....	127
<i>Fertility Public Health Programs</i>	127
<i>Sexually Transmitted Infection Public Health Programs</i>	128
Multijurisdictional Prenatal Health Program Evaluations.....	129
Prenatal Health is Public Health	130
Adverse Prenatal Health Affects Public Health.....	130
Integration of Public Health into Primary Care.....	132
Future Research	133
Conclusions	134
Bibliography	135

List of Figures

Chapter 3:

Figure 1 (A,B). Comprehensiveness of preconception-prenatal health promotion topics.....	69
Figure 2. Accessibility of online prenatal health promotion.....	70
Figure 3. Inclusivity of online prenatal health promotion.....	71

Chapter 4:

Figure 1. Proposed model for design, implementation and evaluation of prenatal health programs.....	100
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List of Boxes

Chapter 3:

Box 1. Preconception-prenatal topics important for prenatal health.....	64
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Chapter 4:

Box 1. WHO recommendations on health promotion interventions for maternal and newborn health.....	93
Box 2. Evaluation criteria for prenatal health programs.....	94

List of Tables

Chapter 1:

Table 1. Modifiable maternal health influences.....	3
--	---

Chapter 2:

Table 1. Evaluation criteria for comprehensive prenatal health promotion content.....	28
Table 2. Evaluation criteria for evidence-based prenatal health promotion content	30
Table 3. Evaluation criteria for accessible prenatal health promotion content.....	31
Table 4. Evaluation criteria for inclusive prenatal health promotion content	32
Table 5. Evaluation criteria for the components of prenatal program design.....	34
Table 6. Evaluation criteria for the components of prenatal program implementation and evaluation.....	35
Table 7. Evaluation criteria for the components of prenatal program population reach.....	35
Table 8. Evaluation criteria for the components of patient care models for prenatal services.....	36

Chapter 3:

Table 1. Government-hosted websites evaluated for online prenatal health promotion.....	65
Table 2. Prenatal e-classes evaluated for online prenatal health promotion.....	66
Table 3. Breadth of online prenatal health promotion topics.....	67
Table 4. Prenatal e-classes providing comprehensive prenatal-postpartum health promotion.....	68

Chapter 4:

Table 1A. Canadian prenatal health guidance documents.....	95
Table 1B. U.S. prenatal health guidance documents.	96
Table 1C. Australian prenatal health guidance documents.....	97
Table 1D. U.K.– Ireland prenatal health guidance documents.	97
Table 2. Multijurisdictional practices for prenatal program design.	98
Table 3. Multijurisdictional practices for prenatal program implementation and evaluation.....	98
Table 4. Multijurisdictional practices for prenatal program population reach.....	99
Table 5. Multijurisdictional models of patient care for prenatal health services.....	99

List of Abbreviations

American Academy of Pediatrics	AAP
American College of Obstetricians and Gynecologists	ACOG
Canada Prenatal Nutrition Program	CPNP
Centers for Disease Control and Prevention	CDC
Fetal Alcohol Spectrum Disorders	FASD
Gestational Weight Gain	GWG
Healthy Babies Healthy Children	HBHC
Health Resources and Services Administration	HRSA
Human Immunodeficiency Virus	HIV
Large for Gestational Age	LGA
Lesbian, Gay, Bisexual, Transgender, Queer	LGBTQ
Local Health Integration Network	LHIN
Low Birth Weight	LBW
Maternity Experience Survey	MES
Obstetrician and Gynaecologist	OB/GYN
Oeuf, Lait, Orange	OLO
Public Health Agency of Canada	PHAC
Sexual and Reproductive Health	SRH
Sexually Transmitted Infection	STI
Small for Gestational Age	SGA
Society of Obstetricians and Gynaecologists of Canada	SOGC
Socioeconomic Status	SES
United Kingdom	U.K.
United States	U.S.
World Health Organization	WHO

Chapter 1: Introduction and Literature Review

THESIS RESEARCH SUMMARY

This thesis research assesses online prenatal health promotion programs and prenatal health frameworks and guidance documents. This research will inform best practice recommendations for the design of online prenatal health promotion and for the planning, implementation and evaluation of prenatal health programs. Two studies were conducted: (1) evaluation of prenatal health promotion content on Canadian government-hosted websites and prenatal e-classes; (2) evaluation of prenatal and maternity care guidelines, policy documents and frameworks across Canada, the United States (U.S.), Australia, the United Kingdom (U.K.), and Ireland.

PRENATAL HEALTH PROMOTION

Building on the Ottawa Charter (1986) definition, prenatal health promotion enables women to develop self-efficacy, knowledge and awareness about pregnancy within physical, mental and social contexts. Prenatal health promotion requires the empowerment and meaningful participation of women to become aware of their modifiable risks to pregnancy, strategies for behaviour change and available health and community resources. Prenatal health promotion broadly includes public health policies, supportive environments, community engagement, enabling personal and social development and health and non-health sector collaborations (WHO, 1986). Although both prenatal health promotion and prenatal care aim to improve maternal and child health, prenatal care is typically recognized as the services delivered by a

health care provider. A more comprehensive, interdisciplinary model of prenatal care warrants education and risk prevention, delivery of prenatal health promotion, in addition to providing prenatal clinical services (WHO, 2016).

Prenatal Health Influences

A Public Health Approach to Prenatal Health Promotion

Public health is supported by the organized collaboration of community programs, services and policies designed to promote health and prevent illness (PHAC, 2008). Prenatal health promotion benefits from a public health approach, which involves identification and communication of risks for adverse pregnancy outcomes, as well as the design, implementation and evaluation of prenatal interventions across communities (PHAC, 2008; WHO, 1986). A population health approach to prenatal health is also beneficial, as interventions can be developed from evidence and theories, which are informed by established health determinants. By incorporating both a population and public health approach, prenatal interventions are framed by interacting determinants of health, thereby reducing health inequities (PHAC, 2013a).

Modifiable Prenatal Health Risks

Promotion of health and raising awareness of health risks aligns with the goals of both public health activities and prenatal care (PHAC, 2008; WHO, 2016). Prenatal health influences include biological aspects, behaviours and lifestyles, environmental exposures and social interactions. Many of these determinants, particularly behaviours and lifestyle, are modifiable (Shah & Shah, 2010; Brauer et al., 2008; Siega-Riz et al., 2009; Chiolero et al., 2005) and are

typically well-represented in public health promotion (Table 1). Prenatal health communication and the delivery of support services, prenatal classes and prenatal programs are examples of public health initiatives used to mitigate prenatal health risks (PHAC, 2008; Godin et al., 2015; Muhajarine et al., 2012). In general, public health interventions aim to reduce risk behaviours and improve population health. Smoking cessation, drinking and driving and oral public health promotion campaigns enhance population health outcomes through multi-layered activities, which target community needs and groups at-risk (Watt, 2005; Holder et al., 2000). Prenatal health similarly benefits from a collaborative community wide approach, using multi-faceted interventions. Although specific communities may be more at risk for adverse pregnancy outcomes, all pregnant women benefit from prenatal health promotion. As such, health promotion messages should provide information on modifiable prenatal health risk factors that influence pregnancy outcome, as these factors are important for all women (Table 1).

Table 1. Modifiable maternal health influences.

Prenatal Health Influence	Examples of Prenatal/Pregnancy Outcomes
Abuse	Maternal abuse is associated with higher rates of low birth weight (LBW) offspring and preterm birth (Shah & Shah, 2010), as well as stress-induced adverse behaviours including smoking, alcohol and drug use (Baily & Daugherty, 2007).
Alcohol	It is advised that women abstain from alcohol consumption during pregnancy. Maternal alcohol consumption risks the development of fetal alcohol spectrum disorders (FASD) (May & Gossage, 2011).
Drugs	Drug use during pregnancy poses risks for prenatal and neonatal health. Maternal opiate use is associated with higher risks for premature offspring and neonatal death and heroin use in later stages of pregnancy is also associated with offspring morphine dependence (Fajemirokun-Odudeyia et al., 2006).
Emotional Health	Maternal stress is associated with risks for spontaneous abortions, preterm births and growth restrictions (Mulder et al.,

	2002), while prenatal partner support reduces emotional distress (anxiety and depression) (Stapleton et al., 2012).
Environmental Exposures	Environmental exposures include both indoor and outdoor surroundings (Brauer et al., 2008; Jedrychowski et al., 2004). Maternal exposure to various forms of air pollution is associated with LBW, small for gestational age (SGA) offspring and preterm birth (Stieb et al., 2012; Brauer et al., 2008).
Gestational Weight Gain (GWG)	Excessive GWG is associated with large for gestational age (LGA) offspring, while inadequate GWG is associated with SGA offspring (Siega-Riz et al., 2009). Excessive GWG is additionally a risk factor for gestational diabetes, offspring obesity (Carreno et al., 2012; Oken et al., 2008) and caesarian sections (Miao et al., 2017).
Nutrition	A healthy diet is important for pregnancy. Maternal malnutrition may be associated with excessive or inadequate GWG (Stuebe et al., 2009; Brawarsky et al., 2005), which risks LGA and LBW offspring (Nutrition Working Group et al., 2016; Siega-Riz et al., 2009). Risk of spontaneous abortion is associated with poor consumption of fruits/vegetables and dairy products (Di Cintio et al., 2001). Limited milk consumption also limits absorption of vitamin D, associated with LBW offspring (Mannion et al., 2006). According to the Canadian Nutrition in Pregnancy guidelines, women are advised to follow Canada's Food Guide pertaining to pregnancy (Nutrition Working Group et al., 2016).
Occupational Health	Occupational exposures may include chemical, biological or physical influences. Occupational exposures to various solvents (Cordier et al., 2012), manual labour, falls and lifting heavy objects (Salihu et al., 2012) are examples of occupational risks associated with adverse pregnancy outcomes.
Physical Activity	Appropriate physical activity is encouraged during pregnancy. Numerous maternal and fetal benefits have been linked with maternal exercise, including reductions in risks for gestational diabetes and pre-eclampsia (Nascimento et al., 2012; Wolfe & Weissgerber, 2003).
Sexually Transmitted Infections (STI)	All women are encouraged to practice safe sex, as maternal STIs risk adverse pregnancy outcomes. For example, chlamydia trachomatis is associated with preterm birth (Blas et al., 2007) and human immunodeficiency virus (HIV) increases risks for preterm birth, perinatal mortality and SGA offspring (Habib et al., 2008).
Smoking	Both maternal smoking and exposure to second-hand smoke risk adverse pregnancy outcomes. Smoking during pregnancy is associated with LBW, preterm birth and SGA offspring (Chiolerio et al., 2005), while maternal exposure to second-hand smoke is associated with preterm birth (Mojibyan et al., 2013).

Vaccinations	Pregnant women are advised to ensure their vaccinations are up to date, as exposures to influenza, such as H1N1 virus and the seasonal flu, may compromise both fetal and maternal health outcomes (Jamieson et al., 2009; Yudin, 2014; Rasmussen et al., 2012).
Vitamins	Sufficient intake of vitamins/minerals is recommended during pregnancy. For example, low iron levels risk LBW offspring, while folic acid consumption reduces risks for neural tube defects and associated neonatal mortality (Lee et al., 2006; Blencowe et al., 2010).

Maternal and Child Health Status in Canada

Pregnancy complications and maternal/fetal death are generally not very common in Canada. According to a 2015 World Health Organization (WHO) report, Canadian maternal mortality rates were generally similar to other developed countries like Australia and the U.K. (WHO, 2015). Although Canadian rates of maternal mortality (7 cases per 100,000 live births in 2015) are lower than those from the U.S. (14), they remain higher than some countries, including Finland (3) and Sweden (4) (WHO, 2015), which suggests there is still room for improvement. The most common causes of maternal mortality in Canada are related to circulatory system diseases, including hypertension (PHAC, 2017a). Maternal hypertension was reported in approximately 46 cases per 1000 deliveries in 2010/2011, with higher rates observed in older mothers (PHAC, 2014a). Gestational diabetes was reported in approximately 54 per 1000 deliveries (PHAC, 2014b), with rates notably higher in marginalized populations, where it is 2-3 times higher in Aboriginal compared to non-Aboriginal Canadian women (Canadian Diabetes Association, 2015). As described in Table 1, many of these health issues may be modified through healthy maternal behaviours, such as exercise, smoking cessation and appropriate diets and GWG.

Preterm birth, another indicator of maternal-child health status, was reported in approximately 8 per 100 Canadian live births in 2014. The highest rates of preterm Canadian birth were documented in Nunavut, which reports prematurity (<37 weeks gestation) in approximately 12 per 100 live births (PHAC, 2017a). Infant mortality was noted as approximately 5 per 1000 Canadian live births in 2011, again with highest rates of infant death recorded in Nunavut (\approx 18 per 1000 live births in the first year after birth). Most infant deaths are caused by immaturity and congenital anomalies (PHAC, 2017a). Though Canadian maternal and child health mortality and complications are not overly prevalent, there is still opportunity to enhance prenatal health status of minority groups, such as Indigenous women living in Canada.

Populations at-Risk for Adverse Pregnancy Outcomes

Marginalized populations are particularly at-risk for adverse pregnancy outcomes, which encompass women of immigrant (Shah et al., 2011a), Aboriginal (Shah et al., 2011b) and low socioeconomic status (SES) (Blumenshine et al., 2010) and adolescents (Chen et al., 2007). Other high-risk populations include women who live with a chronic illness (Macintosh et al., 2006), including obesity (Marchi et al., 2015), are older (>35 years old) (Laopaiboom et al., 2014; Kenny et al., 2013), experience abuse (Shah & Shah, 2010), or are exposed to occupational chemicals and manual labour (Cordier et al., 2012; Salihu et al., 2012).

Risk behaviours may explain higher rates of adverse pregnancy outcomes in teens, women of low SES (PHAC, 2009), immigrant (Kingston et al., 2011) or Aboriginal status (Lowell & Miller, 2010). The Canadian Maternity Experience Survey (MES) reports that younger mothers (<20 years old), with both low education and SES, have less preconception intake of

folic acid and high rates of pre-pregnancy smoking and drug use, compared to more educated and socioeconomically-advantaged mothers (PHAC, 2009). This survey also documents the experiences of immigrant Canadian women as having poor access to social supports (Kingston et al., 2011). Compared to non-Aboriginal women, Canadian Aboriginal populations are reported to have higher GWG (Lowell & Miller, 2010), and higher rates of maternal smoking (Heaman & Chalmers, 2005). As adverse pregnancy outcomes may be further complicated by women's risky behaviours and lifestyles, prenatal health promotion should target these high-risk, marginalized communities.

According to the socio-ecological model (McLeroy et al., 1988), health status and risk behaviours in all communities may be attributed to social factors, including discrimination, poverty and violence. These social health disparities are not only experienced by Aboriginal women and racial/ethnic minorities (Adelson, 2005; Nazroo, 2003; Karlsen & Nazroo, 2002), but are prevalent among many communities of low SES (Pampel et al., 2010; Yen & Syme, 1999). Maternal risk behaviours may also be interrelated. For example, women who experience stress due to intimate partner violence, are more likely to cope by smoking and using alcohol and drugs (Bailey & Daugherty, 2007). Additionally, low SES is often associated with physically demanding employment, stress, lack of proper nutrition and substance use, all established risk factors for adverse pregnancy outcomes (Table 1) (Kramer et al., 2000; Abu-Saad & Fraser, 2010).

Barriers to the prevention of prenatal risk behaviours may include environmental and personal factors. Maternal risk behaviours may occur due to lack of time or resources to adopt healthy

lifestyle behaviours, lack of social support or resource awareness (PHAC, 2009; Baily & Daugherty, 2007; Evenson et al., 2009; Laraia et al., 2010; Laraia et al., 2004). American women express their lack of motivation, time and social support related to their engagement in regular physical activity during pregnancy (Evenson et al., 2009). The Canadian MES reports that younger mothers (<24 years) with low education and SES are unaware of the importance of preconception intake of folic acid (PHAC, 2009). Although some women may be unaware of risk behaviours, it must be noted that risk behaviour knowledge does not always imply healthy behaviours (PHAC, 2009).

Infrastructure barriers also exist when adopting healthy lifestyles, as there is an intersection between SES and built environment. An individual's social and physical environment influence health, as neighborhood safety concerns, poverty, proximity to a doctor's office or grocery store, are factors that risk unhealthy behaviours and adverse health outcomes (Yen & Syme, 1999; Kamphuis et al., 2007; Tucker-Seeley et al., 2009). Maternal food insecurity has been associated with high GWG, as well as gestational diabetes (Laraia et al., 2010). Grocery store access may also play a role in ensuring healthy pregnancies, as women who live near supermarkets have been noted to consume healthier foods (Laraia et al., 2004). Although risk behaviours and adverse pregnancy outcomes are more prevalent in marginalized communities, several barriers prevent the adoption of healthy lifestyles, thereby all pregnant women benefit from receiving prenatal health promotion.

In summary, despite advanced medical services in developed countries like Canada, adverse pregnancy outcomes are documented across marginalized populations and communities at-

risk. Prenatal health may not only be compromised by modifiable risk exposures, but can also be influenced by an individual's social status, behaviours and environment. Regardless of a community's social and health status, all pregnant women should have access to publicly-delivered prenatal health promotion services, which acknowledge the social determinants of health.

PRENATAL HEALTH INFORMATION CHANNELS

Design and delivery of prenatal health promotion influences population reach and uptake of information (Vonderheid et al., 2007; Muhajarine et al., 2012; Hearn et al., 2014). In general, access to pregnancy risk information can be effective to encourage positive behaviours and mitigate modifiable risks for adverse pregnancy outcomes. Prenatal health promotion information is delivered through several mechanisms, wherein targeted messages improve prenatal health for the mother and baby (Chertok & Archer, 2015; Muhajarine et al., 2012; Lagan et al., 2010; Godin et al., 2015; Burgoyne, 2007; Hearn et al., 2014).

Mechanisms for Prenatal Health Promotion

Formal vs. Informal Prenatal Health Promotion

Prenatal health promotion may be formally or informally delivered. Formal health promotion messages may originate from designed prenatal education programs, awareness campaigns, classes or interventions and counselling. In contrast, informal discussions with health care providers, friends and family, and multimedia use are examples of informal channels for the promotion of prenatal health. Both formal and informal information delivery mechanisms can be successful in improving prenatal health (Godin et al., 2015; Burgoyne, 2007; Chertok et

al., 2015; Ickovics et al., 2007; Tanner-Smith et al., 2014), however both are dependent on the eventual uptake of the information and the behaviours and actions taken by the individual.

Passive vs. Active Uptake of Prenatal Health Promotion

Uptake of formal or informal prenatal health promotion may be passive or active. Maternal information-seeking behaviours depend on personal characteristics, with women of diverse race/ethnicities and low literacy, SES and education, less likely to access prenatal information (Best Start Resource Centre, 2014; Stoll & Hall, 2012; Grewal et al., 2008; Reitmanova & Gustafson, 2008). Thus, prenatal health professionals benefit from possessing a fundamental understanding of behaviours for information access, to create effective health promotion strategies (Longo et al., 2010).

Information delivery channels can stimulate both passive and active information uptake. Passive uptake of health promotion is the unintended acquired health information through daily activities (Longo, 2005) and may include browsing the Internet, exposures to the news and multimedia awareness campaigns, as well as depictions in movies, on television and through commercials. In comparison, active uptake of health content requires individuals to purposely seek health-related information (Longo, 2005). Women can actively acquire prenatal information through both in-person and online channels, which may include community programs, prenatal classes (Godin et al., 2015), Internet websites (Lagan et al., 2010), mobile applications (apps) (Hearn et al., 2014), health care providers (Chertok & Archer, 2015), family, friends, magazines (Lagan et al., 2010; Huberty et al., 2013) and other public health organizations (Muhajarine et al., 2012). Populations are more likely be exposed

to health information passively than actively, which suggests the importance of passive prenatal health promotion to obtain population reach (Longo et al., 2010; Zare-Farashbandi et al., 2015; McCaughan & McKenna, 2007). Passive and active uptake of health information from informal and formal channels can result in retained knowledge about risk perceptions and changes in risk behaviours (Hammond et al., 2003; Swartz et al., 2006; Huhman et al., 2007; Stephens & Allen, 2013). Passive graphic health warning labels, for example, increase risk perceptions and encourage cessation behaviours (Hammond et al., 2003), however active participation in Internet smoking cessation interventions also influences abstinence (Swartz et al., 2006). Similarly, children's passive mass media exposure to physical activity promotion resulted in an increase in knowledge of physical activity benefits and higher engagement in physical activity (Huhman et al., 2007), whereas active participation in mobile apps and text messaging interventions is also effective to increase physical activity (Stephens & Allen, 2013). It is evident that both formal and informal mechanisms for promotion of health, as well as the active and passive uptake of health information are important considerations to inform the public about health issues (Hammond et al., 2003; Swartz et al., 2006; Lagan et al., 2010; Huberty et al., 2013; Zare-Farashbandi et al., 2015; McCaughan & McKenna, 2007; Ellis et al., 2012). Although informal delivery and passive uptake of health information have considerable reach (Zare-Farashbandi et al., 2015; Longo et al., 2010), an individual's willingness to seek out information helps promote control and self-empowerment (McCaughan & McKenna, 2007), thereby increasing the likelihood that the information will be retained. Therefore, multi-platform prenatal health promotion can be used to encourage passive and active uptake of prenatal health promotion, which may be opportunistic to increase prenatal health knowledge and encourage behaviour change.

Models for Prenatal Education

Traditional group classes, online education programs, group prenatal care programs and community services are examples of prenatal education. Prenatal classes are a type of formal education delivered to a group of pregnant women and their support partners, either in-person or online. These classes are designed to enhance the knowledge and skills of parents and to ultimately improve their pregnancy and birth outcomes, as they discuss prenatal care, healthy lifestyles and behaviours, labour/delivery, breastfeeding and postpartum care (Choquette, 2007; Best Start Resource Centre, 2014).

Very little is known about the benefits of traditional, in-person versus online prenatal classes and their influences on women's behaviours and pregnancy outcomes. Evaluations of group prenatal care programs and prenatal classes predominantly focus on labour/delivery satisfaction, pain relief use and neonatal health status (Fabian et al., 2005; Maimburg et al., 2010; Ickovics et al., 2007; Tanner-Smith et al., 2014). Nonetheless, active participation in traditional group and online prenatal education programs increases prenatal health knowledge and awareness (Choquette, 2007; Nova Scotia Health Promotion and Protection, 2008; Godin et al., 2015). Additionally, targeted prenatal education programs such as the Canada Prenatal Nutrition Program (CPNP) reaches local, vulnerable populations and improves their pregnancy outcomes (Muhajarine et al., 2012). Women who receive support, counselling and education through the CPNP are more likely to take prenatal vitamins and are less likely to smoke and use alcohol. Participation in the CPNP is also associated with decreased rates of LBW offspring and preterm births (Muhajarine et al., 2012). Therefore, both online and in-

person prenatal education are advantageous to inform mothers about important pregnancy information.

Health Care Provider Services

Roles of health care providers include patient education about healthy pregnancy behaviours and lifestyles (Vonderheid et al., 2007), routine screening and tests (Op de Coul et al., 2011), response to patient concerns and inquiries (Beldon & Crozier, 2005), interventions and counselling services (Chertok & Archer, 2005) and management of labour and delivery. Discussion of a broad range of health promotion topics during prenatal visits is associated with healthy pregnancy behaviours and decreased substance use (Vonderheid et al., 2007). Prenatal interventions and counselling services can also improve pregnancy outcomes, notably for populations at-risk, such as teen mothers and women who abuse alcohol and drugs (Mersal et al., 2013; Grant et al., 2005). For example, midwife-delivered smoking cessation interventions successively decreased maternal smoking behaviours among American mothers (Chertok et al., 2015) and health care provider dietary and lifestyle counselling similarly helped women reduce excess GWG (Asbee et al., 2009).

In addition to the delivery of individual prenatal services, health care providers may facilitate prenatal care in group settings, including the Centering Pregnancy program implemented in the U.S. (Rising, 1998). This program provides risk assessments, supports and education on a range of pregnancy topics, while encouraging participants to support and learn from each other (Rising, 1998). Benefits of group prenatal care, compared to individual prenatal care, have been reported in many studies, particularly with minority populations (Ickovics et al., 2007;

Thielen, 2012; Tanner-Smith et al., 2014). For example, following participation in group prenatal care, teen women (14-21 years old) had better pregnancy knowledge (Ickovics et al., 2007) and a majority African American sample population had low rates of excess GWG (Tanner-Smith et al., 2014). Thus, health care providers represent a valuable resource to obtain prenatal health information and interventions to improve maternal lifestyles and behaviours, through both individual and group prenatal care services.

Health Awareness Campaigns

Mass media and awareness campaigns can capture the attention of large, diverse audiences, with the ability to enhance awareness about risks and influence healthy behaviours (Wakefield et al., 2010). An Ontario study revealed that 69% of women remembered seeing information from a national Public Health Agency of Canada (PHAC)-commissioned FASD campaign in 2006, which resulted in a significant increase in the number of women who perceived that alcohol consumption can harm a developing baby, compared to 2002 data (Burgoyne, 2007). Therefore, mass media prenatal health awareness campaigns may similarly be used for prenatal health promotion.

Tobacco awareness campaigns are good examples of successful interventions that have raised awareness of risk behaviours and adverse health effects, with a broad population reach. A review of the effects of tobacco product health warning messages revealed higher risk perception and knowledge associated with the implementation of large, fear-arousing images and personal testimonials (Hammond, 2011). Use of health warning images is particularly effective to target typically hard to reach populations, including those of low literacy (Thrasher

et al., 2012). Similarly, it is advantageous to design prenatal health promotion messages in a relatable, easily accessible and understandable manner that targets all pregnant women. As such, depictions of alarming maternal risk behaviours and adverse pregnancy outcomes may be used to trigger an emotional response in women and raise awareness for prenatal health risks (Neuhauser & Kreps, 2003).

The Internet and Mobile Applications

Women may actively or passively obtain online health information from visiting websites, browsing social media, and participating in web-based interventions. In general, online health interventions are cost-effective and provide accessible, customizable (to an extent), interactive and personalized information (Murray et al., 2012; Neuhauser & Kreps, 2003; Kreps & Neuhauser, 2010; Cugelman et al., 2011; Lagan et al., 2010). Internet-based health promotion delivered through tailored, interactive strategies can have a positive impact on behaviour change, as this may stimulate information uptake (Webb et al., 2010; Cugelman et al., 2011; Dunton & Robertson, 2008). Active participation in online quizzes, games and exercises (Hearn et al., 2014) may improve information retention, engagement and contribute to actual behaviour changes. Despite these benefits, online platforms may lack content tailored to the diverse cultural, linguistic and literacy needs of users, as documented in a review of online cancer information (Neuhauser & Kreps, 2008). An Ontario needs assessment demonstrated that prenatal educators perceive online education to be non-user friendly, particularly for low literacy populations, and to lack an interactive component between educators and class participants (Best start Resource Centre, 2014). Although the Internet is a valuable tool with the potential to actively engage users and promote behaviour change, these platforms must be

designed to be inclusive and accessible to all women, for the purposes of prenatal health promotion.

The Internet is a widely accessed pregnancy resource by women around the globe, including women from the U.K., Canada, Australia, the U.S. and Sweden (Hearn et al., 2014; Lagan et al., 2010; Huberty et al., 2012; Larsson et al., 2009). Few studies have evaluated pregnancy behaviour changes associated with online prenatal health promotion, however actively seeking evidence-based online resources positively impacts pregnancy-related knowledge (Comer & Grassley, 2010; Adolfsson et al., 2014; Bates & Riedy, 2012). According to a web-based study with mostly U.K. participants, among the most commonly accessed Internet-pregnancy topics were pregnancy complications and health promotion and lifestyles. Many women in this study also used the Internet to verify information provided by their health care provider (Lagan et al., 2010). American mothers use online-information as a key factor in physical activity and prenatal nutrition decision-making (Huberty et al., 2013). Despite the fact that mothers trust the credibility and quality of evidence-based information on government agency websites, these resources are used less frequently, as they are perceived to be less user-friendly and to lack sufficient promotion of local services (Hearn et al., 2014; Lagan et al., 2010).

An Australian study reported that pregnant women favour individualized online information and thus prefer to use mobile apps (Hearn et al., 2014). Such resources have the capacity to provide quick responses to questions, interactive tools, and allows for progress tracking and self- assessments (Hearn et al., 2014). Several pregnancy mobile apps exist, including OMama (OMama, 2015) in Canada and text4baby app (Evans et al., 2012) in the U.S., which targets

low income and young women with insufficient access to pregnancy services. Assessment of the text4baby app revealed an increase in pregnancy-related knowledge associated with its use (Evans et al., 2012). Therefore, the Internet is a feasible platform for women to access credible, interactive and tailored prenatal health information, as the uptake of online content increases pregnancy knowledge and encourages healthy behaviours.

Barriers to Prenatal Health Promotion Access

It is well established that specific groups lack access to prenatal services or access services less frequently. Women missing from prenatal education programs include those with low education and income, those who are unemployed, born outside of Canada, non-Anglophone, and who are members of a visible minority community (Best Start Resource Centre, 2014; Stoll & Hall, 2012; Grewal et al., 2008; Reitmanova & Gustafson, 2008). Other barriers to prenatal class attendance may be lack of service awareness, lack of specialized and childcare services, as well as time and transportation constraints (Best Start Resource Centre, 2014; Murphy Tighe, 2010; Higginbottom et al., 2015; Brar et al., 2009; Grewal et al., 2008; Reitmanova & Gustafson, 2008). Barriers to prenatal service access experienced by inner city Winnipeg women, largely of Aboriginal status (Heaman et al., 2015), and by Hispanic-born minorities in the U.S. (Berman, 2006), include transportation and financial issues, lack of service awareness, childcare and social support, in addition to distant service locations. Rural Australian women identify cost of travel, the inconvenience of long travel times, and related travel-stress to be associated with access to prenatal care services offered outside their community (Hoang et al., 2014). Financial barriers also exist, which may be the result of insufficient health care insurance. Canada's universal access to health care solely applies to

citizens and therefore undocumented immigrants and some women with legal, temporary statuses may lack health care coverage and attend fewer prenatal visits, at later stages of pregnancy (Jarvis et al., 2011). However, in countries without universal health care coverage, such as the U.S., financial constraints may largely impede access to prenatal health care services for many citizens (Parikh et al., 2014).

Several racial/ethnic, immigrant and Francophone populations experience language barriers with prenatal service access (Reitmanova & Gustafson, 2008; Davies & Bath, 2001; Brar et al., 2009; Lacaze-Masmonteil et al., 2013). Canadian immigrant Muslims and U.K.-Somali women both describe insufficient proficiency in English as hindering their ability to access maternity care specific to their needs (Reitmanova & Gustafson, 2008; Davies & Bath, 2001). Interviews with South-Asian born Canadian women also describe language constraints when using perinatal services, with only 13% of this population sample having attended prenatal classes (Brar et al., 2009). Canadian Francophone women reported that there was limited maternity services available in French and notably experienced language barriers in emergency or stressful situations (Lacaze-Masmonteil et al., 2013).

Barriers to health services may also include lack of cultural, religious and inclusive programs, tailored to specific needs of populations or groups at-risk. Cultural and religious beliefs and practices are important and differ in many cultures, as seen from the experiences of immigrant Punjabi (Grewal et al., 2008), Muslim-Canadian (Reitmanova & Gustafson, 2008) and African-Australian women (Carolan & Cassar, 2010). Immigrant Canadian-Muslim women perceive health care providers to lack knowledge, insight and sensitivity in regard to their specific cultural and religious beliefs (Reitmanova & Gustafson, 2008), while they also

experience discrimination. In example, Muslim women reported encounters with health care providers who were uninformed on culturally appropriate physical examination strategies and who were unable to provide them with maternity care during their fasting (Reitmanova & Gustafson, 2008). Prejudicial attitudes of health care workers have also been encountered by U.K.-Somali women, who felt judged by their health care provider for their inability to speak English and thus decreased compliance with following instructions (Davies & Bath, 2001). Women of immigrant Hispanic origin perceived U.S. prenatal education classes to use inappropriate teaching strategies and styles, which were culturally insensitive (Berman, 2006). It is therefore suggested that culturally and linguistically accessible maternity services be offered to all women.

Unaccommodating prenatal services and lack of social inclusion have also been described by members of lesbian, gay, bisexual, transgender, queer (LGBTQ) communities (Hayman et al., 2013; Wilton & Kaufmann, 2001). An Australian study highlights lesbian couples' experiences of homophobia and discomfort when asked inappropriate questions from health care providers (Hayman et al., 2013). According to a U.K. study, many pregnant lesbian couples did not feel comfortable disclosing their sexuality to their midwife, as they felt they may be judged. Many lesbian women who participate in prenatal classes felt excluded, as they perceived classes to be specifically targeted to heterosexuals (Wilton & Kaufmann, 2001). In addition to lesbian couples, transgender men also experience discrimination when accessing maternity care (Light et al., 2014).

Other marginalized populations who experience barriers for social and physical inclusion are pregnant women living with disabilities. A study that interviewed Ontario women with disabilities and chronic illnesses revealed that these mothers perceived prenatal classes as ineffective and unhelpful in terms of pregnancy recommendations targeted to their conditions (Blackford et al., 2000). A review on pregnant women living with physical disabilities found that this population generally experiences barriers when obtaining perinatal care services. The women documented in this study describe health care providers as having insufficient knowledge to provide them with specialized prenatal care, while they also encounter both physical and financial constraints when accessing in-person services (Tarsoff, 2015).

In summary, women may passively or actively uptake prenatal health information through various online and in-person information channels that deliver both general and customized services. Despite availability of these resources, some women experience barriers in accessing prenatal services, due to their diversity in culture, language, race/ethnicity, disability, sexual identities, citizenship and Francophone, Indigenous and immigrant status.

A MULTIJURISDICTIONAL APPROACH TO PRENATAL HEALTH

A summary of the organization of health care and public health for each jurisdictional region that will be discussed in this thesis' research studies are described below.

Canadian Health System Organization

Canada's Medicare system is managed by provincial/territorial and federal governments and provides Canadians free access to medically necessary health services. Although health care

standards and funds are established at the federal level, provinces and territories are responsible for organizing and delivering health care services (Government of Canada, 2016). Canadian public health activities are delivered through each of the governmental levels, with federal and provincial governments involved in research, surveillance and health policy, while municipalities deliver local health services (PHAC, 2013b).

In most provinces, public health is organized as regional health authorities, except territories, which are each considered a health region (Statistics Canada, 2015a). Ontario is divided into Local Health Integration Networks (LHIN), which plan and fund provincial health services in addition to public health activities, such as health promotion (Statistics Canada, 2016a). Health regions are administrative areas responsible for health services (Statistics Canada, 2016a), including the provision of in-person and online prenatal classes. Throughout this thesis, I have used the term ‘**public health regional units**’ to describe either regional health authorities, health regions or LHIN-affiliated public health units.

United States Health System Organization

Health care in the U.S. does not include a national health care plan. Private health care insurance may be purchased or may be publicly funded for certain populations, including those socioeconomically disadvantaged or living with disabilities (Ridic et al., 2012). However, some U.S. jurisdictions administer state wide insurance under the Affordable Care Act (Obamacare), which aims to improve access and affordability of health care (Obama, 2016).

In the U.S., federal public health responsibilities include research, funding and formulating standards and guidelines, while state public health authorities are involved in surveillance, screening and treating diseases. Similar to Canada, health priorities may vary between states (Health Resources and Services Administration (HRSA), 2016). The U.S. federal government additionally funds states with the Title V Maternal and Child Health Services Block Grant Program. This grant supports state-wide development and implementation of maternal and child services. The goal of these services is to provide access to comprehensive prenatal care, notably for low SES and pregnant women at-risk and to support reducing the rates of infant mortality (HRSA, 2016).

Australian Health System Organization

Australia is organized into 6 states and 2 mainland territories (Australian Government, n.d.a). Similar to the U.S. and Canada, Australia's federal government administers health policy, with health services delivered at the state and territory levels (Australian Government, n.d.b). Australian health care is provided through both private and government organizations, which includes the free Medicare system (Australian Government, 2017). Delivery of prenatal services follows the National Maternity Services Plan, agreed upon by Australia's health ministers in 2010 (Australia Government, 2015).

U.K. (England, Scotland) Health System Organization

The National Health Service in the U.K. provides access to publicly funded universal health care. England's health system organization slightly differs from Scotland's, as their central government is responsible for their health care and policy, as opposed to transferring this

responsibility to regional units (Grosios et al., 2010; Steel & Cylus, 2012). In Scotland and England, local health authorities are responsible for delivering publicly-funded health services (Steel & Cylus, 2012; Department of Health, 2011).

Ireland Health System Organization

Ireland's health care system is designed in two tiers, with both public and private services available (Health Service Executive, n.d.a). All public and community health services, including public health, are delivered through the Health Service Executive national organization (Health Service Executive, n.d.b).

In summary, although the organization of health care and public health differs among Canada, U.S., Australia, England, Scotland and Ireland, their mandates for the delivery of public health are similar. Both private and public health systems exist, with their respective government levels responsible for administering prenatal health promotion. Despite these differences, all jurisdictions implement methods for improving health and preventing illness.

THESIS OBJECTIVES

Investment in effective prenatal health promotion strategies not only mitigates maternal lifestyle and behaviour risks, but optimizes maternal and child current and future health status. Many pregnancy risks are modifiable and prenatal health promotion strategies delivered through various mechanisms can broadly reach diverse populations. Thus, the purpose of this Master's thesis is to suggest best practices for the design of online prenatal health promotion

and for the planning, implementation and evaluation of prenatal health services. To reach this goal, I addressed 2 main objectives:

- 1) To evaluate prenatal health promotion content provided by currently available Canadian government-hosted websites and affiliated online prenatal education programs (prenatal e-classes).
- 2) To perform a multijurisdictional evaluation of prenatal and maternity care guidelines, policy documents and frameworks, developed by clinical associations and regional governments across Canada, United States, Australia, the United Kingdom and Ireland.

Chapter 2: Methodology

This thesis is comprised of two separate studies:

Study 1: *Best practices for online Canadian prenatal health promotion: A public health approach*

Study 2: *Best practices for the design, implementation and evaluation of prenatal health programs*

This chapter provides a generalized overview of the methodological approaches used by both studies. Methodologies specific to each study are elaborated in the manuscripts which appear in subsequent chapters (Chapters 3 & 4).

General Methodology

Program Planning, Implementation and Evaluation

Theoretical approaches to program planning, implementation and evaluation provide a roadmap for intervention frameworks. Although many health program planning models exist, the generalized model provides a broad overview of planning, implementing and evaluating programs, using the following program components: needs assessments, setting goals and objectives, intervention development and implementation, and evaluation of outcomes (Cottrell et al., 2006).

There are various types of program evaluations including summative, conducted at the end of a program cycle to analyze its success (Scriven, 1981), as well as ongoing process and

formative evaluations, which inform improvements for future program implementation (Scriven, 1981; Dehar et al., 1993). Process evaluations aim to analyze and understand program implementation components that influence operation and delivery and are used to interpret program outcomes (Dehar et al., 1993). The objective of this thesis research is to conduct process evaluations to assess the quality of selected prenatal health promotion programs and prenatal health frameworks, using existing standards from the literature. This approach provides insight on the best practices for the design, implementation and evaluation of prenatal health programs.

Environmental Scans

Environmental scans are applied in diverse areas of research, such as program planning, implementation and policy and decision-making (Graham et al., 2008; Albright et al., 2004). Rowel et al., (2005) elucidates the importance of environmental scans in the design and delivery of public health programs that target community needs (Rowel et al., 2005). In the context of my thesis, environmental scans were used for the initial identification and selection of websites, organizations and jurisdictions included in the evaluations, for which I collected and analyzed publicly available content, frameworks and strategies for prenatal health promotion (Wilburn et al., 2016).

Multijurisdictional Approach

Both studies incorporated a multijurisdictional approach; warranted due to the unique organization of public health within provinces, states and countries. Purposive sampling was used to select online prenatal health promotion platforms from different jurisdictions within

Canada and prenatal health programs and guidance documents from various countries. Several studies have used a multijurisdictional approach to evaluate and compare prenatal care guidelines across jurisdictions (Langer et al., 1999; Haerstsich et al., 1999; Bernloehr et al., 2005; Bernloehr et al., 2006). The use of a multijurisdictional lens to evaluate prenatal health promotion content and prenatal health frameworks and guidelines enables the identification of common strategies and approaches, regional perspectives and community-specific interventions. This ultimately leads to the development of best practices in prenatal health promotion and in the design, implementation and delivery of prenatal health programs.

Sampling and Program Evaluation Grids

Prior to content evaluations, a literature review was performed to identify important strategies for prenatal care and health promotion, as well as gaps in the delivery and access to prenatal health services, notably barriers experienced by marginalized populations. Evaluation grids for each study consisted of content categories and scoring systems for comprehensiveness, as informed by the literature (Tables 1-8).

Study 1: *Best practices for online Canadian prenatal health promotion: A public health approach*

1.1 Government-hosted Websites

A Canadian multijurisdictional approach was used to select three federal, 13 provincial/territorial, eight municipal and 10 public health regional units. This purposive sampling approach enabled the assessment of programs targeted to diverse populations and

geographical regions. Federal government authorities were selected based on their mandates to promote population health and safety. All provincial/territorial government websites were included. Municipal and public health regional unit websites were selected based on geographical representations across Canada, with emphasis on demographically large cities and regions.

1.2 Prenatal e-classes

Environmental scans of municipal and public health regional unit-hosted websites were used to identify endorsed online prenatal education programs (prenatal e-classes).

1.3 Study 1. Program Evaluation Grids

Detailed evaluation grid criteria developed from the literature (Association of Women’s Health, Obstetric, and Neonatal Nurses, 2009; Johnson et al., 2006; Vonderheid et al., 2007; WHO, 2015) were used to score prenatal health promotion content from government-hosted websites and prenatal e-classes. (Tables 1-4).

Table 1. Description of evaluation criteria for comprehensive prenatal health promotion content on government-hosted websites and prenatal e-classes. Essential preconception-prenatal and prenatal-postpartum health promotion topics are scored as follows: 0- no health promotion information provided; 1- topic listed as important; 2- topic explained and/or recommendations/guidelines or resources provided

Comprehensiveness Government-hosted Websites and Prenatal e-classes Scored on a Scale of 0-2		
Evaluation Criteria	Description	Score
Abuse	Maternal exposure to domestic violence or partner abuse.	
Alcohol	Maternal preconception/prenatal consumption of any alcoholic beverage.	

Drugs	Maternal consumption of any type of drug substances including over the counter medications, prescription medications and illegal substances.	
Emotional health	Maternal emotional and mental wellbeing including depression, social support and stress.	
Environmental exposures	Maternal exposures to chemicals or substances in outdoor or indoor environments including, air pollution, dust and household cleaning items.	
Gestational weight gain	Maternal weight gain during pregnancy including issues of excess, appropriate or insufficient weight gain.	
Nutrition	Maternal consumption of various food groups including fruits/vegetables, dairy products, meat and alternatives.	
Occupational health	Maternal workplace health implications including chemical exposures, stress, shift work, heavy lifting.	
Physical activity	Maternal participation in exercise or physical activities including swimming, walking or weight lifting.	
Sexually transmitted infections	Maternal or fetal protection against STIs including safe sex practices and reducing STI transmission to offspring.	
Smoking	Maternal tobacco use and exposure to second-hand smoke.	
Vaccinations	Maternal preconception/prenatal vaccinations including seasonal flu shots and protection against infections like rubella or measles.	
Vitamins	Maternal consumption of vitamins and minerals including, folic acid, calcium, B12 and iron.	

**Comprehensiveness
Prenatal e-classes
Scored on a Scale of 0-2**

Evaluation Criteria	Description	Score
Anemia	Maternal iron consumption.	
Breastfeeding	Includes promoting or describing options for breastfeeding.	
Caesarian section	Includes describing the option of a caesarian section.	
Chronic illness	Maternal chronic illnesses including hypertension, heart disease and disabilities.	
Congenital anomalies	Fetal birth defects including neural tube defects and other organ/body part malformations.	
Doula	Includes promoting or describing maternal services offered by doulas.	

Family doctor	Includes promoting or describing maternal services offered by family doctors.	
Finances	Includes promoting financial support services or describing financial management techniques.	
Gestational diabetes	Includes pre-existing maternal diabetes and diabetes developed during pregnancy.	
Large for gestational Age	Includes behaviours and lifestyles for reducing risks for LGA.	
Midwife	Includes promoting or describing maternal services offered by midwives.	
Natural birth	Includes promoting or describing the option of natural births.	
Obstetrician/gynaecologist (OB/GYN)	Includes promoting or describing maternal services offered by OB/GYNs.	
Pain management	Includes promoting or describing the option of pain management.	
Parenting	Includes information on preparing for parenthood.	
Postpartum depression	Includes information on preventing, recognizing or managing postpartum depression.	
Pre-eclampsia	Includes behaviours and lifestyles for reducing risks and controlling pre-eclampsia symptoms.	
Preterm birth	Includes reducing risks for preterm birth, recognizing preterm birth symptoms and managing preterm newborn health.	
Small for gestational age	Includes behaviours and lifestyles for reducing risks for SGA.	
Social support	Includes promoting or describing social support options.	

Table 2. Description of evaluation criteria for evidence-based prenatal health promotion content on government-hosted websites and prenatal e-classes. Evidence-based essential preconception-prenatal health promotion topics are scored as follows: 0- prenatal content not accompanied by reference of health authorities, government agencies, scientific literature or medical associations; 1- prenatal content accompanied by reference type noted above.

Evidence-Based Content Government-hosted Websites and Prenatal e-classes Scored as 0 or 1	
Evaluation Criteria	Score
Abuse	
Alcohol	
Drugs	
Emotional health	

Environmental exposures	
Gestational weight gain	
Nutrition	
Occupational health	
Physical activity	
Sexually transmitted infections	
Smoking	
Vaccinations	
Vitamins	

Table 3. Description of evaluation criteria for accessible prenatal health promotion content on government-hosted websites and prenatal e-classes. Linguistic accessibility and usability features are scored as follows: 0- criteria not satisfied; 1-criteria satisfied.

Accessibility Government-hosted Websites and Prenatal e-classes Scored as 0 or 1		
Evaluation Criteria	Description	Score
Pregnancy portal/page	Includes organization of pregnancy information in a discrete section, page or portal.	
Concise text	Includes text displayed in short easy to follow sections (i.e. not in large paragraphs or pdf documents).	
Bilingual content	Includes providing most prenatal health promotion content in English and French. This excludes google translate tools.	
Multilingual content	Includes providing some prenatal health promotion content/resources in a third language. This includes linked and downloadable resources and excludes google translate tools.	
Accommodations for visual/hearing impairments	Includes providing disability tools, closed-captioning, audio-recordings and adjustable font sizes. Disability refers to both physical or mental abilities.	
Accommodations for low literacy	Includes providing prenatal health promotion content accompanied by videos or images that directly imply pregnancy behaviour change (i.e. red prohibition sign over a pregnant woman smoking), or that largely aid in understanding the content provided (i.e. Canada's Food Guide). This excludes general images, including happy pregnant women/babies or images of food.	

Table 4. Description of evaluation criteria for inclusive prenatal health promotion content on government-hosted websites and prenatal e-classes. Inclusive images, content and resources are scored as follows: 0- criteria not satisfied; 1-criteria satisfied.

Inclusivity Government-hosted Websites and Prenatal e-classes Scored as 0 or 1		
Evaluation Criteria	Description	Score
Visual depiction of racial/ethnic populations	Includes images or videos of mothers, parents or families of non-Caucasian race or ethnicity.	
Visual depiction of teen populations	Includes images or videos of particularly young mothers or couples.	
Visual depiction of populations living with disabilities	Includes primarily physical disabilities which were evident in visual depictions.	
Visual depiction of LGBTQ populations	Includes images or videos with LGBTQ mothers, parents or families.	
Prenatal health promotion content targeted to Indigenous populations	Includes prenatal health information or promotion of resources targeted to Indigenous mothers, parents or families.	
Prenatal health promotion content targeted to teen populations	Includes prenatal health information or promotion of resources targeted to teen mothers or parents.	
Prenatal health promotion content targeted to populations living with disabilities	Includes prenatal health information or promotion of resources targeted to mothers or parents living with physical or mental disabilities.	
Inclusivity Government-hosted Websites Scored as 0 or 1		
Evaluation Criteria	Description	Score
Prenatal health services/resources targeted to immigrant populations	Includes the promotion of organization names, contact information or links to services or resources targeting the pregnancy needs of immigrant mothers or parents.	
Prenatal health services/resources targeted to populations of low socioeconomic status	Includes the promotion of organization names, contact information or links to services or resources targeting the pregnancy needs of low SES mothers or parents.	
Promotion of in-person prenatal classes	Includes the promotion/description of in-person prenatal classes offered to parents in the government-hosted website catchment region.	
Promotion of online prenatal classes	Includes the promotion/description of online prenatal classes (prenatal e-classes) offered to parents in the government-hosted website catchment region.	

Promotion of teen prenatal classes	Includes the promotion/description of in-person or online prenatal classes or programs offered to teen mothers or parents in the government-hosted website catchment region.	
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Study 2: *Best practices for the design, implementation and evaluation of prenatal health programs*

2.1 Prenatal Health Guidance Documents

A multijurisdictional approach was used to select prenatal health guidance documents developed by professional associations and regional governments across Canada, U.S., Australia, the U.K. and Ireland. This study defines prenatal health guidance documents as frameworks, strategies, and interventions outlining the planning, implementation and evaluation of prenatal health services, with the aim of optimizing maternal and child health. Standardized reports and documents outlining program evaluations and needs assessments were excluded.

Recognizing the organization of health care in Canada and the U.S., provincial/territorial and state guidelines were included as well as federal guidance documents. As Australia consists of national maternity service plans that encompass regional maternal care, only federal and national prenatal guidance documents were selected from Australia. National guidelines from England, Scotland and Ireland were included. Inclusion of prenatal health guidance documents for evaluation was purposive, selecting years from 2000- 2017 and ensuring jurisdictions were geographically and demographically diverse, particularly for Canada and the U.S. Reproductive health guidelines from relevant clinical associations were also included, as they

represent national reproductive health authorities responsible for developing guidelines for both medical and public education.

2.2 Study 2. Program Evaluation Grids

Detailed evaluation grid criteria developed from the literature (Johnson et al., 2006; WHO, 2015; Chalmers et al., 2001; Glanz & Bishop, 2010; Atrash et al., 2006) were used to score prenatal care practices from prenatal health guidance documents (Tables 5-8).

Table 5. Description of evaluation criteria for the components of prenatal health program design. Prenatal guidance documents were scored as 0 or 1: 0- practice not mentioned; 1- practice addressed.

Program Design Prenatal Guidance Documents- Canada, U.S., Australia, U.K., Ireland, Clinical Associations Scored as 0 or 1	
Evaluation Criteria	Description
Evidence-based	Use/promotion of evidence in creating program guidance document, including literature reviews, use of indicators and surveillance/monitoring data.
Theoretical foundation	Use/promotion of theory in creating program guidance document practices including, life course approach, population health approach and the socio-ecological model.
Expert collaborations	Use/promotion of collaborative action with organizations and professionals in the field of maternal and child health, including those from academic, clinical and government fields.
Stakeholder collaborations	Use/promotion of collaborative action with entities involved in promoting maternal and child health, including schools and workplaces.

Table 6. Description of evaluation criteria for the components of prenatal health program implementation and evaluation. Prenatal guidance documents were scored as 0 or 1: 0- practice not mentioned; 1- practice addressed.

Program Implementation, Evaluation Prenatal Guidance Documents- Canada, U.S., Australia, U.K., Ireland, Clinical Associations Scored as 0 or 1	
Evaluation Criteria	Description
Surveillance/monitoring	Inclusion/promotion of the importance of data collection on maternal and child health indicators as well as program activities and successes.
Health care provider training	Inclusion/promotion of practices for enhancing the knowledge, skills and capacities of health care providers in delivering quality, safe and appropriate prenatal care.
Community capacity building	Inclusion/promotion of practices for creating, advancing and sustaining prenatal health programs, services and care.

Table 7. Description of evaluation criteria for the components of prenatal health program population reach. Prenatal guidance documents were scored as 0 or 1: 0- practice not mentioned; 1- practice addressed.

Population Reach Prenatal Guidance Documents- Canada, U.S., Australia, U.K., Ireland, Clinical Associations Scored as 0 or 1	
Evaluation Criteria	Description
Accessibility	Inclusion/promotion of practices for facilitating use of prenatal programs and services, including improvements in transportation, location and availability, as well as the provision of information in various language options and multi-media formats.
Inclusivity	Inclusion/promotion of practices for facilitating use of prenatal programs and services including reducing disparities, enhancing delivery of culturally appropriate care and providing services/care that meet the needs of diverse populations.
Prenatal health promotion	Inclusion/promotion of practices for maternal/parental education and communication, including promoting prenatal classes/programs and use of various technologies.
Strategies for partner/father	Inclusion/promotion of practices specifically targeting a woman's partner/baby's father, including health promotion education, behavioural interventions and disseminating information booklets.

Table 8. Description of evaluation criteria for the components of patient care models for prenatal health services. Prenatal guidance documents were scored as 0 or 1: 0- practice not mentioned; 1- practice addressed.

Models of Patient Care Prenatal Guidance Documents- Canada, U.S., Australia, U.K., Ireland, Clinical Associations Scored as 0 or 1	
Evaluation Criteria	Description
Woman-centred care	Explicit use/promotion of the term ‘woman-centred’ in their approach to prenatal health. This strategy involves the provision of holistic, individualized services and informed decision-making.
Family-centred care	Explicit use/promotion of the term ‘family-centered’ in their approach to prenatal health. This strategy consists of family involvement and family health promotion.
Prenatal provider of choice	Explicit statements that acknowledge women’s freedom to choose their prenatal health care providers including midwives, OB/GYN and family doctors.
Companion of choice	Explicit statements that acknowledge women’s freedom to choose their companion during prenatal visits, care or labour and delivery including, partners, family members, friends and doulas.
Sexual and reproductive health rights approach	Explicit use/promotion of the term ‘sexual and reproductive health rights’ in their approach to prenatal health. This strategy acknowledges women’s rights to family planning and access to reproductive care.

2.3 Developing a Framework for Best Practices

PHAC defines a *best practice* as a high-quality evidence-based program or strategy (PHAC, n.d.). Best practices have high impact upon implementation and successful transferability across different settings (PHAC, n.d.), which thereby aligns with the overall objectives of this thesis. Suggested best practices in the design of online prenatal health promotion and in the planning, implementation and evaluation of prenatal health programs represent the most common and thus successful strategies across jurisdictions. This supports the potential transferability of these best practices across a range of developed countries, as well as at local, national and international levels (PHAC, n.d.).

Data Analysis

Data obtained through evaluating government-hosted websites, prenatal e-classes and prenatal health guidance documents were recorded and organized in an evaluation grid checklist (Tables 1-8) and assessed in a systematic manner by at least two researchers. Evaluation findings were compared between two to three researchers and scoring consensus was reached through discussion. The main goal of each study was not to distinguish jurisdictions with the highest and lowest scores, but to identify major content and strategies among jurisdictions, which collectively inform best practices. Therefore, all results were scored and interpreted as averages per jurisdiction.

In summary, multijurisdictional process program evaluations were conducted for online prenatal health promotion programs and prenatal health guidance documents. Prenatal health content was scored and organized using the literature-informed evaluation grids (Tables 1-8). The resulting recommended best practices described in Chapters 3 and 4, target prenatal program planners, public health professionals and prenatal health care providers. These best practices aim to enhance the capacity of prenatal health professionals to understand the diversity of pregnant women, particularly related to cultural, social and learning characteristics. Another goal is to inform prenatal health professionals about the importance of women's access to credible prenatal health information, especially new residents/citizens, and to foster collaborations among health care providers and public health organizations, thereby addressing all aspects of women's health.

Chapter 3:
Study 1 Manuscript Submitted and Accepted to the Journal
***Women and Birth* (Publication In Press)**

Title: Best practices for online Canadian prenatal health promotion: A public health approach

Running title: Canadian Prenatal Health Promotion

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Abstract:

Background: Prenatal health promotion provides information regarding pregnancy risks, protective behaviours and clinical and community resources. Typically, women obtain prenatal health information from health care providers, prenatal classes, peers/family, media and increasingly, Internet sites and mobile apps. Barriers to prenatal health promotion and related services include language, rural/remote location, citizenship and disability. Online public health platforms represent the capacity to reach underserved women and can be customised to address the needs of a heterogeneous population of pregnant women.

Aim: Canadian government-hosted websites and online prenatal e-classes were evaluated to determine if accessible, inclusive, comprehensive and evidence-based prenatal health promotion was provided.

Methods: Using a multijurisdictional approach, federal, provincial/territorial, municipal and public health region-hosted websites, along with affiliated prenatal e-classes were evaluated based on four criteria: comprehensiveness, evidence-based information, accessibility and inclusivity.

Findings: Online prenatal e-classes, federal, provincial/territorial and public health-hosted websites generally provided comprehensive and evidence-based promotion of essential prenatal topics, in contrast to municipal-hosted websites which provided very limited prenatal health information. Gaps in online prenatal health promotion were identified as lack of French and multilingual content, targeted information and representations of Indigenous peoples, immigrants, and women with disabilities.

Conclusion: Canadian online prenatal health promotion is broadly comprehensive and evidence-based, but fails to address the needs of non-Anglophones and represent the diverse

population of Canadian pregnant women. It is recommended that agencies enhance the organisation of website pregnancy portals/pages and collaborate with other jurisdictions and community groups to ensure linguistically accessible, culturally-competent and inclusive prenatal online resources.

KEY WORDS: health promotion, public health, pregnancy, Internet, prenatal health, prenatal classes

Statement of Significance

Problem or Issue	Prenatal health promotion mitigates adverse pregnancy outcomes; however, women marginalised by race/ethnicity, geography, disability and Indigenous status experience barriers accessing prenatal health information.
What is Already Known	Although increasingly women use online prenatal health resources, these channels may be inaccurate. Public health agencies are mandated to promote health and have the resources and public trust to provide evidence-based, credible prenatal health information.
What this Paper Adds	Canadian government-hosted websites and prenatal e-classes are broadly comprehensive and evidence-based, but to a lesser extent accessible and inclusive. Prenatal health promotion lacked representations of women with disabilities and disability-specific information/resources. Partnerships with at-risk communities and jurisdictional collaborations are recommended.

1. Introduction

Prenatal health promotion encompasses health policies, awareness campaigns and educational interventions that encourage women to optimise healthy behaviours and reduce risks, thereby supporting maternal and child health.¹⁻⁴ Recognising the diverse, interactive determinants of reproductive health throughout the life course,⁵ strategies for promoting prenatal health should also target preconception, interconception and early pregnancy.⁶ Promoting healthy behaviours throughout the life course can positively influence pregnancy outcomes, including reducing risks for birth defects and preterm birth.⁵⁻⁷

Effective prenatal health promotion should be evidence-based and should employ strategies to promote accessible and inclusive prenatal services to at-risk populations.^{7,8} The evidence regarding many modifiable prenatal risks is consistent, yielding relatively standard prenatal health guidelines and recommendations.^{2,7,8} Important areas for prenatal risk screening include chronic medical conditions/infectious diseases, medication use, genetics and immunisation records.⁷ Preconception and early prenatal interventions also represent opportunities to promote nutrition, physical activity and social support, while mitigating risks posed by tobacco, alcohol and substance use, occupational and environmental exposures, and obesity and excess gestational weight gain,^{6,7,9} as described in Box 1.

Women access prenatal health promotion through various channels including health care providers,^{1,2,4} prenatal classes/programmes¹⁰ and the Internet.¹¹ Online health promotion is a

cost-effective strategy to provide information, resources and education to a large diverse audience.^{10,11,12} It is estimated that approximately 87% of Canadians have Internet access,¹³ supporting Internet health promotion strategies as viable and broadly accessible in Canada. Studies from Canada,¹⁴ the U.S.,¹⁵ the U.K.,¹¹ and Australia¹² report that women use the Internet to obtain information on maternal-child health topics including environmental hazards, physical activity, nutrition, labour, and pregnancy complications.

The Centres for Disease Control (CDC)/Agency for Toxic Substances and Disease Registry (ATSDR) Preconception Care Work Group recognise the role of public health agencies in the development and delivery of prenatal health promotion programmes.⁷ Both public health and prenatal health promotion strategies develop targeted interventions for communities marginalised by race/ethnicity, socioeconomic status (SES), and citizenship.³ Public health in Canada includes promotion of healthy pregnancy and childhood development, as well as prenatal education.¹⁰ Canada's geographic diversity (urban, rural and remote) poses unique challenges for the delivery of public and prenatal health services to a heterogeneous, multicultural and multilingual population—challenges which may be addressed by online prenatal health promotion platforms. Recognising the potential role of government-hosted websites to provide prenatal health information, the purpose of this study is to evaluate the current availability and quality of Canadian online prenatal health promotion. Specifically, this study will assess whether government-hosted websites and affiliated online prenatal education programmes (prenatal e-classes) provide accessible, inclusive, comprehensive and evidence-based prenatal health promotion to Canadians.

2. Methods

2.1. Website and prenatal e-class inclusion criteria

A multijurisdictional approach was used to select government-hosted websites at federal, provincial/territorial and municipal levels, along with public health regional units. In Canada, public health activities and services are delivered through three government levels: federal, provincial/territorial and municipal.¹⁶ Federal and provincial/territorial health agencies are involved in research, surveillance and health policy, while most municipalities provide health services at a local, community level.¹⁶ Websites from each province/territory were included in the evaluation (Table 1).

Within each province/territory, public health at the community level is delivered by regional health authorities. In Ontario, Local Health Integration Networks are comprised of public health units.¹⁰ Throughout this paper, we refer to public health units and regional health authorities as “public health regional units”. Municipalities and public health regional units included in the study were selected based on geographic representation across Canada, with emphasis on provincial capitals and demographically large cities or regions (Table 1). Three federal (Health Canada, Public Health Agency of Canada (PHAC), Environment Canada), 13 provincial/territorial, 8 municipal and 10 public health regional unit-hosted websites were assessed (Table 1).

An environmental scan of provincial/territorial, municipal and public health regional unit websites led to the identification of several types of prenatal e-classes endorsed by these organisations (Table 2). Inclusion of prenatal e-classes for evaluation was purposive, ensuring

both geographic representation and widespread affiliation with multiple municipalities/public health regional units (Table 2). Six commercially-developed prenatal e-classes endorsed and promoted by public health regional units and one prenatal e-class developed by an Ontario public health unit (Durham Region Health Department) were included in this study. All classes were freely available to women living in the catchment regions of municipalities/public health regional units. Access to these prenatal programmes was granted to the researchers by public health regional units or the prenatal e-class designer for the purposes of this study. Evaluations were based exclusively on the original programme content and did not include customised information added by municipalities/public health regional units.

2.2. Evaluation methodology

Evaluation of prenatal health promotion content on government-hosted websites and prenatal e-classes began in September, 2016 and was completed in May, 2017, with all websites periodically revisited throughout this time frame. Evaluation grids were created to assess prenatal health content based on four main criteria: comprehensiveness, evidence-based information, accessibility and inclusivity. Each website and prenatal e-class was evaluated in a standardised manner by at least two researchers, using a scoring system described below. Scoring discrepancies were discussed in team meetings with final scores agreed upon by consensus. Scores are reported as the average score per jurisdiction, with atypical findings described in the results.

Parenting/pregnancy portals or the home page of the host website were evaluated followed by keyword searches in English and French, corresponding to terms identified in Box 1. Content

was determined to be ‘prenatal health promotion’ if the information was targeted to lay audiences, used non-expert language and promoted prenatal health information and resources. Scientific articles, technical bulletins or information specifically targeted to health professionals/researchers were not considered health promotion content, and thus were not evaluated. Prenatal e-classes were reviewed in their entirety including the completion of online modules and tests, as well as reviewing videos and other content—similar to the experiences of regular class participants.

2.3. Comprehensiveness of online prenatal health topic content

Government-hosted website and prenatal e-class content was evaluated for the breadth and quality of prenatal health promotion, emphasising established prenatal health topics (Box 1). The total number of prenatal health topics (“breadth”) per website or e-class was determined using the list in Box 1, with a maximum possible score of 13, and presented as an average breadth for each jurisdiction. Prenatal e-classes were further evaluated for breadth and quality of clinical and prenatal-postpartum care topics. Comprehensiveness of prenatal, clinical and postpartum health topics were evaluated as follows: 0- no health promotion information provided; 1- topic listed as important; 2- topic explained and/or recommendations/guidelines or resources provided. The proportion of websites/e-classes per jurisdiction which provided comprehensive prenatal health promotion for each topic (score=2) was determined.

2.4. Scientific quality (evidence-based) of online prenatal health topic content

Websites and prenatal e-classes were considered “evidence-based” if health authorities, government agencies, scientific literature or medical associations were referenced in the presentation of at least three prenatal topics (Box 1).

2.5. Accessibility of online prenatal health content

Accessibility of online prenatal health promotion content was evaluated in terms of linguistic, accessibility and usability criteria. Linguistic criteria included the availability of content as brief text passages and in multiple languages, while accessibility features included accommodations for users with visual/auditory disabilities (e.g. font size adjustments, closed captions/transcript options for videos and audio narration) and availability of health promotion messages depicted by images/videos/diagrams for users with low-literacy. Usability or ‘user-friendliness’ was assessed by the organisation of pregnancy-related information in discrete web pages or portals and the technical functionality of the website. Evaluation scoring for linguistic, accessibility and usability features was as follows: 0- unilingual content, missing features, technical difficulties and 1- multilingual platforms, features present, no technical difficulties.

2.6. Inclusivity of online prenatal health content

Government-hosted websites and prenatal e-classes were evaluated to determine if content and visual depictions were representative of Canadian pregnant women. Specifically, images and videos were evaluated to determine if the following groups were depicted: Indigenous peoples, immigrants/refugees, teens/young parents, lesbian, gay, bisexual, transgender, queer

(LGBTQ) individuals and people with disabilities. Prenatal health promotion content specifically targeted to at-risk groups as well as the promotion of available services and resources was noted for each website/e-class. Visual depictions, targeted content and the availability of services and resources were scored separately for each group as follows: 0- no visual depictions or no content or resources promoted; 1-images/content/resources present.

3. Findings

3.1. Comprehensiveness of online prenatal health promotion

Most federal, provincial/territorial and public health regional unit websites and prenatal e-classes demonstrated both breadth and depth of prenatal topics, in contrast with all but two municipal websites (Table 3, Figure 1). Risk information about alcohol and health benefits of vitamins and nutrition were consistently promoted in a comprehensive manner, unlike maternal abuse, drug use, emotional health and occupational health. For almost all topics assessed (Box 1), public health regional units and prenatal e-classes provided the most comprehensive prenatal health promotion. Risks to pregnancy posed by sexually transmitted infections (STIs) and the importance of immunisations (e.g. influenza vaccines) during pregnancy were notable gaps among prenatal e-classes (Figure 1B).

Our assessment of the quality of prenatal health promotion revealed that 66.6% of federal, 84.6% of provincial/territorial, 80% of public health regional unit-hosted websites and 87.5% of prenatal e-classes included at least three referenced prenatal health topics, indicating the content is evidence-based, whereas only 25% of municipal websites met this criterion. In general, peer-reviewed scientific literature was rarely cited; instead other government

guidelines represented typical expert sources. Health Canada, PHAC or a provincial health agency were frequently cited, particularly in the context of nutrition, alcohol and gestational weight gain guidelines.

Prenatal e-classes provided evidence-based, comprehensive health promotion related to essential prenatal health promotion topics, in addition to generally comprehensive information on health care providers/labour options and postpartum care (Figure 1, Table 3, 4). Less than half (3/7) of prenatal e-classes differentiated the roles of healthcare providers, however comprehensive information about labour options was provided consistently. Similarly, prenatal e-classes provided detailed and thorough postpartum care information including content on breastfeeding, parenting, postpartum depression and the importance of social support (Table 4). Pregnancy complications were addressed to a lesser extent by prenatal e-classes, with classes only briefly listing topics such as LGA (14%), pre-eclampsia (42.8%), anaemia/chronic illness/SGA (57%) without providing explanation or detail. Preterm birth, gestational diabetes and congenital anomalies were well promoted in a comprehensive manner (score =2; Table 4).

3.2. Accessibility of online prenatal health promotion

Provincial/territorial and public health regional unit-hosted websites generally included a designated page/portal for pregnancy-related information enabling users to easily access relevant content. The majority of federal and provincial/territorial-hosted websites provided prenatal content that was bilingual (French-English) and presented as concise text passages (Figure 2). Prenatal e-classes were designed with features which could accommodate low

literacy and visual/auditory disabilities. Designed as educational platforms, prenatal e-class content was available in multimedia formats such as text, images, videos, interactive modules, quizzes and diagrams. Only one French-language prenatal e-class (*Une nouvelle vie*) was endorsed by municipalities/public health regional units in our study. The website for the northern territory of Nunavut was distinctly accessible as prenatal health promotion content was provided in English, French, and two indigenous Inuit languages—Inuinnaqtun and Inuktitut. The Northwest Territories-hosted website included widespread options for page audio narration, accommodating for users with visual impairments. In general, we identified no major technical issues navigating websites/e-classes; however, important gaps in the availability of bilingual and multilingual prenatal content were noted, particularly among municipal and public health regional unit-hosted websites. Accommodations for visual/auditory disabilities and low literacy in the presentation and design of the prenatal content could also be improved for most websites.

3.3. Inclusivity of online prenatal health promotion

In general, most websites and prenatal e-classes depicted pregnant women and their families as racially/ethnically diverse (Figure 3A). Although both public health regional units and prenatal e-classes included images of teen/young parents, members of the LGBTQ community were only well represented in prenatal e-classes. A significant gap for all websites and prenatal e-classes is the lack of visual representation and specific information and resources targeted to women with disabilities (Figure 3A,B). For example, we found no strategies for physical activity or gestational weight management targeted to this community. Less than half of government-hosted websites in each jurisdiction promoted specific prenatal

information/resources for Indigenous peoples and new Canadians. Nunavut’s website provided a colourful Nunavut Food Guide flyer, acknowledging limited supplies of fresh produce in the North and ‘country foods’—referring to traditional diet of wild game, fish and edible plants and berries. Similarly, the Quebec-hosted website provided a link to Canada’s Food Guide for First Nation’s, Inuit and Métis. Prenatal e-classes did not include specific information for Canada’s Indigenous peoples or women with disabilities, but one evaluated e-class, “Welcome to Parenting for Young Parents,” was specifically designed for teens/young mothers.

Websites also provided information about community resources, classes and opportunities for pregnant women (Figure 3C). Most provincial/territorial and public health regional unit-hosted websites promoted in-person prenatal classes, teen-specific prenatal classes and resources for low SES groups. About half of municipalities evaluated promoted resources for teen prenatal classes and pregnant women marginalised by low SES. In general, gaps remain for all jurisdictions in the promotion of resources for pregnant women marginalised by low SES, disability, immigration and Indigenous status.

4. Discussion

Canadian government-online prenatal health promotion is generally comprehensive and evidence-based. Provincial/territorial and public health regional units provided the greatest breadth and depth of prenatal health promotion, comparable to available prenatal e-classes which have been purposefully designed. Notable gaps in government-hosted online health promotion include the limited accessibility of prenatal health promotion to non-Anglophones

and the lack of targeted information for pregnant women marginalised by disability, sexual identities, immigration, or Indigenous status.

There is a paucity of literature regarding standardisation and best practices of prenatal health education content and timing. The literature is equivocal regarding the efficacy of prenatal health promotion/education and maternal outcomes.^{4,10} Recognising that prenatal health promotion programmes represent a diversity of practices, evaluation is difficult. Although interventions designed to target only one or two risk behaviours, such as maternal smoking or alcohol consumption, are well-studied and effective,^{4,6} a more comprehensive approach including a breadth of risk topics better reflects the interacting determinants of maternal-foetal health.⁹

Online health promotion represents an ideal channel to communicate information about seasonal risks (e.g. influenza) and emerging threats to prenatal health (e.g. Zika virus). The American Academy of Pediatrics (AAP) and the American College of Obstetricians and Gynecologists (ACOG) specifically recognise teratogenic medications and chronic conditions or previous exposures including human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS), diabetes, hepatitis B, hypothyroidism, and rubella seronegativity, as critical issues for prenatal evaluation and care.^{6,7} In Canada, HIV-positive women are most likely to be Black, immigrants from an HIV-endemic country or of Aboriginal status,¹⁷ such that these women may experience intersectional marginalisation, stigma and reduced access to care. Incidence of pre-existing major chronic disease in Canada is estimated at 3.67 per 1000 deliveries; posing risks to adverse foetal outcomes and severe maternal morbidity and

mortality.¹⁸ We chose to subsume both medications and substance abuse in the general category of ‘drugs’, noting that most online health promotion emphasised risks from substance abuse, rather than the potential teratogenic consequences of medications used to treat chronic illness.

Most online prenatal health resources addressed potential environmental risks to pregnancy (Figure 1A), which may be represented in the workplace, home or general community,^{14,19} but did not specifically include occupational health risks to pregnancy (Figure 1B) such as biological/chemical exposures, falls or long work hours.^{14,19,20} In Canada, 5.3% of women 15 years and older work in trade, manufacturing and agriculture sectors, with an additional 14.2% employed in health and natural and applied sciences occupations²¹—all sectors associated with workplace injury.

In addition to awareness of the biological/environmental influences on pregnancy, psychosocial factors, including intimate partner violence (‘abuse’)²² and ‘emotional health’ such as stress, social support, depression and postpartum depression²³ should be addressed in prenatal health promotion. Although underrepresented among federal and municipal-hosted websites (Figure 1A), prenatal e-classes provided comprehensive information on these critical psychosocial health topics (Table 4). Interviews with 6,421 recently pregnant Canadian women reveal 15.5% have been diagnosed with depression or treated with antidepressants prior to becoming pregnant. History of depression, self-reported stress and domestic violence can be associated with maternal smoking and drug use,²³ reflecting the interdependency between psychosocial factors and behaviours. Postpartum depression, abuse and stress may be

more prevalent in teen and lower SES mothers, with this population also expressing reduced breastfeeding intention.²³ A large 16-state American study reports younger (<20 years old), black, unmarried, and less educated women experience the highest prevalence of violence prior to pregnancy,²² supporting the need for early information, resources and interventions, particularly for marginalised communities.

The prevalence of disability for Canadian women of reproductive age ranges from 4.3 to 7.1%,²⁴ however we noted almost a complete absence of online targeted information, resources and visual representation of pregnant women living with disabilities (Figure 3). Pregnant women with functional limitations face barriers accessing services, may not be able to comply with physical activity guidelines, and often encounter health care providers who lack specific knowledge concerning their prenatal care.²⁵ Further, pregnant women living with disabilities may be provided with insufficient, inappropriate care and face negative attitudes and social prejudice from their health care providers about their capacity to adapt to motherhood.²⁵ Online prenatal health promotion has the capacity to provide generalised, comprehensive and evidence-based information, while still providing inclusive strategies for different communities of women. Strategies include promotion of links to disability-specific websites, support groups and online outreach to healthcare providers.

Communities marginalised by Indigenous status, immigration status, geographical isolation, language, sexual identities, adolescence and low SES face barriers to prenatal health services access, which ultimately contributes to prenatal health disparities.^{2,3} We noted that provincial/territorial, municipal and public health regional unit-hosted websites provided

resources and specialised programming targeted to at-risk marginalised mothers, specialised in-person classes (Figure 3C), targeted phone lines and support programmes.

4.1. Best practices in online prenatal health promotion

4.1.1. The medium— Internet

The Internet is an established channel for health promotion and as discussed, is a major source of prenatal health information for pregnant women globally. Advantages of online health promotion include cost, ability to link to relevant content, presentation of content in multimedia formats (e.g. images, videos and interactive modules) to appeal to users with different learning styles, social media platforms to encourage networking and the opportunity to provide rapidly emerging health information and/or threats to a wide audience. Health communications for users challenged by low literacy in general, or limited ‘health’ literacy, may be optimised by use of audio, animations, videos and images of healthy behaviours.²⁶

4.1.2. Evidence-based, credible and comprehensive

Challenges for online health promotion remain, emphasising the need for users to avoid websites which may be commercialised, incomplete, of poor quality or which promote health myths or inaccuracies.^{19,27} Users typically overestimate the accuracy and quality of health information online and cross-reference websites to provide matching information that is cognitively consistent with their a priori beliefs, as evidence of credibility.²⁷ A 2002 American Pew study noted that 42% of users rejected health information if the source or reference could not be identified, with 58% of respondents checking health information sources from multiple websites most of the time or always.²⁸ This practice supports the need for prenatal health websites to provide references for their content, including peer-review scientific literature and

guidelines from medical associations and governments. Both government-hosted websites and prenatal e-classes included references to accepted government/health association guidelines using our minimal criteria. Online resources however made no effort to explain more complex maternal risk relationships and health outcomes within the context of scientific uncertainty, or the absence of expert consensus or health association guidelines. Credibility of the website host is achieved through transparency, acknowledging scientific uncertainties and providing content that is consistent with recognised guidelines, frameworks and evidence.²⁹ There is already a high degree of trust placed in government, medical and academic host online information.^{11,19} Government public health agencies may still provide advice to pregnant women by first acknowledging the uncertainty in the field, and promoting the precautionary principle, wherein unnecessary exposures are avoided or reduced.^{19,29} Patients are encouraged to discuss their use of online, social media and mobile prenatal health promotion with their health care providers, thereby providing opportunities for clarification, individualised support and correction of misinformation.^{11,12}

Prenatal health promotion should provide both generalised health risk information and strategies to optimise prenatal health, consistent with guidelines and responsive to emerging information. Prenatal health topics should be introduced individually, but should also be discussed in terms of interacting determinants of reproductive health. Emotional stressors, such as adverse life events, should be related to tendencies to increase dependence on unhealthy habits such as drinking and smoking. Although most pregnancies are uneventful, adverse pregnancy outcomes, targeted information, and resources for at-risk women should be included through links and online networking with government, clinical, academic and

community partners. Designing online health promotion to be interactive creates opportunities for users to meaningfully participate in the development of their health literacy, which will ultimately enhance uptake of the prenatal health promotion messages.²⁶ Finally, organisation of prenatal content into distinct portals/pages optimises the user experience and encourages women to access these credible resources.¹²

4.1.3. Proactive—Preconception, interconception and prenatal health promotion

Most pregnancies are unanticipated and many modifiable risks to pregnancy require significant commitment to make lifestyle changes to lose weight, stop smoking/drinking and increase physical activity. We advocate for preconception health promotion, agreeing with the statement that for many pregnant women, “early prenatal care is too late”.⁶ A valuable best practice in prenatal health promotion is the encouragement of both in-person and online prenatal class participation in early pregnancy and dedicating a significant portion of classes to encouraging healthy lifestyles and behaviours. All other online prenatal resources should be widely accessible by women at all stages of the maternal life course- preconception, interconception, pregnancy and postpartum. Given the interdependency of health behaviours and determinants, and the importance of preconception health, prenatal health promotion benefits from a public health, population health and life course approach,⁵⁻⁷ and has been demonstrated to improve maternal and child health outcomes.^{6,7,10}

4.1.4. Inclusive and accessible= health equity

The impact of online prenatal education depends on a woman’s ability to understand and relate to the information provided. In many respects, accessibility and inclusivity are interdependent variables of best practices in health promotion. Features which render online resources

accessible, including technological and linguistic adaptations, also ensure that the needs of a heterogeneous population of users who represent non-Anglophone, visual or hearing-impaired communities are addressed. Health communication is most effective when targeted groups respond to health messages emotionally as well as rationally, and when messages relate to individuals' social or life contexts.³⁰ These conditions are also met when health messages are tailored to specific communities, with respect to age, gender and race/ethnicity.^{26,30} Addressing the needs of all pregnant women requires both online and in person collaboration among regions, jurisdictions and communities. Inclusion of community stakeholders to periodically evaluate online prenatal health promotion ensures understanding of each community's needs, risk perceptions and cultural beliefs, ultimately producing effective online prenatal health promotion.

4.2. Limitations

There are several limitations associated with our study. First, we acknowledge that online health promotion is a small portion of the activities of many of the organisations evaluated here, such that we cannot comment on the overall comprehensiveness of individual prenatal health promotion programmes. Second, websites were evaluated throughout a specific time period, with the possibility that website redesign or updates may have been scheduled in the near future. Third, our study is not generalisable to all online health promotion in Canada, but is instead a purposeful sample of Canadian online prenatal health promotion during a specific window of time. Fourth, commercial prenatal e-classes may be available in different languages and customisable formats; however, we chose to evaluate the core products that were widely promoted by Canadian public health regional units. Finally, we are aware that regional health

authority boundaries and catchments are also subject to change, with Saskatchewan as an example, planning to amalgamate all 12 regional units under one authority—the Saskatchewan Health Authority. Such consolidations may bring together necessary expertise for health promotion efforts and commensurate budget adjustments.

5. Conclusions

In conclusion, Canadian government-hosted websites and prenatal e-classes generally provided comprehensive and evidence-based prenatal health promotion. Major gaps in online prenatal health promotion included the availability of bilingual and multilingual resources, representations of non-traditional families, including LGBTQ parents, and lack of specialised pregnancy information targeted to women living with disabilities and communities of Indigenous peoples and immigrants. Organisations are encouraged to collaborate with other jurisdictions and community stakeholders to facilitate the exchange of online resources and materials, ensuring visual representation of our heterogeneous community of pregnant women, and the availability of evidence-based, comprehensive, accessible and inclusive prenatal health promotion.

Disclosures

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Figure 1. (A,B) Relative comprehensiveness of preconception-prenatal topics important for health promotion. Comprehensive scores were evaluated for each website and e-class using a scale of 0-2, 0- no health promotion information provided; 1- topic listed as important; 2- topic explained, and/or recommendations/guidelines or resources provided. Shown is the percentage of websites/e-classes within each jurisdiction which provided comprehensive prenatal health information (score =2). “n” is the sample size per jurisdiction. GWG- gestational weight gain, STIs- sexually transmitted infections.

Figure 2. Accessibility of online prenatal health promotion. Websites and prenatal e-classes were evaluated using a scale of 0-1, 0- accommodation/feature missing; 1- criteria met. *Pregnancy Portal/Page* (most prenatal health promotion organised in one section/portal); *Concise Text* (Information presented in reasonable length); *Bilingual Content* (English/French); *Multilingual Content* (other than English/French); *Accommodations Visual/Hearing Impairments* (e.g. adjustable text size, closed captioning, transcripts, audio narration); *Accommodations Low Literacy* (health promotion message represented by photograph, image, diagram or video).

Figure 3. Inclusivity of online prenatal health promotion. Websites and prenatal e-classes were evaluated using a scale of 0-1, 0- no visual depictions/content/available resources; 1- criteria met. (A) *Visual*. Visual depictions included images, photographs and videos of pregnant women, partners and families representing the following communities: racial/ethnic minorities, teens/young parents, people living with disabilities, and LGBTQ. (B) *Content*. Targeted prenatal health promotion specific for the following communities: Indigenous peoples, teens/young parents, and people living with disabilities. (C) *Available Resources*. Website available resources/contact information for immigrants/newcomers, populations of low SES and promoted prenatal classes in person, online and targeted to teens/young parents. LGBTQ- lesbian, gay, bisexual, transgender, queer; SES- socioeconomic status.

Box 1. Preconception-prenatal topics important for prenatal health.^{2,7,9}

Abuse
Alcohol
Drugs
Emotional Health
Environmental Health
Gestational Weight Gain
Nutrition
Occupational Health
Physical Activity
Sexually Transmitted Infections
Smoking
Vaccinations
Vitamins

Table 1

Government-hosted websites evaluated for online prenatal health promotion.

Province/territory website	Regional population ³¹	Public health unit/ regional health authority	Catchment region	Municipality	Population ³¹
Government of Newfoundland & Labrador	519,716	Eastern Health	300,000 ³²	St. Johns	108,860
Government of Prince Edward Island	142,907				
Government of Nova Scotia	923,598	Nova Scotia Health Authority (Capital Health)	923,598 ³¹	Halifax	403,131
Government of New Brunswick	747,101				
Gouvernement de Québec- <i>Institut national de santé publique du Québec (INSPQ)</i>	8,164,361	Centre intégré universitaire de santé et de services sociaux (CIUSSS) de la Capitale-Nationale	737,000 ³³	Montreal	1,704,694
		Les centres intégrés de santé et de services sociaux (CISSS) de la Montérégie ^a	1,323,000 ³⁴		
Government of Ontario	13,448,494	Hamilton Public Health Services	536,917 ³¹	Ottawa	934,243
		Region of Waterloo, Public Health ^b	535,154 ³¹	Toronto	2,731,571
Government of Manitoba - <i>ManitobaParentZone.ca</i>	1,278,365	Winnipeg Regional Health Authority	700,000 ³⁵	Winnipeg	705,244
Government of Saskatchewan- <i>Ministry of Health</i>	1,098,352	Saskatoon Health Region	350,000 ³⁶		
Government of Alberta- <i>MyHealth.Alberta.ca</i>	4,067,175	Alberta Health Services	4,067,175 ³¹	Calgary	1,239,220
Government of British Columbia- <i>Health Link BC & HealthyFamiliesBC</i>	4,648,055	Fraser Health	1,800,000 ³⁷	Vancouver	631,486
Government of Yukon	35,874				
Government of Northwest Territories	41,786				
Government of Nunavut- <i>Department of Health, Healthy Living</i>	35,944				

^a Les CISSS de la Montérégie includes : CISSS de la Montérégie-Centre, CISSS de la Montérégie-Est and CISSS de la Montérégie-Ouest; region served calculated as the total catchments of these three centres.

^b Region of Waterloo, Public Health serves: Cambridge, Kitchener, Waterloo, North Dumfries Township, Wellesley Township, Wilmot Township and Woolwich Township; region served calculated as the total catchments of these municipalities and townships.

Table 2

Prenatal e-classes evaluated for online prenatal health promotion.

Prenatal e-class	Company/developer	Canadian distribution
A Gift of Motherhood	Customized Communications, Texas, USA	Ontario Newfoundland and Labrador
A New Life (English) Une Nouvelle Vie (French)	SolviWeb, New Brunswick, Canada Adapted from <i>Healthy Pregnancy... Healthy Baby - A NEW LIFE</i> © Province of New Brunswick, 2008	Ontario Quebec New Brunswick
Online Prenatal Class- "One Healthy Life Leads to Another"	Durham Region Health Department Ontario, Canada	Ontario
Understanding Birth eClass	InJoy Health Education, Colorado, USA	Saskatchewan
Welcome to Parenting Welcome to Parenting for Young Parents	Phoenix Centre for Children and Families, Ontario, Canada	Ontario Nova Scotia

Table 3

Breadth of online prenatal health promotion topics (score= 1 or 2).

	Federal (n=3)	Provincial/ territorial (n=13)	Municipal (n=8)	Public health Regional unit (n=10)	Prenatal e-classes (n=7)
Essential prenatal topics (Box 1) maximum score= 13	7.3 ± 3.7	9.0 ± 1.0	3.6 ± 2.05	10.8 ± 1.29	10.9 ± 1.3
Pregnancy complications (maximum score =8)	_____	_____	_____	_____	5.14 ± 0.6
Health care/ labour options (maximum score =7)	_____	_____	_____	_____	6.43 ± 0.3
Postpartum care (maximum score=5)	_____	_____	_____	_____	4.43 ± 0.2

Table 4

Online prenatal classes providing comprehensive (score=2) prenatal-postpartum health promotion.^{2,7,8}

Pregnancy complications	% Prenatal e-classes (n=7)	Health care/ labour options	%Prenatal e-classes (n=7)	Postpartum care	%Prenatal e-classes (n=7)
Anaemia	0	Doula	71.4	Breastfeeding	100
Chronic illness	0	Family doctor	42.9	Finances	42.9
Congenital anomalies	85.7	Midwife	42.9	Parenting	100
Gestational diabetes	71.4	Obstetrician/gynecologist	42.9	Postpartum depression	100
Large for gestational age (LGA)	0	Caesarian section	100	Social support	85.7
Pre-eclampsia	42.9	Natural birth	100		
Preterm birth	100	Pain management	100		
Small for gestational age (SGA)	0				

Figure 1

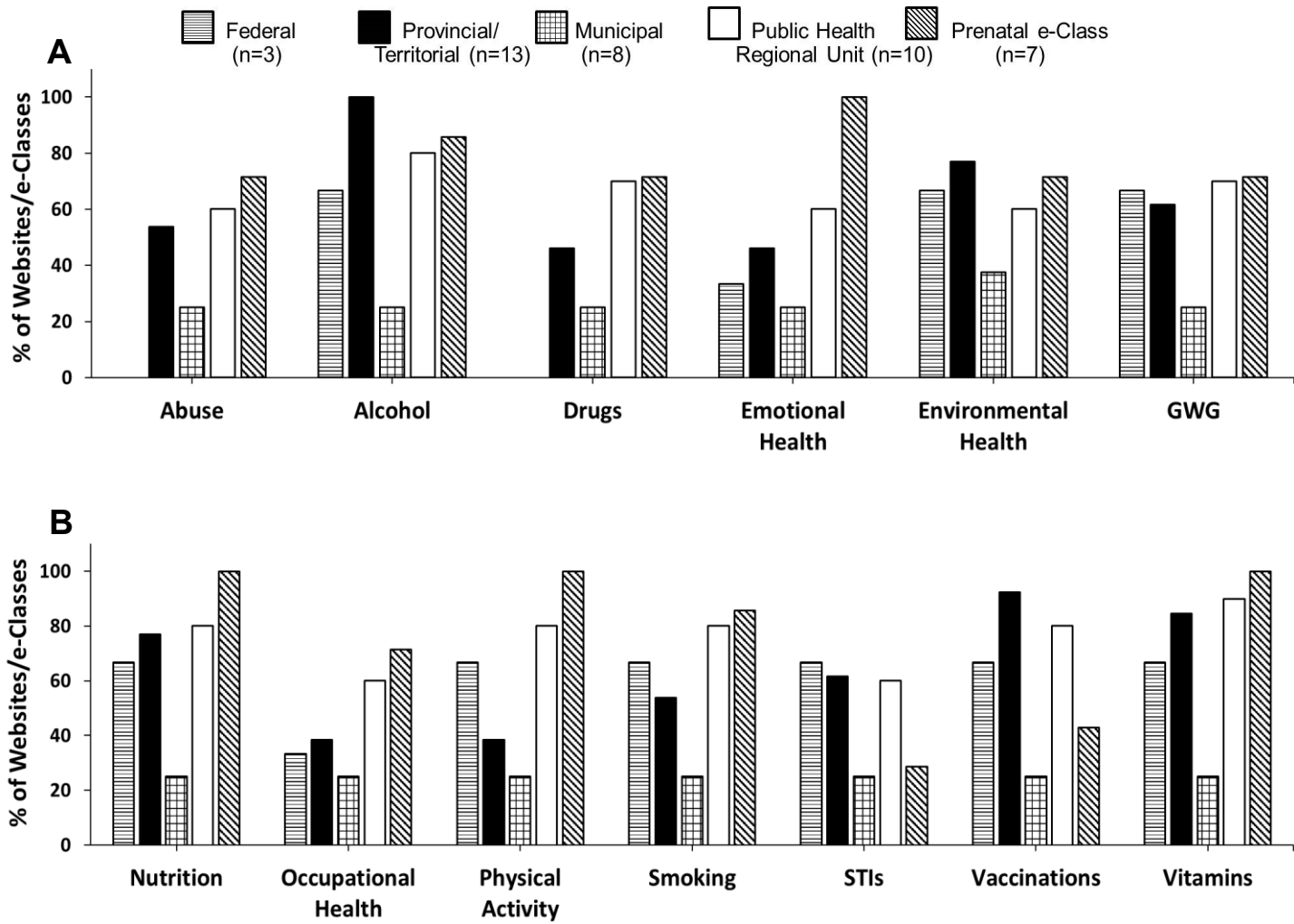


Figure 2

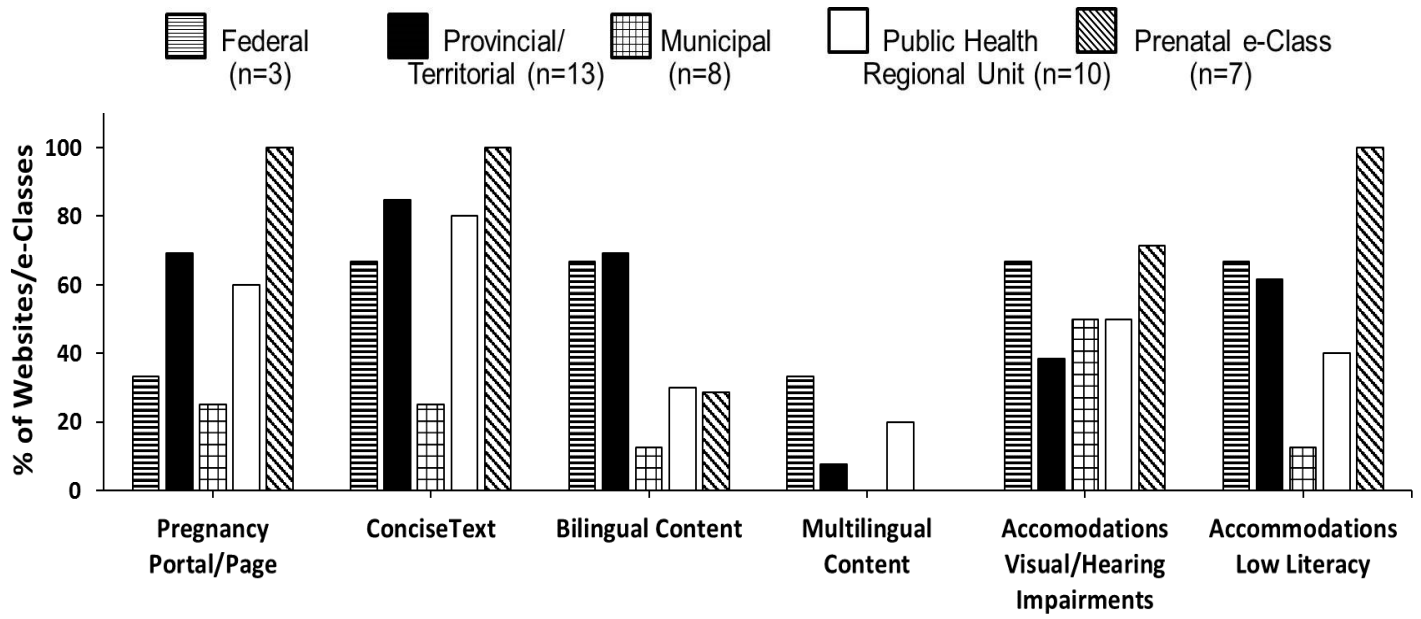
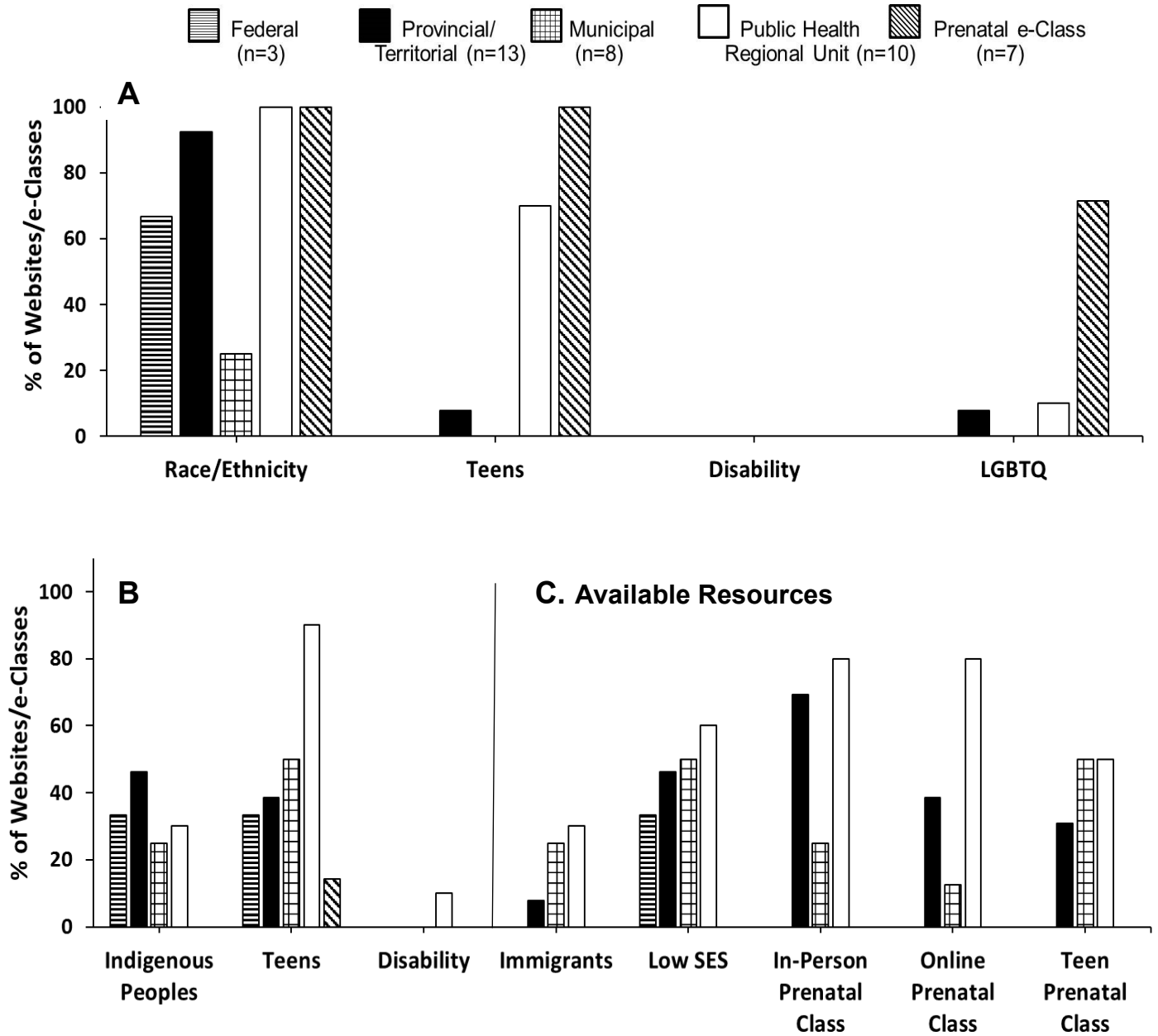


Figure 3



Chapter 4:
Study 2 Manuscript Submitted to the *Maternal and Child Health Journal*

Title: Best Practices for the Design, Implementation and Evaluation of Prenatal Health Programs

Running title: Prenatal Health Programs: Best Practices

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Abstract

Introduction: Prenatal health programs provide health education, reproductive care and related services to women. Prenatal health programs may be administered individually or collaboratively by agencies including public health units, community agencies, non-governmental organizations, hospitals and health clinics. Prenatal health disparities among populations at-risk may be reduced through the accessible provision of health education, services and resources to help women mitigate modifiable risks to pregnancy. Although standardized guidelines inform clinical screening, testing and maternity care, gaps exist regarding the design, implementation and evaluation for comprehensive prenatal health programs. **Methods:** Using a multijurisdictional approach, prenatal health guidance documents released by clinical associations and regional governments across Canada, Australia, United States, United Kingdom and Ireland were systematically reviewed to identify standards and practices regarding the design, implementation and evaluation of prenatal health programs. **Results:** Evidence-based, surveillance/monitoring, and expert/stakeholder collaborations were principles affirmed by guidance documents across all jurisdictions. Each jurisdiction described tailored strategies to optimize prenatal health in their respective communities. Divergence between jurisdictions was noted for patient care models and promotion of providers and companions of choice. **Conclusions:** Prenatal health programs should be grounded in a theoretical approach, fundamentally woman-centered and designed to address interacting prenatal health determinants across the lifespan. Accessible and inclusive prenatal health care can be achieved through provider training and community stakeholder collaborations. Identification of best practices for prenatal health program design,

implementation and evaluation ensures that service standards are harmonized across communities, thereby optimizing maternal and child health.

KEY WORDS: pregnancy, health promotion, prenatal care, prenatal health, woman-centered care

Significance

What is already known about this subject?

Recognizing that pregnancy is a complex social and biological transition in a woman's life, prenatal health programs must go beyond clinical services to address the interacting determinants of health throughout a woman's lifespan. Optimization of maternal-child health outcomes requires prenatal health programs to address the needs of women marginalized by race/ethnicity, citizenship, geography, disability, language and sexual identity.

What this study adds?

Emerging from our multijurisdictional review of prenatal guidance documents, we propose a model describing fundamental best practices for the design, implementation and evaluation of inclusive, accessible and woman-centered prenatal health programs.

Introduction

Prenatal interventions encompass education, health services and outreach programs designed to help women optimize their pregnancy outcomes. Prenatal health promotion requires the empowerment and meaningful participation of women throughout their reproductive lives [1]. It is well established that women marginalized by socioeconomic status (SES), citizenship, race/ethnicity, age and sexual identity under-utilize prenatal health services, including prenatal education, and consequently experience disparities in maternal and child health outcomes [2-4].

The World Health Organization (WHO) [5] recommends maternal and newborn health interventions (Box 1) to address the needs of women in both developing and high-income countries. It is unknown however, to what extent these recommendations have been incorporated in prenatal health programs. Countries with technologically-advanced maternal healthcare often differentiate clinical service delivery from sexual and reproductive health (SRH) promotion [3]. For many urban centers in the United States (U.S.) [3] and Canada [6], public health agencies are mandated to provide broad health promotion programming, including prenatal education. These community-based, public-health organizations with the promise of delivering local and relevant services may require standardized criteria for the design and implementation of prenatal health interventions. Multijurisdictional evaluations of prenatal health programs enable identification of best practices and standardization of fundamental principles of prenatal care. Only a few multijurisdictional comparisons have been published evaluating prenatal care in North America, Europe and Australia [7-9], with an emphasis on clinical testing practices. Recognizing that pregnancy is a complex social and

biological transition in a woman's life, a broad, interdisciplinary approach is essential to produce integrated clinical and social prenatal care. A multijurisdictional review of prenatal health practices, guidelines and principles would greatly enhance harmonization of maternal health services across regions, thereby optimizing maternal and child health outcomes.

The purpose of our study is to evaluate prenatal and maternity care guidelines, policy documents and frameworks developed by professional clinical associations and regional governments from Canada, U.S., Australia, the United Kingdom (U.K.) and Ireland, to identify best practices for the design, implementation and evaluation of prenatal health programs.

Methodology

Sample

A multijurisdictional approach was used to select prenatal and maternity care guidance documents released between 2000-2017 by clinical associations and regional governments across Canada, U.S., Australia, the U.K. and Ireland. The sample of prenatal health guidance documents included frameworks, guidelines and strategies outlining the design, implementation and evaluation of prenatal health services. All guidance documents were publicly available and intended for use by health care professionals and program administrators. Inclusion of prenatal guidance documents for evaluation was purposive to ensure both geographic representation and demographic diversity, particularly for Canada and the U.S. (Tables 1A-D). *Canada:* One federal and eight provincial/territorial government prenatal frameworks representing distinct geographic regions of Canada were selected. *U.S.:* Ten state government prenatal reports, one from each U.S. Department of Health and Human

Services region, and four national prenatal guidelines were included in the U.S. sample. The Title V Maternal and Child Health Services Block Grant Program provides federal government funding to each state to support the development and implementation of maternal and child health services and requires standardized reporting criteria and applications for funding. For each of the ten states included in the sample, their most recent Title V Maternal and Child Health report and proposal were evaluated. *Australia:* Although similarly comprised of regional territorial governments, in 2010 Australia's health ministers agreed to a National Maternity Service Plan, subsuming regional maternity care under a federal set of guidelines [10]. The four Australian prenatal health guidance documents reviewed represent the federal-level jurisdiction. *U.K.– Ireland:* Perinatal frameworks from England, Scotland and Ireland consisted of national strategies describing maternal health services. *Clinical Associations:* Prenatal guidelines produced by clinical health associations were selected to ensure representation of the major regions in this study (Canada, U.S., Australia, U.K., Europe). Obstetrics and gynecology associations were emphasized, with the inclusion of nursing association documents from the U.S. and Canada.

Evaluation Methodology

Prenatal guidance documents were evaluated (May–July 2017) to determine if structured criteria (Box 2) were represented as essential components of program design, implementation and evaluation. Each document was evaluated in a standardized manner by two researchers, with scoring discrepancies discussed in team meetings to reach consensus.

Results

Program Design

All prenatal guidance documents affirmed childbirth as a natural process, and prioritized patient care and safety as central tenets of their respective approaches. Guidance documents from all jurisdictions used an evidence-based approach and incorporated clinical professionals in program design (Table 2). Non-health sector stakeholder involvement generally occurred after initial program design. Almost all guidelines included a theoretical perspective, however it was not always evident that theory provided the foundation for the interventions proposed. A population health approach was explicitly referenced in Canadian guidelines, while implicitly acknowledged as social determinants of health by other jurisdictions. The U.S. Title V Grant program formally endorses the life course theory and as such, all U.S. guidelines reviewed emphasized the life course perspective as a theoretical foundation.

Program Implementation, Evaluation

All jurisdictions described the importance of surveillance and monitoring practices to ensure patient safety and effective implementation of the proposed interventions (Table 3). Surveillance and monitoring included community needs assessments, maternal health indicator data collection and quality of care assessments. The commitment to ongoing prenatal provider training was expressed by all jurisdictions and was typically described as clinical skills and techniques, cultural competency and specialized care (e.g. mental health and disability services). U.S. frameworks notably placed emphasis on increasing provider knowledge on preconception health and family planning.

Community capacity-building is a valuable component of prenatal health interventions, particularly for rural and remote communities, where skilled prenatal care providers may be limited. Canadian, U.S. and U.K. guidelines addressed the need to train both lay community members and providers, however community capacity-building was largely absent from most clinical association guidelines and was not well-emphasized in guidelines from Australia (Table 3).

Population Reach

The principles of accessible and inclusive prenatal health care were affirmed as fundamental components by almost all reviewed prenatal guidance documents (Table 4). Recognized barriers to prenatal care included hours of operation, availability of providers, awareness of services, and direct and indirect costs. Guidance documents also recognized that women who are non-Anglophone, have low literacy or experience mental illness, including addiction, may encounter significant barriers to prenatal services, necessitating optimization of service delivery channels. All prenatal guidelines described strategies to target marginalized populations within their specific regions (Table 4). Women at-risk were identified as women living with disabilities, immigrants, refugees, racial/ethnic minorities, Indigenous peoples, travelers/Romani and lesbian, gay, bisexual, transgender, queer (LGBTQ) individuals. Jurisdictions aimed to both reduce health disparities and deliver ‘culturally-competent care’. Promoting the prenatal health of Indigenous peoples was emphasized in Canadian and Australian documents through strategies such as community-collaborations, cultural sensitivity and stakeholder involvement.

Prenatal health promotion, including preconception and prenatal education, multilingual awareness campaigns and promoting prenatal resources, was recognized as an essential component of prenatal care by all jurisdictions. Several guidance documents from Canada and clinical associations acknowledged the general inclusion of fathers and partners in prenatal health promotion. Select guidelines from the U.K., Australia and U.S. explicitly described strategies and interventions tailored to the specific needs of partners and fathers (Table 4). Prenatal information channels incorporated community stakeholders, multimedia platforms, social media, websites and traditional print messaging. U.S. documents identified community collaborations with universities, hair salons and other gathering places to target preconception health promotion to communities at-risk. Canadian programs included action plans to improve participation in prenatal class education through enhancing collaboration and referrals between health and non-health sectors.

Models of Patient Care

All guidance documents recognized the principle of patient-centered care, however the approach varied across jurisdictions. Australia, England and Ireland documents explicitly affirmed a woman-centered care model, whereas Canada, U.S. and clinical associations favored a family-centered approach (Table 5). Although many North American documents did not explicitly use the term ‘woman-centered’, principles such as woman’s autonomy and informed decision-making were described as central to patient-care. Few guidelines explicitly promoted the provider of choice principle, wherein the autonomy of women to choose their preferred prenatal care provider is acknowledged as fundamental. Provider choice was only emphasized in documents from Ireland, U.K. and select guidelines from Canada and clinical

associations. It was apparent that the U.S. and Canada promoted traditional medical models of maternity care, whereas midwives appeared to be the dominant prenatal care provider in Australia, U.K. and Ireland.

Another component of a woman-centered approach is the ability of the woman to select her preferred prenatal care and labor support –“companion of choice”. Once again, this principle was rarely made explicit in the guidelines reviewed, however, several jurisdictions from Canadian and Australian guidelines acknowledged and supported a woman’s choice to include a support person throughout prenatal care and childbirth, generally identified as a partner, family or friend (Table 5). The promotion of doula services was rarely addressed in the evaluated prenatal health frameworks. Finally, the WHO recommends the need for continued research into the application of a SRH rights approach (Box 1) to prenatal care, however this approach was absent from all prenatal guidance documents reviewed.

Discussion

Evaluated prenatal guidelines were remarkably consistent in their recommendations for program design, implementation, evaluation and general strategies for population reach. Marked differences in patient care models were apparent, resulting in jurisdictional differences in incorporating the provider of choice and companion of choice principles [5,11]. Guidance documents were evidence-based and developed using relevant expert collaboration. Each jurisdiction described specific and tailored strategies to optimize prenatal health for women at-risk in their respective communities. Although most documents were developed prior to the

release of the WHO, 2015 [5] recommendations, there was significant agreement with many of the core principles.

Using the findings from our multijurisdictional evaluation of prenatal guidelines, we propose a model for prenatal health program design, implementation and evaluation (Figure 1). The main elements of the model are discussed below within the context of our study.

Prenatal Program Design

The most effective prenatal program planning models are founded on evidence and theory [6,12,13]. An evidence-based approach is essential to identify prenatal risk factors, mechanisms of outreach and strategies for effective interventions, which are appropriately tailored to the needs of communities at-risk. From our review and evaluation of prenatal guidelines, we recommend a mixed-theoretical approach combining population health theory with a life course approach (Figure 1). Modifiable lifestyle prenatal risk factors interact with biological, social and environmental determinants, as elaborated by the population health theory [14], and are further influenced by individual, interpersonal and organizational behaviors, as described by the socio-ecological model [15]. The population health theory is well integrated within the Canadian prenatal care approach, with all other jurisdictions recognizing the social determinants of health in the design of their prenatal health programs. The life course model posits health as a continuum across an individual's life, influenced by the interplay of social, behavioral, biological, psychological and environmental factors [13]. U.S. prenatal health programs are founded on the life course model [13], recognizing the reality that many pregnancies are unplanned, and thus lifestyle risk factors may adversely

affect pregnancy outcomes before traditional prenatal care visits [16]. It is therefore advisable that SRH promotion should be introduced to both men and women at the preconception stage, using an integrated theoretical approach comprised of the population health theory and life course model, thereby enabling early behavioral interventions to mitigate lifestyle risks [3,13,17].

Integration of relevant theoretical approaches within clinical programs necessitates the participation of both academic and clinical experts in the initial design of prenatal health programs. Stakeholder collaborations contribute to community engagement, outreach and mobilization and can be essential partners for the eventual delivery of the program [18,19]. Recognizing the disparities in the health statuses of Indigenous peoples in Australia and Canada, regional guidelines have incorporated representative stakeholders throughout prenatal program planning and delivery for relevant communities. Benefits of Canadian maternal-child health programs with sustained Indigenous community participation and leadership include positive birth outcomes, improved access to prenatal and postnatal care and increased rates of breastfeeding [18]. U.S. guidance documents described partnerships with Hispanic communities and traditionally Black colleges to ensure dissemination of preconception health promotion to minority men and women. Stakeholder collaborations enhance all phases of prenatal programs- design, implementation and service delivery- as reflected in our model (Figure 1).

Prenatal Program Implementation, Evaluation

Program implementation and evaluation requires ongoing analysis of program indicators to ensure program success. Surveillance and monitoring ensures patient safety, quality of care and captures program indicator data to ensure program targets are met [12]. The Intervention Wheel, a population-based public health strategy, describes 17 public health interventions including surveillance, assessments, interventions and collaborations at the community, system, and individual/family levels [20]. U.S. guidance documents referenced the Centers for Disease Control and Prevention (CDC)- PRAMS (Pregnancy Risk Assessment Monitoring System) project, which collects state-level indicators on maternal experiences throughout pregnancy [3]. Australian guidance documents noted the need to standardize patient indicators, establish national benchmarks and obtain maternal morbidity and mortality data. British guidelines suggest collection of clinical team service quality and outcomes data to prompt any necessary changes to protocols or training. Assessments of community needs, program evaluations and surveillance, including collection of clinical endpoint data, are essential to optimize prenatal interventions (Figure 1).

Ongoing health care provider training ensures patient safety, uptake of new technologies and inclusive and accessible care. All jurisdictions emphasized ongoing professional development in areas of smoking cessation/addictions counselling, maternal mental health and cultural competency. WHO implemented maternity provider training courses across Europe in 1999, recognizing psychological pregnancy needs, including the companion of choice principle and the need for culturally appropriate care [11]. Gaps in provider knowledge regarding the needs of pregnant women with a disability can contribute to inadequate prenatal health promotion,

quality of care and stigma [21]. Collaborations with disability, addictions or mental health advocates and community stakeholders may address these specific training needs.

Building sustainable prenatal health programs also necessitates community capacity building [20]. Partnerships and community capacity building are particularly important for rural/remote populations who typically lack access to health services [22]. The prenatal guidance document of a Northern Canadian territory, Nunavut, described their goal to recruit and train midwives to ensure sustainable prenatal and postnatal services for rural and remote residents [23]. Stakeholders, auxiliary health providers and social services workers may also require training to ensure services are culturally competent and evidence-based [23,24]. Enhancing both individual and collective community ownership promotes community participation and healthy behavior change, optimizing population health [18]. The term ‘cultural integrity’ has been used to describe the transmission of Indigenous cultural knowledge and practices which in turn, translates to uptake of prenatal health promotion by the community [18]. Maternity providers working in diverse settings, including rural/remote locations, experience many benefits including participation in collaborative practice models of care, high level of local community support and opportunities to develop ‘generalist’ skills in aspects of maternity care and related health services [25]. Thus, prenatal health community capacity building benefits practitioners, patients and the local community (Figure 1).

Enhancing Population Reach

Effective prenatal programs require uptake of health promotion messaging and for women to actively participate in relevant interventions, including prenatal classes. As discussed,

community engagement and collaborative leadership opportunities increase protective prenatal behaviors among local women [18]. Barriers to prenatal class attendance and prenatal services are varied and include perceptions of stigma and social exclusion, lack of specific interventions to address needs of women with disabilities, in addition to structural barriers such as finances, time constraints and the requirement of travel to access services [21,24,26]. Inclusivity and accessibility are interrelated principles of good prenatal program practices, as programs designed to be inclusive of all women, are apt to consider mechanisms to optimize accessibility. Although tailored prenatal interventions are essential to target women at-risk in the community, prenatal health education is most successful when a wide range of both risk and protective behaviors are discussed [26]. Prenatal health promotion becomes a by-product of community participation and capacity building, wherein all members of the community work towards raising awareness about preconception and pregnancy education, including education in schools, community centers, workplaces and post-secondary institutions, as described by some U.S. guidance documents. Ultimately, stakeholder participation throughout the design, implementation and delivery of prenatal programs will ensure that principles of inclusivity and accessibility remain paramount. Use of an equity lens will provide the impetus for prenatal interventions to explore community partnerships, new channels for service delivery, including online or e-learning, and the development of cultural competency among providers, thereby ensuring population program reach (Figure 1).

Models of Patient Care

Most North American prenatal guidance documents evaluated here promoted a family-centered model of patient care, which was at times combined with a woman-centered approach (Table 5). Although several documents appeared to describe components of a woman-centered

approach, appropriate implementation requires programs, providers and interventions to explicitly assert a woman-centered model of care. As described in our model (Figure 1), we recommend a woman-centered approach which recognizes and supports families and partners. Woman-centered care is tailored to a woman's individual needs and expectations, through holistic approaches that recognize the cultural, spiritual and psychological aspects of health [27]. A woman-centered approach is also congruent with SRH rights [27,28] and is recommended by the WHO [5]. As not all families or partners are supportive, and indeed, may contribute to sexual/reproductive coercion, social control or intimate partner violence [29], a woman's autonomy, decision-making and choices must remain central for prenatal health programs. A woman-centered approach recognizes a woman's need to identify her provider of choice and her companion(s) of choice, who will support her during pregnancy, labor and delivery [27]. In North America, physicians, obstetricians and gynecologists are the typical prenatal provider, whereas in the U.K. and Australia, a midwifery practice model is more common. Developing interprofessional collaborations and recognizing the strengths of different provider models and support professionals, such as midwives and doulas, facilitates accessible and inclusive care through individualized, holistic, culturally-appropriate and evidence-based services [24,27].

Women must be able to choose companions for prenatal support and labor, and might also identify partners or co-parents who may themselves require prenatal education and support. Preferred companions during prenatal care and labor and delivery may be identified as the biological father, a romantic male or female partner, a friend or relative [11,30]. Providers must understand that for certain cultures, men's involvement during labor and delivery is not

traditional or perceived as appropriate, requiring healthcare providers to refrain from assumptions regarding the father's apparent interest in the mother and baby [11,30]. Strategies for partner prenatal education and support must first recognize that some women may be single, partnered with someone other than the biological father of the baby, or in a non-heterosexual relationship. Building on the life course perspective, promoting prenatal health includes strategies targeting partner health throughout their lifespan [13]. Preconception health strategies for biological fathers may differ from emphasis on lifestyle behaviors for cohabiting partners of both sexes including smoking cessation, intimate partner violence prevention and stress management [26,29]. An inclusive, woman-centered model of care that provides support for family and partners identified by the woman, best reflects the complex social relationships in her life and ensures that her autonomy remains central.

Limitations

We recognize that our review of prenatal guidance documents may be limited by several factors. First, many of the prenatal guidelines evaluated were released prior to the WHO 2015 [5] recommendations (Box 1), although these standards were available in other forms of publications, conferences and reports [11]. For some evaluated guidelines, no updates were available prior to 2015 and in some instances, updates were limited to specific chapters. Second, we recognize that other resources and guidelines are available within each jurisdiction, with program administrators and providers able to assess and harmonize all available literature prior to planning and implementing prenatal services. Third, we did not assess the uptake of these prenatal guidelines within each jurisdiction and thus cannot comment on the translation of guidelines and recommendations to clinical practice. Finally,

we acknowledge that our multijurisdictional evaluation was limited to technologically-advanced, Anglophone, Western countries. Although our sampling should provide a comprehensive portrait of maternity care in the regions evaluated, we cannot extrapolate our findings to other jurisdictions.

Conclusion

In conclusion, the design, implementation and evaluation of prenatal health programs should be established using an evidence-based, theoretical and collaborative foundation. Recognizing the diverse influences on maternal health, clinical prenatal care providers should partner with public health and community agencies to address the interactions of biological, environmental and psychosocial determinants on pregnancy. Enhancing population reach requires training prenatal professionals to provide inclusive and accessible care that responds to the needs of communities marginalized by race/ethnicity, citizenship, geography, SES, disability and sexual identity. A woman-centered approach, recognizing her autonomy, SRH rights and need for continuity of clinical care and social support, is central to optimizing her experiences with prenatal programs.

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Box 1. World Health Organization recommendations on health promotion interventions for maternal and newborn health [5].

Recommendations
Birth preparedness and complication readiness Male involvement interventions for maternal and newborn health Partnership with traditional birth attendants Providing culturally appropriate skilled maternity care Companion of choice at birth Community mobilization through facilitated participatory learning and action cycles with women's groups Community participation in quality-improvement processes Community participation in programme planning and implementation
Conditional Recommendations
Maternity waiting homes Community-organized transport schemes
Research Recommendations
Interventions to promote awareness of human, sexual and reproductive rights and the right to access quality skilled care Community participation in maternal death surveillance and response

Box 2. Evaluation criteria for prenatal health programs [3,5,11,12,17].

Program Design
Evidence-Based Theoretical Foundation Expert Collaborations Stakeholder Collaborations
Program Implementation, Evaluation
Surveillance/Monitoring Healthcare Provider Training Community Capacity Building
Population Reach
Accessibility Inclusivity Prenatal Health Promotion (<i>e.g. education, communication strategies</i>) Strategies for Partner/Father
Models of Care
Woman-Centered Care Family-Centered Care Prenatal Provider of Choice Companion of Choice (<i>e.g. partner, husband, family-member, friend</i>) Sexual and Reproductive Health Rights Approach

Table 1A. Canadian prenatal health guidance documents.

Federal Jurisdiction
Government of Canada: Health Canada: <i>Family-Centred Maternity and Newborn Care: National Guidelines, 2000</i>
Provincial/Territorial Jurisdictions
Government of British Columbia, Perinatal Services BC: <i>Perinatal Services BC, Provincial Perinatal Guidelines, Population and Public Health Prenatal Care Pathway, 2014</i>
Government of Manitoba, Manitoba’s Regional Health Authorities and Manitoba Health, Healthy Living and Seniors: <i>Provincial Public Health Nursing Standards: Prenatal, Postpartum, and Early Childhood, 2015</i>
Government of Newfoundland and Labrador, Department of Health and Community Services: <i>Education and Support Standards for Pregnancy, Birth and Early Parenting, 2005</i>
Government of Nova Scotia, Public Health Services, Health Promotion and Protection: <i>Prenatal Education & Supports Standards for Public Health Services, 2005</i>
Government of Nunavut, Department of Health and Social Services: <i>Nunavut Maternal and Newborn Health Care Strategy 2009-2014</i>
Government of Ontario, Child and Youth Development Branch, Strategic Policy and Planning Division, Ministry of Children and Youth Services: <i>Healthy Babies Healthy Children Guidance Document, 2012</i>
Government of Ontario, Standards, Programs & Community Development Branch, Ministry of Health Promotion: <i>Reproductive Health, Guidance Document, 2010</i>
Le Gouvernement du Québec, Santé et Services Sociaux: <i>La Politique de périnatalité 2008-2018, un projet porteur de vie, 2008</i>
Clinical Associations
Association of Women’s Health, Obstetric, and Neonatal Nurses: <i>Standards for Perinatal Nursing Practice and Certification in <u>Canada</u>, 2nd Edition, 2009</i>
<u>Canadian</u> Association of Perinatal and Women’s Health Nurses: <i>CAPWHN Position Statement on Cultural Safety/Humility, 2017</i>, Retrieved from: http://www.capwhn.ca/en/capwhn/About_CAPWHN_p3185.html
The Society of Obstetricians and Gynaecologists of <u>Canada</u>: <i>Healthy Beginnings, 5th Edition, 2017</i>
The Society of Obstetricians and Gynaecologists of <u>Canada</u>: <i>Rural Maternity Care, 2012</i>

Table 1B. U.S. prenatal health guidance documents.

Federal/National Agencies
Association of Maternal & Child Health Programs (AMCHP): <i>Health for Every Mother, A Maternal Health Resource and Planning Guide for States, 2015</i>
Centers for Disease Control and Prevention: <i>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 MMWR 55(RR06);1-23, 2006</i>
Centers for Disease Control and Prevention’s Division of Reproductive Health: <i>Developing and Sustaining Perinatal Quality Collaboratives, A Resource Guide for States, 2016</i>
March of Dimes: <i>Toward Improving the Outcome of Pregnancy III, Enhancing Perinatal Health Through Quality, Safety and Performance Initiatives, 2010</i>
State Jurisdictions
California-Health and Human Services Agency, California Department of Public Health: <i>Maternal and Child Health Services Title V Block Grant, California, 2017 Application, 2015 Annual Report, 2016</i>
Colorado Department of Public Health and Environment: <i>Maternal and Child Health Services Title V Block Grant, Colorado, 2017 Application, 2015 Annual Report, 2016</i>
Florida Health: <i>Maternal and Child Health Services Title V Block Grant, Florida, 2017 Application, 2015 Annual Report, 2016</i>
Iowa Department of Public Health, Promoting and Protecting the Health of Iowans: <i>Maternal and Child Health Services Title V Block Grant, Iowa, 2017 Application, 2015 Annual Report, 2016</i>
Michigan Department of Health and Human Services: <i>Maternal and Child Health Services Title V Block Grant, Michigan, 2017 Application, 2015 Annual Report, 2016</i>
New York, Department of Health: <i>Maternal and Child Health Services Title V Block Grant, New York, 2017 Application, 2015 Annual Report, 2016</i>
Oregon Health Authority, Public Health Division, Center for Prevention and Health Promotion: <i>Maternal and Child Health Services Title V Block Grant, Oregon, 2015</i>
Pennsylvania Department of Health: <i>Maternal and Child Health Services Title V Block Grant, Pennsylvania, 2015</i>
Texas Department of State Health Services: <i>Maternal and Child Health Services Title V Block Grant, Texas, 2017 Application, 2015 Annual Report, 2016</i>
Vermont Department of Health, Division of Maternal and Child Health: <i>Maternal and Child Health Services Title V Block Grant, Vermont, 2017 Application, 2015 Annual Report, 2016</i>
Clinical Associations
American Academy of Pediatrics, The American College of Obstetricians and Gynecologists: <i>Guidelines for Perinatal Care, 7th Edition, 2012</i>

(U.S.) Association of Women's Health, Obstetric and Neonatal Nurses: *Perinatal Nursing, 4th Edition, 2014*

Table 1C. Australian prenatal health guidance documents.

Australian Government, Department of Health and Ageing: <i>Clinical Practice Guidelines, Antenatal Care – Module I, 2012</i>
Australian Government, Department of Health: <i>Clinical Practice Guidelines, Antenatal Care – Module II, 2014</i>
National Health Workforce Taskforce and the Maternity Services Inter-Jurisdictional Committee: <i>Core Competencies and Educational Framework for Maternity Services in Australia Final Report, 2010</i>
Standing Council on Health and Community and Disability Services: <i>National Maternity Services Capability Framework, 2012</i>
Clinical Associations
The Royal <u>Australian</u> and <u>New Zealand</u> College of Obstetricians and Gynaecologists: <i>Standards of Maternity Care in Australia and New Zealand, 2016</i>

Table 1D. U.K.– Ireland prenatal health guidance documents.

Healthy Ireland, Department of Health, Patient Safety First: <i>Creating a Better Future Together, National Maternity Strategy 2016-2026</i>
NHS England: National Maternity Review: <i>Better Births, improving outcomes of maternity services in England, A five Year Forward View for maternity care, 2016</i>
The Scottish Government: <i>The Best Start, A Five-year Forward Plan for Maternity and Neonatal Care in Scotland, 2017</i>
The Scottish Government, Healthier Scotland: <i>A Refreshed Framework for Maternity Care in Scotland, The Maternity Services Action Group, 2011</i>
Clinical Associations
European Board and College of Obstetrics and Gynaecology: <i>Standards of Care for Women's Health in Europe, Obstetrics and Neonatal Services, 2014</i>
(U.K.) Royal College of Obstetricians and Gynaecologists: <i>Providing Quality Care for Women, A Framework for Maternity Service Standards, 2016</i>

Table 2. Multijurisdictional practices for prenatal health program design.

Jurisdiction	Evaluation Criteria ^a			
	Evidence- Based	Theoretical Foundation	Expert Collaborations	Stakeholder Collaborations
Canada (N=9)	++++	++++	++++	++++
U.S. (N=14)	++++	++++	++++	++++
Australia (N=4)	++++	++++	++++	++++
U.K. – Ireland (N=4)	++++	++++	++++	++++
Clinical Associations (N=9)	++++	++++	++++	++++

^a Prenatal guidance documents from each jurisdiction were evaluated using the criteria described in Box 2. Each parameter was scored using a scale of 0 or 1: 0- practice not mentioned, 1- practice addressed. Average percentage scores per jurisdiction are represented as “-” (0%), “+” (0-24%), “++” (25-49%), “+++” (50- 74%) and “++++” (75- 100%).

Table 3. Multijurisdictional practices for prenatal health program implementation and evaluation.

Jurisdiction	Evaluation Criteria ^a		
	Surveillance/Monitoring	HCP Training	Community Capacity Building
Canada (N=9)	++++	++++	++++
U.S. (N=14)	++++	++++	++++
Australia (N=4)	++++	++++	+++
U.K. – Ireland (N=4)	++++	++++	++++
Clinical Associations (N=9)	++++	++++	++

HCP- Health care provider

^a Prenatal guidance documents from each jurisdiction were evaluated using the criteria described in Box 2. Each parameter was scored 0 or 1: 0- practice not mentioned, 1- practice addressed. Average percentage scores per jurisdiction are represented as “-” (0%), “+” (0-24%), “++” (25-49%), “+++” (50- 74%) and “++++” (75- 100%).

Table 4. Multijurisdictional practices for prenatal health program population reach.

Jurisdiction	Evaluation Criteria ^a			
	Accessibility	Inclusivity	Prenatal Health Promotion	Strategies for Partner/Father
Canada (N=9)	++++	++++	++++	++
U.S. (N=14)	++++	++++	++++	+++
Australia (N=4)	++++	++++	++++	+++
U.K. – Ireland (N=4)	++++	++++	++++	++++
Clinical Associations (N=9)	++++	++++	+++	++

^a Prenatal guidance documents from each jurisdiction were evaluated using the criteria described in Box 2. Each parameter was scored 0 or 1: 0- practice not mentioned, 1- practice addressed. Average percentage scores per jurisdiction are represented as “-” (0%), “+” (0-24%), “++” (25-49%), “+++” (50- 74%) and “++++” (75- 100%).

Table 5. Multijurisdictional models of patient care for prenatal health services.

Jurisdiction	Evaluation Criteria ^a				
	Woman-Centered Care	Family-Centered Care	Provider of Choice	Companion of Choice	SRH Rights Approach
Canada (N=9)	+	++++	++	+++	-
U.S. (N=14)	-	++++	-	+	-
Australia (N=4)	++++	++	-	++++	-
U.K.– Ireland (N=4)	+++	++++	++++	++	-
Clinical Associations (N=9)	+	+++	+	+++	-

SRH – Sexual and reproductive health.

^a Prenatal guidance documents from each jurisdiction were evaluated using the criteria described in Box 2. Each parameter was scored 0 or 1: 0- practice not mentioned, 1- practice addressed. Average percentage scores per jurisdiction are represented as “-” (0%), “+” (0-24%), “++” (25-49%), “+++” (50- 74%) and “++++” (75- 100%).

Figure 1 top

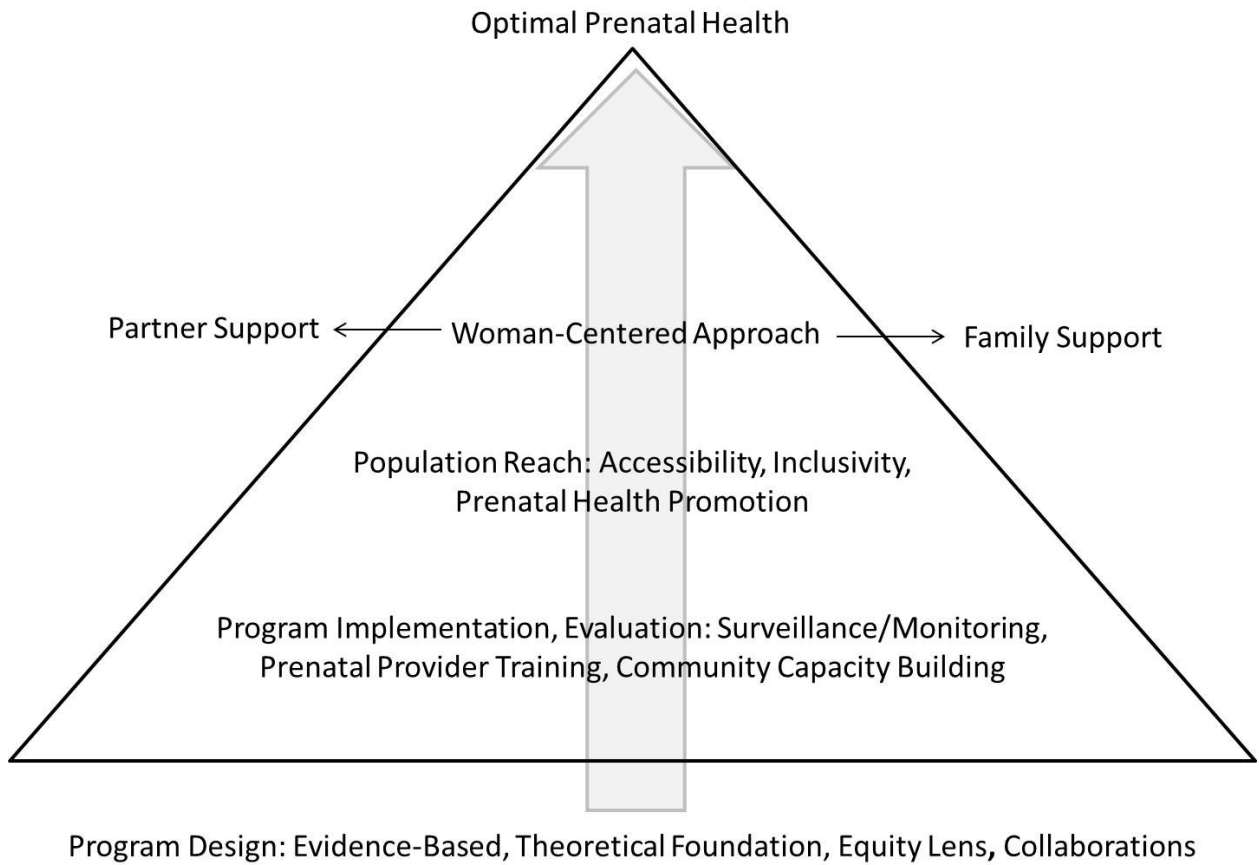


Figure Captions

Figure 1. Proposed model describing the design, implementation and evaluation of prenatal health programs. Recommendations for best practices were informed from the multijurisdictional evaluation of prenatal health guidance documents from Canada, U.S., Australia, U.K.–Ireland and related clinical associations.

Chapter 5:

Case Study: Does online Canadian prenatal health promotion reflect the inclusivity and accessibility principles described by Canadian prenatal health guidance documents?

Canadian provincial/territorial, federal and clinical association prenatal health guidelines were assessed as part of the study that evaluated prenatal program design and implementation (Chapter 4). These Canadian guidance documents described recommendations, practices, principles and values endorsed by each jurisdiction. As I have also evaluated the online prenatal health promotion content of Canadian government websites and affiliated prenatal e-classes in Chapter 3 (Chedid et al., In press), harmonization of online prenatal programs with the Canadian prenatal guidance documents can be assessed. Inclusive and accessible prenatal health practices will be compared in this Chapter, as these evaluation criteria were common in both studies: *Best practices for online Canadian prenatal health promotion: A public health approach* (Chapter 3) and *Best practices for the design, implementation and evaluation of prenatal health programs* (Chapter 4).

CANADIAN GOVERNMENT-HOSTED WEBSITES

Inclusivity and accessibility evaluation criteria for online prenatal health promotion programs referred to the provision of prenatal health promotion content, resources, images and accommodation tools tailored to women of diverse race/ethnicity, ability, sexual identity, SES and age, in addition to Francophone, Indigenous and immigrant women (Chedid et al., In press; Chapter 3). Similarly, I characterized the promotion of inclusivity and accessibility by

prenatal guidance documents as practices that tailor and promote prenatal services to populations with diverse needs including linguistic, cultural, physical and financial accommodations (Chapter 4). Although all evaluated Canadian prenatal health guidance documents addressed program design strategies that recognized cultural competency and populations at-risk, many did not refer to specific minority groups. Examples that will be discussed further include: women living with disabilities, LGBTQ communities, as well as women of immigrant, Indigenous, low SES, teen and francophone status.

Women Living with Disabilities and LGBTQ Communities

Evaluation of prenatal health promotion through government-hosted websites revealed notable gaps in content targeted to populations living with disabilities and the LGBTQ community (Chedid et al., In press; Chapter 3). Ontario's *Healthy Babies Healthy Children (HBHC)* guidelines (Government of Ontario, 2012), British Columbia's *Perinatal Services BC Provincial Perinatal Guidelines* (Government of British Columbia, 2014), and Health Canada's *Family-Centred Maternity and Newborn Care: National Guidelines* (Health Canada, 2000), were the only prenatal documents to explicitly address women marginalized by disability or sexual identity. The HBHC Ontario prenatal guidelines notably recognized that Ontario's diversity encompasses people with different sexual identities and disabilities and addressed the importance of social support for diverse families.

“The board of health shall provide client centered services in a culturally relevant and inclusive manner. Diversity considerations may include but are not limited to: language, socioeconomic status, race, religious affiliation, sexual identity, immigration status and mental or physical ability” (Government of Ontario, 2012, pg. 28).

“Lack of social support or isolation may be a particular issue for families from marginalized populations such as new immigrants, Gay, Lesbian or Transgender families or Aboriginal families who face barriers of access and equity related to social services” (Government of Ontario 2012, pg. 160).

Despite the inclusive strategies for disability and sexual diversity that were outlined in Ontario’s prenatal guidance document, these practices were not well reflected by most government-hosted websites (Chedid et al., In press; Chapter 3). Waterloo’s public health regional unit government-hosted website was the only Ontario jurisdiction to promote a local resource for pregnant women with a disability, in the context of prenatal health promotion (Region of Waterloo, n.d.a).

Health Canada’s federal prenatal health program, *Family-Centered Maternity and Newborn Care: National Guidelines* (Health Canada, 2000), specifically recognized the needs of women living with disabilities and the LGBTQ community, however the Health Canada website did not provide prenatal health promotion content tailored to these groups. Health Canada’s prenatal guidance document addressed the importance of ensuring parking access to women living with disabilities and acknowledged the diversity of couples, by describing families as follows:

““Typical” family structures may include two-parent heterosexual couples; two-parent lesbian and/or gay couples; single-parent families of either gender; blended families; extended families including grandparents, aunts, uncles; or community families made up of close friends” (Health Canada, 2000, pg. 3.6).

Among the few government-hosted websites that tailored their prenatal health content to women living with disabilities or LGBTQ communities, only one jurisdiction, *Region of Waterloo, Public Health and Emergency Services*, harmonized with the strategies outlined in Ontario's HBHC prenatal guidance document. These findings further demonstrate the noted gaps in the evaluation of Canadian online prenatal health promotion content (Chedid et al., In press; Chapter 3). In the context of this study, the term 'disability' is broad and may include physical, mental, sensory or functional limitations, which may be acute or chronic in nature. Approximately 7% of Canadian women of reproductive age (15-44 years old) reported having a disability in 2012 (Statistics Canada, 2013). In 2009, an Ontario study documented 20.3 per 10000 births attributed to intellectual and developmental disabled mothers (Brown et al., 2016). Although this does not encompass physical disabilities or the entire Canadian population, it is nonetheless a sufficient representation of women in need of tailored prenatal health services.

The Canadian prevalence of women who identify as LGBTQ is increasing. Between 2006 and 2011, Statistics Canada reported numbers of same-sex marriages to have tripled, following its legalization in 2005 (Statistics Canada, 2015b). It was also estimated that approximately 16.5% of same-sex female couples lived with children in 2011 (Statistics Canada, 2015b). Although lesbian women would not require tailored prenatal interventions, transgender men who wish to become pregnant will require specialized interventions regarding hormone replacement therapy regimens. Thus, prenatal program planners have a responsibility to provide sensitive, evidence-based and inclusive prenatal health promotion, resources and services for women with disabilities and non-heterosexual identities.

Immigrant Women

Several Canadian prenatal guidance documents (Government of Ontario, 2012; Gouvernement du Québec, 2008; Government of British Columbia, 2014; Government of Nova Scotia, 2005; Health Canada, 2000) acknowledged the importance of targeting prenatal health services to immigrant families. However, Ontario was the only jurisdiction to include immigrant-tailored prenatal strategies and health promotion content in both their prenatal guidance documents (Government of Ontario, 2012; Government of Ontario, 2010) and government-hosted websites (Region of Waterloo, n.d.a; City of Toronto, n.d.a). *Region of Waterloo Public Health and Emergency Services'* pregnancy section contained contact information for Canadian newcomers (Region of Waterloo, n.d.a), while the city of Toronto endorsed the HBHC program (City of Toronto, n.d.a), which recognizes the importance of delivering culturally inclusive prenatal services. Ontario's HBHC home visitation program promotes resources to support health workers in assisting pregnant newcomers (Government of Ontario, 2012), while the inclusion of immigrant women in Waterloo and Toronto's online prenatal health content aligns with the HBHC program vision:

“Offer home visits combined with service coordination as early as possible, preferably starting in the prenatal period for high-risk populations such as young, first-time, low-income mothers or new immigrant families” (Government of Ontario, 2012, pg. 72-73).

Although Manitoba's prenatal guidance document did not address practices or provide local resources that would target immigrant women, government websites hosted by both the province of Manitoba and Winnipeg's public health regional unit, contained prenatal resources tailored to Canadian newcomers (Government of Manitoba, n.d.; Best Start, 2010). For

example, *Winnipeg Regional Health Authority's* online resource, *Giving Birth in a New Land, A guide for women new to Canada and their families*, provides information on the Canadian health care system and local health resources (Best Start, 2010). A similar lack of harmonization was apparent between prenatal guidance documents from the provinces of Quebec, Nova Scotia, British Columbia and federal Health Canada (Gouvernement du Québec, 2008; Government of Nova Scotia, 2005; Government of British Columbia, 2014; Health Canada, 2000) and their respective government-hosted websites, as these documents recognized the needs of pregnant immigrant women. Health Canada's prenatal guidance document specifically addressed the fact that immigrant mothers require specialized and targeted prenatal services:

“Some groups of women, however, such as adolescents, Aboriginal women, immigrant and refugee women, women with low incomes, incarcerated women, and women having a second or subsequent baby may never have used the existing services” (Health Canada, 2000, pg. 4.28).

The website evaluations from Chapter 3 (Chedid et al., In press) revealed gaps in the prenatal health promotion content targeted to immigrants. However, several Canadian prenatal guidance documents acknowledged the need to target Canadian newcomers, while others tailored services to religious and cultural needs, without explicitly describing the needs of distinct immigrant groups (Government of Nunavut, 2009; Government of Manitoba, 2015; Miller et al., 2012). Ontario's prenatal guidance documents described strategies to promote inclusive and accessible prenatal health services for immigrant populations, which harmonized with the content delivered on their local government-hosted websites. Canada is home to

several immigrant and refugee communities, who require special attention to reduce health inequities. According to the National Household Survey, non-Canadian born populations represent the largest portion of the Canadian population since 1931, currently at 20.6% (Statistics Canada, 2016b). Given recent influxes of Syrian refugees in Canada, prenatal health promotion resources should be better designed to specifically target this population's needs, which also includes the provision of multilingual content.

Indigenous Women

Prenatal health guidance documents produced from the Society of Obstetricians and Gynaecologists of Canada (SOGC), Health Canada, Ontario and Nunavut, all described the importance of targeted prenatal strategies for Indigenous women (Miller et al., 2012; Health Canada, 2000; Government of Ontario, 2012; Government of Nunavut, 2009). Each of these jurisdictions also provided specialized prenatal health content on their respective government-hosted websites (Health Canada, 2010; City of Ottawa, n.d.; Government of Nunavut, n.d.).

The *Rural Maternity Care* SOGC guideline was specifically designed to promote the training and retention of local maternity health professionals in order to provide safe, culturally appropriate and woman-centred care to rural communities and reduce the need for women to travel outside their community for health care services (Miller et al., 2012). Implementation of low-risk services provided by Indigenous and traditional midwives positively impacts rural community birthing and social and mental health:

“These programs strive to help communities “retain and restore” what is important from their own birth traditions without losing the benefits of modern obstetrical practice. Although in

areas of extremely low population density it is unrealistic to believe that all women can deliver in their home communities, it is important that Aboriginal, rural, and remote women can access low-risk maternity care that reflects their experiences, expectations, and culture” (Miller et al., 2012, pg. 987).

The Health Canada website provided a distinct section for prenatal health needs of First Nation and Inuit women and promoted a food guide tailored to First Nations (Government of Canada, 2014; Health Canada, 2010). This content is consistent with Health Canada’s prenatal guidelines which address the prenatal needs of Indigenous communities, in part by endorsing the CPNP and other programs that target these communities (Health Canada, 2000).

Ontario’s provincial government-hosted website did not provide targeted prenatal health promotion content for Indigenous women. In contrast, Ottawa and Toronto’s municipal websites promoted prenatal classes and community resources (HBHC program) designed to reach Indigenous women (City of Ottawa, n.d.; City of Toronto, n.d.a). Ontario’s HBHC program is intended to promote equity and cultural inclusivity across diverse populations and recognizes the need to reach Indigenous communities that are at-risk (Government of Ontario, 2012).

Nunavut’s prenatal guidance document is consistent with the content provided on their government website, which promoted detailed prenatal resources and guidelines on culturally specific foods, as described in their *Nunavut Food Guide* and their nutritional fact sheet on Inuit traditional foods (Government of Nunavut, n.d.). Such inclusive prenatal health

information is also reflected in Nunavut’s prenatal guidance framework, which aims to ensure Indigenous women receive safe and culturally appropriate maternity care through:

“Improved access to traditional food and nutritious store bought food for pregnant and breastfeeding women through:

- *Healthy Foods North program as an evidence based community approach*
- *Community-based approaches that will increase access to traditional food*
- *Improved delivery of supplemental food”* (Government of Nunavut, 2009, pg. 14).

British Columbia recognized Indigenous cultural inclusion as an important component to maternal care (Government of British Columbia, 2014); however, we found no specialized prenatal health content for Indigenous women on their provincial-hosted website. British Columbia’s vision of prenatal care specifies that:

“Culturally competent care involves creating a care environment that is free of racism and stereotypes, where Aboriginal women and families are treated with empathy, dignity, and respect” (Government of British Columbia, 2014, pg. 4).

Indigenous-specific prenatal health promotion on government-hosted websites generally reflects the inclusive practices outlined in prenatal health guidance documents. Indigenous populations have not only experienced discrimination throughout Canadian history, but also have higher rates of adverse pregnancy outcomes and risk behaviours (Adelson, 2005; Shah et al., 2011b; Heaman & Chalmers, 2005). Thus, it is important that all prenatal health channels unanimously address the specific maternal health needs of these vulnerable communities.

Low Socioeconomic Status and Teen Women

Prenatal guidance document strategies and online resources for low SES women were generally in harmonization. The *Oeuf, Lait, Orange* (OLO) program is an established provincial service in Quebec that supports low SES families and provides them with essential foods and vitamins (Gouvernement du Québec, 2008). Quebec’s provincial (Gouvernement du Québec, 2017), and regional public health unit (Gouvernement du Québec, n.d.) websites endorsed the OLO program, consistent with Quebec’s prenatal health guidance document that addressed the following goal:

“Maintenir, dans le cadre du programme OLO (œuf, lait, orange), la distribution de suppléments alimentaires aux femmes vivant en contexte de vulnérabilité, en complément à l’intervention nutritionnelle qui leur est déjà offerte” (Gouvernement du Québec, 2008, pg. 38).

Similar to Quebec’s OLO program, Ontario’s HBHC program also targets low SES families and advises health care providers to be aware of socioeconomic diversity, which could potentially influence prenatal health behaviours and access to services (Government of Ontario, 2012). Local government-hosted websites of Toronto (City of Toronto, n.d.a), Hamilton (City of Hamilton, 2017a) and Waterloo (Region of Waterloo, n.d.c;d) were consistent with strategies from Ontario’s HBHC guidance document. As such, these local websites acknowledged community diversity and provided local resources that assist low SES mothers, which included the promotion of prenatal classes, the CPNP and the HBHC programs. Additionally, British Columbia’s prenatal health guidance document expressed the need to provide prenatal health information in various formats to target low SES audiences

(Government of British Columbia, 2014), while their provincial website (Government of British Columbia, 2016) promoted contact information for low SES-tailored prenatal programs. Although the Health Canada website did not explicitly endorse these prenatal resources, the *Family-Centred Maternity and Newborn Care National Guidelines* acknowledged the need to include low SES women in the delivery of prenatal services (Health Canada, 2000).

Another population at-risk are adolescents who are pregnant. Several prenatal guidance documents described strategies to support teen mothers (Government of Ontario, 2012; 2010; Gouvernement du Québec, 2008; Government of Newfoundland and Labrador, 2005; Government of British Columbia, 2014; Government of Nunavut, 2009; Health Canada, 2000), with practices from Ontario, Quebec, Newfoundland and Labrador and British Columbia harmonizing with the teen-specific resources available on their respective government-hosted websites (City of Ottawa, n.d.; Gouvernement du Québec, n.d.; Eastern Health, 2017; Fraser Health, n.d.). The HBHC program and teen prenatal classes and community services were promoted by the city of Ottawa (City of Ottawa, n.d.) and Toronto (City of Toronto, n.d.b), as well as Hamilton (City of Hamilton, 2017b) and Waterloo (Region of Waterloo, n.d.d) public health regional unit websites. Quebec's OLO program that targets teens, was found on the Capitale-Nationale public health regional unit webpage (Gouvernement du Québec, n.d.). Teen-specific prenatal classes and programs were promoted on Newfoundland and Labrador's public health regional unit website, *Eastern Health*, (Eastern Health, 2017), as well as British Columbia's provincial and local (Fraser Health) websites (Government of British Columbia, 2016; Fraser Health, n.d.). In contrast, Nunavut

(Government of Nunavut, 2009) and Health Canada's (Health Canada, 2000) prenatal guidance documents recognized the importance of addressing the needs of pregnant teens, although their respective government-hosted websites lacked resources for these women.

Therefore, these results demonstrate that the inclusion of teen moms in prenatal programs and services by prenatal guidance documents, is not necessarily associated with the provision of teen-specific resources on government-hosted websites. Teen mothers often experience self-esteem issues, lack partner support (Smith & Roberts, 2009), have higher rates of adverse pregnancy outcomes (Chen et al., 2007) and are at higher risk for STIs (Borges-Costa et al., 2012). Pregnancy resources that are relatable to teen mothers, provide them with much needed prenatal health information and may encourage their participation in prenatal services and engagement in healthy maternal behaviours.

Francophone Women

Canadian Francophone populations are considered minority groups, and as such, experience social and health disparities (Bouchard & Desmeules, 2013). In addition, many Francophone women prefer to receive prenatal health services in their maternal language (Moreau et al., 2015), which may not always be offered (Lacaze-Masmonteil et al., 2013). Although several government-hosted websites provided prenatal health promotion content in French, Ontario was the only jurisdiction to specifically address the need to include Francophone populations in their prenatal health strategies (Government of Ontario, 2012). Among the goals of Ontario's HBHC program is to:

“Respond to the needs of francophone families” (Government of Ontario, 2012, pg. 6).

This principle was reflected in the government-hosted websites of Ontario (provincial) and Ottawa (Municipal), which provided French-language prenatal health promotion content (Gouvernement de l’Ontario, 2017; Santé publique Ottawa, n.d.).

While many jurisdictions provided accessible prenatal health promotion content in French on their government-hosted websites, including Health Canada (Santé Canada, 2012), Nova Scotia (Gouvernement de la Nouvelle-Écosse, n.d.), Manitoba (Gouvernement du Manitoba, n.d.) and Nunavut (Gouvernement du Nunavut, n.d.), the specific needs of Francophone women were not addressed in their respective prenatal health guidance documents.

Thus, there are gaps in the explicit recognition of minority Francophone women in the planning and implementation of provincial prenatal health services. Francophones consist of 23% of our Canadian population (Statistics Canada, 2015c), most living in English-dominant communities outside of Quebec, contributing to their marginalization (Bouchard & Desmeules, 2013; Lacaze-Masmonteil et al., 2013). It is important for communities to provide inclusive and accessible prenatal health services, including French-language services. As the provision of French-language services in every community across Canada may be cost-prohibitive, online resources and links to French-language websites from Quebec may be a collaborative solution.

ONTARIO PUBLIC HEALTH-AFFILIATED PRENATAL E-CLASSES

Ontario public health regional units endorsed six out of seven of the evaluated prenatal e-classes. The Ontario prenatal health guidelines and frameworks are notably inclusive and accessible, as they explicitly promoted programs that addressed the diverse needs of marginalized populations, including LGBTQ women, immigrants, teens, and women with various physical and mental abilities, as described above (Government of Ontario, 2012; 2010). Many prenatal e-classes displayed images of racial/ethnic groups, LGBTQ families and teen mothers (Chedid et al., In press), but lacked targeted content for women of Indigenous, teen or disabled status. Three prenatal e-classes included culturally sensitive prenatal health content, which aligns with Ontario prenatal health guidelines' recognition of cultural/religious diversity (Government of Ontario, 2012; 2010).

As prenatal e-classes were primarily available in English, most did not address the linguistic barriers to prenatal service access and mitigation strategies that were acknowledged in Ontario's prenatal health guidance document (Government of Ontario, 2012). Only one e-class, *A New Life/Une Nouvelle Vie*, was promoted in both French and English (Chedid et al., In press), although public health regional units may have experienced financial restrictions on purchasing such programs. Therefore, inclusive and accessible prenatal health strategies are mainly reflected through visual depictions of diverse populations in Canadian prenatal e-classes.

In summary, the inclusive and accessible strategies described by prenatal health guidance documents were not always consistent with the prenatal health content on their respective

government-hosted websites and prenatal e-classes. The harmonization of inclusive and accessible prenatal strategies would be an important step in the creation of consistent practices across Canadian communities and would help reduce health inequities.

A HEALTH EQUITY LENS FOR PRENATAL HEALTH PROMOTION

Accessibility and inclusivity are interrelated concepts that contribute to health equity, which should be considered at prenatal program design phases and carried out all the way through program implementation and evaluation (Chapter 4). Often, barriers to program accessibility result from poor program design that does not fully recognize that the local population of pregnant women is heterogeneous with respect to physical and mental ability, SES, education, literacy, citizenship, sexual identity, age, race/ethnicity, language and marital status (Berman, 2006, Blackford et al., 2000; Tarasoff, 2015; Hayman et al., 2013; Reitmanova & Gustafson, 2008; Heaman et al., 2015; Best Start Resource Centre, 2014). Although society recognizes the existence of these groups, program planners may not realize these women require specialized services and that pregnancy may impact their social and environmental circumstances. Use of an equity lens for the planning, implementation and evaluation of prenatal services encourages populations to relate to specific messages and can potentially encourage behaviour change.

CONCLUSION

It is evident that there are several instances wherein inclusive and accessible prenatal health strategies are consistent between Canadian prenatal guidance documents and online Canadian government-hosted websites and prenatal e-classes. All women should have access to prenatal

services to promote prenatal health and improve pregnancy outcomes. The findings from this case study further support the importance of sharing and implementing best practices across prenatal health guidelines and online platforms, to optimize inclusive and accessible prenatal health services and ensure health equity.

Chapter 6: Discussion of Prenatal Health Programs

This thesis explored prenatal program design, implementation and evaluation of (1) online Canadian prenatal health promotion and (2) an international sample of prenatal health guidance documents. A multijurisdictional approach was used to systematically evaluate prenatal health promotion content from Canadian government-hosted websites and prenatal e-classes, as well as prenatal health program practices from prenatal guidance documents across five countries. The findings from this thesis will inform recommendations for the planning, implementation and evaluation of prenatal health programs, including the provision of prenatal health promotion services.

PRENATAL HEALTH PROGRAM COMPONENTS

The best practices in prenatal program planning, implementation and evaluation are outlined in Figure 1, Chapter 4. All practices in this framework are interrelated and collectively contribute to prenatal health program optimization. The following section will further elaborate this model and highlight specific approaches and interdisciplinary collaborations to enhance prenatal program design, implementation and evaluation.

Indicators for Program Success

This thesis research emphasized process program evaluations, however formative and summative evaluations are also valuable strategies to provide data on areas of program improvement or success (Scriven, 1981). Effective program evaluations consist of the collection of program indicators and the evaluation of program impact, which are carried out at regular intervals throughout program delivery (Wholey, 2004). Program indicators include

measurable outcomes that demonstrate a program's progress towards achieving its goals (Scriven, 1981). Many of the reviewed prenatal guidance documents incorporated various types of program evaluations (Chapter 4). Newfoundland and Labrador's prenatal strategy described process evaluation indicators as prenatal service satisfaction and the number of women directed to appropriate prenatal resources (Government of Newfoundland and Labrador, 2005). Summative program indicators described in Nunavut's guidance document incorporated several measurable outcomes including, a decrease in pregnancy risk behaviours and rates of preterm birth, as well as an increase in prenatal class attendance and community involvement (Government of Nunavut, 2009). Although I was not able to measure uptake of prenatal health content through e-classes and government websites, process and summative evaluations are strategies that these agencies can use to track the number of women who access these online resources and determine population reach.

Population Reach Through Evidence and Theoretical Approaches

Our review of prenatal guidance documents (Chapter 4) revealed that best practices for the design, implementation and evaluation of prenatal health programs should be based on theory, evidence and equity (Figure 1, Chapter 4). As described in Chapter 5, use of an equity lens acknowledges the needs of minority populations and thus prompts the design for inclusive and accessible prenatal programs. Prenatal health information and guidelines (Institute of Medicine, 2009) continuously evolve due to changes in technology, clinical guidelines, demographic shifts within communities and research advancements. Prenatal health strategies should not only be grounded in the most relevant evidence and theories, but should convey these strategies to their targeted audiences.

Evidence-Based Approaches and Public Trust

Effective clinical practice guidelines are informed by standardized protocols which are critically and routinely evaluated (Horvath, 2015). It therefore follows that all stages of prenatal health program development should similarly be evidence-based (Figure 1, Chapter 4). Evaluated government-hosted websites and prenatal e-classes provided evidence-based prenatal health promotion content (Chedid et al., In press; Chapter 3), however in most cases information sources, including primary and scientific literature, were not cited or linked for public use. Displaying sources for health information is important for gaining public trust, as an American study showed that 42% of website users do not accept health information if sources or references were not provided (Fox, 2002). Health information from doctors, scientific journals, and university scientists are perceived by Canadians as credible sources for health risk information (Krewski et al., 2006) and pregnant women particularly trust the credibility of government websites (Lagan et al., 2010; Hearn et al., 2014). Although prenatal health programs may be designed using an evidence-based approach, this practice should extend to prenatal health websites and e-classes.

Interdisciplinary Approaches to Prenatal Service Access

The suggested best practices for prenatal programs (Figure 1, Chapter 4) incorporates a combination of the population health, socio-ecological and life course models, as fundamental theories for program design- thereby using an interdisciplinary approach. The integration of these theories enables the articulation of the diverse influences on prenatal health. Recognizing the constant interaction between individuals and their environment, which in turn influences behaviour, Bandura's Social Cognitive Theory and McLeroy's socio-ecological perspective

on health promotion were used by Sword (1999) to understand the barriers and facilitators to prenatal service use. Prenatal service access can be based on women's social influences, health care provider interactions and health care service organization, availability and delivery (Sword, 1999). This approach acknowledges the intersecting influences of behaviour change and population and public health theories, which help prenatal program planners understand access to prenatal services.

Behaviour Change Theories & Development of Self-Efficacy

As my thesis evaluated non-clinical prenatal services, many of the approaches to optimize prenatal health require women to commit to changes in behaviours. Limitations of passive uptake of health promotion programs, including many of the Canadian government-hosted websites evaluated here (Chedid et al., In press; Chapter 3), are the reduced opportunity for women to develop self-efficacy (Bandura, 1977) through interactive exercises (Neuhauser & Kreps, 2003). Positive maternal behaviour change depends on women's ability to access, comprehend and relate to health promotion messages and services (Neuhauser & Kreps, 2003). Effective prenatal health promotion helps women understand their susceptibility to prenatal risks, the severity of risk consequences and the actions that can reduce risks; as described by the Health Belief Model (Rosenstock, 1966; 1974). The U.S. text4baby prenatal mobile app is an example of a program designed using the Health Belief Model and Social Cognitive Theory (Evans et al., 2012). This mobile intervention increased maternal self-efficacy through improvements in health literacy and an increase in knowledge of behavioural health risks (Evans et al., 2012).

Strategies that support self-efficacy and prenatal health behaviour change include interventions, counselling and the provision of interactive tools and opportunities for social support. Many evaluated government-hosted websites and prenatal e-classes in Chapter 3 did not provide interactive components, such as tools for tracking gestational weight or platforms that encourage dialogue among users and between users and health professionals (Chedid et al., In press). In-person prenatal classes, counselling and other mediated interventions can provide opportunities for interaction, however online resources, including mobile apps, may also represent a cost-effective, accessible mechanism to promote healthy behaviour changes (Hearn et al., 2014). PHAC's government-hosted website currently promotes a national STI clinical guideline mobile app for health care professionals (PHAC, 2017b), which may provide a model for the generation of a similar prenatal health app, such as OMama (OMama, 2017). A notable gap in the evaluation of prenatal e-classes was the inability of participants to ask questions, as would be encouraged through participation in in-person classes or online features such as live chat or social media. Although prenatal e-classes are a practical resource, both in terms of delivery costs and given women's identified time and transportation constraints (Best Start Resource Centre, 2014; Murphy Tighe, 2010), pregnant women still value face-face interactions with prenatal class instructors (Svensson et al., 2008; Moreau et al., 2015), as well as the possibility to interact with other mothers (Fabian et al., 2005). Enhancing opportunities for both social and virtual interactions may help bridge the gap between the scientific information retrieved online and risk perceptions, thereby contributing to the development of self-efficacy for maternal behaviour change (Tyshenko et al., 2008).

A woman's ability to develop self-efficacy for prenatal behaviour change may also be encouraged through emphasis on development of health literacy. Women with poor health literacy (Shieh & Halstead, 2009; Delanoë et al., 2016) experience barriers with prenatal service access. Given that many consumers use electronic resources to obtain health information (Lagan et al., 2010; Larsson et al., 2009; Cugelman et al., 2011; Murray et al., 2005), Norman and Skinner (2006) propose the e-Health Literacy Model, defined as an individual's ability to look for, find, comprehend and evaluate health information retrieved from an electronic resource, to benefit their health (Norman & Skinner, 2006). An evaluation of antenatal education recommended strategies to enhance health literacy, which included educating women on how to understand and use health information, interact with health care providers and engage in positive health behaviours (Renkert & Nutbeam, 2001). Similarly, prenatal e-classes and other in-person prenatal services can improve maternal self-efficacy by increasing women's health and e-health literacy skills.

Health promotion messages are most effective for encouraging self-efficacy and positive behaviours when they relate to mothers on an emotional and social level (Neuhauser & Kreps, 2003). Self-referencing is a theory that describes how individuals relate messages to their own self-concept and has been shown to increase message recall and successfully reach racial and ethnic minority communities (Burnkrant & Unnava, 1989; Martin et al., 2004). All government-hosted websites and prenatal e-classes evaluated in Chapter 3 displayed images of women and families from minority populations, which is an appropriate practice to encourage self-referencing. Women who see themselves represented in the images and videos

on these websites and e-classes may be more likely to understand and apply the prenatal health promotion messages, which in turn may lead to positive lifestyle and behaviour changes.

All components of the best practice model developed for the design, implementation and evaluation of prenatal health programs (Figure 1, Chapter 4) benefit from an interdisciplinary approach. Optimal pregnancy health relies on prenatal program planners' recognition that prenatal health is influenced by diverse interacting determinants across the lifespan (Lu, 2010), in addition to prenatal service organization and delivery (Sword, 1999). Thus, maternal behaviour change requires collaborations among prenatal, health and non-health sectors, throughout all stages of a woman's pregnancy (preconception to postpartum). Collaborations with allied health services, including dietitians and exercise specialists, may help design interventions to limit excess GWG, control gestational diabetes and optimize nutrition and regular physical activity. Collaborations with non-health community resources, including legal and child services may be required to provide support, counselling and interventions in cases of intimate partner violence (Bailey & Daugherty, 2007). Collaborative action, information sharing and referrals among all health and non-health organizations including prenatal instructors, family doctors, OB/GYNs, nurses, dieticians, community programs, websites, financial services, legal services, translating services, as well as cultural and religious groups, can provide greater scope to the provision of prenatal health services and interventions.

As all services accessed by pregnant women influence maternal and child health, interdisciplinary collaborations among these resources can aid in local needs assessments,

ultimately optimizing prenatal programs (Figure 1, Chapter 4). Thus, evidence-based approaches used to gain public trust, acknowledgment of the interdisciplinary theories that influence service use and the promotion of self-efficacy for behaviour change, are fundamental best practices in program design that support population reach (Figure 1, Chapter 4).

Prenatal Services Centred Around Women

As described in the evaluation of prenatal health guidance documents in Chapter 4, a woman-centred approach, with recognition of the family's role in prenatal health, is important for the delivery of holistic and culturally competent prenatal services. However, some aspects of woman-centred care were poorly addressed by the evaluated prenatal documents (Chapter 4).

Women and Sexual and Reproductive Health Rights

A woman-centred approach to care reflects the Beijing sexual and reproductive health (SRH) rights agreement (United Nations, 1996). Women's SRH rights are not upheld in jurisdictions that limit access to abortion and contraception and sexual health education (United Nations, 1996). Societies which limit women's SRH rights pose challenges to the adoption of a woman-centred approach for prenatal health. Although the SRH rights principle was not explicitly mentioned in the evaluated Canadian prenatal guidance documents (Chapter 4), the Government of Canada supports SRH rights advancements through sexuality and family planning education, legal access to abortion and the prevention and response to sexual and gender-based violence (Government of Canada, 2017). Canadian prenatal health guidelines should also explicitly promote the SRH rights concept to ensure prenatal care is centred around women's needs and expectations.

Woman-Centred vs. Family-Centred

Many North American prenatal guidance documents did not explicitly promote woman-centred care (Chapter 4), however implicitly women's autonomy, decision-making and respect were made paramount. Health care generally takes a woman-centred approach, however delivery of prenatal care in North America is often framed as 'family-centred' (Chapter 4). Family-centred care entails the collaborative decision-making among families and health care providers, where family diversity, culture and preferences are respected (Kuo et al., 2012). A family's involvement in patient-centred care is not the same as family-centred care. Cancer care is an example of a patient-centred approach to care, as both patients and family members are consulted during decision-making (Balogh et al., 2011). However, when it comes to children with cancer, decision-making may be more family than patient-centred, as parents mainly collaborate with health care providers and make informed decisions (Holm et al., 2003).

Unlike patient-centred care in cancer treatment, prenatal care can be family-centred (Zwelling & Phillips, 2001). However, according to my best practices model (Figure 1, Chapter 4), I assert that the woman alone should have sole autonomy regarding her medical decision-making and prenatal choices. A primary woman-centred approach, with a component for partners and families, enables women to ultimately decide all aspects of her prenatal health, which includes decisions on the inclusion or exclusion of her partner and family during care. This type of decision-making is crucial to women, as not all partners and families are supportive, such as in the case of women who experience partner violence or sexual coercion (Shah & Shah, 2010; Martin et al., 2003). Many evaluated prenatal health guidance documents

failed to explicitly promote women's freedom to choose her companion during prenatal care (Chapter 4). A Canadian study shows that a woman's choice of labour and delivery companion resulted in satisfaction in the support received, as women chose companions who they were confident would provide them with individualized support, comfort and control (Price et al., 2007). Woman-centred care also implies the right of women to choose health care providers and attendants of choice, including a doula as a labour companion (Lundgren, 2010). Thus, women are the sole decision makers on all aspects of prenatal care, while partner and family supports should be provided, if desired by the woman. For women who choose to include their family members in decision-making and intervention programs, this may encourage healthy family behaviours and environments, which is beneficial in preventing prenatal risks, such as partner abuse or smoking (Shah & Shah, 2010; Baily & Daugherty, 2007; Langley et al., 2012).

In summary, the best practices in online prenatal health promotion (Chedid et al., In press; Chapter 3) and the planning, implementation and evaluation of prenatal programs (Figure 1, Chapter 4) necessitate interdisciplinary collaborative action to promote healthy pregnancies. Prenatal program planners must understand women's risk perception, trust of information channels, opportunities to influence self-efficacy and behaviour change, as well as the benefits of woman-centred services.

PUBLIC HEALTH PROGRAM EVALUATIONS

Effective design, implementation and evaluation of prenatal programs can be modeled from successful public health interventions, notably reproductive health promotion programs.

Identification of best practices for all prenatal and reproductive health programs benefit from multijurisdictional program evaluations.

Lessons Learned from Sexual and Reproductive Health Programs

Prenatal and reproductive health promotion and education share similar messaging, and both are within the public health sector's mandate related to disease prevention and health promotion (PHAC, 2008). Successful prenatal public health programs can particularly be modeled from fertility promotion and STI prevention public health programs.

Fertility Public Health Programs

Several public health programs that promote fertility have been implemented (Hammarberg et al., 2017; Stern et al., 2013; Daniluk & Koert, 2015). In the U.S., Centers for Disease Control and Prevention (CDC) addresses the need to enhance research and surveillance systems that report data on environmental, behavioural and sociodemographic factors associated with infertility (Macaluso et al., 2010). A successful national fertility plan would ideally include effective public communication and education on fertility risks and maximize the dissemination of fertility surveillance and research data (Macaluso et al., 2010). An Australian web-based program that promotes fertility and reproductive awareness has been shown to be evidence-based, accessible, inclusive and successful at reaching target audiences (Hammarberg et al., 2017). Developed in collaboration with various experts, including stakeholders from the field of public health, gynaecology, family planning, obesity and fitness, this Australian website (*Your Fertility*) was designed to be interactive and accessible through use of animations and images, while targeting content to both males and females (Hammarberg

et al., 2017). Such practices are also reflected by this thesis's best practices for prenatal health promotion.

Sexually Transmitted Infection Public Health Programs

Sexual education programs, which increase knowledge and awareness about sexual health risks, provide opportunities to model sexual relationship behaviours, including consent and condom use and discuss healthy lifestyle behaviours. Such program practices have been demonstrated to be successful through, a decrease in rates of unintended pregnancy (Kohler et al., 2008) and an increase in condom use and HIV testing (Selkie et al., 2011; Kohler et al., 2008; Bennett & Assefi, 2005; Basen-Engquist et al., 2001; Raj et al., 2001). Building on these effective STI prevention education programs, it is evident that user-friendly, comprehensive and tailored programs, designed through intersectoral collaborations and the use of evidence and appropriate communication strategies, are among the essential components of any successful public health promotion strategy (Selkie et al., 2011; Kohler et al., 2008; Raj et al., 2001; Bennett & Assefi, 2005; Basen-Engquist et al., 2001).

Many SRH programs consist of similar approaches outlined in my prenatal program best practices model (Figure 1, Chapter 4) and my proposed best practices for online Canadian prenatal health promotion (Chedid et al., In press; Chapter 3). Both fertility promotion and STI prevention public health programs incorporate evidence-based approaches, expert collaborations, surveillance and monitoring, and ensure appropriate communication strategies that delivery, accessible, inclusive and tailored health information.

Multijurisdictional Prenatal Health Program Evaluations

Regardless of the differences in the organization of health care across countries, standardization of prenatal program best practices across jurisdictions can help target underlying prenatal health issues, such as the lack of tailored resources. Prenatal program evaluations and recommendations for best practices benefit from multijurisdictional, evidence-based approaches, as supported by numerous prenatal care guideline evaluations across Europe, Canada, Australia, U.S. and Germany (Langer et al., 1999; Haerstsich et al., 1999; Bernloehr et al., 2006; Bernloehr et al., 2005).

A multijurisdictional comparison of obstetrics and gynaecology guidelines across several countries revealed many differences in prenatal care practices (Langer et al., 1999; Haerstsich et al., 1999; Bernloehr et al., 2006; Bernloehr et al., 2005). Haerstsich et al., (1999) found commonalities limited to clinical testing strategies among evaluated clinical guidelines from Canada, Australia, U.S. and Germany (Haerstsich et al., 1999). Evaluation of prenatal care guidelines from European obstetrics and gynaecology departments also noted differences in many prenatal care examinations (Langer et al., 1999). Similarly, surveys across the European Union demonstrated that only 3 prenatal test practices were common among the 25 states assessed (Bernloehr et al., 2005). Missing from these studies was any evaluation of the design, implementation and evaluation of these obstetrics and gynaecology programs. Nevertheless, the results from these evaluations support the need to enhance the development and implementation of evidence-based, consistent prenatal health programs, which would encompass clinical care and public health promotion.

In summary, several aspects of my recommended best practices for online prenatal health promotion (Chedid et al., In press; Chapter 3) and for the planning, implementation and evaluation of prenatal health programs (Figure 1, Chapter 4), are supported by successful sexual and reproductive public health programs. Multijurisdictional program evaluations can additionally be justified as an appropriate approach for the development of best practices in the design of online prenatal health promotion and in program development (Chapter 3 & 4).

PRENATAL HEALTH IS PUBLIC HEALTH

Prenatal health is an important aspect of public health and as such, ensuring healthy pregnancies is indirectly in the public's best interest. Strategies to improve public health generally target all populations, however to maximize the health of pregnant women, prenatal care and prenatal public health promotion should target communities at-risk (PHAC, 2013a).

Adverse Prenatal Health Affects Public Health

Prenatal health programs should not follow a “one size fits all” approach and should ideally aim to be broadly inclusive. Early investments in prenatal health can result in sustainable improvements to the health of children, adolescents and adults. The fetal origins of disease hypothesis proposes that adult-onset disease susceptibility, such as cardiovascular disease, is influenced by fetal environment (Barker, 1990; 1995). Thus, prenatal risks may not only impact neonatal health, but also affect child development and adult-onset disease risks, both of which pose significant economic and social costs to the public.

Maternal exposures to air pollution and alcohol and excess GWG are examples of prenatal influences that can adversely affect neonatal, child and adult health (Stieb et al., 2012; Perera et al., 2013; May & Gossage, 2011; Streissguth et al., 2004; Siega-Riz et al., 2009; Oken et al., 2008).

In addition to the risks for LBW and SGA offspring and preterm birth (Stieb et al., 2012; Brauer et al., 2008), maternal exposures to air pollution is shown to adversely impact children's cognitive development (Perera et al., 2009; Sunyer et al., 2015) and be associated with childhood anxiety/depression, aggressive behaviours (Perera et al., 2013) and attention deficit and hyperactivity disorders (Peterson et al., 2015). Maternal alcohol consumption risks FASD (May & Gossage, 2011), which negatively affects intelligence and memory in children (Rasmussen et al., 2006), in addition to being implicated in behaviour issues and learning difficulties in adolescence (Olson et al., 1997). FASD is also associated with depression, suicide, addictions, early school drop outs, cheating, stealing, unemployment and inappropriate sexual behaviours in adolescents (Streissguth et al., 2004; Clarke & Gibbard, 2003). Developmental disabilities, such as FASD, and mental health and childhood conduct disorders can contribute to economic, legal and social costs to society, along with loss of employee productivity due to disability and the increased need for health and emergency services (Popova et al., 2016).

Women are advised to gain appropriate gestational weight, as excess GWG is associated with LGA offspring (Siega-Riz et al., 2009) and is a risk factor for obesity in childhood and adolescence (Wrotniak et al., 2008; Oken et al., 2008), as well as cardiovascular disease and

metabolic syndrome in adulthood (Gaillard, 2015). Obesity has become a prevalent public health issue, as it not only leads to other health complications including diabetes (Abdullah et al., 2010) and cardiovascular disease (Lavie & Milani, 2003), but is an economic burden on the health care system (Yach et al., 2006).

Therefore, adverse pregnancy outcomes which negatively affect childhood development, ultimately pose long-term social, economic and health costs to the public. Prenatal exposures to air pollution, alcohol and excess GWG are only a few examples of modifiable risks to pregnancy, which may have long-term health affects. As future generations will be the leaders of our society, it is crucial they have the healthiest start to life, to ensure healthy childhood and adulthood.

Integration of Public Health into Primary Care

Although health system organization differs between jurisdictions, the best practices for online prenatal health promotion and the planning, implementation and evaluation of prenatal health programs proposed in this thesis can be applied in diverse settings (Chedid et al., In press; Chapter 3 & 4). These best practices should inform policies that strengthen the integration of prenatal public health into primary care, which is suggested to improve population health outcomes, as demonstrated in models from Canada (Rowan et al., 2007) and the U.S. (Koo et al., 2012).

Commonalities between public health and primary care include surveillance, health promotion and prevention of disease (Rowan et al., 2007). Thus, this integration allows for both individualized and community approaches to population health, providing both upstream and

treatment interventions (PHAC, 2008; Rowan et al., 2007), while creating true partnerships between health care providers and community programs/services (Koo et al., 2012; Rowan et al., 2007). Collaborations among public health and primary care will additionally help educate health care providers on the availability of credible prenatal resources and foster intersectoral collaborations.

FUTURE RESEARCH

As this thesis research evaluated online prenatal health promotion program designs, other prenatal health promotion channels and prenatal services should also be evaluated in the future, including public health nurse education, community programs and prenatal care. Inquiry of best practices and gaps from other prenatal resources accessed by women will not only inform best practices for the service evaluated, but will build on my proposed best practice model introduced in Chapter 4 (Figure 1). Within these program evaluations, it would also be advantageous to assess the perspectives of program administrators and the targeted audiences. Therefore, future research should survey Canadian pregnant women to obtain their opinions on barriers and facilitators to accessing prenatal health content from government-hosted websites and prenatal e-classes, as well as other channels which may be evaluated in the future. Prenatal program administrators include health care providers, prenatal class instructors and prenatal program coordinators, all who bring valuable perspectives and experiences to identify gaps in prenatal service use and recommendations for mitigation strategies. I am currently involved in a parallel project that evaluates prenatal health promotion in the Ottawa region through surveys with prenatal class instructors and interviews with

prenatal health key informants. I am eager to see how the perspectives and experiences of prenatal instructors relates to my thesis findings.

CONCLUSIONS

In conclusion, my thesis research has culminated with a proposed model for the best practices for prenatal health program design, implementation and evaluation. It is anticipated that the findings from my thesis will help improve prenatal program development and practices, both in Canada and internationally. Standardized practices and the integration of a public health approach to all prenatal programs is not only beneficial for maternal and child health, but also for children's long-term health outcomes. Finally, I strongly recommend intersectoral collaborations to ensure inclusive and accessible prenatal health services for all women, including those marginalized by race/ethnicity, geography, SES, disability, sexual identity, age, immigrant, Francophone and Indigenous status.

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