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Teaching by texting to promote positive health behaviours in pregnancy: a protocol for a randomised controlled trial of SmartMom

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ABSTRACT

Introduction Prenatal education is associated with positive health behaviours, including optimal weight gain, attendance at prenatal care, acceptance of routine screening tests, smoking cessation, decreased alcohol consumption and breast feeding. Adoption of these behaviours has been associated with reduced rates of caesarean birth, preterm birth and low birth weight. Barriers to prenatal class attendance faced by parents in Canada include geography, socioeconomic status, age, education, and, among Indigenous peoples and other equity-deserving groups, stigma. To address the need for easily accessible and reliable information, we created 'SmartMom', Canada's first prenatal education programme delivered by short message service text messaging. SmartMom provides evidence-based information timed to be relevant to each week of pregnancy. The overall goal of SmartMom is to motivate the adoption of positive prenatal health behaviours with the ultimate goal of improving health outcomes among women and their newborns.

Methods and analysis We will conduct a two-arm single-blinded randomised controlled trial. Blinding of participants to trial intervention will not be possible as they will be aware of receiving the intervention, but data analysts will be blinded. Our primary research questions are to determine if women experiencing uncomplicated pregnancies randomly assigned to receive SmartMom messages versus messages addressing general topics related to pregnancy but without direction for behaviour change, have higher rates of: (1) weight gain within ranges recommended for prepregnancy body mass index and (2) adherence to Canadian guidelines regarding attendance at prenatal care appointments.

Ethics and dissemination The study has been granted a Certificate of Approval, number H22-00603, by the University of British Columbia Research Ethics Board. To disseminate our findings, we are undertaking both integrated and end-of-grant knowledge translation, which will proactively involve potential end-users and stakeholders at every phase of our project.

Trial registration number NCT05793944.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The sample will be representative of women across Canada.
⇒ Outcomes will be attributable to texting methodology controlled for the use of apps, web pages and other mobile technology.
⇒ Participants will require access to the internet in order to retrieve additional online information via links in text messages, which will limit generalisability to populations who do not have internet access.
⇒ Data from participants with community births will not be available from the Canadian hospital discharge abstract database but will be available through provincial perinatal registries.
⇒ The programme is only available in English at this time.

INTRODUCTION

Background and rationale

Prenatal education is designed to teach expectant parents and their support persons about the physiologic and psychological changes of pregnancy, what to expect during prenatal care (PNC), and how to prepare for labour, birth and newborn care. In this paper, we use the term 'women' to refer to women and gender diverse people who are capable of giving birth.[1] Attendance at prenatal education classes has been associated with positive health behaviours, including optimal weight gain,[2] attendance at PNC,[3] acceptance of routine screening tests,[4] smoking cessation, decreased alcohol consumption and increased rates of breast feeding.[5] Moreover, adoption of these behaviours has been associated with reduced rates of caesarean birth,[3 6] preterm birth and low birth weight.[7] The pan Canadian Maternity Experiences Study (MES) reported that only one-third of Canadian women attend prenatal classes.[8]

Women with Indigenous identity, younger age, low socioeconomic status, less education, non-dominant ethnic identity or residing in rural locations were even less likely to attend.[9 10]

To navigate the complexities of pregnancy and childbirth, expectant parents are increasingly turning to the internet and smartphone apps.[11 12] However, there are serious concerns about the quality and comprehensiveness of this information.[13] In addition, expectant parents participating in focus groups in British Columbia (BC) have revealed that information from apps or the internet is overwhelming in its sheer volume and that they 'don't have time' to scroll through windows and search for topics.[14]

In the absence of effective, structured prenatal education, expectant parents are experiencing concerning gaps in knowledge. For example, a Canadian population-based survey indicated that only 25% of respondents had been informed that there are risks associated with suboptimal weight gain during pregnancy.[15] The MES reported that 59.4% of women surveyed gained above the recommended weight for their body mass index (BMI).

Gestational weight gain above the Institute of Medicine recommendations[16] is associated with caesarean delivery, gestational diabetes, large for gestational age newborns with potential for birth injury and pre-eclampsia in the current pregnancy as well as increased risk for type 2 diabetes, cardiovascular disease and metabolic syndrome in later adult life.[17] In addition, excessive weight gain, if not lost after delivery, is likely to influence future pregnancy outcomes.[18] Inadequate gestational weight gain below the institute's recommendations is associated with both preterm birth and small for gestational age (SGA) status at birth.[19]

As well, the MES reported 18.9% of women had inadequate attendance at PNC visits.[20] Inadequate attendance at PNC is associated with low birth weight, stillbirth, SGA status and neonatal death.[21–23]

To address the need for easily accessible and reliable information, we created 'SmartMom', Canada's first prenatal education programme delivered by short message service (SMS) text messaging. SmartMom provides relevant, timely, gestational age-tailored and evidence-based information aimed at motivating behaviour change.[24] Each message contains links to online sources for additional information. Different from apps, SmartMom delivers messages to the user's mobile phone, three times weekly, without requiring any effort on the part of the user. The overall goal of SmartMom is to motivate adoption of positive prenatal health behaviours in order to improve pregnancy and newborn health outcomes.

The use of text messaging for health promotion is based on the social cognitive theory of behaviour change.[25] Our links take participants to interactive learning tools, such as videos and animated stories, which are designed to model healthy behaviours and thus enhance engagement, and promote self-efficacy, all critical elements in behaviour change.[25 26] Our focus group findings[27] and those of others[28] have reported that parents want a 'personalised touch' in digital programmes. To achieve this, SmartMom provides optional supplemental streams for individuals who wish to have additional messages addressing special topics such as reducing use of substances, mental health, weight management and others.

Recent evidence, including randomised controlled trials (RCTs), indicates that text messaging can improve health behaviours. An RCT of the Text4Baby programme in the USA reported higher rates of alcohol reduction among those who received text messages.[29] In South Africa, an RCT showed that SMS messaging improved PNC attendance, increased rates of vaginal birth after a previous caesarean (VBAC) and decreased the risk of delivering a low birthweight infant.[30] Decreased perinatal mortality has been reported in Zanzibar,[31] lowered levels of anxiety in Thailand[32] and reduced rates of macrosomia in China.[33] Further, meta-analytical evidence suggests that in low-income and middle-income countries text messaging is associated with higher rates of breast feeding at birth.[34] There have been no trials of pregnancy outcomes related to texting programmes in high-income countries.

SmartMom was developed in BC, Canada with over 16 000 participants to date. Pilot observational data have demonstrated significant improvements in knowledge and mental health scores among programme users[35] and improvements in pregnancy outcomes among programme participants compared with a random population sample.[36] We now propose a Canadian RCT of the SmartMom programme.

Objectives

Primary objectives

Our primary objectives are to determine if women experiencing uncomplicated pregnancies who receive the SmartMom messages versus messages addressing general topics related to pregnancy but without recommendations for behaviour change have:

1. A higher rate of weight gain within recommended ranges for prepregnancy BMI.
2. A higher rate of adherence to Canadian guidelines regarding adequate attendance at PNC appointments.

Secondary objectives

Our secondary objectives seek to determine if women who receive SmartMom have:

1. Improved health literacy as evidenced by:
   a. A greater increase on a knowledge test score between enrolment and 38 weeks gestation.
   b. More often reporting (1) information-seeking from local health and social services resources; (2) awareness of their choice to have serum genetic screening and (3) awareness of their choice to have serum glucose screening.
2. Improved mental health as evidenced by reduction or larger reduction in (a) fear of childbirth, (b) depressive symptoms and (c) anxiety as measured on stan-

dardised scales at enrolment and 38 weeks of pregnancy.
3. A lower rate of exposure to tobacco, vaping, alcohol and cannabis.
4. More frequent healthy choices including:
   a. A higher rate of choosing to plan vaginal birth (VBAC) after a previous caesarean birth among those eligible.
   b. A higher rate of exclusive breast feeding at hospital discharge.
5. Improved pregnancy outcomes including a lower rate of gestational diabetes, stillbirth, preterm birth (<37 weeks gestation) and SGA status at birth.
6. Lower costs per incidence of inappropriate weight gain and inadequate PNC avoided expressed as an incremental cost-effectiveness ratio.

Trial design

We will conduct a two-arm single-blinded superiority RCT. While it is not possible to blind participants to group allocation, data analysts will be blinded.

METHODS AND ANALYSIS

Study setting

The study takes place in Canada.

Eligibility criteria

The trial will be open to women who (1) can read and understand English at grade 8 level; (2) live in Canada; (3) have a cell phone and internet access; (4) have a singleton pregnancy and (5) are at 15 weeks gestation or earlier. Women will be excluded if they (1) live in BC (where we piloted SmartMom); (2) have a health condition existing prior to pregnancy that requires individualised care including hypertension, cardiac disease, diabetes, psychiatric disorders requiring medication, neurological conditions or (3) are age 14 or younger.

Interventions

Experimental arm (SmartMom programme)

Participants randomised to the experimental arm will receive three SMS text messages each week until 41 weeks gestation. Messages focus on improving knowledge, providing information about prenatal assessments and encouraging the adoption of behaviours to support healthy pregnancy and physiological birth. Messages are consistent with current professional guidelines[37] and peer-reviewed prenatal education curricula.[38] They are brief (160 characters or fewer) and at a grade eight reading level.[39] They contain embedded links to additional online information and resources. Message content has been developed in partnership with health authorities in BC and informed by focus groups with expectant and new parents in BC.[27]

The software sending messages to subscribers was developed by Memotext, a Canadian company with extensive experience in mHealth (mobile health). The message set is anchored to an 'expected due date' so as to be salient to each week of gestational age for individual participants. Memotext is based in Toronto and encrypts and stores all data on Canadian servers.

Table 1 Health Canada guidelines for gestational weight gain

Prepregnancy BMI	Recommended total weight gain	
	kg	lbs
<18.5 underweight	12.5–18	28–40
18.5–24.9 normal	11.5–16	25–35
25.0–29.9 overweight	7–11.5	15–25
≥30.0 obesity	5–9	11–20

BMI, body mass index.

Control arm

Participants randomised to the control arm will receive one text message each week. These messages will address general topics related to pregnancy but without recommendations for behaviour change. All trial participants will be able to access other pregnancy-related phone apps that are available to the general public.

Outcomes

Primary outcomes

Our primary outcomes are prenatal healthcare behaviours associated with pregnancy outcomes: (1) rate of weight gain in a range appropriate for prepregnancy BMI and (2) rates of attendance at PNC appointments in adherence to Canadian guidelines.[40 41] Optimal gestational weight gain will be defined according to Health Canada published standards and recorded as meeting less than or more than recommended standards[42] (table 1).

Adequate PNC attendance will be defined according to the Adequacy of Prenatal Care Index (APNCUI)[20 43] and documented as inadequate, intermediate, adequate or adequate plus. The APNCUI is a composite of two adequacy components: the adequacy of the initiation, measuring the timing of PNC visits in weeks and the frequency of visits adjusted for gestational age during the time of PNC (table 2).

Table 2 Adequacy of prenatal care Utilisation index

Prepregnancy BMI	Initiation	No of visits
Inadequate	After 17 weeks	Less than 6 visits
Intermediate	At 17 weeks	6–9 visits
Adequate	At 17 weeks	10–12 visits
Adequate plus	At 17 weeks	More than 12 visits

BMI, body mass index.

Secondary outcomes

1. Changes in health knowledge as measured by a 10-item knowledge test. In our pilot, scores improved 7% on average during pregnancy, p<0.001.
2. Health literacy at end of pregnancy as measured by self-report of (1) information-seeking from local health and social services resources; (2) awareness of their choices regarding serum genetic screening and (3) awareness of their choices to have (yes/no) serum glucose screening.
3. Changes in fear of childbirth as measured by the Childbirth Fear Scale, an 11-item, self-report measure with high internal consistency reliability (Cronbach's alpha>0.86) and strong discriminant and convergent validity.[44] We observed statistically significant decreases in fear of childbirth using this scale among pilot participants, p=0.01.[35]
4. Changes in depression as measured by the Edinburgh Postnatal Depression Scale.[45] This is a 10-item, self-report screening tool for postnatal depression and is also valid for use during pregnancy.[46] Its sensitivity and specificity are in acceptable ranges (65%–100% and 49%–100%, respectively). A four-point decrease will be deemed clinically important.[47]
5. Changes in anxiety through pregnancy as measured by the 33-item Pregnancy-Specific Anxiety Tool (PSAT). The PSAT has been validated for measuring pregnancy-specific anxiety and its severity.[47] Scores over 10 are indicative of clinical anxiety requiring treatment. Our online scales inform participants of their scores and provide contact information for assistance, if needed.
6. Changes in use of tobacco, vaping, alcohol and cannabis through pregnancy among users. Change will be assessed by self-report and detailed data from perinatal registries in provinces where they exist (Alberta, Ontario and Nova Scotia). The accuracy of self-report on our questionnaires will be assessed by comparison with registry data.
7. Rates of planned vaginal birth after caesarean reported as the proportion of participants choosing to plan VBAC after a previous birth, among those deemed eligible by their caregivers.
8. Rates of exclusive breast feeding at hospital discharge.
9. Rates of adverse pregnancy outcomes as measured by gestational diabetes, stillbirth, preterm birth (<37 weeks gestation) and SGA status at birth.
10. Incremental costs per incidence of suboptimal weight gain and inadequate PNC avoided for the intervention group when compared with control group as an incremental cost-effectiveness ratio.

Prenatal glucose (for gestational diabetes) and serum genetic screening are among the most common prenatal tests declined for reasons of misalignment with personal values[48]; therefore, we wish to measure knowledge of choice rather than uptake of screening. Rates of VBAC among eligible participants, and exclusive breast feeding at hospital discharge are each a consequence of participants' decision-making, associated with neonatal outcomes[49] and amenable to change with education. Preterm birth and SGA status in the newborn are associated with weight gain[7] and attendance at PNC visits.

We will record use of resources as a continuous variable (number of times participants report acting on message content to contact agencies or caregivers). Awareness of screening options will be documented in the 38-week questionnaire and compared between groups as yes/no (see table 3 for schedule of assessments).

Similarly, exclusive breast feeding at hospital discharge and planned VBAC after caesarean will be recorded on our questionnaires and compared with registry data.

Participants will be asked to provide their personal health numbers (PHNs). This will allow us to access outcome data (gestational diabetes, stillbirth, preterm

Table 3 Frequency and duration of follow-up

	At enrolment	At 38 weeks gestation	At 1-month postdelivery
Sociodemographic information, prepregnancy BMI	X		
Knowledge quiz, including options for screening	X	X	
Fear of childbirth, depression, anxiety scales	X	X	
Weight	X	X	X
No and timing of prenatal care visits*		X	X
Seeking resources based on messaging		X	
Exposure to tobacco, vaping, alcohol, cannabis*	X	X	
Planning VBAC after previous cesarean*†	X	X	
Exclusive breast feeding at hospital discharge*			X
Preterm birth*†			X
SGA status at birth*†			X

*Available also from provincial perinatal registries.
†Available also from the Canadian Hospital Discharge Abstract Database.
BMI, body mass index; SGA, small for gestational age; VBAC, vaginal birth after a previous caesarean.

birth, SGA) from the Canadian Discharge Abstract Database for all provinces/territories as well as from the provincial registries. Participants in our pilot have been compliant with requests to provide PHNs to Memotext via an encrypted portal. Outcome data from registries will be anonymised.

Trial status

Enrolment began on 10 November 2023. We are reporting on protocol version 3, 4 July 2023.

Recruitment

We will take a multimodal approach to recruitment, using social media platforms; Facebook, Instagram, Twitter and TikTok. We will have links to SmartMom on provincial prenatal registry webpages where women register their pregnancies. Additionally, partnerships with individuals and organisations connected to rural, remote and Indigenous communities will help us to refine communication strategies that are acceptable and accessible for these groups. Social media will direct women to the study website and contact information for the study team. From there, women will access an online eligibility form, hosted by REDCap at the BC Children's Hospital Research Institute.[50]

Assignment of interventions

After a positive screen on the eligibility form, the potential participant will enter their phone number on the REDCap website, which will trigger an email to the study coordinator. The study coordinator will then phone the participant, review the consent form with them and answer questions. After the participant consents online by adding their name to the consent form and then clicking on a tick box to accept the terms in the consent form, the research coordinator will access a password-protected computer webpage on the REDCap platform to obtain the trial allocation. Randomisation will be centrally controlled using a randomisation platform (REDCap) at the BC Children's Hospital Research Institute, Clinical Research Support Unit. Allocation to intervention group will be 1:1, with permuted blocks of variable size and stratified by province/territory and parity (nulliparous/multiparous). Participant identification number, cell phone number, intervention allocation, due date and time of randomisation will be sent by REDCap to Memotext, linking the REDCap study ID with an Internal Memotext ID. This will trigger a 'welcome to the study' text from Memotext to the participant and a text with a link to the online participant survey. The research coordinator will remain on the phone to answer any questions participants have about this enrolment procedure or protocols in either trial arm.

Sample size

We have calculated the prevalence of desired outcomes with Canadian population-based studies based on Canadian clinical guidelines. We used simulations to determine the sample size required to achieve 80% power applying a Benjamini-Hochberg false-discovery rate p value correction to correct for multiple primary outcomes. This correction maintains the experiment-wise type I error rate at 0.05. Our sample size simulations indicate that 1539 persons per study arm will grant sufficient power to detect absolute differences of 5% or more in our outcomes. Pilot data from our BC health authorities demonstrate a 5.6% increase in appropriate weight gain (favouring persons enrolled in SmartMom) and a 12% improvement in PNC attendance. A 5% decrease in suboptimal weight gain would affect 18 744 pregnancies in Canada annually. Gestational weight gain below the Institute of Medicine Recommendations[16] is associated with an attributable risk of 5% of both preterm birth and SGA status at birth in a recent large meta-analysis.[19] During the last 18 months, our SmartMom drop-out rate has been 2.7%. Adding 2.7% to 1539 results in 1580 participants per group (table 4).

Table 4 Sample size

Outcome	Proportion in Canadian population	Absolute differences to be detected	No required per study arm
Appropriate weight gain[42]	40.6%[7]	5%	1539
Adequate prenatal care	81.1%[20]	5%	860

In BC, we are enrolling 300 women among 3000 potentially eligible births per month. Assuming enrolment is proportional to our 18-month pilot, we could potentially enrol 1485 women per month, which is more than adequate for our sample size. However, only 50% of the participants in our pilot enrolled at 15 weeks gestation or earlier.

Analysis

We will undertake an intention-to-treat approach analysing all individuals in the group to which they were allocated. Hypothesis testing will use a two-sided 0.05 significance level. We will report relative rates and absolute risk differences and their 95% CIs for categorical variables, as estimated using log binomial regressions. For outcomes that are continuous, we will perform independent t-tests and treatment effect will be expressed as the mean difference with 95% CIs. Changes in scores on standardised scales will be assessed adjusting for baseline values using an analysis of covariance (ANCOVA) approach. To adjust for prognostic variables not balanced at baseline, we will undertake multivariable log-binomial regression for our binary outcomes and general linear regression modelling for continuous outcomes. Our primary approach will be a complete-case analysis, including all individuals with available data. We will perform a sensitivity analysis to account for missing outcome data using multiple imputation. Individuals with conditions arising during pregnancy that are not amenable to change through prenatal education but that could influence outcomes will be

retained in the primary analysis then excluded in a sensitivity analysis to determine their influence on measures of association. These conditions include multiple gestation, placenta previa, Rh iso-immunisation, premature changes in the cervix and hyperemesis gravidarum. We will plan to analyse outcomes only at the end of the trial as the intervention does not pose a safety risk. Subgroup analysis will be performed accompanied by tests of interaction between treatment effect and subgroup. Subgroup analysis will be based on rural/urban, socioeconomic status, Indigenous identity, social support and use of other apps.

We will undertake an economic evaluation from the perspective of the public healthcare payers and provincial/territorial Ministries of Health. We will consider the programme implementation costs of ~CAD$25 000 and monthly costs of CAD$5460 per province, as well as relevant healthcare costs including the cost of prenatal/postnatal care visits calculated using the provincial physician payment schedule[51 52] and the delivery/birth-related hospitalisation cost calculated using standard casemix groups and hospital-and year-specific resource intensity weights (RIWs) and cost of a standard hospital stay available from the Canadian Institute for Health Information.[53] Casemix groups and RIWs for individuals can be obtained through linkage with PHNs. Our analysis will report on incremental costs per incidence of suboptimal weight gain and inadequate PNC avoided for the intervention group when compared with control group as an incremental cost-effectiveness ratio.[54] Uncertainty of the findings will be characterised using 95% CIs and a cost-effectiveness acceptability curve using bootstrapping methods.[55]

Mitigating bias

While social desirability could influence self-reporting, there is no reason to believe that this would differ between randomised groups and studies suggest that response bias is less common in online modalities than in face-to-face interviews.[56] We will assess the accuracy of self-report against detailed data collected from provincial perinatal databases in Alberta, Ontario and Nova Scotia. Much of our outcome data will be obtained through standardised unbiased third party databases. We will ask participants if they have used apps, websites and blogs with hours of use per week so we can adjust for this in our analysis. We will also ask participants if they forwarded messages to or received messages from other participants.

Compliance

Strategies to monitor compliance will include documenting drop-out rates, the number of times links in each message are followed online and use of supplemental message streams using Bitly URL analytics. Our follow-up questionnaire asks participants about how often they read the texts, if the information was new to them, and if they acted on the messages. This will allow us to measure compliance according to 'dose' and satisfaction with the programme. All participants will receive incentives to keep them engaged in the trial, including social media posts about SmartMom as well as reimbursements of CAD$15, CAD$20 and CAD$25 for completion of questionnaires at enrolment, 38 weeks and 1 month after giving birth. Pregnancy loss before 20 weeks will be considered as drop-outs; the most common reason for withdrawal in our pilot, and data provided by participants who experience pregnancy loss will be excluded from the analysis.

Trial management

Coordination of the trial will be undertaken by a trial coordinator, a marketing specialist who is responsible for recruitment via social media and the PI. Recruitment is online and will be coordinated from one centre. The steering committee will consist of the principal applicant, trial coinvestigators from provinces submitting perinatal registry data, our senior biostatistician, the project manager at Memotext, a prenatal educator, a patient representative and our trial coordinator. Decisions about protocol modifications will be communicated by the steering committee to all coinvestigators and the ethics boards. A data safety monitoring board consisting of an expert in clinical maternal health, a clinical trials statistician and a perinatal epidemiologist will be struck and will be convened to assess progress towards recruitment goals, address protocol adherence issues, undertake an interim analysis if necessary, if there are concerns about slow enrolment and futility.

Patient and public involvement

We have involved potential end-users and stakeholders at every phase of our project. We have worked closely with public health practitioners to develop our messages. The intervention for this study was developed in response to a series of focus groups conducted with expectant parents conducted by members of the trial investigator group.[14 27] We developed supplemental 'opt-in' messages in response to users request that the programme be tailorable to the needs of individual users. We also embedded links to online sources of information in every message, based on focus group feedback. Content has been further developed based on responses to our study questionnaires from over 1500 participants in BC. Members of our advisory committee, including representatives from BC Health Authorities, including the First Nations Health Authority, reviewed all of our survey questionnaires. Our follow-up survey asks participants if they have any suggestions for improvement of the programme. Access to the full protocol, data and statistical code will be granted after review of written proposals with appropriate ethical approval and if not being requested for commercial purposes.

Ethics and dissemination

The study has been granted a Certificate of Approval, number H22-00603, by the UBC Research Ethics Board. Questionnaire responses and PHNs submitted online

will be stored on the computer servers of REDCap in a manner compliant with Canadian privacy regulations. PHNs will then be encrypted and sent through dedicated secure file transfer servers to provincial or national data registries for linking with personal health data. Health data will be sent to the researchers using an encrypted file without the PHN or any other identifying information. Online data forms include logic and range checks to assure accuracy.

We have developed a robust plan for disseminating study findings to target audiences. For expectant families, we will include interviews with national lay press outlets, postings on our websites and YouTube videos. For health system decision-makers, we will provide findings on relevant organisation websites, in email newsletters, at conferences and in policy briefs. For primary maternity care providers, we will engage in a series of cross-country webinars. For maternity care researchers, we will disseminate results at key scientific meetings.

DISCUSSION

The SmartMom trial will provide a foundational understanding of the utility of an SMS text messaging system to motivate health behaviour change among expectant women. It will be the first trial to study a comprehensive array of health outcomes in a high-income country. SmartMom texting overcomes barriers to attendance at traditional prenatal education classes such as remote location, lack of qualified instructors, socioeconomic status, age, education and stigma. The programme could be essential in the event of future pandemics. If shown to be effective in our trial, we anticipate that SmartMom will be implemented throughout Canada and other high-income countries. With the overwhelming majority of expectant parents within cellular coverage in high-income settings.[57] SMS text messages can be an efficient and cost-effective means of providing essential prenatal education.

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Contributors PJ wrote the introduction, providing justification for the study. PJ, RR, WZ, SV, WVN and CLD developed the research objectives. PJ, SL, NM, RR, WZ, ST and CLD contributed to the design of the study. HB contributed expertise choosing measures for maternal outcomes. JM advised on data access and management in light of participation of Indigenous study subjects. PJ wrote the first draft of the manuscript. All authors contributed to revisions. All authors have approved the final version. Authorship of papers arising from the study will require contribution to the manuscript, approval of the final version and public accountability for the results. Professional writers were not employed to develop this manuscript.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

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