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Getting a "SMART START" to gestational diabetes mellitus education: a mixed-methods pilot evaluation of a knowledge translation tool in primary care

Sujane Kandasamy[1,*], Saima Amjad[2], Russell de Souza[1,3], Naila Furqan[2], Tejal Patel[4,5], Meredith Vanstone[4], Sonia S. Anand[1,3,6]

[1]Department of Health Research Methods, Evidence & Impact, McMaster University, Hamilton, Ontario, Canada
[2]Private Medical Practice, Peel Region, Ontario, Canada
[3]Population Health Research Institute, McMaster University, Hamilton, Ontario, Canada
[4]Department of Family Medicine, McMaster University, Hamilton, Ontario, Canada
[5]Maternity Centre of Hamilton, David Braley Health Sciences Centre, McMaster University, Hamilton, Ontario, Canada
[6]Department of Medicine, McMaster University, Hamilton, Ontario, Canada

[*]Corresponding author: Department of Health Research Methods, Evidence & Impact, McMaster University, 1280 Main Street West, MDCL 3200, Hamilton, Ontario, L8S4K1, Canada. Email: Kandas3@mcmaster.ca

Background: South Asian people living in Canada face higher rates of gestational diabetes mellitus (GDM) compared to national trends. The objective of this study was to design and pilot test a knowledge translation (KT) tool to support GDM prevention counselling in primary care.

Methods: This study is a mixed-methods pilot evaluation of the "SMART START" KT tool involving 2 family physicians in separate practices and 20 pregnant South Asians in Ontario, Canada. We conducted the quantitative and qualitative components in parallel, developing a joint display to illustrate the converging and diverging elements.

Results: Between January and July 2020, 20 South Asian pregnant people were enrolled in this study. A high level of acceptability was received from patients and practitioners for timing, content, format, language, and interest in the interventions delivered. Quantitative findings revealed gaps in patient knowledge and behaviour in the following areas: GDM risk factors, the impact of GDM on the unborn baby, weight gain recommendations, diet, physical activity practices, and tracking of weight gain. From the qualitative component, we found that physicians valued and were keen to engage in GDM prevention counselling. Patients also expressed personal perceptions of healthy active living during pregnancy, experiences, and preferences with gathering and searching for information, and key preventative behaviours.

Conclusions: Building on this knowledge can contribute to the design and implementation of other research opportunities or test new hypotheses as they relate to GDM prevention among South Asian communities.

Key words: gestational diabetes, knowledge translation tools, knowledge, attitudes, practices, mixed methods, pilot study, South Asian health, primary care

Background

Gestational diabetes mellitus (GDM) is associated with adverse health consequences for pregnant people and their offspring.[1,2] Adverse health consequences include a higher risk of future type 2 diabetes and atherosclerosis for the mother, and large-for-gestational-age size, delivery complications, and type 2 diabetes mellitus (T2DM) for the child.[3–5] GDM is becoming a global health concern with a prevalence of 1 in 7 births and rising. Globally, South Asian people are at higher risk of the condition compared to other non-South Asian ethnic groups.[6,7] GDM presents a similar concern within a Canadian context, with overall rates ranging from 3% to 20% but a heightened rate of 36% among South Asian people.[8] This illustrates a need for the timely design of interventions that directly address this challenge, particularly for this population.

South Asians (i.e. people who originate from the Indian subcontinent) are an important sub-set of Canada's mosaic as they comprise both the largest and fastest-growing ethnic group in the country.[9] This number is projected to reach over 4 million by 2031, of which nearly 1 million will be people of child-bearing age.[10] Evidence collected over the last 20 years suggests that cardiovascular disease (CVD) rates in South Asians are higher than other ethnic groups living in Canada,[11,12] and that CVD cases in South Asians are more severe, present at younger ages, and that South Asians in some contexts have differential access to diagnostic and treatment services compared to non-South Asians.[13,14] Among South Asians, the reasons for increased risk have been attributed to high pre-pregnancy weight, advanced maternal age, family history of diabetes, excess gestational weight gain, and low diet quality.[8,15,16] A component of addressing early risk factors includes the importance of high-quality, culturally sensitive evidence-informed GDM resources.[17,18] Existing literature informed our understanding of culturally sensitive perspectives related to diabetes prevention among families living in the Peel region.[17] As a result, a potential intervention shall seek to encourage women to seek out support from family/spouse, dietary substitutes that align with cultural ingredients, and to centre walking as the primary vehicle of physical activity

Key messages

- This study enhances approaches to GDM counselling in primary care
- Culturally sensitive, design-focussed, pragmatic KT tools hold promise
- Future research can test new hypotheses in KT tool design and evaluation
- The focus on diverse populations can benefit the expanding Canadian context

while simultaneously correcting misconceptions (e.g. jumping or vigorous work was thought to cause miscarriages by some elders).

To address some of these gaps, we designed and evaluated a theory-based, evidence-informed, design-centred Knowledge Translation (KT) tool ("SMART START"). "SMART START" was designed to address gaps in knowledge, attitudes, practices (behaviours), and confidence among pregnant South Asian people and their primary care practitioners regarding GDM lifestyle counselling.

Methods

Study design

We conducted a pilot mixed-methods parallel convergent randomized control trial comparing pregnant people and family physicians receiving the "SMART START" KT tool ("intervention group") to those receiving the standard care College of Family Physicians Prenatal Health resource ("control group"). Both resources can be found here https://drive.google.com/drive/folders/1QMdzMNDcDfia64EDOJGvQixBdk0f3XNK?usp=drive_link. Our primary outcome was the assessment of feasibility (as described by recruitment, retention, intervention acceptability, and overall experiences), and our secondary outcomes included an assessment of change in knowledge, attitudes, practices (KAP), and confidence. For this pilot evaluation, we aimed to recruit 2 family practices (one to be randomized to the intervention group and the other to the control group) and 10 pregnant people from each practice, for a total sample size of 20.

The intervention

"SMART START" is composed of 2 complementary components, one for the patient and one for the provider. The patient-facing component consists of 3 unique but synergistic components: (i) a digital narrative about GDM (short introductory video); (ii) a pocketsize booklet containing information about GDM risk factors, maternal and child health impacts of GDM, guiding questions for patients to explore with their family doctors, and options for tracking weight goals; (iii) a reminder magnet summarizing key actionable lifestyle modification tips. The family physician-facing component contains scripts and evidence-informed information to counsel South Asian patients on GDM prevention during pregnancy.

This toolkit was designed to address the key modifiable risk factors as per South Asian-specific birth cohort data[8] and reviewed with over 20 diverse Peel-region dwelling South Asian birth cohort participants prior to use. We also collaborated more closely with a patient partner to ensure it reflected the lived experiences of a first-generation currently pregnant South Asian woman living in the Peel Region. It is also important to mention that many of the investigators identify with South Asian ancestry, and some having gone through multiple pregnancies. Based on feedback from all aforementioned groups, "SMART START" was developed to convey background information and actionable tips, written in simple English, and inclusive of broad but representative imagery. The purpose of an English language base was to assess the content—prior to investing resources into translating material into other South Asian languages.

While the label "South Asian" has come into popular use during transnational movements in some ways to expand the Western world's India-centric perspectives, it is not necessarily how people of South Asian descent may currently identify, or may have identified before moving to Canada. This umbrella term may artificially homogenize a diasporic group with immense diversity across country of origin, culture, language, immigration history, family composition, and lived experiences. Our perspective around using the term 'South Asian' comes from a strengths-based approach to celebrate diverse histories, cultures, and ancestries of the Indian subcontinent. Thus, we aimed to include different sources of imagery while building upon shared experiences of food staples (e.g. use of lentils, turmeric, cumin, etc.) that are likely to transcend immigration experiences.

Incorporation of design elements

Innovative KT strategies are increasingly becoming viable means of engagement by providing evidence-based products and tools in palatable, culturally sensitive, and lay-language formats.[19,20] These approaches combine non-academic modes of communication such as digital media (e.g. videos, short films, infographics) and artistic expressions (e.g. story-telling) to re-dress traditional KT outcomes such as changes in knowledge, attitudes, and behaviour modification practices.[21] Design elements that relate to the efficient use of language, readability, typography, graphics and illustrations, layout, space, paper selection, and audience relevancy can improve the quality of patient education tools.[22–24] With the support of patient and physician feedback, the primary researcher (SK) distilled key pieces of health information into the patient and provider versions and partnered with a film-maker/illustrator to develop the multi-media components of the "SMART START" KT tool. The integration of the following elements was based on creating an appealing KT tool that is easy to read and comprehend and relevant to its respective audiences: (i) colours: palette informed by South Asian cultural ceremonies; (ii) fonts: clear, easy to read, large size; (iii) interactive layout: encourages patient-physician communication, allows patients to track their own health information; (iv) patient-oriented language: written in the second person "you…", short/concise/simple, assumes no prior scientific knowledge, suggestions aim to empower patients to act; (v) image selection: different styles and textures (e.g. photos, illustrations, outlines) that resonate with diverse South Asian

communities. Pictures that are closely linked to text markedly increase attention and recall to health education information[25–27] and culturally sensitive images facilitate comprehension more than those that are not culturally sensitive[28]; (vi) size: the patient version is pocket-sized, can fit inside a small handbag for easy transport; the provider version is laminated and larger to allow for easy access in the clinic environment; (vii) inclusion of audio-visual components: diverse methods can spark attention, tell a story (narrative approach), and sustain interest[29]; (viii) supplementary reminder material that concisely summaries the key points from the main booklet.
We acknowledge that there are many dynamic aspects to one's identity, including diverse immigration experiences and living circumstances (multi-generational households, single-parent families, nuclear units, etc.) that are not captured in this toolkit. Furthermore, as "South Asian" is not a homogenous society and is inclusive of immense diversity across culture, language, and lived experiences. Thus, we aimed to include different sources of imagery while building upon shared experiences of food staples (e.g. use of lentils, turmeric, cumin, etc.).

Study population

Two local family practice clinics in the Peel Region, Ontario, Canada took part in this study. The Peel Region consists of the municipalities of Brampton, Caledon, and Mississauga. It is home to 1.5 million residents and with 50.8% self-identifying as South Asian, it is the largest community of South Asians in Ontario.[30] Eligibility criteria for participants included the following: being <12 weeks gestation with a live singleton pregnancy, no previous clinical diagnosis of type 1 or 2 diabetes, and an elementary-level proficiency in English. Patients were excluded from this study if they were pregnant with multiples, were not planning to attend a prenatal visit with their family doctor, or were receiving specialized dietary counselling due to a previous diagnosis of diabetes.

Recruitment and study conduct

Approval from the Hamilton Integrated Research Ethics Board was obtained prior to the commencement of this study (Project #: 5863). A double-pronged recruitment strategy was deployed. First, researchers SK and SSA sent out 45 personalized faxes to family doctors in the Peel Region to recruit interested practices. Second, SK contacted high-volume clinics from our list of previously established partnerships. We recruited the first 2 clinics with similar-style practices and patient demographics. Once confirmed, SK held a meeting with the interested family physician to review the study protocol and complete the informed consent process. The family physician completed the baseline assessment and an open-ended interview. Using a public flip of a coin, both clinics were randomized to either the intervention or control group. After randomization, a package containing: (i) referral forms; and (ii) 10 colour copies of the respective resource packages were delivered to the clinic reception. Family physicians proceeded to introduce the study to consecutive patients as they presented for potential pregnancy confirmation. If patients were interested in the study, a consent to contact form was completed by the physician and faxed to the research office for processing. On the same day the fax was received, SK contacted the potential participant. First, a text message was sent to remind the participant of the study and to request an appointment time. Once confirmed, SK called the participant to review the study and complete the informed consent and baseline assessments. Initially planned face-to-face visits at the family practice transitioned to phone calls, text/Whatsapp messages, and email correspondence due to the limitations imposed by the COVID-19 pandemic. The RedCap link to the informed consent form, electronic signature option, demographic questions, and quantitative survey was administered via email. All baseline open-ended interviews were conducted via telephone. After each enrolment, the full name of the participant and the date of baseline assessment were communicated to the family physician directly. At their next visit (major prenatal assessment), the intervention or control resource and corresponding GDM counselling were administered. Each participant also received a $10 gift card for their involvement in the study. When the participant entered their third trimester (approximately between 24 and 30 weeks gestation), the final study visit was administered. Similar to the baseline assessment, the RedCap link to the quantitative survey was shared via email, and the open-ended interview was conducted via telephone. After all participants completed their exit interview, the clinic physicians were contacted for their final study visit. The RedCap link to the quantitative survey was shared with them via email, and the open-ended interview was conducted via telephone. All interviews were audio-recorded and transcribed verbatim. All quantitative data were stored on the password-protected RedCap database and all interview transcripts were de-identified and stored on a password-protected server.

Quantitative component

We developed patient-facing questions to assess knowledge, attitudes, and practices using a combination of 5-point Likert scales and multiple-choice questions. These scales were validated by an interdisciplinary team of experts (face validity). With a total maximum score of 16, knowledge questions focussed on GDM risk factors, the impact of GDM on the unborn baby, weight gain recommendations, physical activity guidelines, and diet. To assess attitudes (total score of 15), we inquired about their concern around GDM, willingness to make change, and willingness to engage with their family physicians on this topic. To assess current practices, we developed questions around behaviours related to healthy active living, such as dietary choices, frequency of physical activity, choices around tracking weight gain, completion of risk assessments, and screening decisions. Physician-facing questions also focussed on knowledge, attitudes, and practices using a 5-point Likert scale. With a maximum score of 5, the knowledge assessment focussed on a self-reflective knowledge score on counselling pregnant South Asian people on GDM prevention. With a maximum score of 5, the attitude assessment was a self-reflective score of the importance of counselling South Asian people on GDM prevention. With a maximum score of 5, the practice assessment was a self-reflective score on how well GDM counselling is performed. Finally, we assessed patient-level confidence in continuing with or making adjustments to healthy active living lifestyle practices (total score of 20) and provider-level confidence in GDM prevention counselling (total score of 65). All domains were assessed for face validity (via expert review) prior to use and were designed to take approximately 15 min to complete in full.

Qualitative component

We developed a semi-structured interview guide with brief, open-ended questions to better understand knowledge,

attitudes, current practices, and confidence (at baseline and end-of-study). Questions inquired about familiarity with GDM, lifestyle change (including barriers and facilitators), diet/physical activity, preferences around knowledge exchange, and additionally at the exit interview only, general attitudes towards the KT tool in terms of content, information, and layout.

Data analysis

According to a convergent parallel design, both quantitative and qualitative strands were conducted in tandem. Demographic variables, study recruitment, retention, acceptability, knowledge, attitude, practice, and confidence scores were collated using descriptive statistics. Variables were also exploratorily compared between the intervention group and the control group using a Mann–Whitney *U* test. All quantitative data were analysed using R V4.0.3. Qualitative data were transcribed verbatim and analysed using a qualitative description (thematic analysis) approach by researcher SK.[31–33] A staged coding process was employed. This approach allowed us to explore relevant themes from participant interviews by systematically identifying patterns and logically organizing qualitative data into broader common and representative insights. This logical organization of data into broader recurring themes (e.g. data reduction) helps to better explain aspects of the phenomena under examination (i.e. prenatal GDM counselling using health resources). In general, our analytic strategy of constant comparison included the following stages: (i) code development as the basic analytic unit capturing important aspects of data and (ii) the derivation of broader themes that illustrate a coherent picture of collected data.[32,33] After the collection of qualitative and quantitative data, the results were integrated into a mixed-methods analysis[34] so that inferences within both strands and meta-inferences across both strands could be made.[35] Our integration approach involved the direct comparison of qualitative and quantitative findings and making assessments about congruency and discrepancies using a circular joint display.[34]

Results

Recruitment

Between January and July 2020, we enrolled 20 pregnant people into this study (10 women from each of the 2 clinics), averaging 3 participants/month. Despite the challenges coupled with limited in-person clinic visits since the onset of the COVID-19 pandemic, recruitment was completed within a 7-month time frame. All follow-up was completed by January 2021.

The mean age of participants was 31.7 and 29.7 years in the control and intervention groups, respectively, and all participants were planning to include their family physician in their prenatal care. In addition to English, diverse South Asian languages were spoken across both groups—Urdu, Hindi, Punjabi, Kannada, Tamil, Dhari, and Persian. Religious affiliations ranged from Hindu, Sikh, Muslim, and multiple (Hindu and Sikh), with more diversity in the control group compared to the intervention. Most participants were employed full-time, had been pregnant before, and were born outside Canada (See Table 1 for more details).

There was some disparity between the number of years participants had spent in Canada, with the mean number of years being 7 and 13 for the control group and intervention group, respectively. The providers had 12 years of experience each in independent practice, spoke a variety of South Asian languages, had a prenatal patient population of 20–25%, saw 60–80% South Asians, and currently spent between 5–6 min counselling their prenatal patients on gestational diabetes prevention (See Table 2 for more details).

Quantitative component

With strong partnerships from clinic physicians, we were able to screen and enrol on average 3 pregnant South Asian patients per month with 2 centres. Two pregnant participants were unenrolled due to miscarriage. All others completed all components of the study (See Fig. 1 for the CONSORT Flowchart). A high level of acceptability was received from patients and practitioners for timing, content, format, language, and interest of the interventions delivered. The median score was 18 (total 21), with 50% of pregnant participants ranking their acceptability scores at >87%. The median score for the family physicians was 28 (total 31), with both ranking their acceptability at >90%.

Secondary outcomes

Median knowledge, practice, and confidence scores improved in the patient and provider intervention groups compared to the control group; attitudes scores, which were demonstrated to be high at baseline remained consistent throughout the evaluation period. There was no significant difference between the control and intervention groups for any of the secondary outcomes (see Tables 3 and 4 for more information).

Gaps in patient knowledge and practices were present in the following areas: GDM risk factors, impact of GDM on the unborn baby, weight gain recommendations, diet, physical activity practices, and tracking of weight gain.

Qualitative component

Our qualitative description illustrates the distinct and shared perspectives of primary care physicians and their pregnant South Asian patients as it pertains to GDM counselling.

Physician perspectives

Practitioners mentioned that they typically engage in open-ended counselling and use simple hand-drawn visuals (e.g. to illustrate portion sizes) to increase receptiveness. They begin the prenatal visit with a brief screening around family history of diabetes and previous pregnancies (with an emphasis on previous diagnoses of gestational diabetes and newborn birth weights). Guided by goals to motivate, remind, and promote, physicians favoured using a personalized approach that focussed on weight management. Physicians acknowledged that these interactions existed within a cultural mix of different lifestyles and food preferences. For example, one physician said, "*So it's kind of this big cultural mix that you have to think about and advise them you know? There are challenges with each and every scenario. It's just that every time they come and they are persistent and reminding them to keep going.*" Both physicians were approaching this study with over 12 years of family medicine expertise each but were open to learning about and incorporating new patient-facing approaches and resources to enhance their prenatal counselling efforts. Both physicians appreciated the provision of a toolkit for their patients, with the intervention physician stating that

Table 1. Demographic details of enrolled pregnant participants.

	Control (n = 10)	Intervention (n = 10)
Age (mean [SD])	31.70 (3.16)	29.70 (4.95)
Practitioners to be included in prenatal care		
Family physician	10 (100.0)	10 (10.0)
OB/GYN	5 (50.0)	7 (70.0)
Midwife	3 (30.0)	2 (20.0)
Other	1 (10.0)	0 (0.0)
Languages spoken (%)		
English	10 (100.0)	10 (100.0)
Urdu	3 (33.3)	9 (90.0)
Hindi	2 (22.2)	2 (20.0)
Punjabi	3 (33.3)	1 (10.0)
Kannada	1 (11.1)	0 (0.0)
Tamil	2 (22.2)	0 (0.0)
Dari	0 (0.0)	1 (10.0)
Persian	0 (0.0)	1 (10.0)
Religion (%)		
Hindu	4 (40.0)	0 (0.0)
Hindu & Sikh	1 (10.0)	0 (0.0)
Muslim	3 (30.0)	10 (100.0)
Sikh	2 (20.0)	0 (0.0)
Highest level of education attained (%)		
Bachelors	4 (40.0)	4 (40.0)
College diploma	2 (20.0)	5 (50.0)
Masters	3 (30.0)	1 (10.0)
Professional degree (e.g. MD)	1 (10.0)	0 (0.0)
Current employment status (%)		
Employed full-time	5 (50.0)	4 (10.0)
Employed part-time	0 (0.0)	1 (10.0)
Home-maker	4 (40.0)	5 (50.0)
Unemployed	1 (10.0)	0 (0.0)
# of total pregnancies (mean [SD])	2.20 (1.14)	1.70 (1.06)
# Previous births (mean [SD])	0.80 (0.63)	0.50 (0.97)
Current living situation (%)		
Live with parents only	0 (0.0)	2 (20.0)
Live with parents and siblings only	0 (0.0)	1 (10.0)
Live with spouse only	4 (40.0)	1 (10.0)
Live with spouse and other children only	5 (50.0)	3 (30.0)
Live with spouse and in-laws only	1 (10.0)	2 (20.0)
Live with spouse, parents, and other children	0 (0.0)	1 (10.0)
Birth location in Canada	1 (10.0)	1 (10.0)
# Years in Canada if born elsewhere (mean [SD])	7.11 (9.02)	13.70 (10.10)

the toolkit is useful for all pregnant South Asians, regardless of whether they had previous pregnancies or a previous gestational diabetes diagnosis because most could "*benefit from a refresher.*"

Table 2. Demographic details of enrolled physician participants.

	Control (n=1)	Intervention (n=1)
Years in practice post-residency (total # years)	12	12
Languages spoken with patients		
English	Yes	Yes
Urdu	Yes	Yes
Hindi	Yes	Yes
Punjabi	Yes	No
Patient population seen prenatally (%)	20	25
Pregnant patients seen during the first trimester (%)	90	95
Prenatal patient population of South Asian descent (%)	60	80
Time spent counselling on GDM (mins)	6	5
Difference in time spent counselling South Asian patients vs. other ethnicities on GDM	Yes, more time spent	No difference

Pregnant South Asians' perspectives

Key themes identified among patients were (i) personal perceptions of healthy active living during pregnancy; (ii) experiences and preferences with gathering and searching for information; (iii) key preventative behaviours. Regardless of allocated group, pregnant South Asians expressed that healthy lifestyles and the associated preventive practices was an important topic to discuss and gain more knowledge about. Food and nutrition concerns were prioritized over physical activity concerns. There were concerns about how weight gain impacts labour and delivery, and some expressed worry about their downstream type 2 diabetes risk (especially if there was a family history of diabetes). Many equated physical activity with "moving around and staying active" rather than with structured physical activity, described "sugar" as bread, rice, and sweets with their intake being limited, the importance of partaking in GDM screening, and a gap in knowledge around the impact of GDM on the unborn baby and risk factors in addition to family history.

Compared to participants with previous children, primiparous patients prioritized searching for and engaging with prenatal information. Healthcare providers, mobile healthcare applications, and peers were important sources of information; searching via Google was not a preferred route because it can lead to unnecessary fears, and participants were cognizant that every pregnancy is different and not everything may apply to them directly. Participants preferred personalized guidance, especially in regard to weight gain. Those who received the intervention expressed that it was a great 'springboard' to learning more. They wanted more guidance around simple exercises for better weight gain control, step-by-step videos on food preparation, and how other aspects of healthy active living can help prevent other pregnancy complications (e.g. pre-eclampsia and bacterial/viral infections).

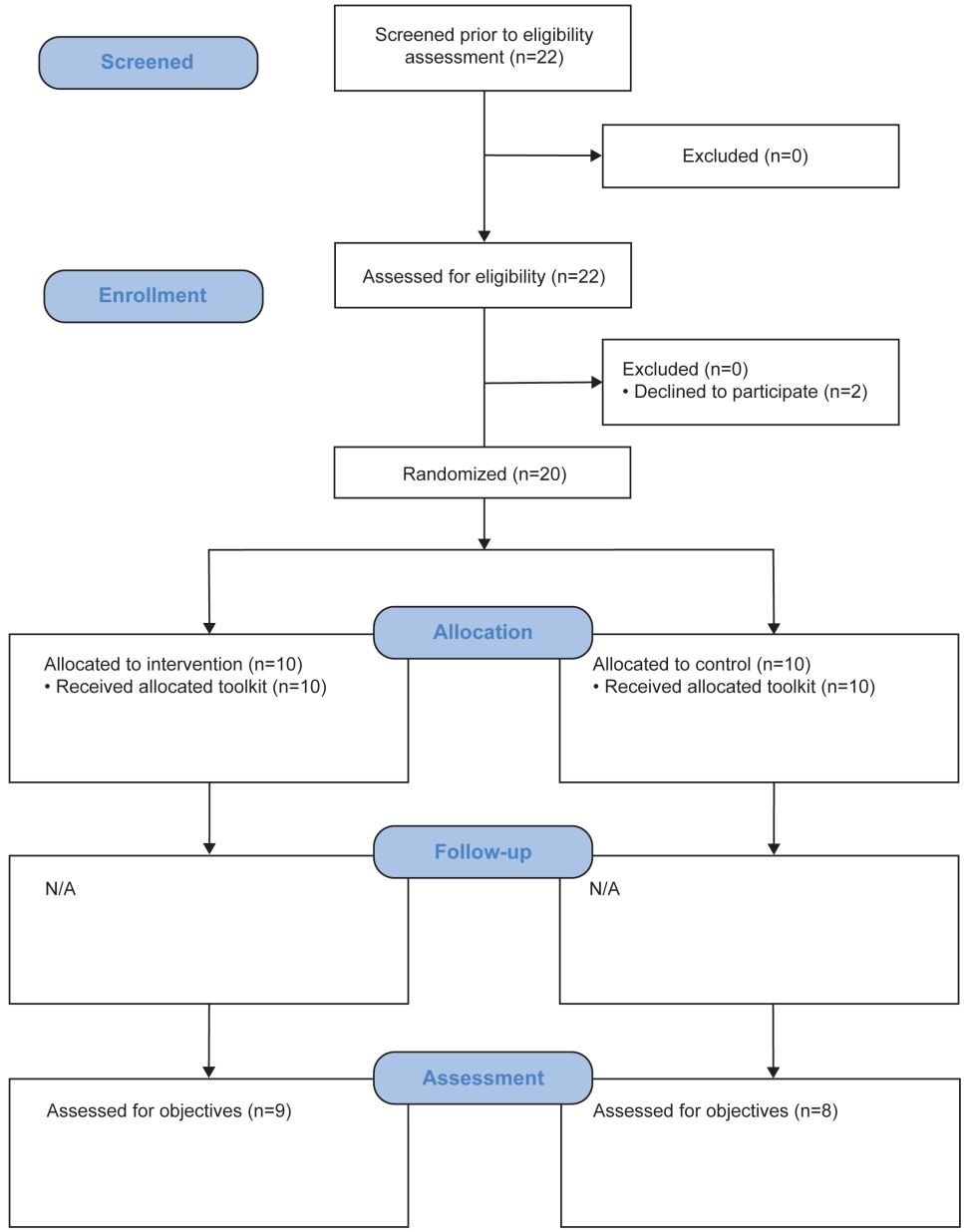

Fig. 1. CONSORT flowchart.

The paper format, rather than an app, was preferred by most because looking at screens made them more nauseous. Some wanted both in case they misplaced the physical copy.

All participants stated that they would recommend the intervention toolkit to their family and friends because of the quality of information, style, colour choice, and eye-catching visuals (e.g. pictures allowed people to connect to the material). Many could recall the contents of the intervention toolkit, which was not the case for the control toolkit. Those who received the control toolkit indicated that they would also share it with family and friends but for reasons related to the information enclosed.

With regard to prioritizing key GDM preventative practices, participants described that they aim to actively avoid bread, "too much rice," fruits, and processed sugars and prioritize balanced meals by creating "a colourful plate." They also stressed the importance of portion control rather than eliminating certain foods (e.g. eating one square of chocolate from a bar because it is tough to "cut everything out"). Challenges included cravings (especially for sweets/sugars/chocolates), nausea, and limited confidence in cooking/food preparation skills, especially in regard with traditional South Asian foods. Many also expressed that they need more than a recipe to confidently make South Asian meals (e.g. step-by-step video with detailed explanations). Interestingly, although all participants who received the intervention toolkit praised the recipes, they did not actually make any of the dishes. They described that they did not have the time to make them or that they are not the primary food preparers in their households—it is either their mother, mother-in-law, or they order home-cooked meals from a community "Aunty" or "Tiffin service" (homecooked takeout).

Table 3. Patient scores (pre- and post-test) between intervention and control groups across the domains of knowledge, attitudes, practices, and confidence.

	Median Knowledge Score (/16)	Median Attitudes Score (/15)	Median Practices Score (/5)	Median Confidence Scores (/20)
Intervention (n = 8)				
Pre-test	7.0	14	2.5	13. 0
Post-test	12.5	13.5	3.5	14.5
Change	5.5	-0.5	1.0	1.5
Control (n = 6)				
Pre-test	3.0	13.5	1.5	13.0
Post-test	5.5	13	1.0	12.0
Change	2.5	−0.5	−0.5	−1.0

Table 4. Practitioner scores (pre- and post-test) between intervention and control groups across the domains of knowledge, attitudes, practices, and confidence.

	Knowledge Score (/5)	Attitudes Score (/5)	Practices Score (/5)	Confidence Scores (/65)
Intervention (n = 1)				
Pre-test	3	5	3	45
Post-test	4	5	4	57
Change	1	0	1	12
Control (n = 1)				
Pre-test	4	5	4	46
Post-test	4	5	5	57
Change	0	0	1	11

Shared perspectives and mutual understandings

Perspectives that were shared by both physicians and patients include (i) increasing receptiveness of healthy active living counselling by meeting people where they are and (i) opportunities for new interventions and resources.

In regard to "meeting people where they are," it was important to set the ground for GDM counselling by getting to know the patient (including family arrangement), building a trusting relationship, starting simple, tailoring guidance, using identifiable stories/explanations, being able to use South Asian languages to better connect (if needed), and taking a family-centric approach to healthy active living. In regard to new opportunities and resources to supplement current healthy active living counselling approaches, the following areas were suggested: the provision of specialized content for patients with obesity who became pregnant while in the midst of weight reduction, more information about community resources (e.g. especially for newer South Asian immigrants to the Peel Region), more education around the importance of weight control, the greater need to provide encouragement and motivation around maintaining physical activity, the need for health communication to be provided in digestible components (e.g. by trimester), the inclusion of other related concerns such as isolation/mental wellbeing due to the pandemic/stay-at-home orders, and lastly, it was noted that because more health conscious patients are coming in for preconception physicals, this could allow for additional feasible avenues for health communication.

Convergent analysis and integration

Joint displays integrate the qualitative and quantitative data to help draw out new synergies beyond the separate analyses. After several iterations, we crystallized the final circular joint display to illustrate the converging and diverging components of both the qualitative and quantitative meta-interferences. This joint display was a fusion between side-by-side and comparing results display.[35] We developed concentric rings around the primary and secondary outcomes of the evaluation, followed by the quantitative survey data, qualitative themes, and finally with indications of convergence and divergence. To illustrate and describe this merging of data, we used words such as confirmation, discordance, and expansion to indicate similarities, discrepancies, and a need for further exploration between the data strands, respectively.[36] Integration illustrates that the primary outcomes of feasibility and acceptability have convergence in terms of qualitative and quantitative data. The knowledge and confidence domains exhibit features of expansion (a need for further exploration due to quantitative data demonstrating positive change and qualitative data illustrating additional recommendations); practices indicate convergence (positive qualitative and quantitative data); and attitudes display features of discordance (negative change in quantitative data and positive change in qualitative data). We found that quantitative and qualitative data aligned for the following domains: feasibility, acceptability, and practices. There was diverging data in terms of attitudes, and a need for expansion in the knowledge and confidence domains. See Fig. 2 for the joint display and the specific details around each domain.

Discussion

We demonstrated the feasibility and acceptability in design, content, format, language, interest, and timing of intervention delivery among pregnant South Asians and their family physicians. Successful components of this pilot were recruitment completed within 12 months (20 patients over 12 months, which equates to 1–2 pregnant patients recruited per month) with >80% (16 pregnant patients) retention and acceptability. As we were able to achieve these two key components, it is predicted that a fully powered trial can be conducted to evaluate the intervention as it relates to the improvement knowledge, attitudes, and practices towards HAL in this population. Interestingly, we found that although participants appreciated and reviewed the toolkit, they did not try any of the suggested advice (including the healthy recipes). This observation warrants further exploration, as it indicates that deeper engagement or more tailored advice may be required.

Because pilot studies are small-scale, preliminary studies that aim to investigate crucial components of a larger randomized control trial, they provide insight into process, resources, and management.[37] Sample size discussion should prioritize the recruitment of a representative sample and for the generation of enough information to make assessments about feasibility components; they are not powered to detect meaningful differences in clinical endpoints.[37] The pairing

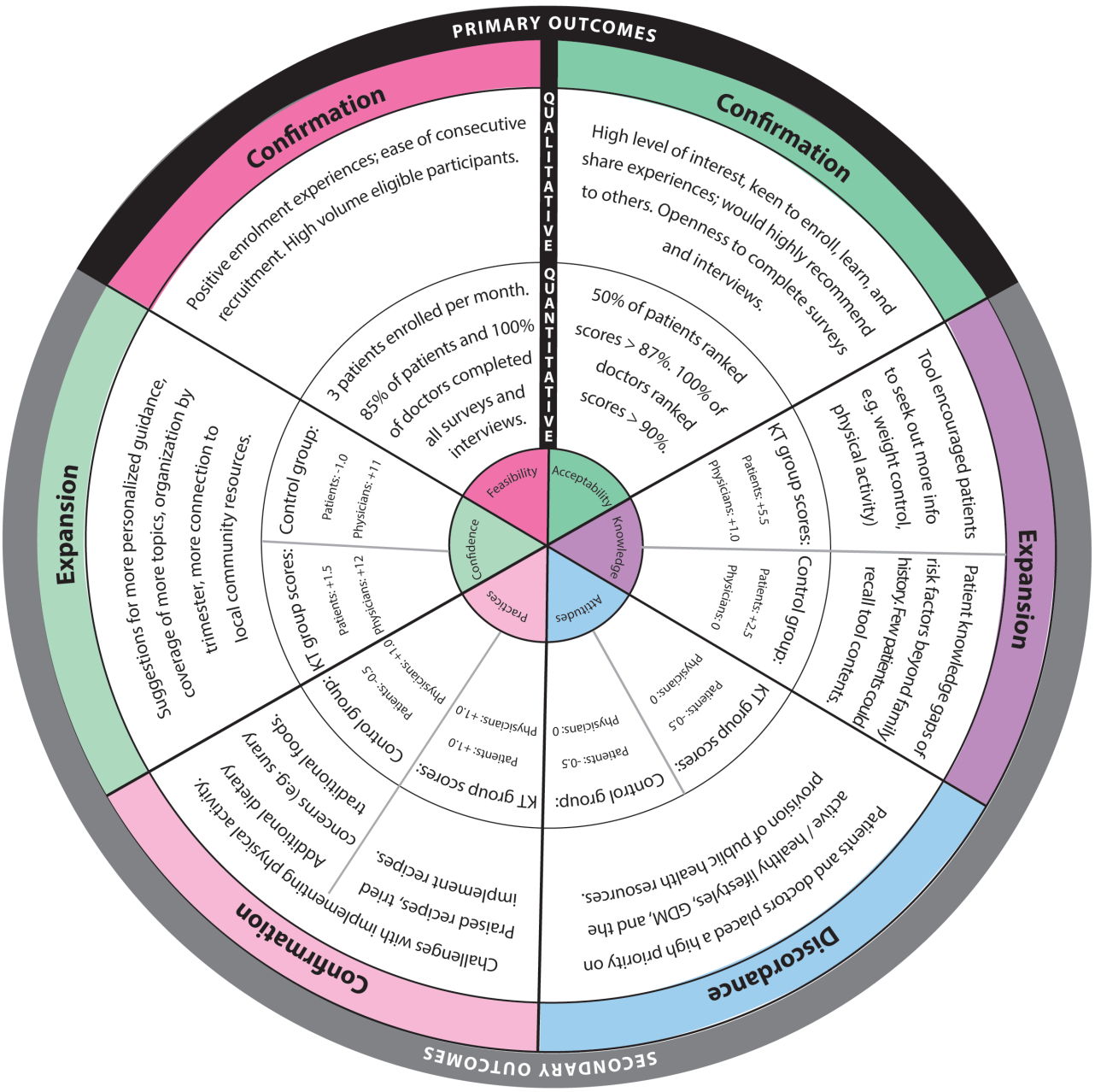

Fig. 2. Joint display. The centre circle outlines primary and secondary outcomes. The first circle outside of the centre describes the quantitative summaries as per each outcome and per group. The next circle describes qualitative findings per group. The third circle indicates the level of convergence and divergence and the outermost circle re-iterates which analyses were primary and secondary.

of (i) a sample size of 20 pregnant participants and 2 family physicians across 2 different medical clinics with (ii) the use of a mixed-methods approach, we were able to generate the necessary information to draw rich conclusions about the feasibility and intervention acceptability. Although the evaluation of knowledge, attitudes, practices, and confidence was exploratory, it provided some useful insights into how the KT tool can be further improved to meet the needs of this population.

There was deep interest in the provision of resources and information about healthy active lifestyles, GDM, and other related prenatal concerns. Other recent studies have also demonstrated similar interests for KT tools in prenatal settings as they relate to gestational weight gain (e.g.[38]). Design-focussed KT tools, such as the SMART START tool, show promise. Artistic representations are visual in nature, and as such, foreseeably impact viewers in distinct ways.[39] For example, visual representations may foster more emotive responses when compared with text only, which elude more rational responses[40]; music provokes imagination and fosters meaning-making[41], and theatre promotes engagement and helps crystallize abstract concepts.[42] Due to these differences, the selection of innovative approaches should be informed by an understanding of the form, population (culture), context, location of use, desired outcomes (e.g. improving knowledge, attitude change), the extent of message distillation, and efforts to co-create products with communities of interest.[19] When designing the "SMART START" KT tool, we used

multi-media and digital features (specifically the choice of music, use of video, building in a narrative approach, supplementary visuals, language selection) to help balance comprehensiveness with simple explanations that better resonate with the priority population. We also designed the tools with coordination and consistency across the multi-media formats and the meaningful use of visuals to enhance text. In general, tool content and style were well accepted; however, some modifications are required before proceeding to a full trial. These include revisions to the KT tool to reflect patient and provider suggestions: the addition of step-by-step prenatal physical activity videos, step-by-step food preparation videos, and links to local community resources. Lastly, given the diverse languages (in addition to English) spoken by the South Asian diaspora, it is recommended that the tools, surveys, and interviews be developed in multiple South Asian languages.

Conclusion

This pilot evaluation of a theory-based, evidence-informed, design-based KT tool created to educate pregnant South Asians and their family physicians on the topic of GDM demonstrated feasibility and acceptability in the process. This information will help guide the advancement of emerging research in the field of GDM prevention.

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Author contributions

All authors contributed to the study conception, design and material preparation. SK completed data collection and analysis and the first draft of the manuscript. All authors commented on previous versions of the manuscript and approved the final version.

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Conflict of interest

None declared.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee (Hamilton Integrated Ethics Board Project # 5863). Informed verbal and written consent was obtained from all individual participants included in the study.

Data availability

All available data are included in this publication.

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