Spanish Translation of StartSmart™ using the Beaton Process to Ensure Tech Equity

Bonnie Gance-Cleveland, Jenn Leiferman, Susan Yates, Ana T. Williams, Claudia R. Amura, Mia Roberts, Jennifer Hyer, Jessica Anderson, Priscilla Nodine

Journal of Health Care for the Poor and Underserved, Volume 32, Number 2, May 2021 Supplement, pp. 85-105 (Article)

Published by Johns Hopkins University Press

DOI: <https://doi.org/10.1353/hpu.2021.0052>

➔ *For additional information about this article*

<https://muse.jhu.edu/article/789659>

Spanish Translation of StartSmart™ using the Beaton Process to Ensure Tech Equity

Bonnie Gance-Cleveland, PhD, RN

Jenn Leiferman, PhD

Susan Yates, MS, CNM, WHNP

Ana T. Williams, CNM

Claudia R. Amura, PhD, MPH

Mia Roberts, MS, PNP

Jennifer Hyer, MD

Jessica Anderson, MSN, CNM, DNP

Priscilla Nodine, CNM, PhD

Abstract: Objective. Perinatal outcomes in the United States are poor among Hispanics, the country's fastest-growing population. Hispanics experience higher rates of obesity, diabetes, gestational diabetes, preterm birth, and pregnancy-related hypertension, as well as 20% of infant deaths. *StartSmart™*, an mHealth app, screens for risk and protective factors. This project translated and culturally adapted *StartSmart™* for Spanish-speaking pregnant women. **Methods.** Using the Beaton process for translation and cultural adaptation, we completed a six-stage process. Stage I: Translation into Spanish, Stage II: Synthesis of the translations, Stage III: Back-translation, Stage IV: Expert committee review, Stage V: Pretesting with Spanish-speaking pregnant women, Stage VI: Appraisal of process. **Results.** *StartSmart™* was acceptable and feasible for use during prenatal visits. Participants reported ease of use and understanding the material. No issues regarding literacy were identified, and participants provided helpful feedback for refining *StartSmart™* for Spanish-speaking women. **Conclusions.** The Beaton process ensures culturally appropriate translation.

Key words: Decision support technology, individualized patient education, prenatal screening for risk and protective factors, tech equity, Technology Acceptance Model, Beaton Process for Translation and Cultural Adaptation.

Many conditions and lifestyle factors during pregnancy affect a woman's health as well as the health of her child—some effects lasting long after birth.¹ Despite

BONNIE GANCE-CLEVELAND, SUSAN YATES, ANA T. WILLIAMS, CLAUDIA AMURA, MIA ROBERTS, JESSICA ANDERSON, and PRISCILLA NODINE are affiliated with the College of Nursing, University of Colorado Anschutz Medical Campus, Aurora, CO. **JENN LEIFERMAN** is affiliated with the Colorado School of Public Health, University of Colorado Anschutz Medical Campus, Aurora, CO. **JEN HYER** is affiliated with the Denver Health and Hospitals Authority. Please address all correspondence to: Bonnie Gance-Cleveland, College of Nursing, University of Colorado Anschutz Medical Campus, 13120 E. 19th Ave, Mail Stop C288-18, Aurora, CO 80045; Phone: 303-724-7443; Fax: 303-724-6185; Email: Bonnie.Gance-Cleveland@CUAnschutz.edu.

advances in perinatal health care, infant morbidity and mortality have seen little improvement in the United States (U.S.),² and rates of severe maternal morbidity have continued to rise.³ Hispanics are the fastest-growing population of childbearing women in the U.S. In 2018, nearly a quarter of live births in the U.S. were to Hispanic mothers,⁴ and the U.S. Census Bureau projects a 74% increase in births among Hispanic women.¹ Preterm births in Hispanic women account for over one in five (22%) of the total preterm births in the U.S.⁵ Hispanic women have higher rates of obesity, diabetes, gestational diabetes, and pregnancy-related hypertension compared with White women, resulting in poor birth outcomes.⁶ Hispanic pregnant women also receive fewer mental health services than any other racial/ethnic group.⁷ Neural tube defects, birth defects that can be prevented by prenatal folic acid, are also significantly higher in Hispanics.⁶ Given these facts, it is essential to identify risk and protective factors during pregnancy in Hispanic women in order to improve perinatal outcomes and prevent health problems for the mother and child. Prevention and early intervention depends on effective screening, education, and referral.^{8,9} The American College of Obstetricians and Gynecologists (ACOG) and the American College of Nurse Midwives (ACNM) have published guidelines for screening and counseling women on these risk and protective factors.^{10,11}

Evidence points to a link between poor perinatal outcomes and pregnancy health risks such as mental health conditions, substance use, and chronic diseases, including obesity and diabetes, during pregnancy.¹² Protective factors that influence pregnancy outcomes include immunizations, nutrition, folic acid, physical activity, and sleep, yet pregnant women are not consistently counseled on these.¹³ Discussions of prenatal guidelines are often constrained by clinical work-flow and time limits; language can be an additional barrier for Hispanic women.¹⁴

In an effort to address these barriers, self-administered, computerized instruments may be used in order to elicit more accurate responses than face-to-face interviews in both the general population and specifically among pregnant women.^{15,16} In one study screening pregnant women on sensitive information and risky behaviors including alcohol, drug, and tobacco use, as well as intimate partner violence, respondents reported a higher prevalence of these behaviors when using technology than was reported in studies using other data collection methods.¹⁷

Barriers to the application of perinatal guidelines also exist for providers. Lack of time, awareness, resources, availability of specialist referral, and discomfort with discussing sensitive topics can be barriers to guideline adherence.^{18–24} Similarly, providers have expressed value in technologies that support clinical implementation of perinatal guidelines, and there is significant evidence for decision-support technology to improve patient outcomes in ambulatory care settings.^{25–28,29} The aim of our work has been to extend the reach of technology to a Spanish-speaking population.

Our team has developed *StartSmart*™^{30,31} a tablet-based, English-version technology to facilitate comprehensive screening with self-administered questionnaires and to automate decision support to improve brief motivational interviewing counseling and referral for treatment when indicated. The technology was developed using the Davis' Technology Acceptance Model (Figure 1), which is an iterative development process

Figure 1. Iterative development using the Davis' Technology Acceptance Model.

with end-users (patients and providers) involved at each step.³² During the initial development, this process was limited to English-speaking participants.

The system uses validated screening instruments to gather information from pregnant women and treatment algorithms based upon the guidelines to create individualized counseling and education information (see Table 1). The potential for algorithm bias is minimized through the use of instruments that have been validated for Spanish-speaking populations including those for anxiety, depression, sleep, physical activity.^{33–35} The rigorous Beaton process was used for translation and cultural adaptation of measures as described below. The Spanish versions were compared with the translated versions when they were available. *StartSmart™* consists of two web-based applications: a touch screen interview and a webpage for entry of measurements and generation of patient and provider summaries. Both applications are accessed through standard web browsers on internet-connected computers. The patient completes the screening prior to the encounter. The measurement-entry application is accessed by staff where the height, weight, blood pressure, laboratory findings, and immunizations are entered into the system. A risk summary and individualized recommendations are given to the patient to increase the understanding of risks and provide the patient-specific recommendations. The provider handout includes prompts for ordering laboratory assessments, brief interventions with motivational interviewing, and referrals as indicated.

Due to the escalating birth rates and the prevalence of poor birth outcomes in Hispanics, it is imperative that providers screen all Hispanic women including Spanish-speaking-only women for related risk and protective factors and provide appropriate

Table 1.

SCREENING INSTRUMENTS AND TREATMENT ALGORITHM

Screen Treatment Approach	No/Low Risk	Moderate Risk	High Risk
	Positive Reinforcement	Brief Intervention	Referral to specialty care
<i>Emotional Conditions</i>			
Anxiety (Generalized Anxiety Disorder [GAD] 2; GAD7)	GAD-2: ≤ 3 GAD-7:< 5 —Positive reinforcement	GAD-7: 6–10 —Brief intervention —Educational handouts on anxiety	GAD-7: ≥10 —Refer to Perinatal Clinic at Health Dept
Depression (Patient Health Questionnaire [PHQ]2; PHQ9)	PHQ-2: ≤ 3 PHQ-9: ≤ 9 —Positive reinforcement	PHQ-9: 10–14 —Educational handouts on depression —Refer if patient prefers	Suicidality (Question 9): Escort to emergency department or PHQ-9: ≥15 without suicidality —Refer to Mood Disorders Clinic
Domestic Violence (Abuse Assessment Scale [AAS])	AAS < 1 finished AAS>1 follow with Safety assessment (11 items)	AAS > 1 Currently safe —Educational handout with a safety plan is given —Information on resources	AAS > 1 Unsafe or requests help Referral to shelter and legal assistance. Information on resources given
<i>Substance Use</i>			
Alcohol (NIDA quick screen)	No alcohol <1 —Positive reinforcement	Audit-C: 1–2 —Brief intervention re. harm —Reassess next visit	Audit-C: > 3 —Health Team Works —Families First
Drugs (NIDA quick screen)	Quick screen <1 —Positive reinforcement	Quick screen: 1–2 —Brief intervention re. harm —Reassess next visit	Quick screen > 3 —Health Team Works —Families First
Tobacco (NIDA quick screen)	Quick screen < 1 —Positive reinforcement	Quick screen 1–2 —Counseling on risks & handouts —Reassess next visit	Quick screen > 3 —Colorado Quit Line ^a —Stress management resources

(continued on p. 89)

Table 1. (continued)

Screen Treatment Approach	No/Low Risk Positive Reinforcement	Moderate Risk Brief Intervention	High Risk Referral to specialty care
<i>Substance Use</i>			
Marijuana (NIDA quick screen)	Quick screen <1 —Positive reinforcement	Quick screen: 1–2 —Brief intervention re. harm —Reassess next visit	Quick screen > 3 —Health Team Works —Families First
<i>Obesity and Related Conditions</i>			
Underweight (pre-pregnancy BMI)	BMI 18.5–24.9 kg/m ² —Reinforce healthy weight gain (25–35 pounds)	BMI <18.5 kg/m ² —Discuss GWG 28–40 pounds —Nutritional handout	BMI <18.5 kg/m ² + eating disorder —Refer to counseling ^a —GWG 28–40 pounds
Overweight or Obese (pre-pregnancy BMI)	BMI 18.5–24.9 kg/m ² —Reinforce healthy weight gain (25–35 pounds)	BMI 25–29.9 kg/m ² —Discuss GWG 15–25 pounds —Nutritional and activity handouts	BMI ≥ 30 kg/m ² —Referral nutrition/activity counseling —GWG 11–20 pounds
Gestational Diabetes Mellitus 50g Oral Glucose Tolerance Test (OGTT)	50g OGTT results < 135 mg/dL —Reinforce diet and activity	50g OGTT results ≥ 135 mg/dL; 100g 1 abnormal: Fasting ≥95; 1-hr ≥ 180; 2-hr ≥ 155; 3-hr ≥ 140 —Set self-management goals around diet and activity	50g OGTT results ≥ 200 mg/dL Fasting ≥95 OR 100g 2 abnormal: Fasting ≥95; 1-hr ≥ 180; 2-hr ≥ 155; 3-hr ≥ 140 —Referral to endocrinology/medication
<i>Protective Factors</i>			
Immunizations (Tdap 3 rd trimester, influenza)	Yes —Reinforce importance	No (interested in being vaccinated) —Discuss risks & answer questions —Administer inactivated influenza/Tdap	No (not interested in being vaccinated) —Discuss risks and give handouts —Follow-up at next visit

(continued on p. 90)

Table 1. (continued)

Screen Treatment Approach	No/Low Risk Positive Reinforcement	Moderate Risk Brief Intervention	High Risk Referral to specialty care
<i>Protective Factors</i>			
Prenatal Vitamins (adherence question)	Yes —Reinforce; prescription Adherence: 0–1 —Reinforce importance ≥ 150 minutes/week —Reinforce behaviors —Warn unsafe activities for pregnant women	No (interested in taking) —Discuss risks; prescription Adherence: 2–3 —Discuss risks 30–149 minutes/week —Set self-management goals —Troubleshoot barriers —Reinforce positive behaviors —Referral if desired —Highlight unsafe activities Score 15–21: Clinical insomnia, moderate —Educate on sleep hygiene/habits	No (not interested in taking) —Refer to dietitian Adherence > 4 —Refer to dietitian <30 minutes/week —Refer to intervention to promote physical activity among sedentary women —Highlight starting slow, encourage walking, activities to avoid Score 22–28: Clinical insomnia, severe —Referral Sleep Center
Physical Activity (Godin-Shepherd)			
Sleep (Insomnia Severity Index)	Score 0–14 None or subthreshold insomnia —Positive reinforcement		
<i>Notes:</i>			
NIDA—National Institute of Drug Abuse			
BMI—body mass index			
kg—kilogram			
m—meter			
mg—milligram			
dL—deciliter			
g—gram			
hr = hour			
OGTT—oral glucose tolerance test			
Tdap—tetanus, diphtheria, acellular pertussis			

counseling to improve birth outcomes. *StartSmart*TM has the potential to fill this need, but the technology was not available in Spanish.

The translation and cultural adaptation of a self-administered health questionnaire such as *StartSmart*TM requires a refined method to reach equivalence between the original source and the target version of the questionnaire.³⁶ In order for measures to be used across cultures, the items must not only be translated well linguistically, but also must be adapted culturally to maintain the content validity of the instrument at a conceptual level across cultures.^{37–39}

Attention to this level of detail allows increased confidence that the impact of the condition and treatment is described in a similar manner.³⁶ “Cross cultural adaptation” is a process that looks at both language (translation) and cultural adaptation issues in the process of preparing a questionnaire and education materials for use with another population.³⁶ Thus, the purpose of this study was the translation and cultural adaptation of *StartSmart*TM, using the Beaton process to enhance usability and acceptability for Hispanic pregnant women and their providers.

Methods

Beaton process for translation and cultural adaptation. The Beaton guidelines for translation and cultural adaptation of self-report measures (Figure 2) were developed based upon a review of medical, sociological, and psychological literature and was used to guide this study.³⁶ The Colorado Multiple Institution Review Board approved the study and re-reviewed the adapted interview process using Zoom (video conferencing software; www.zoom.us) when the COVID-19 pandemic halted all clinical research at our institution.

Stage I. Translation included forward translation of the screening instrument and patient education materials from bilingual translators (T1 & T2) who were native Spanish speakers. Both women were born in Mexico and now live in the U.S. One translator was aware of the concepts being examined and one was not aware of the content. Each translator provided a written report that highlighted challenges and their rationale for their choices.

Stage II. Synthesis of the two translations occurred with the two translators and the primary investigator (PI) working from the original questionnaires and Spanish versions when available (some of the screening instruments used in the app are available in Spanish), to create a synthesis by consensus. The PI reviewed the two separate translations and created a document with all discrepancies for discussion. A Zoom meeting was conducted between the two translators and the PI to discuss the best translation given the intent of the question or educational material and the possible audience.

Stage III. Back-translation occurred working from the synthesized translation created in Stage II. Two bilingual, English first-language translators back-translated the documents into English and provided a written report (BT1 & BT2) of their process. These translators were blind to the original documents and project.

Stage IV. Expert committee review was conducted by the research team, the translators, and language specialists with expertise in nuances of Spanish language to consolidate all versions and reach consensus on the version to pretest. The PI reviewed

Figure 2. Beaton process for translation and cultural adaptation.

the back-translation for consistency with the original instruments when available in Spanish and educational materials and discussed with the team to reach consensus on the best translation.

Stage V. Pretesting of the translated and culturally-adapted application was conducted guided by the Technology Acceptance Model³² with attention to usability and acceptability from patient and provider perspectives. The Spanish version of *StartSmart*™ was pilot-tested in a federally qualified health center (FQHC) in the Southwestern U.S. Due to the restrictions imposed by the COVID-19 pandemic, a bilingual pre-doctoral fellow mentored by the PI who was a provider at the clinic was allowed to recruit, obtain informed consent, facilitate the patients' completion of the screening, and connect the patients with a bilingual interviewer via Zoom. Spoken consent was obtained to video-record the Zoom interviews. Participants received a \$25 gift card for participation.

The women completed prenatal screening on a tablet-based touch screen for risk and protective factors, including: weight status and related conditions (underweight, overweight/obese, gestational weight gain, gestational diabetes mellitus), substance use (alcohol, drugs, tobacco), emotional conditions (anxiety, depression, domestic violence), and protective factors (immunizations, prenatal vitamins, physical activity, sleep). The clinic staff then entered measurements, laboratory findings, and immunizations, and generated an individualized summary of risk and protective factors for the provider and an education packet for the woman based upon her responses to the screening questions.

A bilingual research team member interviewed the patients regarding their experience with completion of the app screening, their perspectives on the education materials, the providers' counseling using the education materials, and their intent to make

Table 2.**PARTICIPANT INTERVIEW QUESTIONS**

-
-
1. Describe any challenges you had while completing the screening such as trouble navigating or layout, knowing where to go, if a link did not work, if you went a way you did not expect, if pages loaded too slowly, etc.
 2. Tell us about your experience as you completed the screening. Did you understand the questions? Were the questions clear? Is there a better way to ask for the information?
 3. Are the questions acceptable in your culture? Is there a better way to ask Spanish-speaking women for this information?
 4. Did the brief intervention [counseling from the provider], and patient education information make sense? Did it help you understand the current risks to you and your baby? Is there a better way to describe this information to make it more useful to women like you?
 5. What do you think about the lay out of the information?
 6. Are the graphics acceptable? Do you have any recommendations for making the materials better for patients?
 7. Are the questions a good way to get this information from patients like you?
 8. Do the patient education material help you better understand risk and protective factors?
 9. Is there a better way to present the information?
 10. Do you intend to change anything based upon the counseling by your provider?
 11. Is the information acceptable to women like you?
 12. Do you have any other suggestions for us?
-

changes based upon the recommendations. Participants were asked the 12 questions outlined in Table 2.

Recruitment continued until saturation was achieved. Previous data suggest the majority of usability problems will be detected with three to four participants and that seven participants will identify the majority of problems.⁴⁰ Acceptability and cultural appropriateness were addressed in interviews with the 17 participants.

Additionally, a focus group with providers was conducted via Zoom at the end of the study to get their perspectives on: 1) the feasibility of using the technology in their clinic and with their population; 2) the usability of the technology, with special emphasis on the ease of use and usefulness for conducting comprehensive screening per guidelines and counseling women on the areas of need; 3) the effects on clinic flow; and 4) suggestions for improving the screening and/or education materials for use with their population. Spoken consent was obtained to record the focus group. Lunch was provided for participants.

Data from interviews and focus groups were transcribed verbatim. Transcripts were analyzed independently using directed content analysis. Discrepancies in interpretation were discussed and consensus reached. The themes were agreed upon as well as the plans for adaptations to the mHealth app.

Stage VI. Appraisal by the committee that developed *StartSmart*TM took place to

Table 3.**DEMOGRAPHICS**

N = 15					
Age					
Mean (Range)	20–25 years	26–30 years	31–35 years	36–40 years	>40 years
31.8 (20.5–40.5)	3	4	5	2	1
Race/Ethnicity					
	Hispanic	Caucasian	Am Indian	Asian	Other
	14	5	0	0	7
Pregnancy					
	First	Second	Third	Fourth	≥ 5
# of pregnancies	7	3	1	4	0
# of infants					
	Singleton	Twin	Triplet	Quadruplet	Unknown
N =	14	0	0	0	1
Insurance					
	None	Medicaid	Private	Other	Missing
	10	4	0	1	0

determine whether the Beaton process was followed to translate and culturally adapt the system and to suggest refinements to the technology.

Population studied. *Demographic characteristics.* We recruited a diverse population of Spanish-speaking women at a federally qualified health center (FQHC) (see Demographics in Table 3). Seventeen women consented to complete the tablet-based screening and be interviewed. Due to problems with Internet connectivity, data from screening were not captured for two participants. Thus, interview data from 17 women and screening data for 15 women are included in this report. Women aged 20.5 to 40.5 were asked to complete the tablet-based screening, were counseled by their provider using the individualized patient educational materials that were generated, and then were interviewed by a bilingual research team member. Most women (15 of 17) identified as Hispanic. When responding to the second question about race, many of the participants did not understand that even if they responded Hispanic to ethnicity they were also to indicate race. Thus, responses to race included: seven responded other, five Caucasian, and four were missing data.

Screening data suggested this was the first pregnancy for the majority of women ($n=7$), but we were able to recruit a diverse sample, with three participants experiencing their second pregnancy, one in her third pregnancy, and four in their fourth pregnancy. Fourteen participants identified their current pregnancy as a singleton and one unknown.

Measures. *Anxiety.* The Generalized Anxiety Disorder 7-item instrument (GAD-7) was used to assess anxiety.⁴¹ It consists of seven questions concerning the preceding two weeks; they ask how often the individual has been bothered by the following problems: feeling nervous, anxious, or on edge; not being able to stop or control worrying; worrying too much about different things; trouble relaxing; being so restless that it's hard to sit still; become easily annoyed or irritable; feeling afraid as if something awful might happen. Responses are rated on a 0–3 Likert scale where 0 = not at all; 1 = several days; 2 = over half the days; 3 = nearly every day. Scores are summed and

interpretation ranked as 0–4 minimal anxiety, 5–9 is mild anxiety, 10–14 is moderate anxiety, and 15–21 is severe anxiety. The GAD-7 has a sensitivity of 89% and specificity of 82%.⁴¹ A study using the GAD-7 in pregnant women reported good reliability with Cronbach's alpha of 0.89.³⁴

Depression. The Patient Health Questionnaire (PHQ) is used to screen for depression.⁴² The PHQ-2 (first two questions on the instrument) are used as a preliminary screen: little interest or pleasure in doing things, and feeling down, depressed, or hopeless. Responses are on a 0–3 Likert scale with 0 = not at all, 1 = several days, 2 = more than half the days, and 3 = nearly every day. If the patient score is greater than 3, the remaining PHQ-9 questions are added. The PHQ-2 has a sensitivity of 87% and a specificity of 86% for any depressive disorder.⁴³ Cronbach's alpha for PHQ-2 was 0.767 and PHQ-9 0.851.⁴⁴

Intimate partner violence (IPV). The Abuse Assessment Scale was used to assess for IPV.⁴⁵ It is a five-item questionnaire that has yes/no responses asking about history of abuse, abuse in the last year, abuse during pregnancy, sexual abuse, and fear of abuser. A positive response to any question is followed by a safety assessment. Sensitivity is reported as 93–94% and specificity ranges from 55–99%.

Substance use. The National Institute on Drug Abuse (NIDA) quick screen was used to assess for alcohol, prescription or illegal drug, tobacco, and marijuana use in pregnancy.⁴⁶ There is one question for each substance type, "Since you have been pregnant, how often have you used. . ." The quick screen has a sensitivity of 79.7% and a specificity of 82.8%.

Obesity. A body mass index (BMI) was generated based upon the height and weight entered by the clinic personnel using the standard formula (weight [kg]/height [m]²).⁴⁷ A BMI less than 18.5 kg/m² is classified as underweight, 18.5–24.9 kg/m² is normal weight, 25–29.9 kg/m² is overweight, and greater than or equal to 30 kg/m² is obese. Guidelines suggest early screening for gestational diabetes for Hispanic women with a BMI greater than 25 kg/m² and for all women at 28 weeks gestation.⁴⁸

Physical activity. The Godin-Shepherd Physical Activity Questionnaire was used to assess physical activity.⁴⁹ It consists of three questions: During a typical seven-day period (one week), how many times on average do you do the following kinds of exercise for more than 15 minutes during your free time? a) strenuous exercise (heart beats rapidly—like running, swimming laps, biking [10 miles per hour or more], aerobic exercise); b) moderate exercise (not exhausting—like walking briskly, biking [less than 10 miles per hour]); and c) mild exercise (not much effort—like slow walking, light housework). The activity score is calculated using the following formula (9 X Strenuous activity) + (5 X Moderate activity) + (3 X Mild activity) = Weekly Activity Score. Norms are ≥ 24 units is active, 14–23 units are moderately active, and less than 14 units is sedentary or insufficient activity. Sensitivity is reported at 62% and specificity ranges from 68–97%.

Sleep. The Insomnia Severity Index was used to assess sleep.⁵⁰ It consists of three questions concerning a) difficulty falling asleep; b) difficulty staying asleep; and c) problems waking up too early. Participants select a response on the Likert 0–4 scale for each: 0 = None, 1 = Mild, 2 = Moderate, 3 = Severe, 4 = Very Severe. Responses are summed and interpreted using the following cut points: 0–7 = No clinically significant

insomnia; 8–14 = subthreshold insomnia; 15–21 = moderate clinical insomnia; and 22–28 = severe clinical insomnia. Sensitivity is reported at 86% and specificity is 87%. Cronbach's alpha is excellent at 0.90.⁵¹

Results

Patient risk and protective factor clusters. Participants scored 0–6 on the GAD-7, with a mean of 1.5. The majority of participants (n=13) were classified as having minimal anxiety, with two participants having mild anxiety. Depression scores ranged from 0–2 with a mean of 0.5. None of the participants in our study had a score greater than 3, so the additional questions were not needed. The majority of participants reported no abuse (n=13), and one participant reported a past history of abuse but none in past year during pregnancy. One participant reported using marijuana and tobacco during pregnancy. No other substance use (alcohol, prescription drug, illegal drug) was reported. No reportable clinical outcomes were disclosed.

Over half of our participants were overweight or obese, and only one was underweight (see Table 4). Five participants had glucose screening, three had early screening for a BMI greater than 25 kg/m², two participants over 28 weeks were screened, and four were missing the date of their last menstrual period (LMP) so weeks gestation could not be calculated. Our results indicated that seven (47%) of the women were active, two (13%) had moderate activity, and six (46%) were sedentary. The sedentary women reported zero activity in all categories. Of the sedentary women, three (50%) were obese, one (16%) was overweight, and two (33%) were normal weight. The majority of women (n=10 [66%]) indicated no insomnia and five (33%) met the criteria for subthreshold insomnia.

Patient interviews. Seventeen women were interviewed regarding the completion of screening with the StartSmart™ app, the educational materials generated for them, the provider's counseling using the educational materials, and their intent to make changes based upon the recommendations. Participant interviews took place after the prenatal visit and were relatively short, ranging from seven to 12 minutes.

The major themes from the interviews are summarized below for usability, acceptability, intent to change, and challenges and suggestions for refinement.

Usability and acceptability. Participants reported that StartSmart™ was very easy to use, the Spanish language used was very easy to understand, the handouts were acceptable, and graphics were clear. One participant suggested, "The design was beautiful to me, as they have babies, but a baby with a mother would be beautiful, because I did not see that." Several women reported that the physical activity questions were difficult to answer since they were divided across separate screens for strenuous, moderate, and mild activity. One participant stated, "It was good for me, I think they give you the screening and then you have confidence and open yourself up if you have a problem... to be able to tell if something is happening to you."

Intent to change. Participants also reported appreciation for the individualized educational materials and conversation with the provider (e.g., "I did not know that physical activity was important for me and my baby;" and "Women go through things [like violence and depression] and it is not talked about, it is delicate and you need

Table 4.
RISK AND PROTECTIVE FACTORS

Anxiety (mean 1.5; range 0–6)					
N =		Minimal	Mild	Moderate	Severe
		13	2	0	0
Depression (mean 0.5; range 0–2)					
PHQ-2 Score	0–3		4–6		missing
N =	15		0		0
Intimate Partner Violence (Abuse Assessment Screen AAS)					
Zero	One	Two	Three	Four	Five
14	1	0	0	0	0
Substance Use (NIDA Quick Screen)					
	0	1–2	>3		Missing
Alcohol	15	0	0		0
RX drugs	15	0	0		0
Illegal drugs	15	0	0		0
Tobacco	14	1	0		0
Marijuana	14	1	0		0
Weight Related Risks					
Weight-related	Underweight	Normal weight	Overweight	Obese	Missing
N =	1	5	2	6	1
GDM screen	0	1	2	2	0
Screen by dates		<28 weeks		≥ 28 weeks	
		3 (3 met BMI criteria)		2 (3 with no dates; others < 28wks)	
Vitamins (all 15 reported taking)					
# days missed	Zero	One	Two	Three	Four
	10	1	2	1	1
Physical Activity (Godin Leisure-Time Questionnaire)					
Weekly activity		Active	Moderately active	Sedentary	Missing
		7	2	6	0
Sleep (Insomnia Severity Index)		No insomnia	Subthreshold	Moderate	Severe
		10	5	0	0

information”). All of the participants indicated they would follow the recommendations provided. One participant stated she would follow the recommendations, “Because it helps one maintain a healthy pregnancy, which is what one wants, that the delivery goes well for me.”

Challenges and suggestions for refinement. The major challenges mentioned by several participants was that there was a glitch in the app causing the program to revert to English when the participant hit the back button. The other issue raised by multiple participants was understanding the physical activity questions spread across multiple screens. Programmers are working to resolve these issues. Another participant reported

Figure 3. Screenshot of more diverse babies.

grammatical issues with translation (masculine word was used instead of the feminine version), which are now being addressed by the translators.

Provider interviews. Three providers were interviewed via Zoom. Overall, feedback from providers was positive. They reported *StartSmart*™ was useful and allowed them to complete a comprehensive screening on all patients. The providers suggested that some Spanish-speaking clients do not read Spanish very well, and they noted that some participants struggled with completing the questions in 45 minutes. They suggested adding the following question, “Would you like to have someone read the questions to you?” Providers also wanted to have the ability to edit the estimated due date based upon ultrasound findings. The app currently asked women the date of their last menstrual period (LMP) and then estimated a due date based upon it. Providers felt that ultrasound provided a more accurate gestational age when compared with a patient remembering her LMP and requested the ability to edit the due date. Providers also wanted more details when a woman screens positive, specifically, which questions she responded positively to on the validated instruments. They also requested an additional question on the mental health screening to include: Have you ever had care for a mental health problem in the past?

Refinement. Based upon the feedback from the participants (both patients and providers), the following refinements were made to the mHealth prenatal screening app including: 1) language revisions as agreed upon through the process, 2) graphics changed to represent more Hispanic babies (see Figure 3), 3) physical activity questions reformatted on one page to improve understanding (see Figure 4), 4) glitches in the program addressed so that app did not change to English language when participants hit the back button, 5) due date can be edited by the provider based upon the ultrasound findings, 6) the provider summary is being reformatted to include more details specific to the patient's response to individual items when she falls into the medium or high-risk categories, and 7) additional question regarding past treatment for mental health will be added.

Step 10 of 35

25%

Start Smart

During a typical 7-day period (a week), how many times on average do you do the following kinds of exercise for more than 15 minutes during your free time? Strenuous exercise means your heart beats rapidly. Moderate exercise is not exhausting. Mild exercise means not much effort.

Strenuous Exercise (heart beats rapidly)
ex/ running, swimming laps, hiking (10mph or more), aerobic exercise

Moderate Exercise (not exhausting)
ex/ walking briskly, hiking (less than 10mph)

Mild Exercise (minimal effort)
ex/ slow walking, light housework

< Back Next >

Figure 4. Screenshot of refined physical activity questions.

Discussion

Birth outcomes in the U.S. consistently rank lower than other developed countries, and significant health disparities exist between racial and ethnic minority groups and Whites in the U.S.^{6,52–55} Prenatal health care counseling is associated with positive health outcomes.^{56,57} Women with greater understanding of risky behaviors have been shown to be more likely to change those behaviors than women whose beliefs are not as strong.⁵⁸ Provider advice is a catalyst for behavior change.⁵⁸ Patient-provider communication, however, can be challenging for patients who do not speak English.⁵⁹

Research also suggests that technology decision support, self-management, and behavior change programs have increased healthy behaviors^{23–26} and may improve patient outcomes.^{27,28,56} *StartSmart*TM is screening technology that provides individualized patient education and provider support for counseling on risk and protective factors.³¹ To maximize accessibility, the technology had to be translated and culturally adapted for use by Spanish-speaking pregnant women.

This article describes the Spanish translation and cultural adaptation of *StartSmart*TM, an mHealth technology designed to provide a comprehensive assessment of risk and protective factors in pregnant women, individualized patient educational materials, a provider summary of risk and protective factors, and prompts for counseling on risk and protective factors using motivational interviewing. The technology was developed using the Technology Acceptance Model that includes an iterative process using end user (patient and provider) feedback at each step in the process.³² The translation was guided by the Beaton process, which includes a rigorous translation and back-translation procedure and the cross-cultural adaptation that includes attention to both languages in the translation and cultural adaptation issues in preparing the instruments for use in a particular population.³⁶ After translation and back-translation, the translated instrument was pretested with a diverse population of Spanish-speaking women including immigrants from Mexico, Central America, and South America. The profile of risk and protective factors in this small, clinical sample revealed a diverse sample with a wide

age range, range in the number of pregnancies, and range of risk and protective factors, allowing us to get feedback on a variety of presentations of the educational materials that are specific to the participants' risk and protective factors.

A key tenet of the Beaton process is that translation alone does not automatically provide culturally nuanced language concerning health, and this was carefully monitored throughout the process. In the final testing, we continued to concern ourselves with how well the material performed through questions about the acceptability of the questions and educational materials.³⁶ Participants were also asked if there was a better way to present the material for people like them. The pretesting was guided by the Technology Acceptance Model,³² with feedback from both patients and providers. Refinements based upon the feedback are currently underway.

There are multiple strengths and weaknesses to our study. The process of translation was guided by the rigorous Beaton process. We engaged a total of four bilingual translators—two native Spanish-speakers to complete the forward-translation, and two native English-speakers to complete the back-translation. Final agreement on the Spanish translation was reached by consensus of the translators and research team.

We completed pretesting in a small federally qualified health center (FQHC) with a diverse population of Spanish-speaking women, but the pretest results only represent feedback from one clinic. There were challenges due to the COVID-19 pandemic that limited the researchers' access to the clinic; therefore, we engaged a pre-doctoral fellow who was a clinician working at the clinic to perform the consent procedures with participants. We also adapted the data collection plan to conduct the interviews via Zoom.

Weaknesses of the study included a few technical issues and a small provider sample. A few issues with Internet connectivity affected two of the participants' experience with the mHealth screening. Only three providers in this FQHC see pregnant women, so feedback from providers was limited to this small sample. The study was also limited by the small sample of Spanish-speaking participants who completed the screening with a limited number of risk factors reported other than weight. Thus, our ability to draw conclusions about the cultural appropriateness of the assessment of the stigmatizing behaviors is limited.

Future research is planned to expand our understanding of the utility of *StartSmart*™ in screening and counseling Spanish-speaking pregnant women. A comprehensive evaluation of algorithm bias was not conducted and should be examined in the future. When refinements based upon this provider and patient feedback are completed, large-scale testing must be completed to establish the efficacy of the revised application on birth outcomes for mothers and babies. Feedback from a larger population of providers is needed in future studies to optimize its use with diverse populations. Additional studies are planned to examine the prevalence of risk and protective factors in Spanish-speaking populations.

References

1. Barker DJP, Winter PD, Osmond C, et al. Weight in infancy and death from ischemic heart-disease. *Lancet*. 1989;2(8663):577–80.
[https://doi.org/10.1016/S0140-6736\(89\)90710-1](https://doi.org/10.1016/S0140-6736(89)90710-1)
2. United Nations Inter-agency Group for Child Mortality Estimation (UN IGME).

- United States of America: under-five mortality rate. New York, NY: UN IGME, UNICEF, 2014. Available at: <https://childmortality.org/data/United%20States%20of%20America>.
3. Centers for Disease Control and Prevention (CDC). Reproductive health: severe maternal morbidity in the United States. Atlanta, GA: CDC, 2014. Available at: <http://www.cdc.gov/reproductivehealth/MaternalInfantHealth/SevereMaternalMorbidity.html>.
4. The Annie E. Casey Foundation, Kids Count Data Center. Total births by race in the United States. Baltimore, MD: Annie E Casey Foundation, 2020. Available at: <https://datacenter.kidscount.org/data/tables/6038-total-births-by-race?loc=1&loct=2#detailed/2/2-53/false/1729,37,871,870,573,869,36,868,867,133/3,2,1,4,13/12703,12704>.
5. March of Dimes. Health equity and birth outcomes. Arlington, VA: March of Dimes, 2020. Available at: www.marchofdimes.org/materials/March-of-Dimes-Health-Equity-Birth-Outcomes-091920.pdf.
6. March of Dimes. Maternal and infant health in U.S. Hispanic populations: prematurity and related health indicators. Arlington, VA: March of Dimes, 2014. Available at: https://www.marchofdimes.org/Peristats/pdflib/991/MOD_2014HispanicReport.pdf.
7. Chang JJ, Tabet M, Elder K, et al. Racial/ethnic differences in the correlates of mental health services use among pregnant women with depressive symptoms. *Matern Child Health J.* 2016;20(9):1911–22.
<https://doi.org/10.1007/s10995-016-2005-1>
PMid:27126445
8. Carroll AE, Biondich P, Anand V, et al. A randomized controlled trial of screening for maternal depression with a clinical decision support system. *J Am Med Inform Assoc.* 2013;20(2):311–16.
<https://doi.org/10.1136/amiajnl-2011-000682>
PMid:22744960 PMCID:PMC3638168
9. Tsoh J, Kohn M, Gerbert B. Promoting smoking cessation in pregnancy with video doctor plus provider cueing: a randomized trial. *Acta Obstet Gynecol Scand.* 2010;89(4):515–23.
<https://doi.org/10.3109/00016341003678419>
PMid:20196678 PMCID:PMC3312043
10. The American College of Obstetricians and Gynecologists (ACOG). Prepregnancy counseling. Washington, DC: ACOG, 2019. Available at: <https://www.acog.org/clinical/clinical-guidance/committee-opinion/articles/2019/01/prepregnancy-counseling>.
11. American College of Nurse-Midwives (ACNM). Position statement. Silver Spring, MD: ACNM, 2013. Available at: <http://www.midwife.org/ACNM/files/ACNMLibraryData/UPLOADFILENAME/000000000052/Addiction%20in%20Pregnancy%20May%202013.pdf>.
12. Callaghan W, Creanga A, Kuklina E. Severe maternal morbidity among delivery and postpartum hospitalizations in the United States. *Obstet Gynecol.* 2012;120(5):1029–36.
<https://doi.org/10.1097/AOG.0b013e31826d60c5>
PMid:23090519 PMCID:PMC4010855
13. Leiferman J, Sinatra E, Huberty J. Pregnant women's perceptions of patient-provider communication for health behavior change during pregnancy. *Open J Obstet Gynecol.* 2014;4(11):672–84.
<https://doi.org/10.4236/ojog.2014.411094>

14. Riley M, Galang S, Green L. The impact of clinical reminders on prenatal care. *Fam Med*. 2011;43(8):560–5.
15. Thornberry J, Bhaskar B, Krulewitch CJ, et al. Audio computerized self-report interview use in prenatal clinics: audio computer-assisted self interview with touch screen to detect alcohol consumption in pregnant women: application of a new technology to an old problem. *Comput Inform Nurs*. 2002;20(2):46–52.
<https://doi.org/10.1097/00024665-200203000-00009>
PMid:11984122
16. Center for Substance Abuse Treatment. Substance abuse treatment: addressing the specific needs of women. Treatment Improvement Protocol (TIP) Series, No. 51. Rockville, MD: Substance Abuse and Mental Health Services Administration, 2009: 1–367.
17. Mears M, Coonrod D, Bay R, et al. Routine history as compared with audio computer-assisted self-interview for prenatal care history taking. *J Reprod Med*. 2005;50(9):701–6.
18. Leiferman JA, Dauber SE, Heisler K, et al. Primary care physicians' beliefs and practices toward maternal depression. *J Womens Health (Larchmt)*. 2008;17(7):1143–50.
<https://doi.org/10.1089/jwh.2007.0543>
PMid:18657043
19. Mears M, Coonrod DV, Bay RC, et al. Routine history as compared with audio computer-assisted self-interview for prenatal care history taking. *J Reprod Med*. 2005 Sep;50(9):701–6.
20. McDonald SD, Machold CA, Marshall L, et al. Documentation of guideline adherence in antenatal records across maternal weight categories: a chart review. *BMC Pregnancy Childbirth*. 2014;14:205.
<https://doi.org/10.1186/1471-2393-14-205>
PMid:24927750 PMCID:PMC4065541
21. Moleda P, Fronczyk A, Jablonska K, et al. [Practical implementation of recommendations concerning diagnostic procedures in gestational diabetes]. *Ginekol Pol*. 2015;86(2):132–6.
<https://doi.org/10.17772/gp/2000>
PMid:25807838
22. Nagpal J, Sachdeva A, Sengupta Dhar R, et al. Widespread non-adherence to evidence-based maternity care guidelines: a population-based cluster randomised household survey. *BJOG*. 2015;122(2):238–47.
<https://doi.org/10.1111/1471-0528.13054>
PMid:25145674
23. Nielsen KK, Kapur A, Damm P, et al. From screening to postpartum follow-up—the determinants and barriers for gestational diabetes mellitus (GDM) services, a systematic review. *BMC Pregnancy Childbirth*. 2014;14:41.
<https://doi.org/10.1186/1471-2393-14-41>
PMid:24450389 PMCID:PMC3901889
24. Waring ME, Moore Simas TA, Barnes KC, et al. Patient report of guideline-congruent gestational weight gain advice from prenatal care providers: differences by prepregnancy BMI. *Birth*. 2014;41(4):353–9.
<https://doi.org/10.1111/birt.12131>
PMid:25187296
25. Moore Simas TA, Waring ME, Sullivan GM, et al. Institute of medicine 2009 gesta-

- tional weight gain guideline knowledge: survey of obstetrics/gynecology and family medicine residents of the United States. *Birth*. 2013;40(4):237–46.
<https://doi.org/10.1111/birt.12061>
 PMid:24344704 PMCID:PMC3974574
26. Lee PY, Liew SM, Abdullah A, et al. Healthcare professionals' and policy makers' views on implementing a clinical practice guideline of hypertension management: a qualitative study. *Plos One*. 2015;10(5).
<https://doi.org/10.1371/journal.pone.0126191>
 PMid:25942686 PMCID:PMC4420249
 27. McDonald J, Goldman RE, O'Brien A, et al. Health information technology to guide pediatric obesity management. *Clin Pediatr*. 2011;50(6):543–9.
<https://doi.org/10.1177/0009922810395131>
 PMid:21565885
 28. Stotland NE, Gilbert P, Bogetz A, et al. Preventing excessive weight gain in pregnancy: how do prenatal care providers approach counseling? *J Womens Health*. 2010;19(4):807–14.
<https://doi.org/10.1089/jwh.2009.1462>
 PMid:20078239 PMCID:PMC2867592
 29. Lobach D, Sanders GD, Bright TJ, et al. Enabling health care decisionmaking through clinical decision support and knowledge management. Evidence Report/Technology Assessments, No. 203. Rockville, MD: Agency for Healthcare Research and Quality, 2012.
 30. Gance-Cleveland B. StartSmart: health information technology to improve adherence to prenatal guidelines. Rockville, MD: Agency for Healthcare Research and Quality, 2016–2018.
 31. Gance-Cleveland B, Leiferman J, Aldrich H, et al. Using the technology acceptance model to develop StartSmart™: mHealth for screening, brief intervention and referral to treatment for risk and protective factors in pregnancy. *J Midwifery Womens Health*. 2019;64(5):630–40.
<https://doi.org/10.1111/jmwh.13009>
 PMid:31347784
 32. Davis FD. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*. 1989;13(3):319–40.
<https://doi.org/10.2307/249008>
 33. Fernandez-Mendoza J, Rodriguez-Muñoz A, Vela-Bueno A, et al. The Spanish version of the Insomnia Severity Index: a confirmatory factor analysis. *Sleep Med*. 2012;13(2):207–10.
<https://doi.org/10.1016/j.sleep.2011.06.019>
 PMid:22172961
 34. Zhong Q, Gelaye B, Zaslavsky AM, et al. Diagnostic validity of the generalized anxiety disorder – 7 (GAD-7) among pregnant women. *Plos One*. 2015;10(4):e0125096.
<https://doi.org/10.1371/journal.pone.0125096>
 PMid:25915929 PMCID:PMC4411061
 35. Mills SD, Fox RS, Malcarne VL, et al. The psychometric properties of the generalized anxiety disorder-7 scale in Hispanic Americans with English or Spanish language preference. *Cultur Divers Ethnic Minor Psychol*. 2014;20(3):463–8.
<https://doi.org/10.1037/a0036523>
 PMid:25045957 PMCID:PMC4129392

36. Beaton DE, Bombardier C, Guillemin F, et al. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine*. 2000;25(24):3186–91.
<https://doi.org/10.1097/00007632-200012150-00014>
PMid:11124735
37. Ferraz MB. Cross cultural adaptation of questionnaires: what is it and when should it be performed? *J Rheumatol*. 1997;24(11):2066–8.
38. Guillemin F, Bombardier C, Beaton D. Cross-cultural adaptation of health-related quality of life measures: literature review and proposed guidelines. *J Clin Epidemiol*. 1993;46(12):1417–32.
[https://doi.org/10.1016/0895-4356\(93\)90142-N](https://doi.org/10.1016/0895-4356(93)90142-N)
39. Guyatt GH. The philosophy of health-related quality of life translation. *Qual Life Res*. 1993;2(6):461–5.
<https://doi.org/10.1007/BF00422220>
PMid:8161980
40. Nielsen J, Landauer TK. A mathematical model of the finding of usability problems. In: *Proceedings of ACM INTERCHI'93 Conference, Amsterdam (The Netherlands), April 1993*.
<https://doi.org/10.1145/169059.169166>
PMid:8348158
41. Spitzer R, Kroenke K, Williams J, et al. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med*. 2006;166(10):1092–7.
<https://doi.org/10.1001/archinte.166.10.1092>
PMid:16717171
42. Arroll B, Goodyear-Smith F, Crengle S, et al. Validation of PHQ-2 and PHQ-9 to screen for major depression in the primary care population. *Ann Fam Med*. 2010;8(4):348–53.
<https://doi.org/10.1370/afm.1139>
PMid:20644190 PMCID:PMC2906530
43. Löwe B, Kroenke K, Gräfe K. Detecting and monitoring depression with a two-item questionnaire (PHQ-2). *J Psychosom Res*. 2005;58(2):163–71.
<https://doi.org/10.1016/j.jpsychores.2004.09.006>
PMid:15820844
44. Maroufizadeh S, Omani-Samani R, Almasi-Hashiani A, et al. The reliability and validity of the patient health questionnaire-9 (PHQ-9) and PHQ-2 in patients with infertility. *Reprod Health*. 2019;16(1):137.
<https://doi.org/10.1186/s12978-019-0802-x>
PMid:31500644 PMCID:PMC6734346
45. Breiding M, Basile KC, Smith SG, et al. *Intimate partner violence surveillance: uniform definitions and recommended data elements (version 2.0)*. Atlanta, GA: Centers for Disease Control and Prevention, 2015. Available at: <https://www.cdc.gov/violenceprevention/pdf/ipv/intimatepartnerviolence.pdf>.
46. National Institute on Drug Abuse. *Resource guide: screening for drug use in general medical settings*. Bethesda, MD: National Institutes of Health, 2012. Available at: <https://www.drugabuse.gov/publications/resource-guide-screening-drug-use-in-general-medical-settings/nida-quick-screen>.
47. Centers for Disease Control and Prevention (CDC). *Body mass index (BMI)*. Atlanta, GA: CDC, 2020. Available at: <https://www.cdc.gov/healthyweight/assessing/bmi/index.html>.
48. Committee on Practice Bulletins—Obstetrics. ACOG practice bulletin No. 190: Gestational Diabetes Mellitus. *Obstet Gynecol*. 2018;131(2):e49–64.

- <https://doi.org/10.1097/AOG.0000000000002501>
PMid:29370047
49. Godin G, Shephard RJ. Godin Leisure-Time Exercise Questionnaire. *Oncology Nursing Society*. Available at: https://www.ons.org/sites/default/files/Godin%20Leisure-Time%20Exercise%20Questionnaire_070815.pdf
50. Bastien C, Vallieres A, Morin C. Validation of the insomnia severity index as an outcome measure for insomnia research. *Sleep Med*. 2001;2(4):297–307.
[https://doi.org/10.1016/S1389-9457\(00\)00065-4](https://doi.org/10.1016/S1389-9457(00)00065-4)
51. Morin CM, Belleville G, Bélanger L, et al. The insomnia severity index: psychometric indicators to detect insomnia cases and evaluate treatment response. *Sleep*. 2011;34(5):601–8.
<https://doi.org/10.1093/sleep/34.5.601>
PMid:21532953 PMCID:PMC3079939
52. Centers for Disease Control and Prevention (CDC). Pregnancy Mortality Surveillance System (PMSS). Atlanta, GA: CDC, 2019. Available at: https://www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2F%2Freproductivehealth%2Fmaternalinfanthhealth%2Fpregnancy-mortality-surveillance-system.htm.
53. Jones R. American women are still dying at alarming rates while giving birth. Washington, DC: National Geographic, 2018. available at: <https://www.nationalgeographic.com/culture/article/maternal-mortality-usa-health-motherhood>.
54. MacDorman M, Declercq E, Cabral H, et al. Is the United States maternal mortality rate increasing? Disentangling trends from measurement issues. *Obstet Gynecol*. 2016;128(3):447–55.
<https://doi.org/10.1097/AOG.0000000000001556>
PMid:27500333 PMCID:PMC5001799
55. March of Dimes. Maternal and infant health in U.S. Hispanic populations: prematurity and related health indicators. Arlington, VA: March of Dimes, 2014. Available at: https://www.marchofdimes.org/Peristats/pdflib/991/MOD_2014HispanicReport.pdf.
56. Ebell M. Use of clinical decision rules for point-of-care decision support. *Med Decis Making*. 2010;30(6):712–21.
<https://doi.org/10.1177/0272989X10386232>
PMid:21183758
57. Ta Park VM, Hayes DK, Humphreys J. Disparities in intimate partner violence prenatal counseling: setting a baseline for the implementation of the guidelines for women's preventive services. *Hawaii J Med Public Health*. 2014;73(5):137–43.
58. Oza-Frank R, Kachoria R, Keim SA, et al. Receipt and timing of pregnancy-related preventive health messages vary by message type and maternal characteristics. *Am J Health Promot*. 2015;30(2):109–16.
<https://doi.org/10.4278/ajhp.131015-QUAN-524>
PMid:25372233
59. Green TL, Bodas MV, Jones HA, et al. Disparities in self-reported prenatal counseling: does immigrant status matter? *J Community Health*. 2018;43(5):864–73.
<https://doi.org/10.1007/s10900-018-0495-z>
PMid:29516385