Assessing the Digital Divide Among Low-Income Perinatal Women: Opportunities for Provision of Health Information and Counseling

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Abstract

Objectives: Technology-based health interventions may provide a means to reach low-income perinatal women and improve outcomes for both mother and infant, yet little is known about technology access and interest among this population. This study explored interest, attitudes, and concerns regarding technology to deliver health information and interventions.

Methods: Between May and October 2014, a cross-sectional study of 161 low-income pregnant and/or postpartum mothers (up to 1 year) was conducted, assessing attitudes and behaviors regarding the current use of devices and receptivity to interventions delivered through devices. Participants (ages 18–41) were pregnant or postpartum and able to read and comprehend English. Women were recruited from waiting areas at two urban clinics affiliated with the local health department in a Midwestern city in the United States. Surveys included 46 questions and were completed at the time of invitation. Descriptive statistics, independent sample t test, or chi-square for independence tests were completed using SPSS (version 23).

Results: Participants from this sample were mostly African American (60%) and had a mean age of 26 years. Most were postpartum (67%). The majority of the sample used mobile phones (most being smartphones), with less access and use of computers and tablets.

Conclusion: A moderate level of interest in utilizing technology for health-related information and interventions was found, with concerns related to privacy and time.

Keywords: technology, pregnancy, postpartum, e-health

Introduction

Researchers and healthcare providers are increasingly turning to technology to implement health interventions as most Americans have access to mobile phones, tablets, and/or computers. According to the Pew Charitable Trust (2017), in 2016, 95% of Americans had a mobile phone (77% smartphone ownership), 51% a tablet computer, and 78% a desktop or laptop. As of 2016, 88% use the Internet, with 12% of those individuals only using their phone to access the Internet instead of purchasing broadband.¹ Furthermore, as of 2015, 62% of individuals who had a smartphone looked online for health-related information.¹ Because individuals who are low income and minorities are at higher risk for morbidity and mortality compared with the general population,^{2,3} researchers and healthcare providers are interested in targeting these populations for interventions. Eighty-four percent of individuals whose annual household income is less than \$30,000 a year have a cell phone and 79% use social media.⁴ In addition, minorities and lower-income individuals are more likely to only access the Internet through their smartphone.⁴

Low-income women who are pregnant and/or who have infants (perinatal) face many challenges to accessing healthcare, including lack of support, childcare, and transportation.⁵ Even after these barriers have been addressed, there are pragmatic factors that affect healthcare utilization, such as reliable appointment reminders being delivered and remembering scheduled healthcare visits. One study found that text messages as appointment reminders for obstetrics and gynecology appointments were acceptable in a young, female, inner city, low-income clinic population and all, but one participant, had a mobile phone for personal use.⁶ Using mobile phones, smartphones, and related technology could help to overcome some of these problems faced by low-income pregnant and postpartum women. Technology could also provide a means of disseminating health information to pregnant and postpartum women or delivering interventions to promote healthy behavior, as an adjunct to their normal obstetric care.

Preliminary work has been conducted to explore the use of technology with a perinatal population across a range of

health behaviors. Several studies have found that communication technology is fairly ubiquitous among this population, but with mixed results in terms of preferences for the use of technology for healthcare or intervention delivery. One study of 63 low-income expectant women in Milwaukee, Wisconsin, found that about half of the sample had computer and Internet access, while 75% had access to a mobile phone.⁷ Despite this access, the Internet was not commonly used to search for health-related information and participants largely received health information interpersonally.⁷ Another study of 100 pregnant women found similarly high rates of technology access and use.⁸ While 83% were willing to participate in a computer-based intervention, only 49% had interest in a mobile phone-based intervention. Finally, a study of low-income pregnant and postpartum women located in southeastern United States not only found high rates of technology use and access but also showed disparities in Internet use and text messaging among those with limited English proficiency.⁹ Taken together, these studies demonstrate that the technology access tends to be high; however, results are mixed regarding how best to deliver health information and interventions. Moreover, a gap still remains in the literature on low-income women's technology use and addressing health-related issues within this population.¹⁰

Many health disciplines are assessing how technology might be harnessed to improve people's lives, and low-income perinatal women represent an important group to target for health behavior interventions. They are likely to have access to several forms of technology, which could be leveraged for health intervention delivery and evaluation, but first an assessment of their technology use, concerns, and interests should be conducted. It is probable that preferences will vary based on the characteristics of the sample or the individual, so preference assessments are necessary before implementation of interventions.

This study aimed to contribute to the feasibility literature by asking pregnant and postpartum women if and how they use technology, if they would like to receive health-related information through technology, and what types of health-related issues they most want to address. We expect that technology access will be high among this population based on previous literature. Beyond technology use, the goal of this study was to assess interest, attitudes, and concerns regarding technology to deliver health information and interventions among low-income pregnant and postpartum women (up to 1 year).

There were two objectives:

- (1) assess receptivity to receiving health counseling through a computer or mobile phone and
- (2) identify concerns related to these counseling platforms.

Methods

DESIGN AND SETTING

This study was designed as a cross-sectional survey of 170 low-income pregnant and/or postpartum mothers (up to 1 year) on their attitudes and behaviors regarding the current use of technology and receptivity to interventions delivered through devices. The study was completed between May 2014 and October 2014. Study procedures were approved by the Institutional Review Boards of the academic institution and local health department and were performed in accordance with ethical standards of the 1964 Declaration of Helsinki. To be eligible for participation, the women had to be (1) currently pregnant or have had a child within the last year, (2) able to read and comprehend English, and (4) between the ages of 13 and 45 years. After recruitment, it was decided to exclude those participants under the age of 18 as they would be reliant upon their parent/guardian for access to technology (e.g., mobile phone plan). Women were recruited from waiting areas at two urban health department clinics in Midwestern United States. Both passive and active recruitment methods were used. For the former, flyers were posted and handed out to staff at the clinics. For the latter, women were invited to participate while they were waiting on their clinic appointment. Surveys were completed at the time of invitation after screening for study criteria and obtaining consent. Upon receipt of the completed survey, participants were provided a \$5 gift card for a local grocery store. The survey contained 46 questions, some adapted from McClure et al.¹¹ and some locally developed. The survey asked participants about their use of technology and whether they would use these tools to receive health information; questions asked were about demographic information, mobile phone, computer, Internet, and social media access and use.

Participants also provided information on their receptivity, thoughts of effectiveness, helpfulness, convenience, utilization, and concerns of using a technology-based application for a health behavior intervention through computers, tablets, and mobile phones. The survey took ~10 min to complete.

Demographic data are reported as mean and standard deviation (SD) for interval-level data or as number and percentage for nominal-level data. An independent sample *t* test or χ^2 test was used to determine whether responses differed by age, race, or education categories. The categories were defined as follows: (1) age: <30 or ≥ 30 years; (2) race: African American or white; and (3) education: <12 or ≥ 12 years. Significance was defined as $p < 0.05$. Statistical analyses were performed using the Statistical Package for Social Sciences.¹²

Results

A total of 170 surveys were collected at the health clinics. Nine surveys were excluded—six were from participants under the age of 18 years and three were missing data on age. The final sample consisted of 161 perinatal women.

DEMOGRAPHIC INFORMATION

Demographic data are summarized in *Table 1*. Participants' ages ranged from 18 to 41 years with a mean of 26.3 (SD 5.5) years. Most women self-identified as African American (60%).

Table 1. Demographic Characteristics of Respondents*

VARIABLE	MEAN $\pm$ SD OR N (%)
Age (years)	26.3 $\pm$ 5.5
Education (years)	11.2 $\pm$ 1.3
Race	158
African American/black	95 (60)
White	56 (35)
Mixed race	6 (4)
Asian	1 (1)
Ethnicity	143
Latina	6 (4)
Relationship status	161
Single, never married	125 (78)
Married or domestic partnership	26 (16)
Widowed	1 (1)
Divorced	2 (1)
Separated	7 (4)
Type of government assistance received	157
Special Supplemental Nutrition Program for Women, Infants, and Children	128 (82)
Supplemental Nutrition Assistance Program	71 (45)
Section 8 Housing	22 (14)
Medicaid	117 (75)
Temporary Aid to Needy Families	8 (5)
Supplemental Security Income	23 (15)
Reproductive status	
Currently pregnant	60 (37)
Child within the last 12 months	107 (67)

*(N = 161)

SD, standard deviation.

There was no difference in educational level or age by race (data not shown). Fifty-five percent of women completed high school or earned a GED. More women were postpartum than pregnant. The predominant forms of federal assistance received were from the Special Supplemental Feeding Program for Women, Infants, and Children.

TECHNOLOGY USE

Technology usage is shown in *Table 2*. The use of mobile phones (96%) was more common than use of computers (44%) or tablets (37%). Among those using mobile phones, 74% used smartphones. Few women received a free phone from the government (9%); rather, the most common source for obtaining a mobile phone was through a monthly contract (55%). Two-thirds of women had changed their phone number in the past year (67%). Nearly all women used their phones for calls and texts and ~70% used their phones as a camera, to access the Internet, or as a source of music. The most popular social media site used by participants was Facebook (81%).

E-mail was checked less frequently ($\bar{x} = 4.0 \pm 2.4$ days/week) than Facebook/social media ($\bar{x} = 4.5 \pm 2.6$ days/week) or the Internet ($\bar{x} = 5.1 \pm 2.4$ days/week). Weekly use of Facebook/social media was higher in women 29 years old or younger ($\bar{x} = 4.8 \pm 2.5$ days) compared with women 30 years old or older ($\bar{x} = 3.5 \pm 2.9$ days; $p < 0.01$). Weekly usage was unrelated to education level or race. Usage of apps for health behavior change was less frequent than searching the Internet for information related to pregnancy, children, or nutrition.

Differences in the proportion of women, stratified by age and race, for use of various technologies on their mobile phones are presented in *Table 3*. Age was significantly associated with the use of apps, the Internet, music, and viewing of movies. More young women reported using their phones for these functions than older women. Race was significantly associated with playing games or music on the phone with higher proportions of African American women reporting these activities. Education level was unrelated to any of the functions.

USE OF TECHNOLOGY FOR INFORMATION OR BEHAVIOR CHANGE

Eighty-eight percent of participants reported using the Internet to search for information on pregnancy, breastfeeding, parenting, child health, and nutrition. The use of apps was low, in that only 30% reported using a health-related or self-help app to stop smoking, lose weight, get healthy eating suggestions, or count steps on their mobile phone. Awareness of Text4baby, CDC texts to pregnant women and new moms,¹³ was also low at 35% of the sample having heard of it.

Table 2. Technology Usage by Low-Income Women

	<i>N</i> (%)
Computer	160
At least once/week	71 (44)
Have a home computer	62 ^a (43)
Mobile phone	161
Own a mobile phone	155 (96)
Type of contract	150
Free from the government	14 (9)
Pay as you go	46 (31)
Monthly	83 (55)
Yearly	7 (5)
Regular phone access >3 years	111 (71)
Changed mobile number (past year)	157
Never	52 (33)
Once	45 (29)
Twice	28 (18)
Three or more times	32 (20)
Unlimited data	103 (66)
Uses for mobile phone	
Applications (apps)	77 (49)
Camera	117 (75)
E-mail	79 (51)
Games	97 (62)
Internet	116 (74)
Music	107 (69)
Phone calls	151 (97)
Social media (Facebook or other)	94 (60)
Texting	147 (94)
Watching movies, television, videos	56 (36)
Tablets	
Access to iPod touch, iPad, Kindle, eReader, or similar devices	58 (37)
Usage of communications and Internet	
E-mail	161
At least once/week	115 (71)
Days/week mean $\pm$ SD	4.0 $\pm$ 2.4
Internet	154
At least once/week	114 (74)

continued →

Table 2. continued

	<i>N</i> (%)
Days/week mean $\pm$ SD	5.17 $\pm$ 2.4
Social media	161
At least once/week	131 (81)
Days/week mean $\pm$ SD	4.5 $\pm$ 2.6
Use of technology for health	160
Apps (smoking, steps, lose weight, or diet)	48 (30)
Internet for information (pregnancy, breastfeeding, parenting, child's health, or nutrition)	142 (88)

^a*N* for completing this question was 146.

USE OF TECHNOLOGY FOR COUNSELING

The overall interest in health counseling for assistance with healthy eating, managing stress, or quitting smoking through any format was low (24%). Participants were asked about interest and helpfulness of receiving health counseling through the computer, and 36% of women were interested in computers for health counseling if available. Most women (39%) thought that counseling would be a little helpful, followed by 28% selecting moderately helpful, 23% very helpful, and 11% not helpful at all. When asked about their preference for counseling over a computer versus face-to-face in person or a combination of both, few women selected computer-based counseling by itself (8%). The preference for in-person versus computer-based counseling varied by age, but not by race or education. Younger women preferred face-to-face counseling to computer-based counseling, while women over the age of 30 preferred a combination of methods ($\chi^2=9.45$, $p=0.02$). Age had a small to medium effect size on the preference of method for counseling ($\Phi=0.249$; $p=0.02$).

Sixty-eight percent of women expressed some level of interest in receiving treatment for a health issue through a cell phone, ranging from a little (36%) to very interested (11%). Age had a small to medium effect on interest in health counseling over the cell phone ($\Phi=0.23$, $p=0.003$). Forty-six percent of women 29 years of age or younger and 73% of women over 30 were interested in the cell phone for counseling ($\chi^2=7.53$, $p=0.006$).

Effectiveness and convenience of mobile counseling were queried. Thirty-nine percent of women perceived counseling over the cell phone as less effective than in person. Forty-two percent believed it would be more convenient and 34% the same (not more or less convenient than face-to-face counseling). The most frequent concerns expressed about counseling over a cell

Table 3. Women Reporting the Use of Technologies on Mobile Phones, Stratified by Age or Race

USES	AGE			RACE		
	TOTAL	< 30 YEARS	≥30 YEARS	TOTAL	AFRICAN AMERICAN	WHITE
	N	N (%)	N (%)	N	N (%)	N (%)
Apps	77	64 (83)	13 (17) ^a	75	47 (63)	28 (37)
Camera	117	89 (76)	28 (24)	114	70 (61)	44 (39)
E-mail	79	59 (75)	20 (25)	78	53 (68)	25 (32)
Games	97	79 (78)	21 (22)	95	64 (67)	31 (33) ^a
Internet	116	92 (79)	24 (21) ^a	114	72 (63)	42 (37)
Music	107	87 (81)	20 (19) ^b	105	70 (67)	35 (33) ^a
Social media	94	75 (80)	19 (20)	94	56 (60)	38 (40)
Texting	147	110 (75)	37 (25)	114	87 (60)	57 (40)
Watching movies/TV/videos	56	48 (86)	8 (14) ^a	54	39 (72)	15 (28)

χ^2 differences for age categories or race categories.

^a $p \leq 0.05$; ^b $p \leq 0.01$.

phone were confidentiality (14%) and taking too much time (12%). Sixty-eight percent of women had no concerns.

Discussion

Results from this cross-sectional survey study among low-income perinatal women found that rates of mobile phone access were high, similar to rates found in the study by Cibulka et al.⁶ Although our study represents a cross-sectional survey conducted only at one study location, the rates of mobile phone access and use were higher (96%) than in studies by Chilukuri et al.⁹ (90%) and Song et al.⁷ (78%). However, rates of computer access were lower (44%) compared with the studies by Urrutia et al.⁸ (89%) and Song et al.⁷ (51%). These differences may be related as women who do not have access to the Internet using a computer may use their mobile phones, as demonstrated by 74% of our participants. Furthermore, we also had significant findings that study participants who were younger accessed the Internet using a mobile phone more so than by a computer. Finally, more women in our study were found to have changed their mobile phone number in the past year than in the study by Chilukuri et al.⁹ (65% vs. 25%). This is a relevant concern for mobile-based interventions as a change in phone number may result in losing contact temporarily or permanently with the participant. In addition, certain health information or modules may not be delivered to the participant, and depending on the technology platform or program, it may be challenging to resend missed information.

Interventions for low-income women should consider how participants can reliably access the platform the intervention is dependent upon.¹⁴

There were differences in the use of technology by race and age, indicating that specific approaches in various health interventions may appeal to different ages and races. For example, interventions that involve the use of reviewing video clips may be popular among younger women, while specific approaches utilizing music may be appealing to those women who are African American. Further exploration on these differences is needed. Similar to the Pew Research Center¹ finding that Facebook is the most popular social media choice for 83% of American women, our results showed that for our study sample, it was the number one choice for participants (81%). Facebook is already being utilized as an intervention in health promotion. For example, a recent study of young adult cancer survivors within a Facebook-based physical activity intervention indicated that group discussions on Facebook were more likely to contribute to physical activity among the participants ($p=0.040$).¹⁵ Outcomes of a Facebook group-based smoking reduction and cessation intervention of 16 smokers indicated that a week after the intervention, 4 participants (25%) were not smoking.¹⁶ There were no differences found on social media use among women in this study, indicating that this approach could benefit health interventions targeted toward all perinatal women.

A high rate of participants in our study reported using the Internet to search for health-related information. Participants were somewhat receptive to health counseling through the computer or mobile phone. Fewer participants were interested in health interventions delivered by computer compared with mobile phones, in contrast to the study by Urrutia et al.⁸ (36% vs. 52%; 83% vs. 49%). The difference may be related to the specificity of the question as our question was broader, focusing on health interventions, while Urrutia et al.⁸ asked about weight-loss interventions. Rates of mobile counseling interest were comparable with Urrutia's study. These differences suggest that receptiveness rates of mobile counseling remain the same, but computer-based counseling may be more appealing if it is on a specific topic. Furthermore, in our study, women under 30 preferred the use of technology for health counseling. The most commonly endorsed concerns about using mobile phones for health counseling included accessibility, time, and confidentiality.

This study has several limitations. Identifying information was not collected as part of the survey, so it is possible that some participants participated twice. Additionally, participants' responses to eligibility questions could not be verified. While income level was not utilized for eligibility criteria, type of government assistance can be a proxy for income levels. Furthermore, the recruitment settings primarily serve low-income women. Participants represented a convenience sample within a specific geographic location in the United States and were self-selected and thus not generalizable to a larger population of low-income perinatal women. This represents a specific urban healthcare setting that may not generalize to other health centers. However, these data are useful in the development of an intervention targeting this population. There are likely differences in treatment preference based on demographics, characteristics of the sample, and location, so these assessments will help to inform the development of interventions. The age breakdown of women utilized by the authors (<30 or >30) may not accurately depict social media use as it can vary by age. Future research using smaller age ranges may assist in providing further insight. Most questions were locally developed and so reliability and/or validity is unknown. Finally, data for this study were collected in 2014 and technology use rates may be even higher at this point among this population. However, we would expect that interest in technology-delivered interventions and concerns are most likely the same.

There is no large evidence base regarding the feasibility of using technology to help with promoting healthy be-

haviors in low-income pregnant and postpartum women, although many related findings suggest that education dissemination through the Internet is possible and could be effective, as is suggested in this survey. The results of this survey study also demonstrated that low-income pregnant and postpartum women showed some interest in utilizing technology for health-related information and interventions. It is important for researchers and practitioners to address this population's technology concerns and skills related to the use of technology and determine if and how a behavioral health intervention with technology can lead to success.

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No competing financial interests exist.

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