Information Needs and Information-Seeking Processes of Low-Income Pregnant Women in Relation to Digital Maternity Education Resources

Adriana Arcia, PhD, RN

Samantha Stonbraker, PhD, MPH, RN

Eva Rose Asaan Warner, MS, CNM

ABSTRACT

Pregnant women need high-quality, timely information for self-management. The extent to which digital education resources meet their needs is unclear. This study elucidated how low-income pregnant women characterize their digital information needs and seeking processes and identified barriers/facilitators to meeting them. Focus groups bookending field-testing of a digital maternity education resource elicited barriers to and facilitators of Internet access, Internet use patterns, preferred methods to access information, and explored acceptability and desired features of online resources. Content analysis was used to analyze transcripts and six thematic categories were identified. Digital maternity education resources should be flexible, easily shared with loved ones, and responsive to users' experiences. Although helpful, digital resources are insufficient to meet pregnant women's need for social support.

The Journal of Perinatal Education, 28(3), 151–162, <http://dx.doi.org/10.1891/1058-1243.28.3.151>

Keywords: information seeking behavior, patient education as topic, prenatal education, social support, consumer health informatics

Pregnant women need high-quality, timely information on which to base their self-management decisions, but short office visits that are concentrated late in pregnancy are insufficient to provide the necessary anticipatory guidance at the time women need it most (Kraschnewski et al., 2014; Lagan, Sinclair, & Kernohan, 2010). For example, traditional childbirth education classes that start in the second trimester occur too late to convey information needed earlier

in the pregnancy, such as the importance of supplementation with folic acid (U.S. Department of Health and Human Services, 2014). Furthermore, only about half of all mothers report attending such classes at all (Declercq, Sakala, Corry, Applebaum, & Herrlich, 2013), which suggests that many pregnant women are not getting the information that they need given the current methods of information provision. In response, pregnant women frequently

consult digital technologies such as the Internet or mobile health applications to answer their maternity questions (Arcia, 2013; Declercq et al., 2013; Huberty, Dinkel, Beets, & Coleman, 2013; Lagan et al., 2010; Larsson, 2009; Laz & Berenson, 2013; Lima-Pereira, Bermudez-Tamayo, & Jasienska, 2012; Narasimhulu, Karakash, Weedon, & Minkoff, 2016; Rodger et al., 2013; Sayakhot & Carolan-Olah, 2016; Scaioli et al., 2015; Wallwiener et al., 2016), in spite of some women's doubts about the trustworthiness of available information (Larsson, 2009; Lee & Moon, 2016; Lupton, 2016; Narasimhulu et al., 2016; O'Donnell, Lewkowitz, Vargas, & Zlatnik, 2016). However, the extent to which these digital maternity education resources (i.e., the Internet, health portals, and mobile apps) are actually sufficient to meet the needs of low-income women, who are known to encounter barriers to accessing and using available information, is unclear (Shieh, Mays, McDaniel, & Yu, 2009).

Ensuring that correct and timely information is genuinely accessible to low-income pregnant women requires a thorough understanding of their specific information needs, information-seeking processes, and the factors that influence both. Therefore, the purpose of this paper is to report on a qualitative exploration of the following questions: (a) how do low-income pregnant women characterize their information needs and information-seeking processes as they relate to digital resources? and (b) what factors do they identify as barriers and facilitators to meeting those needs? Our findings build upon previous studies focused specifically on low-income women in the United States (Guendelman, Broderick, Mlo, Gemmill, & Lindeman, 2017; Guerra-Reyes, Christie, Prabhakar, Harris, & Siek, 2016; Kraschnewski et al., 2014; Shieh, Broome, & Stump, 2010; Shieh, McDaniel, & Ke, 2009; Song, Cramer, McRoy, & May, 2013). Similar to other studies of pregnant women's information-seeking (Hsieh & Brennan, 2005; Shieh et al., 2010; Shieh, McDaniel, et al., 2009), we view our findings through the lens of Wilson's 1996 Model of Information Behavior which is meant to guide information studies through a comprehensive search of factors related to the information-seeking process (Wilson, 1999). In this model, the process of acquiring information is unique to each information seeker or "person-in-context" and depicts the process through which individuals must travel to acquire required information. According to Wilson, the process begins with recognition of an information need, then moves through

identifying sources of information (marked by barriers and facilitators of numerous origins), and culminates when the individual seeking information is able to acquire and use the needed information (Wilson, 1999).

LITERATURE REVIEW

Information Needs and Sources During Pregnancy

Health topics of greatest general interest to pregnant women include maintenance of a healthy lifestyle (Arnold et al., 2001; Lagan et al., 2010; Scaioli et al., 2015; Shieh, McDaniel, et al., 2009)—especially nutrition (Da Costa et al., 2015; Larsson, 2009; Narasimhulu et al., 2016; Sayakhot & Carolan-Olah, 2016) and physical activity (Cannella, Lobel, & Monheit, 2010; Da Costa et al., 2015; Huberty et al., 2013)—medications (Hämeen-Anttila et al., 2015; Shieh, McDaniel, et al., 2009), fetal development (Lagan et al., 2010; Larsson, 2009; Narasimhulu et al., 2016; Sayakhot & Carolan-Olah, 2016; Scaioli et al., 2015; Shieh, McDaniel, et al., 2009), genetic screening (Durand, Stiel, Boivin, & Elwyn, 2010), breastfeeding (Scaioli et al., 2015; Shieh, McDaniel, et al., 2009), and physiology and complications of pregnancy and birth (Lagan et al., 2010; Larsson, 2009; Lima-Pereira et al., 2012; Narasimhulu et al., 2016; Scaioli et al., 2015). Women may seek additional condition-specific information, for example, following discovery of elevated risk for fetal anomalies (Lowe, Powell, Griffiths, Thorogood, & Locock, 2009) and low-income women have been shown to seek information about jobs and government assistance (e.g., Women, Infants, and Children [WIC]) (Song et al., 2013).

The Internet is used as an information source by approximately twice as many women as use mobile apps (Rodger et al., 2013; Wallwiener et al., 2016). Search engines, such as Google, are the most frequent starting point for information-seeking; commercial pregnancy-specific sites such as BabyCenter, What to Expect and YouTube also are popular (Lagan et al., 2010; Rodger et al., 2013). Nondigital information sources include family members, health-care providers, friends, books, magazines, and TV shows (Arcia, 2013; Cannella et al., 2010; Song et al., 2013).

Reasons for Information-Seeking

Women are motivated to (a) be knowledgeable about pregnancy in general, especially to prepare for unknown eventualities; (b) have control over the amount, timing, and sources of information; (c)

get anticipatory guidance; (d) determine if signs or symptoms are normal or cause for concern; (e) get support for their decision making; (f) validate the trustworthiness of information; and (g) obtain social support (Cohen & Raymond, 2011; Kraschnewski et al., 2014; Lagan, Sinclair, & Kernohan, 2011; Lewallen & Côté-Arsenault, 2014; Lowe et al., 2009; Lupton, 2016). Many of the same motivators continue into the postpartum period (Evans, Donelle, & Hume-Loveland, 2012; Slomian et al., 2017).

Limited Health Literacy as a Barrier to Information Use

Limited health literacy (LHL) can be a barrier for pregnant women to finding and correctly interpreting maternity health information (Arnold et al., 2001; De Santis et al., 2010). This is of particular concern among disadvantaged populations because, compared to the general population, rates of LHL are higher among people of color, individuals with low income, and individuals with low educational attainment (Paasche-Orlow, Parker, Gazmararian, Nielsen-Bohlman, & Rudd, 2005). Among pregnant women, LHL has been associated with lower medication adherence (Lupattelli, Picinardi, Einarson, & Nordeng, 2014), less understanding of screening tests (Cho, Plunkett, Wolf, Simon, & Grobman, 2007), a higher likelihood of smoking during pregnancy (Arnold et al., 2001), and those with LHL may have more difficulty enrolling in mobile programs than their higher literacy counterparts (Gazmararian, Yang, Elon, Graham, & Parker, 2012). Other correlates of LHL include a higher need for information regarding medications during pregnancy (Hämeen-Anttila et al., 2015), a decreased propensity to search for pregnancy information online (Shieh, Mays, et al., 2009), and maternity information needs that are not met by print materials (Peyton, Poole, Reddy, Kraschnewski, & Chuang, 2014).

Disparities in Use of Digital Resources for Health Information

The ability to find and use needed maternity information is influenced not only by health literacy, but by the related concept of e-health literacy which is “the ability to seek, find, understand, and appraise health information from electronic sources [emphasis added] and apply the knowledge gained to addressing or solving a health problem” (Norman & Skinner, 2006b). Low e-health literacy, along with limited Internet access, are key drivers of disparities in

the use of digital resources for health information seeking in the United States (Bodie & Dutta, 2008; Neter & Brainin, 2012). Disparities are evident along socioeconomic lines as well as among demographic groups that are disproportionately likely to have low incomes. Among adults seen in outpatient settings, health portal adoption is lower for people of color, individuals with lower socioeconomic status, and those without neighborhood broadband access (Perzynski et al., 2017). Among young women recruited from reproductive health clinics, Black and Hispanic women were less likely than White women to seek health information online generally or to seek information specifically about contraception, smoking cessation, weight loss, alcohol/drug use, and mood disorders; they were more likely to seek information about pregnancy tests and sexually transmitted infections (Laz & Berenson, 2013).

Estimates of the proportion of U.S. pregnant women who access the Internet for maternity information vary substantially (71%–97%) between studies that recruited participants offline (Guendelman et al., 2017; Huberty et al., 2013; Narasimhulu et al., 2016). Within these studies however, disparities follow similar patterns to those in the general population; usage estimates are lower among women who have less education (Cannella et al., 2010; Guillory et al., 2014; Narasimhulu et al., 2016), lower incomes (Cannella et al., 2010), limited English proficiency (Narasimhulu et al., 2016), or less social support (Guillory et al., 2014), or who are women of color (Guillory et al., 2014), or are not partnered (Cannella et al., 2010; Guillory et al., 2014).

Research Context

The findings reported here are drawn from a larger study in which we explored the feasibility and acceptability among Medicaid-enrolled pregnant women of an online maternity education platform (Care Guide). The platform is accessible as a mobile-ready website to all clients of midwifery and birth center practices that subscribe to the electronic health record (Maternity Neighborhood) with which the platform is integrated. Care Guide serves as a searchable library of articles and other digital resources;

Ensuring that correct and timely information is genuinely accessible to low-income pregnant women requires a thorough understanding of their specific information needs, information-seeking processes, and the factors that influence both.

providers can add their own content to the existing curated content provided by Lamaze International, Childbirth Connection, and The Dartmouth Institute. Secure messaging allows for client-provider communication around the content, and has the ability to push content to the client automatically via email based on gestational age. Results specific to the platform regarding use patterns, usability findings, and desired features are reported elsewhere (Arcia, 2017).

METHODS

Participants attended two focus group sessions bookending a four week period during which they were invited to field-test Care Guide. We conducted four sets of focus groups (initial session plus follow-up): two sets in English and two in Spanish in New York City from September through December, 2015. The Columbia University Medical Center Institutional Review Board approved the study.

Participants and Setting

Women were eligible to participate if they were pregnant at less than 35 weeks' gestation, were at least 18 years of age, enrolled in Medicaid, able to speak either English or Spanish, and had a WiFi-enabled device to access the Internet (i.e., smartphone, tablet, or computer). Three organizations that provide free or low-cost doula services and an Early Head Start program referred potential participants and provided meeting space for focus groups. Participants were compensated with a \$50 Target gift card for each focus group. Target sample size of six to eight participants per focus group was based on having groups large enough to include a diversity of perspectives but small enough that everyone would have an opportunity to be heard (Kreuger & Casey, 2014).

Measures

At the initial session, participants provided basic demographic data, information about their Internet access patterns, and completed complementary literacy-related measures. The eHealth Literacy Scale (eHEALS) is a self-reported, subjective measure of e-health literacy (Norman & Skinner, 2006a; Paramio Perez, Almagro & Hernando Gomez, 2015) whereas The Newest Vital Sign (NVS)

is an objective, interviewer-administered measure of health literacy with a focus on numeracy (Weiss et al., 2005). Scores on the eHEALS range from 8 to 40 with higher scores indicating higher e-health literacy (Norman & Skinner, 2006a). For the NVS, scores of 0 or 1 indicate a high likelihood of limited literacy, scores of 2 to 3 indicate the possibility of limited literacy, and scores from 4 to 6 almost always indicate adequate literacy (Weiss et al., 2005).

Procedure

Focus group sessions were audio-recorded and led by one or more trained bilingual facilitators using focus group guides. Study staff took notes during sessions. Sessions with two or more study staff present were followed by an audio-recorded peer debriefing session to enhance credibility of findings (Guba & Lincoln, 1989). Focus group sessions solicited participants' views on: (a) barriers to and facilitators of their access to the Internet (e.g., "Do you experience barriers to getting online? If so, what are they?"); (b) Internet use patterns, including social networking, for maternity information (e.g., "How do you use social networking for information about prenatal health?" "When do you look up information regarding your pregnancy and birth?"); (c) preferred methods to access maternity information (e.g., "Where do you look for information about your pregnancy and childbirth?" "Do you use pregnancy/birth websites and/or apps? What do you like/dislike about them?"); and (d) acceptability and desired features of an online, EHR-integrated resource (e.g., "What kinds of things would you like or expect to be able to do with the platform?").

Data Analysis

Audio recordings of focus groups, interviews, and peer debriefing sessions were professionally transcribed and reviewed for accuracy. Conventional content analysis (Hsieh & Shannon, 2005) was used to analyze the transcripts and notes in their original language by bilingual investigators. All coding was done in TAMS Analyzer 4.0. A primary coder (AA) used an inductive approach to allow the codes to emerge from the data. The preliminary set of codes was provided to a secondary coder (ERAW) who then independently coded the transcripts while having the option to add codes as needed. Coders then met and discussed all codes to consensus. The primary coder then clustered the codes into thematic categories that represent the main study

Limited health literacy can be a barrier for pregnant women to finding and correctly interpreting maternity health information.

findings; these were affirmed by the secondary coder. A third researcher (SS) reviewed the audit trail. Simple descriptive statistics were used to analyze quantitative data.

RESULTS

Participants

Of 16 participants in the study, nine participated in the English-language groups and seven in the Spanish-language groups (Table 1). Participants' average age was 26.0 ($SD = 5.6$) and at the start of the study their average gestational age was 24 weeks, 0 days (range 13/5 to 32/2). Participants were predominantly women of color, evenly split between Hispanic and non-Hispanic, had an average income of \$4,809 ($SD = \$4,842$) per household member per year, and over half (62%, $n = 10$) were married or living with a partner. The majority (69%, $n = 11$) used Android devices and had high-speed Internet at home (69%, $n = 11$). Just under half the participants (44%, $n = 7$) had unlimited mobile data, and most (88%, $n = 14$) rated themselves as either "intermediate" or "expert" Internet users. As classified by the NVS, the majority of participants (69%, $n = 11$) are likely to have LHL. Despite that, they felt confident about their ability to find and use health resources on the Internet, based on their eHEALS scores ($M = 31.5$, $SD = 4.4$).

Focus Groups

Six thematic categories emerged from the data and are described below. Participant quotations in this section are in double quotes. Additional quotes that illustrate the thematic categories are presented in Table 2.

Unique Experience. Participants repeatedly emphasized, "every pregnancy is different." We noted a reciprocal relationship between women's unique experiences and their information needs where certain aspects of a woman's experience would prompt specific information needs. The information received in response to that need might then influence the woman's self-management (e.g., using oatmeal soap to calm itchy skin). As such, the information, advice, and opinions offered by family, friends, and online commenters may or may not be applicable to a specific pregnancy. For that reason, participants relied upon their own judgment and that of their care provider as the ultimate arbiters of information relevance. Given the critical importance of the provider's judgment, participants regarded trust, an adequate flow of

TABLE 1

Participant Characteristics

Characteristic	<i>N</i>	(%)
Preferred language and parity		
English, nulliparous	6	(38)
English, multiparous	3	(18)
Spanish, nulliparous	1	(6)
Spanish, multiparous	6	(38)
Race/Ethnicity		
Hispanic	8	(50)
African American/Black	4	(25)
Non-Hispanic White	1	(6)
More Than One Race or Other	3	(18)
Partnership		
Married or living with partner	10	(62)
Single, never married or separated	6	(38)
Prenatal care provider		
Midwife	4	(25)
Obstetrician	4	(25)
Both	8	(50)
High-speed Internet at home		
Yes	11	(69)
No	5	(31)
Mobile data plan		
Unlimited data	7	(44)
Throttled ^a	2	(12)
Limited or unknown	7	(44)
Mobile platform		
Android	11	(69)
iPhone	5	(31)
How would you rate yourself as a user on the Internet?		
Beginning user	2	(12)
Intermediate user	7	(44)
Expert user	7	(44)
Newest Vital Sign score		
0–1, high likelihood of limited literacy	1	(6)
2–3, possibility of limited literacy	10	(62)
4–6, almost always adequate literacy	5	(31)
	<i>M</i>	<i>(SD)</i>
Participant Age	26.0	(5.6)
Gestational age, weeks/days	24w 0d	(6w 5.5d)
Gestational age, days	168	(47.5)
Income per household member per year ($n = 12$)	\$4,809	(\$4,842)
eHealth Literacy Scale score ($n = 15$) ^b	31.5	(4.4)

Note. eHEALS = eHealth Literacy Scale; NVS = Newest Vital Sign.

^a Data usage is unlimited but download speeds are substantially reduced at a predetermined threshold, such as 1GB.

^b Higher scores indicate higher e-literacy; scores may range from 8 to 40.

TABLE 2

Participant Quotations to Illustrate Thematic Categories

Thematic Category	Quotation
Unique Experience	<p><i>"Every pregnancy is different."</i> (Sapphire, 21, nullipara)</p> <p><i>"I don't feel like I should go to, like Facebook or Twitter to ask about pregnancy, you know? To me, every person's pregnancy is different, so I can't go on what she says with my pregnancy."</i> (Beryl, 24, multipara)</p>
Information Need	<p><i>"You know what? I have lots of questions."</i> (Amethyst, 21, multipara)</p> <p><i>"The more information you give me, I am like the happiest person in the world."</i> (Topaz, 23, nullipara)</p> <p><i>"¿Pero es normal que les dé dolor de cabeza en el embarazo? [But is it normal for women to get headaches during pregnancy?]"</i> (Hyacinth, 29, multipara)</p>
Access to Digital Resources	<p><i>"Bueno, a veces son las páginas que no puedo entrar, no sé cuál será el problema. [Well, sometimes there are web pages I can't access but I don't know what the problem might be.]"</i> (Marigold, 33, multipara)</p> <p><i>"If I am on a website that is, like, more geared towards, like, scientific names and stuff or medical terms, then I might look at it a little sideways."</i> (Topaz, 23, nullipara)</p>
Information-Seeking Process	<p><i>"What did I ask Google today? I have questions for Google every day."</i> (Sapphire, 21, nullipara)</p> <p><i>"WebMD is my friend."</i> (Pearl, 26, nullipara)</p> <p><i>"I'll bring questions to the table and then the appointment, like reflecting on the appointment after will have more questions. So then that brings me to the computer."</i> (Opal, 24, nullipara)</p> <p><i>"I will go anywhere, get any information."</i> (Beryl, 24, multipara)</p>
Trustworthiness of Information	<p><i>"Bueno, yo más o menos le evalúo que, que tenga algo que ver con lo que el doctor me dijo. [Well, I more or less evaluate if it relates to something my doctor has told me.]"</i> (Marigold, 33, multipara)</p> <p><i>"It's always good to have different sources and not just one thing."</i> (Diamond, 23, nullipara)</p>
Need for Social Support	<p><i>"Well, there's not a lot of places that you can go as a mom, and you know, just hear other moms."</i> (Beryl, 24, multipara)</p> <p><i>"I feel like it's easier to connect that way when you already have some common ground."</i> (Opal, 24, nullipara, on the prospect of meeting other clients of the same midwifery practice)</p>

Note. Quotes are identified with participant pseudonyms; flower names for Spanish speakers and gemstone names for English speakers.

information, and responsiveness to their queries as hallmarks of a good client-provider relationship.

Women's health beliefs influenced their self-management practices and thus their unique experiences. Some beliefs were beneficial (e.g., importance of healthy eating) but others were problematic (e.g., one can become "immune" to medication or the flu shot will make you sick). Regardless, these beliefs were stated with conviction—sometimes repeatedly—suggesting they were deeply held and thus, not easily challenged.

Women who had previously been pregnant expressed how that experience influenced their

current pregnancy, including the amount and nature of their information needs. For example, one participant with a history of preterm rupture of membranes sought information to help prevent a recurrence. Additionally, multiparas generally had fewer doubts and questions than nulliparas, unless a new pregnancy complication raised novel concerns. In an exception to this pattern, several Spanish-speaking multiparas said they still felt like "primerizas" (first-time mothers) because they received so little information for prior births in their countries of origin.

Information Need. Participants' numerous information needs spanned a wide variety of topics (e.g., pregnancy discomforts, environmental exposures, cloth diapering) and levels of complexity (e.g., How

The trustworthiness of information sources plays a crucial role in the information seeking process.

many months is eight weeks? Or, what are differences in compounds to treat anemia?). Their preferences for information format (text, audio, video, etc.) varied widely. When in need of expertise, they most often sought care providers and experienced mothers. Because two key types of information needs were anticipatory guidance and decision support, the timing of information was important. Participants were very receptive to receiving anticipatory guidance in the form of content pushed to them via email on the basis of their gestational age (Arcia, 2017).

Participants gave several examples of information failure. None of the participants' providers recommended reputable online resources. Resources they found independently were sometimes poorly organized or full of jargon that was difficult to understand. Sometimes they were unable to find what they sought if they lacked knowledge of the associated terminology (e.g., placenta previa) or its correct spelling. One participant felt that she could have refused an induction, that she subsequently learned was likely unnecessary, if she had received more information about the topic during that pregnancy.

Access to Digital Resources. A key facilitator of access to digital resources for the majority (69%) of participants was having high-speed Internet access at home. For those without home Internet access, barriers included losing signal, running out of battery power, and limited mobile data. Other barriers mentioned were slow, outdated devices and lack of time for information-seeking. Solutions to those barriers included finding free WiFi, accessing the Internet from a public library or a friend's home, rationing data only to essential tasks, and using a portable charger. Participants' self-reported use of digital resources reflected their apparent level of comfort with technology. Among digital newcomers, most of whom were Spanish speakers, we saw some who required hands-on assistance with basic tasks (e.g., setting a password or using email) and others who had gained enough proficiency to report comfort with online messaging and viewing informational videos on YouTube. Our Spanish speakers reported occasionally using translation tools, however, language was still reported as a barrier. Participants only reported issues with comprehension of online resources when content was full of jargon or was as one participant put it, "doctor-ish."

Information-Seeking Process. Participants described using numerous digital resources as part of

their information-seeking process including Google, WebMD, Baby Center, YouTube, El ABC del Beb, What to Expect, and apps such as Ovia Pregnancy, and Mi Embarazo Da a Da. By contrast, most showed little to no interest in using social media for maternity information. Concerns included privacy, "horrible" comments, potentially unreliable information/advice from strangers on the Internet, and audience members (e.g., male friends on Facebook) who might not be able to relate. One participant who did embrace social media said she liked a closed Facebook group called Mommies Unite. Our search for the group turned up well over 200 groups with close variations on that name with memberships ranging from 1 to over 5,000.

Google and YouTube were most often cited as the starting points for a search strategy. Participants described being very persistent in their searches, ready to do whatever it took to find the information they need. They used emails, texts, and screenshots to share content with a partner, but expressed dissatisfaction with the awkwardness of these strategies.

Trustworthiness of Information. Upon locating relevant information, participants had to determine whether or not the information was trustworthy enough to be acted upon: some self-management actions may be minor, but others can be rather consequential. Participants evaluated trustworthiness by triangulating multiple sources, checking with their provider or other mothers, and using their own common sense or intuition. All but one participant agreed they would be more likely to trust a resource if they knew it had been vetted by their care provider.

Need for Social Support. In every group we noted repeated expressions of need for social support, via both online and offline communities. Participants particularly wanted to connect with experienced mothers in similar circumstances who could provide anticipatory guidance and decision support. Existing online forums were not seen as adequate for meeting this need because participants felt they had no basis to trust the other users and there were limited opportunities to meet in person. Therefore, the ideal online forum would be local and give users common ground upon which to build trust, such as receiving care from the same provider or living in the same neighborhood. Gatekeeping and moderation came up as forum features that can help promote trust while the option to remain anonymous was thought to promote users' comfort. Several participants mentioned

that given the ability to connect and establish trust on a local forum, interaction there could lead to the appealing prospect of meeting in person.

DISCUSSION

Six thematic categories were identified in this study: unique experience, information need, access to digital resources, information-seeking process, trustworthiness of information, and need for social support. The credibility of these categories is supported by their concordance with the concepts in Wilson's Model of Information Behavior, despite having been identified inductively. As is the case in Wilson's model (1999), each person's unique experience with their pregnancy is their context from which information needs arise. Their access to digital resources and social support are the intervening factors that influence their information-seeking behaviors. The trustworthiness of information sources plays a crucial role in the information-seeking process. Then, the way information is provided to pregnant women (i.e., level of readability) is relevant to the processing of information, which leads back into informing the person's unique experience/context just as it does in the Information Behavior model.

The findings in this study are consistent with existing literature on pregnant women's information needs, motivations for information-seeking, and the digital resources they use (Lagan et al., 2011; Narasimhulu et al., 2016; Sayakhot & Carolan-Olah, 2016; Shieh, McDaniel, et al., 2009). They are notably similar to those of Peyton et al. (2014) whose participants repeatedly emphasized the uniqueness of each pregnancy, preferred "Dr. Google" to printed pamphlets, were largely uninterested in discussing their pregnancies on social media, and felt frustrated by existing apps' lack of partner-focused features. Our findings also echo those of Connor, Wambach, and Baird (2018) who studied women's use of mobile apps for perinatal health information. Their participants reported triangulating by using multiple apps, not having received recommendations about high-quality apps from their care providers, and having mixed reactions to social media forums with some participants embracing them and others rejecting them. Although the term "pushed content"

does not appear, Lupton's (2016) focus group participants were similar to ours in that they enjoyed content that "just pops up on your phone" (p. 4 of 10). Song et al. (2013) noted the importance of interpersonal—particularly family—sources of information for populations similar to ours.

This study adds to the existing literature in several ways. One, we have identified ways to make digital resources more responsive to the uniqueness of women's experiences. These include providing resources that are flexible, easily shared with loved ones, and tailored to the characteristics and concerns of the individual. Additionally, women need resources that satisfy questions as they arise but that can also provide anticipatory guidance to satisfy emerging information needs. Two, we have highlighted the specific needs of digital newcomers and those with limited English proficiency and have offered ways to meet those needs such as by offering individualized offline technical support and improving the availability of preferred-language content. Three, we have described some limitations and opportunities associated with the use of digital resources for social support. Chiefly, resources that provide a basis on which to build trust are desirable and preferable, but our participants indicated that online forums do not replace the vital social support provided by offline communities.

This study has the limitations inherent to focus group methodology, including possible social desirability bias. Specifically, our participants may have been motivated to downplay any difficulties they experienced with reading comprehension. We attempted to minimize this bias by fostering an open, nonjudgmental environment and by using open-ended questions but this bias may still have influenced findings.

IMPLICATIONS FOR PRACTICE

Professionals involved in childbirth education are ideally positioned to act upon our findings by promoting the accessibility of digital resources and information, harnessing technology to provide anticipatory guidance, endorsing high-quality resources, and creating opportunities for social support.

Promote Accessibility of Digital Resources and Information

The facets of accessibility highlighted in this study are content, functionality, devices/connectivity, and user

Care providers and educators are uniquely positioned to create opportunities for social support among their clients because they are trusted intermediaries.

skills, any of which can be addressed by professionals. For content to be accessible, it should be plain language (in the client's preferred language), and come in a variety of formats (e.g., audio, video, narrated slideshows, infographics) that reduce demands on literacy and appeal to a variety of client preferences. Functionality that makes it easy to share content between the client and their loved ones can promote accessibility, while features like an interactive two-way glossary can help users with LHL map lay terms to medical ones. Because barriers to access include outdated devices and lack of connectivity, remediation strategies could include subsidizing replacement of obsolete devices and providing loaner hotspots to clients with limited data plans. Given that clinical settings that serve disadvantaged women are often under-resourced themselves, such initiatives might require external support such as federal, state, or foundation funding. Educators can assess clients' comfort with technology to help fill the skill gaps needed to effectively use digital resources. Digital newcomers in particular will require basic, in-person technical support in addition to online tutorials to get started.

Harness Technology to Provide Anticipatory Guidance

Our participants' receptiveness to pushed content suggests that this is an ideal means by which to proactively offer information. For example, we propose that pushed content be used to challenge commonly-held, potentially harmful health beliefs or to address topics in which clients consistently demonstrate knowledge deficits.

Endorse High-Quality Resources

Studies on digital maternity education resources consistently conclude that care providers should become familiar with and recommend reputable sources to their clients (Arcia, 2013; Da Costa et al., 2015; Lewallen & Côté-Arsenault, 2014); this study is no exception. Therefore, we propose that providers can save their clients information-seeking time and triangulation effort by directing them toward high-quality, evidence-based resources. Such recommendations may be particularly important for clients with LHL who may have a diminished ability to accurately judge information quality (De Santis et al., 2010).

Create Opportunities for Social Support

Care providers and educators are uniquely positioned to create opportunities for social support

among their clients because they are trusted intermediaries. Group prenatal care (Kennedy et al., 2009), mothers' groups, and play groups (Strange, Fisher, Howat, & Wood, 2014) are evidence-based strategies for fostering social support. Additional approaches to promote community-building that require minimal resources include offering community bulletin boards and building in social opportunities during childbirth education classes.

CONCLUSION

In this study, we generated a deep understanding of the information needs of Medicaid-enrolled pregnant women. Six thematic categories associated with the information behavior of this population were identified: Unique experience, information need, access to digital resources, information-seeking process, trustworthiness of information, and need for social support. Findings can further inform the design of online and mobile health platforms as well as inform clinicians around important considerations regarding information provision to their low-income pregnant clients.

REFERENCES

- Arcia, A. (2013). US nulliparas' perceptions of roles and of the birth experience as predictors of their delivery preferences. *Midwifery*, 29(8), 885–894. doi:10.1016/j.midw.2012.10.002
- Arcia, A. (2017). Time to push: Use of gestational age in the electronic health record to support delivery of relevant prenatal education content. *eGEMs (Generating Evidence & Methods to Improve Patient Outcomes)*, 5(2), 5. doi: <http://doi.org/10.13063/2327-9214.128>
- Arnold, C. L., Davis, T. C., Berkel, H. J., Jackson, R. H., Nandy, I., & London, S. (2001). Smoking status, reading level, and knowledge of tobacco effects among low-income pregnant women. *Preventive Medicine*, 32(4), 313–320. doi:10.1006/pmed.2000.0815
- Bodie, G. D., & Dutta, M. J. (2008). Understanding health literacy for strategic health marketing: eHealth literacy, health disparities, and the digital divide. *Health Marketing Quarterly*, 25(1–2), 175–203. doi:10.1080/07359680802126301
- Cannella, D., Lobel, M., & Monheit, A. (2010). Knowing is believing: Information and attitudes towards physical activity during pregnancy. *Journal of Psychosomatic Obstetrics & Gynecology*, 31(4), 236–242. doi:10.3109/0167482X.2010.525269
- Cho, R. N., Plunkett, B. A., Wolf, M. S., Simon, C. E., & Grobman, W. A. (2007). Health literacy and patient understanding of screening tests for aneuploidy and neural tube defects. *Prenatal Diagnosis*, 27(5), 463–467. doi:10.1002/pd.1712

- Cohen, J. H., & Raymond, J. M. (2011). How the Internet is giving birth (to) a new social order. *Information, Communication & Society*, 14(6), 937–957. doi:10.1080/1369118X.2011.582132
- Connor, K., Wambach, K., & Baird, M. (2018). Descriptive, qualitative study of women who use mobile health applications to obtain perinatal health information. *Journal of Obstetric, Gynecologic & Neonatal Nursing*, 47(6), 728–737. doi:10.1016/j.jogn.2018.04.138
- Da Costa, D., Zelkowitz, P., Bailey, K., Cruz, R., Bernard, J. C., Dasgupta, K., . . . Khalife, S. (2015). Results of a needs assessment to guide the development of a website to enhance emotional wellness and healthy behaviors during pregnancy. *The Journal of Perinatal Education*, 24(4), 213–224. doi:10.1891/1058-1243.24.4.213
- De Santis, M., De Luca, C., Quattrocchi, T., Visconti, D., Cesari, E., Mappa, I., . . . Caruso, A. (2010). Use of the Internet by women seeking information about potentially teratogenic agents. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 151(2), 154–157. doi:10.1016/j.ejogrb.2010.04.018
- Declercq, E., Sakala, C., Corry, M. P., Applebaum, S., & Herrlich, A. (2013). *Listening to mothers III: Pregnancy and birth*. New York, NY: Childbirth Connection.
- Durand, M. A., Stiel, M., Boivin, J., & Elwyn, G. (2010). Information and decision support needs of parents considering amniocentesis: Interviews with pregnant women and health professionals. *Health Expectations*, 13(2), 125–138. doi:10.1111/j.1369-7625.2009.00544.x
- Evans, M., Donelle, L., & Hume-Loveland, L. (2012). Social support and online postpartum depression discussion groups: A content analysis. *Patient Education and Counseling*, 87(3), 405–410. doi:10.1016/j.pec.2011.09.011
- Gazmararian, J. A., Yang, B., Elon, L., Graham, M., & Parker, R. (2012). Successful enrollment in Text4Baby more likely with higher health literacy. *Journal of Health Communication*, 17(Suppl. 3), 303–311. doi:10.1080/10810730.2012.712618
- Guba, E. G., & Lincoln, Y. S. (1989). *Fourth generation evaluation*. Newbury Park, CA: Sage.
- Guendelman, S., Broderick, A., Mlo, H., Gemmill, A., & Lindeman, D. (2017). Listening to communities: Mixed-method study of the engagement of disadvantaged mothers and pregnant women with digital health technologies. *Journal of Medical Internet Research*, 19(7), e240. doi:10.2196/jmir.7736
- Guerra-Reyes, L., Christie, V. M., Prabhakar, A., Harris, A. L., & Siek, K. A. (2016). Postpartum health information seeking using mobile phones: Experiences of low-income mothers. *Maternal and Child Health Journal*, 20(1), 13–21. doi:10.1007/s10995-016-2185-8
- Guillory, J., Niederdeppe, J., Kim, H., Pollak, J., Graham, M., Olson, C., & Gay, G. (2014). Does social support predict pregnant mothers' information seeking behaviors on an educational website? *Maternal and Child Health Journal*, 18(9), 2218–2225. doi:10.1007/s10995-014-1471-6
- Hämeen-Anttila, K., Kokki, E., Lupattelli, A., Nordeng, H., Jyrkkä, J., Vainio, K., & Enlund, H. (2015). Factors associated with the need for information about medicines among pregnant women—A multinational internet-based survey. *Research in Social and Administrative Pharmacy*, 11(2), 297–302. doi:10.1016/j.sapharm.2014.06.003
- Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research*, 15, 1277–1288. doi:10.1177/1049732305276687
- Hsieh, Y., & Brennan, P. F. (2005). What are pregnant women's information needs and information seeking behaviors prior to their prenatal genetic counseling? *AMIA Annual Symposium Proceedings, 2005*, 355–359
- Huberty, J., Dinkel, D., Beets, M. W., & Coleman, J. (2013). Describing the use of the internet for health, physical activity, and nutrition information in pregnant women. *Maternal and Child Health Journal*, 17(8), 1363–1372. doi:10.1007/s10995-012-1160-2
- Kennedy, H. P., Farrell, T., Paden, R., Hill, S., Jolivet, R., Willetts, J., & Rising, S. S. (2009). "I wasn't alone"—A study of group prenatal care in the military. *Journal of Midwifery & Women's Health*, 54, 176–183. doi:10.1016/j.jmwh.2008.11.004
- Kraschewski, J. L., Chuang, C. H., Poole, E. S., Peyton, T., Blubaugh, I., Pauli, J., . . . Reddy, M. (2014). Paging "Dr. Google": Does technology fill the gap created by the prenatal care visit structure? Qualitative focus group study with pregnant women. *Journal of Medical Internet Research*, 16(6), e147. doi:10.2196/jmir.3385
- Kreuger, R. A., & Casey, M. A. (2014). *Focus groups: A practical guide for applied research* (5th ed.). Thousand Oaks, CA: Sage.
- Lagan, B. M., Sinclair, M., & Kernohan, W. G. (2010). Internet use in pregnancy informs women's decision making: A web-based survey. *Birth*, 37, 106–115. doi:10.1111/j.1523-536X.2010.00390.x
- Lagan, B. M., Sinclair, M., & Kernohan, W. G. (2011). What is the impact of the Internet on decision-making in pregnancy? A global study. *Birth*, 38, 336–345. doi:10.1111/j.1523-536X.2011.00488.x
- Larsson, M. (2009). A descriptive study of the use of the Internet by women seeking pregnancy-related information. *Midwifery*, 25(1), 14–20. doi:10.1016/j.midw.2007.01.010
- Laz, T. H., & Berenson, A. B. (2013). Racial and ethnic disparities in Internet use for seeking health information among young women. *Journal of Health Communication*, 18(2), 250–260. doi:10.1080/10810730.2012.707292
- Lee, Y., & Moon, M. (2016). Utilization and content evaluation of mobile applications for pregnancy, birth, and child care. *Healthcare Informatics Research*, 22(2), 73–80. doi:10.4258/hir.2016.22.2.73
- Lewallen, L. P., & Côté-Arsenault, D. Y. (2014). Implications for nurses and researchers of Internet use by childbearing women. *Nursing For Women's Health*, 18(5), 392–400. doi:10.1111/1751-486X.12147
- Lima-Pereira, P., Bermudez-Tamayo, C., & Jasienska, G. (2012). Use of the Internet as a source of health information amongst participants of antenatal

- classes. *Journal of Clinical Nursing*, 21(3–4), 322–330. doi:10.1111/j.1365-2702.2011.03910.x
- Lowe, P., Powell, J., Griffiths, F., Thorogood, M., & Locock, L. (2009). Making it all normal: The role of the internet in problematic pregnancy. *Qualitative Health Research*, 19(10), 1476–1484. doi:10.1177/1049732309348368
- Lupattelli, A., Picinardi, M., Einarson, A., & Nordeng, H. (2014). Health literacy and its association with perception of teratogenic risks and health behavior during pregnancy. *Patient Education and Counseling*, 96(2), 171–178. doi:10.1016/j.pec.2014.04.014
- Lupton, D. (2016). The use and value of digital media for information about pregnancy and early motherhood: A focus group study. *BMC Pregnancy Childbirth*, 16(1), 171. doi:10.1186/s12884-016-0971-3
- Narasimhulu, D. M., Karakash, S., Weedon, J., & Minkoff, H. (2016). Patterns of Internet use by pregnant women, and reliability of pregnancy-related searches. *Maternal and Child Health Journal*, 20(12), 2502–2509. doi:10.1007/s10995-016-2075-0
- Neter, E., & Brainin, E. (2012). eHealth literacy: Extending the digital divide to the realm of health information. *Journal of Medical Internet Research*, 14(1), e19. doi:10.2196/jmir.1619
- Norman, C. D., & Skinner, H. A. (2006a). eHEALS: The eHealth literacy scale. *Journal of Medical Internet Research*, 8(4), e27. doi:10.2196/jmir.8.4.e27
- Norman, C. D., & Skinner, H. A. (2006b). eHealth literacy: Essential skills for consumer health in a networked world. *Journal of Medical Internet Research*, 8(2), e9. doi:10.2196/jmir.8.2.e9
- O'Donnell, B., Lewkowicz, A., Vargas, J., & Zlatnik, M. (2016). Examining pregnancy-specific smartphone applications: What are patients being told? *Journal of Perinatology*, 36, 802–807. doi:10.1038/jp.2016.77
- Paasche-Orlow, M. K., Parker, R. M., Gazmararian, J. A., Nielsen-Bohlman, L. T., & Rudd, R. R. (2005). The prevalence of limited health literacy. *Journal of General Internal Medicine*, 20, 175–184. doi:10.1111/j.1525-1497.2005.40245.x
- Paramio Perez, G., Almagro, B. J., Hernando Gomez, A., & Aguaded Gomez, J. I. (2015). [Validation of the eHealth Literacy Scale (eHEALS) in Spanish university students]. *Revista Espanola de Salud Publica*, 89(3), 329–338. doi:10.4321/S1135-57272015000300010
- Perzynski, A. T., Roach, M. J., Shick, S., Callahan, B., Gunzler, D., Cebul, R., . . . Einstadter, D. (2017). Patient portals and broadband internet inequality. *Journal of the American Medical Informatics Association*, 24(5), 927–932. doi:10.1093/jamia/ocx020
- Peyton, T., Poole, E., Reddy, M., Kraschnewski, J., & Chuang, C. (2014). *Every pregnancy is different: Designing mHealth for the pregnancy ecology*. Paper presented at the Proceedings of the 2014 Conference on Designing Interactive Systems. Retrieved from <https://pdfs.semanticscholar.org/9eef/9d9a40eb393aa87e82a27c653d089b95608e.pdf>
- Rodger, D., Skuse, A., Wilmore, M., Humphreys, S., Dalton, J., Flabouris, M., & Clifton, V. L. (2013). Pregnant women's use of information and communications technologies to access pregnancy-related health information in South Australia. *Australian Journal of Primary Health*, 19(4), 308–312. doi:10.1071/py13029
- Sayakhot, P., & Carolan-Olah, M. (2016). Internet use by pregnant women seeking pregnancy-related information: A systematic review. *BMC Pregnancy Childbirth*, 16, 65. doi:10.1186/s12884-016-0856-5
- Scaioni, G., Bert, F., Galis, V., Brusaferrro, S., De Vito, E., La Torre, G., . . . Siliquini, R. (2015). Pregnancy and Internet: Sociodemographic and geographic differences in e-health practice. Results from an Italian multicenter study. *Public Health*, 129(9), 1258–1266. doi:10.1016/j.puhe.2015.06.012
- Shieh, C., Broome, M. E., & Stump, T. E. (2010). Factors associated with health information-seeking in low-income pregnant women. *Women & Health*, 50(5), 426–442. doi:10.1080/03630242.2010.506152
- Shieh, C., Mays, R., McDaniel, A., & Yu, J. (2009). Health literacy and its association with the use of information sources and with barriers to information seeking in clinic-based pregnant women. *Health Care for Women International*, 30(11), 971–988. doi:10.1080/07399330903052152
- Shieh, C., McDaniel, A., & Ke, I. (2009). Information-seeking and its predictors in low-income pregnant women. *Journal of Midwifery & Women's Health*, 54(5), 364–372. doi:10.1016/j.jmwh.2008.12.017
- Slomian, J., Emonts, P., Vigneron, L., Acconcia, A., Reginster, J. Y., Oumourgh, M., & Bruyere, O. (2017). Meeting the needs of mothers during the postpartum period: Using co-creation workshops to find technological solutions. *JMIR Research Protocols*, 6(5), e76. doi:10.2196/resprot.6831
- Song, H., Cramer, E. M., McRoy, S., & May, A. (2013). Information needs seeking behaviors, and support among low-income expectant women. *Women & Health*, 53(8), 824–842. doi:10.1080/03630242.2013.831019
- Strange, C., Fisher, C., Howat, P., & Wood, L. (2014). Fostering supportive community connections through mothers' groups and playgroups. *Journal of Advanced Nursing*, 70(12), 2835–2846. doi:10.1111/jan.12435
- U.S. Department of Health and Human Services. (2014). *Healthy people 2020 maternal, infant, and child health objectives*. Retrieved from <https://www.healthypeople.gov/2020/topics-objectives/topic/maternal-infant-and-child-health/objectives>
- Wallwiener, S., Muller, M., Doster, A., Laserer, W., Reck, C., Pauluschke-Frohlich, J., . . . Wallwiener, M. (2016). Pregnancy eHealth and mHealth: User proportions and characteristics of pregnant women using web-based information sources—A cross-sectional study. *Archives of Gynecology and Obstetrics*, 294(5), 937–944. doi:10.1007/s00404-016-4093-y
- Weiss, B. D., Mays, M. Z., Martz, W., Castro, K. M., DeWalt, D. A., Pignone, M. P., . . . Hale, F. A. (2005). Quick assessment of literacy in primary care: The newest vital sign. *Annals of Family Medicine*, 3, 514–522. doi:10.1370/afm.405
- Wilson, T. D. (1999). Models in information behaviour research. *Journal of Documentation*, 55(3), 249–270.

DISCLOSURE

The authors have no relevant financial interest or affiliations with any commercial interests related to the subjects discussed within this article.

ACKNOWLEDGMENTS

We are grateful to Heidi Luft, PhD, BSN, RN, and Caroline Handschuh, PhD, CNM, for their assistance with data collection. Many thanks to Ancient Song Doula Services, Healthy Start Brooklyn, Northern Manhattan Perinatal Partnership, and Columbia University Early Head Start for assistance with participant recruitment and meeting space. This study would not have been possible without the collaboration of Brynne Potter and Deren Bader at Maternity Neighborhood, who also

provided the mobile hotspots used in this study. This research was funded by Columbia University Provost's Grants Program for Junior Faculty Who Contribute to the Diversity Goals of the University. Dr. Stonbraker was supported by the Reducing Health Disparities through Informatics (RHeaDI) T32 NR007969 and Training in Interdisciplinary Research to Prevent Infections (TIRI) T32 NR013454 training grants.

ADRIANA ARCIA is an Assistant Professor of Nursing at CUMC, Columbia University School of Nursing. SAMANTHA STONBRAKER is an Associate Research Scientist, Columbia University School of Nursing. EVA ROSE ASAAN WARNER is a Certified Nurse Midwife, University of New Mexico Hospital.