An Exploration of African-American Pregnant Women's Information-Seeking Behavior in Detroit

Grace Burleson
School of Integrative Systems + Design
University of Michigan
Ann Arbor, MI USA
gburl@umich.edu

Mustafa Naseem
School of Information
University of Michigan
Ann Arbor, MI USA
mnaseem@umich.edu

Kentaro Toyama
School of Information
University of Michigan
Ann Arbor, MI USA
toyama@umich.edu

ABSTRACT

In the United States, African-American women are three times more likely to die of pregnancy-related issues, and 57% more likely to have miscarriages than White women. In part, this is due to deficiencies in the information ecology serving pregnant mothers. We report on a qualitative study with 16 low-income, African-American, pregnant women from the Detroit area, focused on understanding their informational needs and information-seeking behavior. We find that our participants consumed information from multiple sources voraciously; treated formal medical sources as no more trustworthy than other information sources; sought corroborative evidence when making decisions; relied on video and social media sources; and voiced requests for material and social support more than for medical information. Among our recommendations are increased use of video as a means for pregnancy-related information dissemination – particularly testimonials by experienced mothers with similar backgrounds – and better integration of medically sound voices in spaces where mothers already congregate online.

CCS CONCEPTS

• Human-centered computing • Human computer interaction (HCI) • User studies

KEYWORDS

Information seeking, pregnancy, health informatics, peer support, low-income women, online health community

ACM Reference format:

Grace Burleson, Mustafa Naseem and Kentaro Toyama. 2020. An Exploration of African-American Pregnant Women's Information-Seeking Behavior in Detroit. In *Proceedings of ACM Information and Communication Technologies and Development, Guayaquil, USA.* https://doi.org/10.1145/3392561.3394647

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from Permissions@acm.org.

ICTD '20, June 17–20, 2020, Guayaquil, Ecuador

© 2020 Association for Computing Machinery.

ACM ISBN 978-1-4503-8762-0/20/06 $15.00
https://doi.org/10.1145/3392561.3394647

1 Introduction

Improved Maternal and Child Health (MCH) is key to global development. But, while maternal mortality rates have reduced by 44% between 1990–2015 globally [66], in the United States pregnancy related deaths have steadily increased over that time period [58]. This rate is markedly higher for Black women, where pregnancy-related maternal mortality between the years 2011-14 was more than three times higher compared to White women [4]. In the Detroit Metropolitan area, one of the most racially and economically segregated regions in the United States [61], Black women experience more than double the infant-mortality rate [69] and have 1.6 times higher odds of delivering a low birthweight infant [40] compared to White women. At a rate of 14 per 1000 births, the infant-mortality rate for Black children in Detroit is higher than that in some low and middle-income countries (LMIC), including Thailand and Colombia [69]. Furthermore, the maternal mortality rate among *Black women is 58.7 per 100,000 babies — higher than in Libya, Uruguay or Vietnam* [21].

We emphasize that these race-based disparities are due to the larger discriminatory context of U.S. history and current society, because of which Black Americans suffer negative impacts on health due to a range of what the public health community calls "social determinants" [34]. We do not expect that African-American mothers and children will attain health equity without addressing those larger disparities, but information technology likely has a role in alleviating them.

Prior ICTD literature has explored the use of technologies to address maternal health, such as an interactive voice response (IVR) system in Pakistan [2], a bidirectional SMS communication system between expectant parents and community health workers (CHW) in Kenya [53], a mobile data collection system for CHW in Bangladesh [3], and a video-based health information dissemination intervention in India [43]. Research that focuses on the unique needs associated with pregnancy and childcare has also become more common in the human-computer interaction community HCI [18, 19, 22, 29, 43, 53, 56]. These studies have explored online information seeking [22, 43], peer support [29, 35, 41], and communication between care providers and expectant couples [53]. However, most of these studies are *not* focused on

low-income, pregnant women of color in the United States. Meanwhile, in the public health literature, studies have found information-seeking process varies depending on the woman's access to healthcare services, self-efficacy, education level, personal and community resources, social circle, and so on [40, 62, 73, 75]. Relative deficiencies in such resources result in health disadvantages of newborns, particularly among women of color and women of lower socioeconomic status [40, 73] who often delay information and/or advice-seeking compared to both high-income and White women [62, 75]. That literature, however, has relatively little to say that is up-to-date about digital technology use.

In this paper, we explore the information needs of low-income pregnant women in Detroit. This is a context where health disparities are significant, but there is considerable access to technology. We present findings from semi-structured interviews with 16 low-income African-American women. Our main goal was to understand challenges in information access among low-income pregnant women in Detroit, with a longer-term objective of designing technology-enabled mechanisms to bridge the gaps.

Our novel contributions include several new findings and some design implications: First, we found among our participants a range of active technology use along with sophisticated strategies to weigh conflicting information, contradicting previous literature. There were nuanced approaches to social media platforms, sophisticated thought processes around determining credible sources, and innovative strategies used to overcome material needs. Second, we found a noticeable absence of local medical institutions in the online information our participants engaged with. Third, in response to these findings, we suggest technology-based interventions such as (a) direct engagement by local health workers on online platforms that participants themselves already use, and (b) health information videos that include, for example, testimonials from real mothers.

2 Background

The U.S health care system is a complex mix of private and public services [46]. The majority of Americans with access to private insurance programs do so through an employer-sponsored plan. The federal government provides healthcare through a variety of programs including Medicaid (for low-income households), Medicare (for elderly), and other plans for federal and state employees. In Detroit, nearly 50% of the medically insured population is covered with a government sponsored program, while communities of color face the lowest rates of insurance, with Black Americans representing 71% of people uninsured in the city as of 2017 [20]. Barriers for qualifying families of Medicaid include long waiting times, confusing documents, lack of trust in institutions, and technical issues with online applications [52]. In 2018, 9,476 live births were delivered in the city of Detroit [49]. Notably, over 60% of pregnant women in Detroit in 2018 were enrolled in the government-sponsored food assistant program (WIC), compared to 35% in all of Michigan [1].

3 Related Work

There is considerable research on low-income pregnant mothers in U.S. contexts. We limit our review to information-seeking behavior – both online and offline – by pregnant women, with a focus on low-income groups.

3.1 Information- and Support-Seeking by Pregnant Women

Studies have shown that a woman's use of the internet, digital solutions, health providers, and her personal social network increases as she looks for health and wellbeing support [63, 65].

However, barriers to information support and access to necessary resources exist particularly among single, low-income, women of color [28, 39, 59], such as unavailability of technologies, unavailability of family/friends to answer questions, and lack of transportation to resources [63]. For example, low-income women's perceptions of mistreatment during reproductive care, compared to higher-income women, lead to gaps of knowledge in available services and health information [75]. In one study of 203 low-income pregnant women, women of color showed a statistically significant disparity in knowledge of child development compared to White women [59]. There are also gaps in prenatal support, including (1) lack of social support for informational, tangible, and emotional care; (2) personal barriers to self-efficacy, such as low self-esteem and stress; and (3) system barriers, such as inaccessible or ineffective services and fear of complicated information systems [14].

Due to the physical, mental, and emotional health effects of pregnancy, women seek support from individuals who are close to them [54]. Sufficient social support has been shown to improve the health of pregnant women by decreasing stress [26], improving prenatal health behaviors [60], and even directly leading to healthy pregnancy weights [55]. Moreover, increased perception of social support is related to increased health information seeking and increased health knowledge [30, 72]. However, due to inaccessibility, distrust of health care providers or contradictory online information, women may rely on their social circles for the majority of information and support [54], which can become problematic when recommendations contradict with medical advice [64]. A study of low-income pregnant women in Pennsylvania found that women's ideas of health were heavily influenced by a range of folklore knowledge, which sometimes conflicted with professional medical advice [54]. While some literature suggests that a focus on peer-to-peer support and coaching is an important element for low-income, African-American women's health management [31], results from a study of 106 low-income pregnant women in Texas correlated strong social support with a lack of healthy lifestyle [23].

The majority of parents in the United States rely on the internet for both social support and online information [57], particularly as a way to supplement the information received after meeting with a health care provider [36]. Specifically, pregnant women and mothers use internet searches to find personalized health

ID	Age (year)	Number of children	Household income	Medical care organization	Medical insurance provider	Highest level of education
P1	25-34	2	$80,000-159,999	Non-profit practice	Private	Associate degree
P2	25-34	0	<$20,000	Non-profit practice	na*	Some college credit, no degree
P3	25-34	4	<$20,000	Non-profit practice	na	Some high school, no diploma
P4	25-34	2	<$20,000	Private practice	Medicaid	High school graduate
P5	18-24	0	<$20,000	Non-profit practice	Medicaid	Bachelor's degree
P6	18-24	2	<$20,000	None	Medicaid	Some high school, no diploma
P7	35-45	4	$20,000-39,999	na	Medicaid	High school graduate
P8	35-45	na	$40,000-79,999	Non-profit practice	Medicaid	Associate degree
P9	35-45	0	$40,000-79,999	Non-profit practice	Medicaid	Bachelor's degree
P10	18-24	0	<$20,000	Private practice	Medicaid	High school graduate
P11	25-34	2	$20,000-39,999	Non-profit practice	Medicaid	Bachelor's degree
P12	18-24	0	<$20,000	Non-profit practice	Medicaid	Some college credit, no degree
P13	35-45	2	$20,000-39,999	Non-profit practice	Medicaid	Associate degree
P14	25-34	1	$20,000-39,999	Non-profit practice	Medicaid	Associate degree
P15	18-24	0	<$20,000	Non-profit practice	Medicaid	No schooling completed
P16	na	0	$80,000-$159,999	Non-profit practice	Medicaid	Associate degree

*na=no answer

Table 1. Demographics of 16 African-American pregnant women from the greater Detroit are.

information all the while resisting mass media portrayals of women's health [65], likely due to the widespread belief that "every pregnancy is different" [11, 54]. The way women use the internet and the degree of information and social support seeking depends on her age, race, and socio-economic status [45, 57]. A survey of internet usage of 3181 women ages 16-24 found that Black women were significantly less likely to search for health information online compared to White women, suggesting racial disparities in internet usage, overall health awareness, or both [45]. Results from a study of 63 low-income pregnant women in Wisconsin suggested that both a lack of access to internet and skill in navigating online resources results in information disparities among pregnant women of different socioeconomic statuses [64]. Moreover, results from a study of 17 women enrolled in Women, Infant, and Children, a U.S food-assistance program for women and children, highlighted a need for assistance in navigation of online resources [42], agreeing with other sources in the literature that health care providers are underutilizing their opportunity to advise and support women regarding health-focused internet queries [28, 32, 48].

3.2 Digital Technology and Pregnancy

More and more women, particularly in the African-American community, are using social media platforms, such as Facebook, as a place for support and information [6, 65]. A survey of 117 U.S women found that 89% looked to social media for advice related to pregnancy and 84% considered interactions on social media a form of social support [7]. Social media offers a space for influencing health behavior changes [6] and it has been shown that women are more likely to follow recommendations on a site and feel a positive attitude toward being healthy when they perceive social support [33]. Exposure to one-sided comments on posts can influence a reader's opinions, especially when the comments are supported by personal stories [71].

Other digital technologies, such as mobile applications and texting services, are showing promise as a source of information and supportive systems during a woman's pregnancy [44]. Texting and calling services have been developed to push health information to women and positively impact health attitudes and behaviors. SMS services between patients and care providers have shown to be an appropriate way to conveniently provide women with information and appointment reminders during perinatal care [10] and even improve attitudes and health behaviors related to healthy breastfeeding practices [44]. One such example in the U.S is Text4baby, a national e-service that sends texts with health information and supportive materials to enrolled pregnant women. Studies have shown that Text4baby increases level of pregnancy-related knowledge and improves mental health [64], in addition to increasing vaccination rates, especially among women whose provider did not emphasize vaccination [13]. Moreover, results from a randomized controlled trial of 91 overweight pregnant women enrolled in another SMS intervention, txt4two, showed that the technology produced positive physical activity and gestational weight gain outcomes [70].

As of May 2019, there were 915 pregnancy-related applications available on mobile platforms, with 321 unique applications supporting patient participation in prenatal care [25]. A study of low-income pregnant women's use of mobile applications found that the platforms ignored the role of the spouse/partner, overestimated the need for social interactions with strangers, and were unable to provide individualized information in the early stages of pregnancy [55]. Furthermore, results from a study of low-

income pregnant women's use of mobile applications determined four key design features that could improve the outcomes, including: (1) focus on first-trimester self-guided information seeking; (2) design long term content with a "hook" of immediate needs (e.g., nausea); (3) incorporate some, but not all, of the woman's social circle; and (4) design features to align with the woman's perceived pregnancy uniqueness [54]. Further, there is increasing interest in the use of videos, which have led to developments of a video based learning tool in Pakistan [38], mobile videos in India [67], and online health communities [37].

3.3 Digital Tools for Low-Income Pregnant Women

Overall, there are a variety of digital interventions that show promise for improving low-income pregnant women's access to relevant health information, social support, and access to tangible resources. Evidence from the literature review suggests that use of mobile application, texting/calling services, and social networking platforms can improve a woman's self-efficacy during her pregnancy [62] and should be explored specifically for economically and racially disadvantaged mothers who are more likely to experience prenatal material hardships [27, 28]. Additionally, there is potential for physicians, midwives, and community health workers to improve the advice and care they give to their patients through digital interventions [48], particularly in the early stages of pregnancy when women participate in self-guided information-seeking and require skills for identifying, locating, and interpreting online information [16, 42]. However, it is essential that new solutions for low-income women are integrated within existing health ecosystems [15], focus on social support and community-wide education [26, 47, 68], and consider disparities in technology and internet access [17, 30].

4 Methodology

We conducted 16 semi-structured interviews with African-American pregnant women living in and around Detroit, most of whom were low-income. The women were recruited through flyers distributed to local non-profits, posts on local Facebook groups, and through a partnership with a large health system in Detroit that hires community health workers to counsel pregnant women. The flyers listed a phone number, and those who called were screened for inclusion criteria. The inclusion criteria were for the participant to be female, over 18 years of age, currently or recently pregnant (within 3 months of terminating pregnancy) and be a resident of the greater Detroit area. Race was not an explicit screening criterion when we began, but all participants were African-American. The screening interview also asked for the highest educational qualification and current medical insurance type, though no one was declined on these bases.

The interviews were conducted in English by the first author and lasted between 40 and 90 minutes. Most interviews took place at public places such as coffee shops. Seven women brought their children to the interview. IRB approval was received before the start of the study, written informed consent was recorded before the start of the interview, and all interviews were audio recorded. Approximately 15 hours of recording and 350 pages of transcripts were collected. At the end of the interview, each participant was compensated $50 for their time. The interviews were transcribed using a commercial transcription service, and qualitatively coded. Personally identifiable information within the transcripts were anonymized.

The coding process was two-part. First, the first author used a deductive process to cluster data into the following information sources: Medical professionals, Google/internet searches, Facebook groups, Social media, Social circle, Pregnancy-related app, and YouTube/videos. Then, after reading through the data multiple times, all three authors engaged in an inductive coding process that brought out the following additional themes: unwanted advice, information seeking behavior, tangible resource seeking, homelessness, feeling judgment, feeling supported, and decision-making process/behavior. The lead researcher for this study is female in her mid-twenties with prior work experience with marginalized populations and prior personal experience with government-sponsored programs. During interviews, she made efforts to minimize power differentials (dress; meeting at neutral place/place suggested by participant; accommodating family presence; being mindful of participant discomfort; etc.).

5 Findings

Our findings below are organized partly based on the source of information (e.g., different technology platforms), and partly based on pregnancy topic. Since the women made distinct choices based on these categories, many of the substantive themes cluster accordingly.

5.1 Information-Seeking Preferences

Participants in our study sought information from a wide variety of sources. No single source stood out as consistently trustworthy, and preferences depended on the person and their situation. In general, however, our participants overwhelmingly preferred timely, personalized information.

5.1.1 Corroboration of Information and Advice. As with other groups of women [29], our participants sought a combination of experiential and medical advice when they experienced unfamiliar or uncomfortable symptoms. However, we found no consensus regarding the relative trustworthiness of information sources. All of our participants used a range of sources – care providers, medical websites, mom blogs, Facebook groups, other friends – and each relied on a unique combination. P9 for instance, when seeking advice for what to take to help with sleeping, consulted Google first, then her friend. When she later saw her doctor, she asked for their opinion, as well. She stated, *"My friend's doctor may have felt like that was totally okay for her, her body, and her baby. And my doctor, looking at me, might feel like that's not the best thing for me."*

Some women used in-person support groups or Facebook groups they trusted as a way to digest the information available to them from the internet, other women, and their medical providers. P12 mentioned she prefers information from people who she trusts since "*everybody is not out to help you.*" P16 claimed, "*Definitely support groups and websites [help digest all the available information]… Well, some of the really good websites takes you like to dig in, 30 to 40 clicks, clicks, clicks before you're finding the best websites. Of course, they wouldn't get the logical thing up first.*"

All women in our study used Google (mainly from their smartphones) to search for information about unfamiliar symptoms, and they appeared to follow a range of relevant links including blogs, forums, peer-reviewed journals, and medical websites. The participants mentioned that they would read "*whatever pops up*" first or "*whatever catches my eye*" when they search.

Upon obtaining information from multiple sources, the women in our study then relied on their beliefs and instinct to assess the information and make decisions. Many women followed their personal intuition, making claims such as, "*you basically go off of instinct and gut, and you're like, 'Hey…I believe it's true,'* and *it's an instinct thing*" (P14). P3 stated, *If I feel it's helpful, then I'll take it...if not, then I'll say, 'Thank you,' still but won't follow by it.*

5.1.2 Skepticism and Gaps in Medical Care. All of the women in our study regularly met with a medical care provider. Overall, the women listened to their medical care providers. However, many felt that there were gaps in both type and depth of information given, and some expressed frustration with the long time between appointments. They sought and preferred additional information and second opinions from their social network or the internet. Many women referred to the gap in their first trimester when their care provider recommends that they wait until their eighth week of pregnancy for their first appointment. During this time and other gaps in medical care, women commonly referred to Google, their pregnancy-tracking app, or friends and family. Participants often sought information online as a first step for answering urgent questions. P12 mentioned that she goes to the internet first before asking others, mentioning "*I don't want to tell people and they think I'm crazy*." Moreover, P14 described her desire to read information online in addition to her medical care provider, "*I was reading the information online like, 'Hey, did anyone go through this?'... A lot of Googling I did in the beginning of our pregnancy… when I do see any of the doctors or my specialists, I ask questions because yeah. You are afraid. You don't know.*"

Two women, P1 and P7, had consulted their health providers for advice on safe medications to take for a mild headache and cold, respectively. However, both women ended up consulting secondary opinions claiming "*I wasn't hearing what I wanted to hear*" (P7). Likewise, when P16 was prescribed vaccinations by her doctor, she checked with her family regarding the safety of vaccines. P16 related a story about her weight. When her measurements disagreed with the sizes that she read online for her pregnancy stage, her next step was to check in with her bi-monthly support group. She claimed, "*[My preferred place to hear advice regarding measuring my baby is] really the other women. My doctor, medical guy, said that doctors give me more accurate information, but some of them don't have kids or they've never been in the situation. It's just more so something that they put together and it's possibly right or it's possibly wrong.*"

5.1.3 Seeking Responsiveness and Timely Advice. Women preferred timely, even immediate responses, especially for unfamiliar health symptoms. There was a general correlation between responsiveness and trust in an information source. Women described late-night Google-searches, calling friends or family, and contacting medical providers with hotlines. Women who used medical provider hotlines or texting services specifically preferred the responsiveness and mentioned annoyance when having to wait for an answer to their questions. P5 mentioned that her nurse was especially responsive and would answer all of her calls, making her feel extremely supported. Similarly, when asked if she preferred online advice or information from her medical provider, P1 claimed, "*Online you get something right now, immediate. And then with the person to person you may have to wait, until an appointment. For me, both works. I wouldn't consider myself a patient person. I would need something to hold me over until I get my questions answered.*" Likewise, P16 mentioned that her health care provider uses an online app that enables her to text questions to her midwife. However, if the responses were delayed, she calls her best friend for more timely advice.

5.2 Pregnancy Apps

A majority of the participants regularly used a pregnancy-tracking app (14, 87.5%), and mentioned liking pregnancy tracking and week-specific information. Participants often referred to their babies in the language of the apps, e.g., "*my baby is the size of a scallion*" or "*cabbage*."

5.2.1 Week-Specific Information. Those participants who used apps mentioned their enjoyment in watching weekly videos of the baby's growth and specific recommendations for nutrition that would support their baby's current growth stage. P1 mentioned, *"When I am doing the scrolling [in the app] each week, when I notice that the lungs are developing, I may look and say 'Okay, what can we eat this week in our household that is good for developing lungs?'"* She then searched the Internet for nutritional tips based on the stage of the baby's growth. Most women only watched or read the week-specific video or article. Participants pointed out other app features, such as recommended exercise videos, recipes, or additional readings with health information, but only one participant specifically mentioned using these other features. Surprisingly, women ignored the additional information and advice available in the pregnancy-tracking applications. P1, who used What to Expect claimed, "*[Do I ever use any of the App's recommended] exercises? Absolutely not*." P2, who used Ovia stated, "*No [I don't read the recipe recommendations], 'cause I'm*

gonna eat what I want to eat." Another participant described how she "*wouldn't recommend the shopping list of things [recommended by the Baby Center app] that you're supposed to get for your baby before they are born"* because doing so in her first pregnancy left her with "*a lot of stuff that I never even opened*."

5.2.2 Desire for Personalized Information. Women appreciated the perceived personalization of their apps, particularly via push notifications (which they received at least once a week) and tracking features available in some of the apps. P2 enjoyed the perception of support from her app, saying, "*It even suggests like, for instance, if I put that I'm feeling sad or overwhelmed, it will put, 'Well, have you talked to your provider about mental health issues?'"* Some women mentioned wanting even more personalized information from their apps, including health advice and resources available locally. P9 stated, "*I wish sometimes there was an app where I could say, not necessarily 'this is my symptom', but…my app tells me [what to expect this week] but it's so short. So I wish it was a little bit more in depth, like the information was a little bit richer."* Regarding locally available resources, P13 described that her support group used an app that sends out information regarding resources and events for pregnant women in the area. She especially enjoyed reading the notifications and that she could "*pick and choose what I want to go to."*

5.2.3 Application Chat Features. Many apps offered comment or chat features, which most women appreciated since they enjoy seeing *"what other pregnant women are going through*." There was a particular interest in reading about other women who were experiencing similar things or in the same stage of pregnancy as the participant. P8 mentioned how she only reads the comments (not health articles) posted by other women, saying, "*I get [the point of the article] even if you don't read the article, those comments can help. They give it feel like you have people that understand, or somebody out there is experiencing something that you're going through right now."* Another woman described how her app placed her in a group with women with similar expectancy dates. There, P9 enjoyed reading other women's experiences as they were preparing for stage-specific events, such as baby showers, ultrasounds, or glucose tests.

However, one participant highlighted her dislike of "*off-topic"* conversations in her app, Social Moms. P3 said, "*The only thing I don't like about the app is the moms that be on there worried about men cheating, and stuff like that. They just dwell on that.... Why you worried about him?"*

5.2.4 Selecting an Application. Since there are hundreds of pregnancy-related apps available, women mentioned various methods of selecting which app to use. Some found their app through ads on other social media while others used the same platform they were using to track their periods before they became pregnant. Others sought tracking apps on the Apple App Store by reading reviews and trying them out. A few women mentioned looking for apps with the "*most helpful"* and *"insightful"* information that didn't seem "*fluffy*."

5.3 Facebook Groups

Social media research finds that there are Facebook groups for every type of interest [9, 51], so it is not surprising on the one hand that our participants were active in online mom groups. Indeed, we update earlier findings [14] with the news that there are a rich range of Facebook groups for low-income mothers, and those groups are both active and large (e.g., membership in the thousands is common). Exactly half of the women in this study were involved in Facebook groups related to their pregnancy. They joined the groups for a variety of reasons, such as practical information-seeking, emotional support, and general curiosity.

5.3.1 Subject Specific Groups as Judgment Free Zones. Participants in our study reported joining subject-specific groups, including groups for stay-at-home-moms, moms with twins, moms with interracial children, and natural birthing. A key reason for joining was because the groups created an environment where participants felt comfortable asking practical questions specific to their needs and situation. P16, whose partner was a different race than her, participated in a group for moms with interracial children. She reported that the group creates a safe space for moms to post questions, sharing an example of "*asking questions regarding hair-care for children who have hair-types they [mothers] don't have experience with"*; or more serious concerns, e.g., "*How to have discussions with their children who were being bullied at school and called mixed breed*?"

A few participants who were members of Facebook groups mentioned that the online community filled in a gap in support. They went online to escape feelings of being judged by family and close friends. P14 stated, "*It does [make me comfortable to interact with strangers online] because your family are more judgmental than other people... [Your family] know more about you than others*."

Some groups had specific guidelines for posting, such as "*not judging too much"* or "*not being a bully*," and the group administrators performed active moderation to ensure that these guidelines were followed. One group disallowed discussion of abortions entirely to prevent disagreements. However, escape from judgment was not guaranteed. P12 shared that she left a judgmental Facebook group: "*Why come on here and vent and tell y'all what I'm going through and ask for advice if you just going to bash me?"*

5.3.2 Informational, Material and Emotional Support. Consistent with research with other online communities [5, 12], we found our participants turn to Facebook groups for both informational, emotional, and even material support. P16 found Facebook groups provide a "*boost of confidence"* and reported that participating "*makes you feel good inside…to say, 'look I'm not the only one.*'" She mentioned telling any pregnant women she knows to join some type of Facebook group, for the moral support. P14, who had medical complications during her pregnancy, sought support online before telling her family. P7 mentioned that members of Facebook groups sometimes responded to women's stories by sending money: "*Some of the stories make you cry...some*

[people] need help...they be cash-apping people!" (sending money digitally).

Participants also used Facebook groups for informational and material support. While some participants asked for medical advice such as "*how much medicine to give their newborn when they have a fever* or *methods for at-home-births*," others used the groups to search for local resources, such as "*baby items for sale"* or "*places to take kids for fun*." P7 stated, "*I would have saved so much money [if I used Facebook to buy used baby items for my previous pregnancies]*, then mentioned that *more groups specifically for moms selling or giving away baby items would be very useful*."

5.3.3 Participant Concerns about Facebook Groups. Privacy, anonymity, and feeling overwhelmed came up as key participant concerns with participating in Facebook groups. Three informants (P5, P13, and P14) mentioned their initial hesitation to participate in pregnancy-related Facebook groups before telling their family and friends that they were pregnant, as they "*feared that they would see their activity online and be suspicious*." P5 specifically chose not to "*follow anything pregnancy-related,"* but instead used the search feature on Facebook to "*seek information regarding community baby showers, baby items for sale, and free pregnancy classes in the area*."

P14 specifically mentioned her desire to share her unique story with other women, which involved a risky medical procedure during her pregnancy. "*There might be somebody with [my medical condition] and they're doing everything in their power not to get pregnant because they don't know if it's going to affect the baby or not, so just for me to show them, 'Hey, I was pregnant and I done made it to the fourth or the fifth month with no complications. I went through a procedure.'"* However, this participant, P14, had never posted her story because of her need for anonymity. She said, "*I'd be happy to tell the story and yeah, I would love for it to be anonymous because I don't want people to know like, 'Hey, let me find this girl.' Just to tell my story and people will grow from it and understand it."*

P16 mentioned that reading too many stories from other pregnant women online sometimes caused more worry, stating, *"Sometimes it's overwhelming to be in groups, because it's like now I'm more worried. Is this going to happen? Especially when you're a new mom, or then you just realize that everybody is different. But still, the same signs mean the same thing, so it's a lot. It's a lot*."

5.4 YouTube

Our participants used YouTube for informational videos, vlogs, and reality television series. Remarks along the lines of, "*everyone loves a good YouTube video"* and "*YouTube is my life"* were common. Only one participant, P13, mentioned not using YouTube but followed up with the interviewer if there were any recommendations for helpful YouTube videos to watch, saying, *"If there's some good ones out there, I will look at them."*

5.4.1 YouTube as an Information Source. Many women used YouTube to emotionally and practically prepare for giving birth, such as packing for the hospital, learning about C-sections and various natural birthing options. P12 watched videos of women who told their stories of complications after having too much medication during the births of their children, while P16 watched women describe their different experiences with hospital verses at-home births. P5 specifically "*watched a lot of birthing videos*," including C-sections, and discussed her searches for preparing a bag for the hospital, stating, "*I just want to be prepared for anything that might happen. Just anything that pops into my head, pretty much look it up [on YouTube] and they have it."*

Additionally, women often searched YouTube for any symptoms they were having during their pregnancy, seeking reassurance that they were not the only women experiencing such symptoms and conditions. Occasionally, the video searches for symptoms were in search of practical guidance, for example, advice for insomnia. More pragmatic information seeking habits on YouTube included searching for DIY baby crafts, homemade soaps and baby wipes, mental health advice, breastfeeding tips, and general stage-specific growth information. Overall, hearing from other women was preferred, compared to videos of doctors. P16 specifically described how she did not like videos of doctors telling women to stay away from more natural birthing procedure, stating: "*They was just basically saying how women need to get with the times and basically against natural births and stuff, but I didn't like that… I'm not going to lie, it was better hearing it from women that actually been through it than not... you take more into consideration when it's somebody who went through it than a person who never actually experienced what you talking about*."

5.4.2 Valuing Authenticity and Relatable Experiences in Videos. Overall, our participants enjoyed watching and hearing other women for their "*practical"* and "*authentic"* advice, which were especially relatable because of the "*face-to-face"* feeling. Many of the women who had gone through difficult times, such as depression, unique medical conditions, or relationship issues, specifically sought encouraging videos as a *kind of reassurance* and *encouragement*. Faced with depression at the start of her pregnancy, P12 found inspiration from hearing another woman's story who "*still kept a positive mind even though she was threatening a miscarriage after 12 years of not conceiving*."

Two women, P3 and P4, watched reality series, Teen Mom OG and Channel Moms, respectively. P4 claimed, "*They're really helpful. Because you're not going through it by yourself,"* when describing the weekly videos of other pregnant women in similar stages as her. Meanwhile P3 found reassurance in watching a series where the mom was going through similar situations with her children and children's father, she stated, "*It's kind of interesting to watch [Teen Mom OG], what they're doing with their kid...Their daughter and my son's nine. I'm like, wow, that's crazy. They really give you advice too on what not to do, and what to do... Macy been having a problem with Ryan being on drugs. I cannot relate to that, because I haven't had a baby daddy on drugs. But, I do have a baby daddy that's domestic violence. He trying to call from jail, and*

talking about can he see his kids when he get out, all that kind of stuff."

While some women "*like [videos about] everything from everybody,"* others noted a dislike of videos that seemed unrealistic and, ultimately, untrustworthy. P9 mentioned avoiding "*fluffy and curated…influencer-like"* videos, saying "*it's hard to know"* if they are making money from the video or sharing their honest opinion. She appreciated a video where a woman did a review of three different types of breast pumps, however, questioned the validity of the reviews stating: "*Who has money for three breast pumps? I appreciate your video but then I don't know if people have paid you, and that's why you like [the product]*."

5.5 Decision-Making

Decision-making, especially around socially controversial topics such as vaccination or alternative medical practices like home births, relied more heavily on people the participants trusted, not solely on medical advice.

5.5.1 Birthing Methods. Over half of the participants (9, 56.25%) specifically mentioned a desire for more natural birthing methods, often mentioning wanting more "*holistic approaches to pregnancy*." Prior research [24] finds that African-American women in the U.S were overall dissatisfied with the medical aspects of intrapartum care and were likely to consider at-home births to increase their level of control and avoid pharmacological pain relief. Likewise, many of our participants heard stories from their friends and family about doctors urging additional medications or going against their desired birth plans, prompting them to research online to be able to "*go into their appointments prepared*." P1 described her desire for more natural method from her doctors but felt they were unable to support her, which she then turned to the internet and friends for advice.

5.5.2 Breastfeeding. Most of the women who participated in the study (12, 75%) discussed their decision-making process regarding whether or not to breastfeed their newborn. Women watched videos on YouTube, read experiences on Facebook, and consulted with family and friends to help them decide whether to breastfeed or not. Some women took local breastfeeding classes, which gave health information and tips to encourage women to breastfeed rather than use formula (which is free for women enrolled in WIC). To decide about breastfeeding, P2 described, "*[I consult] family and friends, YouTube, Google, my pregnancy app, I go everywhere, I'm using everything. If it come up in my head I just, if I have family around I ask them, 'What do y'all feel about breastfeeding?' like that*." P6 recalled hearing from both the internet and her class that breastfeeding helps prevent SIDS (Sudden Infant Death Syndrome). In addition, she heard from her sister that formula makes babies spit up more; all this information combined prompted P6 to decide to breastfeed her child.

Women also expressed desires for resources for breast pumps, which allow them to have more freedom during breastfeeding by choosing when to extract milk and then store it for later. P7 recalled a story of trying to get a free breast pump during a previous pregnancy that her insurance provided, however the doctor never sent off the paperwork, and she never received the pump.

5.5.3 Vaccination. Two of the participants (2, 12.5%) discussed their information-seeking practices to help with vaccine decision-making. Both of these women, P1 and P16 expressed a need for more corroboration of information between the medical professionals and the personal experiences they or those near them had faced. It is interesting to note that both P1 and P16 have significantly higher combined family income compared to the rest of the participants. P16 mentioned that although she agrees that vaccines are essential for society as a whole, she desires more information (both medical and experiential) to help her decide, stating, "*[I need more information regarding vaccines] to help me more understand the things that's being put into the baby… Just a lot more information… I really think is a good thing... And even the study that kids with this or that reacted to it like this, or kids that had normal, they was normal, they reacted to it with no problem. It's the kids that already have things going on with them that reacted differently to certain live vaccinations."*

5.5.4 Abortion. Three women (P6, P12, and P14) recalled their stories of contemplating terminating their current pregnancies. Two of the women sought various information sources to assist with their decision-making. P12 consulted the internet for both medical information (for example, the physical and emotional effects of abortion) as well as reaching out to hear other women's experiences. Meanwhile, P6 only discussed the matter with her mother and best friend and did not use the internet at all. Ultimately, all three women felt they were empowered to make their decision based on spiritual, personal, and emotional judgment.

5.6 Seeking Tangible Support

Although our interview protocol focused on health-related information-seeking, we found an overwhelming need amongst our participants for non-health-related resources and information. Almost all of our participants (15, 94%) actively sought community-based resources such as pregnancy classes, social workers, food-assistance programs, low-income housing, and assistance navigating government resources. The participants discussed community-sponsored baby showers and other programs that offered free car seats, Pack 'n Plays, clothes, shoes, diapers, and formula; among others. Many women discussed their experiences attending free pregnancy classes in the area, which offered health information sessions along with free baby items. P6 shared, "*All you have to do is go to a class, listen to what they got to say, and afterwards you get the item*." Likewise, multiple women relied on support for transportation services to get to and from medical appointments, mentioning gratefully that some programs offered *Lyft* vouchers.

Our participants also expressed strong wishes that information regarding such resources was more easily accessible and "*all in one place."* In her third pregnancy, P4 was involved in many community-sponsored events but said, "*I wish I had more support with [my first two kids]. I didn't know about classes…I wish somebody had told me there's stuff out here, you just got to get out*

here and get. I wish somebody had told me. I didn't know as much as I know." P16 expressed the desire for more locally available resources to be advertised on social media, stating, "*Everybody's constantly on social media. If little things pop up, like if you search women's anything, maybe stuff like [available resources in the area] should pop up. You know, ways to support pregnant women and things like that."*

Although many women mentioned that there were plenty of resources available, "*You just have to get out there*." P11 mentioned that "*financial literacy training was missing from available resources*." Similarly, navigating government-sponsored programs was a challenge among a few of our participants. P5 shared her experience sitting down with a social worker to apply for health insurance at a center that she found by Googling, claiming, *"I was stressed because I didn't know how to do [get health insurance] myself*." P13 received assistance to apply for WIC from a faith-based health organization. Likewise, P8 had insurance complications in a previous pregnancy, which lead to a seven-month delay in health care coverage, and "*wished she had someone to help walk her through the legal processes.* P10 also expressed concerns with navigating government resources, claiming, *as far as like gaps and stuff…really, like government stuff. Like, that is the biggest gap ever. Ever. And especially the [government health service] bullshit."*

At least three participants (3, 19%) experienced homelessness during their pregnancy. While none of the women ended up moving into a shelter, each of them recalled either being evicted or "*kicked-out"* by their partner from their homes. The women stayed with friends or family, and one woman lived in her car. They each described searching online for housing resources or going to social service centers to get more information and help. P15 stated, "*I've tried [applying for housing assistance] on the internet, it wasn't helpful. I think I need to go in person and actually do the application. So, need to work on that too."*

6 Discussion

Much of what we found is consistent with existing work, but there are a number of novel findings not previously reported.

Consistent with previous work, our participants consumed information from multiple online and offline sources to learn about pregnancy and childcare [63, 65]. We also confirmed well-established social media findings among other groups [6, 65] that users reach out to Facebook to seek emotional support.

On the other hand, our findings differ considerably from previous work about low-income mothers and digital media. One representative study of 63 low-income pregnant women in Milwaukee published just four years ago reported that participants "rarely used the Internet for health-related information" [64]. We found instead, voracious use of the internet for pregnancy- and health-related information from multiple online sources, including Facebook groups, YouTube, blogs, forums, research papers, and pregnancy-tracking apps. We assume that this is due to the intervening uptake of smartphones and free WiFi hotspots in the U.S. During the eight years separating data collection between that study and ours (2011 and 2019), smartphone ownership in America increased from 35% to 81% [50]. A meta-implication is that correlations between income and technology change rapidly; technology for public health must adapt quickly to be relevant.

Another new finding is that our participants' information behaviors shifted over the duration of their pregnancies, with concomitant shifts in technology-use patterns. During the first three months, most information searches were for validating ongoing pregnancy-related experiences. During this time, queries tended to start on Google and followed a range of links; at the same time, YouTube videos were the most favored source. Fifteen out of 16 women (94%) had explored YouTube videos to answer questions, and even the remaining participant asked us for YouTube channel recommendations. YouTube videos provided rich media with "*authentic*, *relatable"* content from "*women that actually been through it."* The narrative format of videos, including the ability to discuss serious topics with an informal tone (e.g., pregnancy-themed reality TV) also added to the appeal.

As pregnancy progresses into the second trimester, technology use shifts towards seeking emotional support and *good-to-have information*, such as knowing the size of the baby at a certain week during the pregnancy. Pregnancy apps figured prominently here for half of our participants. And, emotional support was often sought from Facebook groups. Subject-specific Facebook groups provided a judgment-free zone to ask information from other women in similar situations. The participants also found that Facebook groups were more responsive than communication channels with healthcare service providers. Some of the Facebook groups that participants referred to in their responses had several thousand participants. "*Good-to-have"* information was received from pregnancy tracking apps (87.5% of the respondents used pregnancy tracking apps), as they provided personalized information with respect to the individual stage of your pregnancy, and also made it relatable by enabling comments on posts by expectant women and an additional chat feature to chat with other pregnant women.

We also uncovered a sophisticated decision-making process among our participants that included efforts to find corroborative evidence across multiple sources of information, all while attempting to ferret out what "*felt right*" or "*what makes sense to you."* Similar findings have been reported for college-educated groups [16], but never before for low-income mothers with respect to health information. In this complex calculus, formal medical advice was not necessarily accorded more trust than other sources of information. This lack of trust could be because of a general feeling of "*concerns not being heard by medical professionals*," a finding that prior research uncovered with low-income patients [74] compared to high-income women who have been shown to more willingly trust medical advice [75]. We found that our participants tried to validate any unexpected information and became more confident about information once it was corroborated. Some past

literature [14, 23] suggested that low-income women were behind when it came to online access and engagement with information around pregnancy and childcare, but we find the opposite – our participants were all highly informed and digitally engaged.

As with much of public health information, however, access to information did not necessarily turn to sound knowledge or effective action. In some cases, personal judgments countered medical advice, especially when it came to nutritional or exercise-related content. Our participants repeated "*every pregnancy is different"* like a mantra.

Participants tended to trust three types of sources most consistently, though not absolutely: family and friends, healthcare professionals, and content from other pregnant women perceived as trustworthy. We found that our participants frequently brought information from one of these sources to the others for corroboration. For socially controversial topics like vaccination or home births, our participants appeared to rely somewhat more heavily on the opinions of family and friends over medical advice.

Consistent with prior literature, we found that in the case of interactions with healthcare professionals online, participants did not like being talked down to, or told to do something without having their concerns adequately heard [75]. In addition, "*fluffy*, *curated*, *influencer-like"* videos were disregarded, as were videos that had content that the participants did not approve of (e.g., breastfeeding on camera). Interestingly, we found that our participants used the internet to prepare for their appointments with healthcare providers, often with the intent to interrogate them. These latter findings differ from some low-income contexts outside of the United States where individuals strongly defer to medical professionals [8].

6.1 Implications and Recommendations

Relatable video content. Given the preference for video and stories from other mothers, we recommend that organizations catering to low-income pregnant women, curate relatable video content that includes testimonials from the pregnancy-experienced and advice from non-medical professionals such as social workers. The content should go beyond medical advice and incorporate anecdotes and personal backgrounds. Heavy scripting and polished post-production should be minimized, as that erodes apparent authenticity.

Since storytelling is done within a particular cultural context, it is essential that videos portray real individual experiences that the target group can relate to. Among our participants, an African-American culture of storytelling is widely recognized and increasingly available in the digital space; thus, it could be used in ways to make content more compelling.

We also recommend aiming some of the content and marketing towards other stakeholders, such as mothers, friends, or partners of pregnant women, as content shared by a trustable personal connection can have more impact

Meet them where they are online. Some of the Facebook groups and YouTube playlists that our participants showed us had thousands of members and tens of thousands of comments. These existing groups act as communities of support and are providing a range of health-related information – but not all of it is medically sound. Although past literature emphasizes using social media to support African-American mothers [79], our recommendation is for medical outreach to extend to informal, spontaneously formed online communities. Healthcare professionals could lurk on an online forum and offer the occasional corrective comment. Another possibility are "Ask me anything" sessions (real-time online Q&A sessions that tend toward a frank and personal tone) with physicians, nurses, or social workers. However, any healthcare professionals that engage with pregnant women online should be approachable, empathetic, and responsive – all traits that increased trust with our participants.

7 Conclusion

We found a voracious demand for online pregnancy related information and emotional support that is currently being met by YouTube videos, Facebook groups and pregnancy-related apps. The women who participated in our study placed their personal and family interests at the core of their decision-making. Due to the prevailing social construct that "*every pregnancy is different"* coupled with the lack of standardized pregnancy education in the United States, women feel directly responsible for gaining the knowledge and resources they need for themselves and their expectant child. Participants in our study did not always trust the medical establishment, and we recommend use of carefully pitched videos and information interventions in online spaces that the mothers already use.

In future work, we intend to work closely with a large health system in Detroit to curate such content and identify design considerations and policy changes to incentivize online interaction between low-income African-American pregnant women and community health workers, social workers, and doctors.

ACKNOWLEDGMENTS

We are sincerely grateful to the National Academies Keck Futures Initiative for support of this research, to all of our participants for offering their perspectives and sharing their personal stories, and to Dr. Kimberlydawn Wisdom, Ms. Jaye Clement, Ms. Courtney Latimer and Ms. Ally M. Rooker at the Henry Ford Health System for enabling this research.

REFERENCES

[1] 2018 Geocoded Michigan Birth Certificate Registry: 2018. *http://www.mdch.state.mi.us/pha/osr/chi/births14/BxChar/BXCharObject.asp?BirthRow=Standard&ActveTableType=G&Neum=on&Rate=on&TrendType=1&Char=208&Row=RACE&Col=STANDARD&AreaCode=09&AreaType=L&CI=N&Stat=NxP&Average=N&TableType=G&JS=NO&ActiveYear=2018*.

[2] Abid, A. and Shahid, S. 2017. Helping pregnant women in the rural areas of Pakistan using a low-cost interactive system. *ACM International Conference Proceeding Series*. Part F1320, (2017). DOI:https://doi.org/10.1145/3136560.3136607.

[3] Alam, M. et al. 2010. Assessing the scope for use of mobile based solution to

improve maternal and child health in Bangladesh: A case study on efficiency of community health workers, automated risk assessment of patients and web based data collection. *ICTD 2010 London Conference*. (2010), 1–5. DOI:https://doi.org/10.1145/2369220.2370755.

[4] America is failing its black mothers: 2019. *https://www.hsph.harvard.edu/magazine/magazine_article/america-is-failing-its-black-mothers/*.

[5] Andalibi, N. et al. 2016. Understanding social media disclosures of sexual abuse through the lenses of support seeking and anonymity. *Conference on Human Factors in Computing Systems - Proceedings*. (2016), 3906–3918. DOI:https://doi.org/10.1145/2858036.2858096.

[6] Asiodu, I. V. et al. 2015. Breastfeeding and use of social media among first-time African American mothers. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*. 44, 2 (2015), 268–278. DOI:https://doi.org/10.1111/1552-6909.12552.

[7] Baker, B. and Yang, I. 2018. Social media as social support in pregnancy and the postpartum. *Sexual and Reproductive Healthcare*. 17, May (2018), 31–34. DOI:https://doi.org/10.1016/j.srhc.2018.05.003.

[8] Batool, A. et al. 2017. Maternal complications: Nuances in mobile interventions for maternal health in urban Pakistan. *Proceedings of the Ninth International Conference on Information and Communication Technologies and Development* (2017), 1–12.

[9] Bender, J.L. et al. 2011. Seeking support on facebook: A content analysis of breast cancer groups. *Journal of Medical Internet Research*. 13, 1 (2011). DOI:https://doi.org/10.2196/jmir.1560.

[10] Bhat, A. et al. 2018. Text messaging to support a perinatal collaborative care model for depression: A multi-methods inquiry. *General Hospital Psychiatry*. 52, November 2017 (2018), 14–20. DOI:https://doi.org/10.1016/j.genhosppsych.2018.01.005.

[11] Bianchi, C.M. et al. 2016. Concerns, attitudes, beliefs and information seeking practices with respect to nutrition-related issues: a qualitative study in French pregnant women. *BMC Pregnancy and Childbirth*. 16, 1 (2016).

[12] Birnholtz, J. et al. 2015. Is it weird to still be a virgin?: Anonymous, locally targeted questions on facebook confession boards. *Conference on Human Factors in Computing Systems - Proceedings*. 2015-April, (2015), 2613–2622. DOI:https://doi.org/10.1145/2702123.2702410.

[13] Bushar, J.A. et al. 2017. Text4baby Influenza messaging and Influenza vaccination among pregnant women. *American Journal of Preventive Medicine*. 53, 6 (2017), 845–853. DOI:https://doi.org/10.1016/j.amepre.2017.06.021.

[14] Campbell-Grossman, C. et al. 2009. Community leaders' perceptions of Hispanic, single, low-income mothers' needs, concerns, social support, and interactions with health care services. *Comprehensive Child and Adolescent Nursing*. 32, 1 (2009), 31–46. DOI:https://doi.org/10.1080/01460860802610194.

[15] Chaudhry, B.M. et al. 2018. Towards an integrated mhealth platform for community-based maternity healthworkers in low-income communities. *ACM International Conference Proceeding Series*. (2018), 118–127. DOI:https://doi.org/10.1145/3240925.3240938.

[16] Chen, Y.Y. et al. 2018. Health information obtained from the internet and changes in medical decision making: Questionnaire development and cross-sectional survey. *Journal of Medical Internet Research*. 20, 2 (2018), 1–10. DOI:https://doi.org/10.2196/jmir.9370.

[17] Chilukuri, N. et al. 2015. Information and communication technology use among low-income pregnant and postpartum women by race and ethnicity: A cross-sectional study. *Journal of Medical Internet Research*. 17, 7 (2015), 1–10. DOI:https://doi.org/10.2196/jmir.3916.

[18] De Choudhury, M. et al. 2014. Characterizing and predicting postpartum depression from shared facebook data. *Proceedings of the ACM Conference on Computer Supported Cooperative Work, CSCW*. (2014), 625–637. DOI:https://doi.org/10.1145/2531602.2531675.

[19] De Choudhury, M. et al. 2013. Predicting postpartum changes in emotion and behavior via social media. *Conference on Human Factors in Computing Systems - Proceedings*. (2013), 3267–3276. DOI:https://doi.org/10.1145/2470654.2466447.

[20] Detroit, Michigan Healthcare Data: 2017. *https://www.towncharts.com/Michigan/Healthcare/Detroit-city-MI-Healthcare-data.html*. Accessed: 2020-04-27.

[21] Detroit's maternal death rate is triple the nation's: 2014. *https://khn.org/news/detroits-maternal-death-rate-triple-the-nations*.

[22] Enquist, H. and Tollmar, K. 2008. The memory stone - A personal ICT device in health care. *ACM International Conference Proceeding Series*. 358, (2008), 103–112. DOI:https://doi.org/10.1145/1463160.1463172.

[23] Esperat, C. et al. 2007. Health behaviors of low-income pregnant minority women. *Western Journal of Nursing Research*. 29, 3 (2007), 284–300. DOI:https://doi.org/10.1177/0193945906295532.

[24] Farrish, J. and Robertson, R. Von 2014. A qualitative examination of factors that influence birthing options for African American women. *Critical Sociology*. 40, 2 (2014), 271–283. DOI:https://doi.org/10.1177/0896920512437609.

[25] Garchar, E. et al. 2019. Characterization of mobile applications for patient participation in prenatal care. *Obstetrics & Genecology*. 133, 1 (2019), 116S.

[26] Giurgescu, C. et al. 2015. The impact of neighborhood quality, perceived stress, and social support on depressive symptoms during pregnancy in African American women. *Social Science and Medicine*. 130, (2015), 172–180. DOI:https://doi.org/10.1016/j.socscimed.2015.02.006.

[27] Gross, R.S. et al. 2016. Material Hardship and Internal Locus of Control Over the Prevention of Child Obesity in Low-Income Hispanic Pregnant Women. *Academic Pediatrics*. 16, 5 (2016), 468–474. DOI:https://doi.org/10.1016/j.acap.2016.02.003.

[28] Guendelman, S. et al. 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 (2017). DOI:https://doi.org/10.2196/jmir.7736.

[29] Gui, X. et al. 2017. Investigating support seeking from peers for pregnancy in online health Communities. *Proceedings of the ACM on Human-Computer Interaction* (2017), 1–19.

[30] Guillory, J. et al. 2014. Does social support predict pregnant mothers' information seeking behaviors on an educational website? *Maternal and child health journal*. 18, 9 (2014), 2218–2225. DOI:https://doi.org/10.1007/s10995-014-1471-6.

[31] Heisler, M. et al. 2019. Effectiveness of technologically enhanced peer support in improving Glycemic management among predominantly African American, low-income adults with diabetes. *Diabetes Educator*. 45, 3 (2019), 260–271. DOI:https://doi.org/10.1177/0145721719844547.

[32] Hernandez, E.M. 2013. Provider and patient influences on the formation of socioeconomic health behavior disparities among pregnant women. *Social Science and Medicine*. 82, (2013), 35–42. DOI:https://doi.org/10.1016/j.socscimed.2013.01.018.

[33] Hether, H.J. et al. 2014. It's better to give than to receive: The role of social support, trust, and participation on health-related social networking sites. *Journal of Health Communication*. 19, 12 (2014), 1424–1439. DOI:https://doi.org/10.1080/10810730.2014.894596.

[34] Hogan, V.K. et al. 2012. Life course, social determinants, and health inequities: toward a national plan for achieving health equity for African American infants—a concept paper. *Maternal and Child Health Journal*. 16, 6 (2012), 1143–1150.

[35] Holtz, B. et al. 2015. Connected motherhood: Social support for moms and moms-to-be on Facebook. *Telemedicine and e-Health*. 21, 5 (2015), 415–421. DOI:https://doi.org/10.1089/tmj.2014.0118.

[36] Huberty, J. et al. 2013. Describing the use of the internet for health, physical activity, and nutrition information in pregnant women. *Maternal and Child Health Journal*. 17, 8 (2013), 1363–1372. DOI:https://doi.org/10.1007/s10995-012-1160-2.

[37] Huh, J. et al. 2016. Personas in online health communities. *Journal of Biomedical Informatics*. 63, (2016), 212–225. DOI:https://doi.org/10.1016/j.jbi.2016.08.019.

[38] Javaid, M. et al. 2017. Bridging the knowledge gaps in lady health visitors through video based learning tool. *ACM International Conference Proceeding Series*. Part F1320, (2017), 1–4. DOI:https://doi.org/10.1145/3136560.3136603.

[39] Keating-Lefler, R. et al. 2004. Needs, concerns, and social support of single, low-income mothers. *Issues in Mental Health Nursing*. 25, 4 (2004), 381–401. DOI:https://doi.org/10.1080/01612840490432916.

[40] Kothari, C.L. et al. 2016. The interplay of race, socioeconomic status and neighborhood residence upon birth outcomes in a high black infant mortality community. *SSM - Population Health*. 2, April (2016), 859–867. DOI:https://doi.org/10.1016/j.ssmph.2016.09.011.

[41] Kouri, P. et al. 2006. Pregnant Families' Discussions on the Net-From Virtual Connections Toward Real-Life Community. *Journal of Midwifery and Women's Health*. 51, 4 (2006), 279–283. DOI:https://doi.org/10.1016/j.jmwh.2005.10.010.

[42] Kraschnewski, J.L. et al. 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 (2014), 1–8. DOI:https://doi.org/10.2196/jmir.3385.

[43] Kumar, N. and Anderson, R. 2015. Mobile phones for maternal health in rural India. *Conference on Human Factors in Computing Systems - Proceedings*. 2015-April, (2015), 427–436. DOI:https://doi.org/10.1145/2702123.2702258.

[44] Lau, Y. et al. 2016. Efficacy of e-technologies in improving breastfeeding outcomes among perinatal women: A meta-analysis. *Maternal and Child Nutrition*. 12, 3 (2016), 381–401. DOI:https://doi.org/10.1111/mcn.12202.

[45] Laz, T.H. and Berenson, A.B. 2013. Racial and ethnic disparities in internet use for seeking health information among young women. *Journal of Health Communication*. 18, 2 (2013), 250–260. DOI:https://doi.org/10.1080/10810730.2012.707292.

[46] De Lew, N. et al. 1992. A layman's guide to the U.S health care system. *Health Care Financing Review*. 14, 1 (1992), 151–169. DOI:https://doi.org/10.1108/eb046203.

[47] Lewallen, L.P. 2004. Healthy behaviors and sources of health information among low-income pregnant women. *Public Health Nursing*. 21, 3 (2004), 200–206.

[48] Lima-Pereira, P. et al. 2012. Use of the Internet as a source of health information amongst participants of antenatal classes. *Journal of Clinical Nursing*. 21, 3–4

(2012), 322–330. DOI:https://doi.org/10.1111/j.1365-2702.2011.03910.x.
[49] Live Births by County of Residence, State of Michigan, Michigan Counties and Detroit City, 2008 - 2018: *https://www.mdch.state.mi.us/osr/Natality/BirthsTrends.asp*.
[50] Mobile Fact Sheet: 2019. *https://www.pewinternet.org/fact-sheet/mobile/*.
[51] Park, N. et al. 2009. Being immersed in social networking environment: Facebook groups, uses and gratifications, and social outcomes. *Cyberpsychology and Behavior*. 12, 6 (2009), 729–733. DOI:https://doi.org/10.1089/cpb.2009.0003.
[52] Patel, M.R. et al. 2018. Health Insurance Challenges in the Post-Affordable Care Act (ACA) Era: A Qualitative Study of the Perspective of Low-Income People of Color in Metropolitan Detroit. *Journal of Racial and Ethnic Health Disparities*. 5, (2018), 78–85.
[53] Perrier, T. et al. 2015. Engaging pregnant women in Kenya with a hybrid computer-human SMS communication system. *Conference on Human Factors in Computing Systems - Proceedings*. 2015-April, (2015), 1429–1438. DOI:https://doi.org/10.1145/2702123.2702124.
[54] Peyton, T. et al. 2014. "Every pregnancy is different": Designing mHealth for the pregnancy ecology. *Proceedings of the Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques, DIS* (Vancouver, BC, Canada, 2014), 577–586.
[55] Peyton, T. et al. 2014. Information, sharing and support in pregnancy: Addressing needs for mHealth design. *Proceedings of the companion publication of the 17th ACM conference on Computer supported cooperative work & social computing* (2014), 213–216.
[56] Pine, K. 2012. Fragmentation and choreography: Caring for a patient and a chart during childbirth. *ACM Conference on Computer Supported Cooperative Work, CSCW* (Seattle, WA, 2012).
[57] Plantin, L. and Daneback, K. 2009. Parenthood, information and support on the internet. A literature review of research on parents and professionals online. *BMC Family Practice*. 10, (2009), 1–12. DOI:https://doi.org/10.1186/1471-2296-10-34.
[58] Pregnancy Mortality Surveillance System: 2019. .
[59] Reich, S. 2005. What do mothers know? Maternal knowledge of child development. *Infant Mental Health Journal*. 26, 2 (2005), 143–156. DOI:https://doi.org/10.1002/imhj.20038.
[60] Schaffer, M.A. and Lia-Hoagberg, B. 1997. Effects of social support on prenatal care and health behaviors of low-income women. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*. 26, (1997), 433–440.
[61] Schulz, A.J. et al. 2016. Race and the distribution of social and physical environmental risk: A case example from the Detroit Metropolitan Area. *Du Bois Review*. 13, 2 (2016), 285–304. DOI:https://doi.org/10.1017/S1742058X16000163.
[62] Shieh, C. et al. 2010. Factors associated with health information-seeking in low-income pregnant women. *Women and Health*. 50, 5 (2010), 426–442. DOI:https://doi.org/10.1080/03630242.2010.506152.
[63] Shieh, C. et al. 2009. Information-seeking and its predictors in low-income pregnant women. *Journal of Midwifery and Women's Health*. 54, 5 (2009), 364–372. DOI:https://doi.org/10.1016/j.jmwh.2008.12.017.
[64] Song, H. et al. 2013. Information needs, seeking behaviors, and support among low-income expectant women. *Women and Health*. 53, 8 (2013), 824–842. DOI:https://doi.org/10.1080/03630242.2013.831019.
[65] Sundstrom, B. 2016. Mothers "Google It Up:" Extending Communication Channel Behavior in Diffusion of Innovations Theory. *Health Communication*. 31, 1 (2016), 91–101. DOI:https://doi.org/10.1080/10410236.2014.936339.
[66] Trends in Maternal Mortality: 1990-2015: 2015. *https://www.who.int/reproductivehealth/publications/monitoring/maternal-mortality-2015/en/*.
[67] Vashistha, A. et al. 2016. Mobile video dissemination for community health. *ACM International Conference Proceeding Series*. 03-06-June, (2016). DOI:https://doi.org/10.1145/2909609.2909655.
[68] Verma, B.A. et al. 2016. Advice given by community members to pregnant women: A mixed methods study. *BMC Pregnancy and Childbirth*. 16, 1 (2016). DOI:https://doi.org/10.1186/s12884-016-1146-y.
[69] Wallace, M.E. et al. 2019. Privilege and deprivation in Detroit: Infant mortality and the Index of Concentration at the Extremes. *International Journal of Epidemiology*. 48, 1 (2019), 207–216. DOI:https://doi.org/10.1093/ije/dyy149.
[70] Willcox, J.C. et al. 2017. A mobile health intervention promoting healthy gestational weight gain for women entering pregnancy at a high body mass index: the txt4two pilot randomised controlled trial. *BJOG: An International Journal of Obstetrics and Gynaecology*. 124, 11 (2017), 1718–1728. DOI:https://doi.org/10.1111/1471-0528.14552.
[71] Witteman, H.O. et al. 2016. One-sided social media comments influenced opinions and intentions about home birth: An experimental study. *Health Affairs*. 35, 4 (2016), 726–733. DOI:https://doi.org/10.1377/hlthaff.2015.1382.
[72] Youash, S. et al. 2012. Examining the pathways of pre- and postnatal health information. *Canadian Journal of Public Health*. 103, 4 (2012), 314–319.
[73] Zhang, S. et al. 2013. Racial disparities in economic and clinical outcomes of pregnancy among medicaid recipients. *Maternal and Child Health Journal*. 17, 8 (2013), 1518–1525. DOI:https://doi.org/10.1007/s10995-012-1162-0.
[74] Zimmerman, M.S. 2017. Information poverty and reproductive healthcare: Assessing the reasons for inequity between income groups. *Social Work in Public Health*. 32, 3 (2017), 210–221. DOI:https://doi.org/10.1080/19371918.2016.1268990.
[75] Zimmerman, M.S. 2017. Information Poverty and Reproductive Healthcare: Assessing the Reasons for Inequity between Income Groups. *Social Work in Public Health*. 32, 3 (2017), 210–221. DOI:https://doi.org/10.1080/19371918.2016.1268990.