Archives of Women's Mental Health (2019) 22:305–308
https://doi.org/10.1007/s00737-018-0894-2

SHORT COMMUNICATION

Using mobile health applications for the rapid recruitment of perinatal women

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Received: 16 July 2018 / Accepted: 19 July 2018 / Published online: 26 July 2018

Abstract

This article describes how two research teams recruited participants using a mobile application for pregnant women. In both studies, a study description appeared on the home screen of a pregnancy application. Interested women were directed to a secure research website to enroll. Enrollment goals were rapidly exceeded. Both studies enrolled participants from across the USA. Demographic diversity was achieved by one study. Mobile health applications are innovative venues for recruiting research participants.

Keywords Recruitment · Pregnant women · Cross-sectional study · Clinical trial

Meeting study recruitment goals in a timely manner is a common challenge. A review of 73 multicenter, randomized controlled trials in the UK, found only 55% enrolled their target sample size and 45% required a funding extension to meet recruitment goals (Sully et al. 2013). Enrolling ethnically diverse samples can also be challenging, particularly in studies focused on women (Killien et al. 2000). For mental health researchers seeking to enroll perinatal women specifically, the stigma surrounding mental health concerns during the perinatal period may further impede recruitment (Tryphonopoulos and Letourneau 2015). Moreover, in geographic locations outside of large metropolitan areas, researchers must often compete for study participants from a limited subject pool of demographically homogeneous, perinatal women.

In contrast to traditional, local recruiting methods, mobile health applications have the potential to cast a far wider net and capture demographically diverse participant pools. From 2013 to 2015, the number of available mobile health applications increased by more than 100% (Aitken and Lyle 2015). A 2013 search of iTunes and Google Play found 430 applications focused specifically on pregnancy (Tripp et al. 2014). Moreover, a survey of 410 Australian pregnant/postpartum women found 75% accessed at least one such application (Lupton and Pedersen 2016). Indeed, one cross-sectional survey study, which utilized a parenting application to recruit women, efficiently enrolled 1083 postpartum women at a rate of 30 women per day (although this sample was not demographically diverse) (Leach et al. 2017). A recent US survey found 83% of pregnant women indicated a willingness to use an Internet-based behavioral intervention, regardless of respondents' age, race, or income level (Urrutia et al. 2015).

This report addresses the promise of using mobile health applications to rapidly enroll large, demographically diverse samples of perinatal women. More specifically, we describe how two US research teams utilized a mobile health application intended for pregnant women, to recruit pregnant participants for both a cross-sectional study and a clinical trial. The outcomes reported for each study include daily enrollment rate, sample size, and the demographic and geographic diversity of the study sample.

Methods

Ovia pregnancy application

Ovia Health is a women's health company that creates mobile applications addressing fertility, pregnancy, and parenting.

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The Ovia Pregnancy application provides educational content, conducts recurring health assessments, collects health and demographic information, and uses proprietary algorithms and machine learning to provide user-specific support and advice. As of July 2018, over 10 million women and families, worldwide, had used one of Ovia's mobile applications, representing a diverse population throughout the USA and internationally. With IRB approval, the Ovia Pregnancy application was used to recruit women for the two studies.

Study recruitment and enrollment procedures

Study 1—BetterLife This cross-sectional study assessed the relationship between low back and pelvic pain, depression symptoms, and quality of life in a convenience sample of pregnant women in their third trimester.

To recruit, a study advertisement was displayed on home screens of users of the Ovia Pregnancy application who were in their third trimester. The advertisement showed a racially diverse woman, to appeal to a broad range of racial groups. Interested women were directed to a secure, research website to confirm study eligibility: 18 years of age or older, English speaking, and in their third trimester. Eligible women were invited to participate. Those who agreed gave informed consent and answered three questionnaires. Compensation ($15) was mailed to those providing a postal address.

Study 2—Sunnyside This randomized clinical trial compared the efficacy of an *individual* versus *group* format of an online depression-prevention intervention.

Recruitment venues included University mass email, postal mail, Research Match, and the Ovia Pregnancy application. To recruit, Ovia Health targeted a study advertisement to the home screens of Ovia Pregnancy application users who were between 16 and 25 weeks of pregnancy. Because this study sought women at risk for depression, interested women were linked to a secure, study website and asked to complete the Patient Health Questionnaire-8 (PH-Q; Kroenke et al. 2001). Those with PH-Q scores between 5 and 14 were interviewed by a research team member to ensure that they did not meet the diagnostic criteria for major depression and were not receiving psychotherapy. The advertisement on the Ovia Pregnancy application homepage was periodically deactivated to allow interviewers time to complete this screening of the large number of interested women.

Results

BetterLife

Daily enrollment rate and sample size The BetterLife study advertisement was active for 3.5 days. Of the 181 women who clicked on the advertisement, 158 completed all of the study documents, well exceeding our original enrollment goal of 120 women. The enrollment rate was 45/day.

Demographic and geographic diversity The race/ethnicity composition of the BetterLife sample aligned with the 2016 US census, although the BetterLife sample included slightly fewer ethnic-minorities (Table 1). One third of BetterLife participants were insured by Medicaid or had no insurance (36.08%), compared to 46.1% of the 2016 census sample. The BetterLife sample was evenly distributed across the USA (Table 2).

Sunnyside

Daily enrollment rate and sample size The advertisement for Sunnyside was active for 92 days, in eight periods of varying duration, ranging from 1 day to 3 weeks**.** Of the 2062 women who clicked on the study advertisement, 930 met both the PH-Q and interview criteria. The enrollment goal ($n = 110$) was exceeded by almost twofold: 210 women were randomized at a rate of two women/day. Among all recruitment venues, the Ovia pregnancy application recruited 93% of participants.

Demographic and geographic diversity The majority of Sunnyside participants were Caucasian (Table 1), with 11.9% being of Latina/Hispanic ethnicity, with a broad range of educational attainment, although the distribution skewed toward better educated (Table 1). The enrollees' zip codes were evenly distributed across the USA (Table 2).

Discussion

Researchers often struggle to recruit sufficient study participants in a timely manner. By utilizing the Ovia Pregnancy application, here, both studies rapidly exceeded recruitment goals. The daily enrollment rate was 45/day in the BetterLife study and 2/day in the Sunnyside study. Although the daily enrollment rate was significantly higher for the BetterLife study, the Sunnyside trial had more inclusion/exclusion criteria and a considerably higher participation burden, with at least 20 weeks of participation and five assessments. Sunnyside's daily recruitment rate of 2/day was equivalent to the 3/day achieved in a similar clinical-trial evaluation of an online depression intervention for adults in the general population (Morgan et al. 2013).

Enrolling a demographically diverse sample is another frequent challenge, particularly for research teams located in non-metropolitan areas. By utilizing the Ovia Pregnancy application, BetterLife was able to recruit a sample that closely mirrored the US population, in terms of race/ethnicity and insurance type. This achievement is particularly promising

Table 1 Demographic distribution of the two study samples, compared to 2016 US Census Bureau data

	BetterLife		
	Number	Percent	US Census 2016[1]
Race/ethnicity			
Caucasian/not Hispanic	107	67.72	61.3
African-American	17	10.76	13.3
Native American	2	1.27	1.3
Hispanic/Latina	21	13.29	17.8
Asian/Pacific Islander	3	1.90	5.9
Other/two or more races	6	3.80	2.6
Did not report	2	1.27	–
Type of insurance			
Commercial/private	87	55.06	67.5
Medicaid	51	32.28	37.3
None	6	3.8	8.8
Prefer not to answer	14	8.86	–
	Sunnyside		
Race	Number	Percent	US Census 2016[1]
Caucasian	175	83.33	76.9
African-American	7	3.33	13.3
Asian	6	2.86	5.7
Native American	0	0	1.3
Native Hawaiian/other Pacific Islander	2	0.95	.2
More than one race or other	18	8.57	2.6
Did not report	2	0.95	–
Ethnicity			
Hispanic/Latina	25	11.9	17.8
Education			
Less than HS	2	0.95	12.3
High school diploma/equivalent	12	5.7	26.9
Post high school	54	25.7	21.2
Associate degree	18	8.6	9.0
Bachelor	71	33.8	19.0
Graduate/professional degree	49	23.3	11.5
Other/did not report	4	1.9	–

United States Census Bureau 2016 obtained from https://www.census.gov/quickfacts/fact/table/US/PST045216

given the historic barriers of enrolling ethnic minorities in research (Killien et al. 2000). In contrast, ethnic-minority participants were not well represented in Sunnyside, and the majority of participants were highly educated. BetterLife's success in recruiting a racially/ethnically diverse sample may be due to advertising imagery that was tailored to be culturally inclusive. It is also possible that the higher participation burden of Sunnyside reduced interest. Although not used in this study, Ovia Health does have the capacity to ensure study advertisements are viewed by diverse groups, a strategy that

Table 2 Geographic distribution of women who provided zip code information in the two study samples

Location	BetterLife percent (*n*)	Sunnyside percent (*n*)
East	33.9% (37)	36.1% (76)
Central	38.5% (42)	36.7% (77)
West	27.5% (30)	27.1% (57)
Number of women providing zip code	109	210

The three categories of zip code locations were based on the first digit of the zip code: East (codes 0–3), Central (codes 4–7), and West (codes 8–9)

might be used in future studies. Finally, the online recruiting strategy was regionally representative, in that it gathered study samples that were distributed relatively evenly, across the eastern, central, and western regions of the USA.

A key limitation of this descriptive analysis is that comparing enrollment rates across venues was not objective of either study. Nevertheless, the observation that 93% of Sunnyside participants had enrolled via the Ovia Pregnancy application among all the recruitment venues provides an informal comparison. In line with recommendation to systematically investigate recruitment strategies (Le et al. 2008), we thus encourage future studies to directly compare different recruitment venues.

Recruitment through mobile health applications may not be feasible for all types of studies, particularly for clinical trials that require face-to-face contact with participants (e.g., as in the case of emergent clinical risk or safety issues). Yet, despite potential limitations, recruitment via mobile health applications removes a number of barriers that often prevent study participation, particularly by underrepresented, ethnic-minority women. Mobile applications can provide scheduling flexibility, remove the need for transportation, and ensure privacy, which may reduce the stigma of study participation, particularly in studies investigating mental health.

Conclusions

For researchers in perinatal mental health, mobile health applications offer a promising strategy for rapidly recruiting large, diverse samples of research participants. In the Sunnyside trial, we observed that recruitment via the Ovia application accounted for the majority of women enrolled compared to traditional recruitment venues. Experimental studies designed to compare recruitment venues thus points to an important direction for future research.

Acknowledgements The authors recognize the following individuals who commented on earlier drafts of this manuscript: Alberto Segre, Christina Cobb, and Danielle Bradley (Ovia Health); Diana Colgan (Editor, College of Nursing); Ann Marie McCarthy, Maria Hein, Yelena Perkhounkova, Maria Hein, and Seyedehtanaz Saeidzadeh (College of Nursing Office of Research and Scholarship); and Sara O'Brien, J. Austin Williamson, and Graham Nelson (Milltown Writing Group).

Funding The better life study was funded by the University of Iowa College of Nursing, NIH funded T32 Pain and Associated Symptoms Grant (NR11147) and Sigma Theta Tau International Gamma Chapter Research Grant. Funding for the REDCap support reported in this publication was provided by the National Center for Advancing Translational Sciences of the National Institutes of Health (U54TR001356).

The Sunnyside was funded by NIMH R34MH10278 (Duffecy) and NIMH R34MH102469 (O'Hara).

Compliance with ethical standards

Conflict of interest Julie Vignato, Jenna Duffecy, Michael O'Hara and Lisa Segre report no conflict of interests. Erin Landau is an employee of Ovia Health.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants enrolled in the studies.

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