

Investigating the Suitability of the Asynchronous, Remote, Community-based Method for Pregnant and New Mothers

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ABSTRACT

Traditional qualitative research methods, such as, interviews and focus groups, may not be feasible for certain populations who face time, mobility, and availability constraints. We adapted the Asynchronous, Remote, Community-based (ARC) method that used closed Facebook groups to study people with rare diseases, to study a different population - pregnant and new mothers. During the course of eight weeks, we engaged 48 participants in 19 study activities using three closed Facebook groups. We added new activities to the original ARC method, informed by past HCI research, to triangulate participant input. We carefully analyzed participation patterns and activity engagement, to assess the suitability of the ARC method for engaging pregnant and new mothers in remote, group-based, qualitative research. We provide an in-depth analysis of the ARC method, noting participation characteristics, activity preferences, and the suitability of the ARC method as an online focus group.

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g. HCI): Miscellaneous

Author Keywords

focus groups; remote populations; maternal health; social support; Facebook Groups

INTRODUCTION

Design researchers use qualitative methods to conduct needs assessments to design tailored, effective systems. Often these methods include participant observation, in-depth interviews, and focus groups [9]. These methods are typically conducted synchronously, at scheduled times, and are co-located with the study population. This makes it difficult for populations,

such as new mothers, who face time, mobility, or availability constraints to participate in such research studies.

To this end, MacLeod et al. [13] proposed the Asynchronous Remote Community (ARC) method, using a closed Facebook group as a way of facilitating various activities and discussions to identify the needs of remote participants with geographic and mobility constraints. ARC provided them with the ability to identify needs of people with rare diseases who, by virtue of the rarity of their conditions, tend to be geographically distributed and challenging to recruit. The researchers argued that ARC can be considered an augmented focus group, because participants can contribute to activities, build on each other's posts, and receive feedback on questions and comments. The authors encouraged the research community to try ARC in their own needs assessments, to help better understand the strengths and limitations of this new method.

We had previously administered a survey and interviews to identify the needs of pregnant women and mothers with infants [8], but we wanted to expand on these findings in a group setting to better triangulate our understanding through multiple interactions and a range of design activities. The ARC method provided us with the ability to not only administer multiple activities, but also provide enough time between activities to analyze data and to better design the next activities. This method also provided participants with limited mobility - either in late stages of pregnancy or during infant care - the ability to participate in activities in quick, asynchronous time frames and reflect on their contributions between activities. Finally, ARC was appropriate because in our prior interviews, it was difficult to recruit a cohort of women in a certain stage of pregnancy or parenthood to participate in a study [8].

The purpose of this paper is not to discuss the results of this study, but rather to describe our experience using the ARC method. In [13], MacLeod et al. discuss a number of the limitations of their work which we aim to address in our adaptation of the method. The specific contributions of this work are:

1. Replication and extension of the original ARC method.
2. Discussion about the suitability of the ARC method for designing asynchronous activities to triangulate data.

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3. Discussion about the suitability of the ARC method as an online focus group platform.

RELATED WORK

Remote HCI Research Methods

Researchers have identified a need for remote HCI research methods and adapted existing methods for conducting them remotely. In particular, conducting interviews remotely has become common practice in HCI research (e.g., [1, 10, 14]). Volda et al. [19] specifically looked at instant messaging, while Dimond et al. [5] explored email and phone as methods of conducting interviews, finding that the interview method tends to impact the length of the interview, but not necessarily the number of unique ideas presented. More recently, Hillman et al. [11] provided a helpful guide for conducting interviews over video chat.

Social media is also a valuable tool for remote health research. De Choudhury et al. [4] assessed women's public tweets to predict those most likely to have significant postpartum emotional or behavior change. Saeb et al. [18] found that GPS and usage data from cellphones was highly predictive of the severity of depressive symptoms. These types of approaches allow us to learn a great deal about conditions that are otherwise under-reported (e.g., postpartum depression because of its associated stigma). These approaches, however, generally involve mining social media or technology usage data rather than engaging the individual in a participatory research process.

The ARC Method

MacLeod et al. [13] introduced the Asynchronous Remote Community (ARC) method that leverages social media as a platform for conducting research. This work was originally conducted with people with rare diseases who were geographically distributed and challenging to recruit. The authors provided a series of activities to participants within a closed Facebook group consisting of 13 participants. Example activities included keeping a diary of interactions with other people, responding to discussion prompts, providing feedback on design personas, or writing a script for a scene from the movie of their life. In [13], they report in detail on their method, including successes, lessons learned, and recommendations for future use of the method. They encourage researchers to use and adapt the method for other populations or research needs. To this end, they made all their study materials available as supplementary material.

METHODS

In this section, we describe our recruitment methods, procedure, and activities used to engage study participants. We will also discuss how we tailored the ARC method to our population (pregnant women and new mothers). This study was approved by the Institutional Review Board (IRB) of Indiana University.

Recruitment

We posted recruitment flyers on public notice boards of local coffee shops, grocery stores, libraries, and around Indiana University. We additionally posted the flyer on our Facebook

pages and Twitter feeds. A representative of a local birthing service center posted the study information on their website and Facebook page. We coordinated with staff at BabyCenter.com who posted our recruitment message to forums such as "Babies," "Mommy Mentors," "Pregnancy," "July 2015 Birth Club," and "August 2015 Birth Club".

Participants

We recruited pregnant women who were in their third trimester of pregnancy and new mothers with a baby less than four months old. There were 63 potential participants who contacted us with interest in the study and received a consent form. We received 52 signed consent forms; invited all of them to participate; and enrolled 48 women. We recruited a diverse group of participants from 11 different states in the United States. Of these participants, 44 were married and 4 were unmarried. Participants' ages ranged from 22 to 42 years (average of 30 years old).

Procedure

We used the ARC method because the study platform used in the method, Facebook, was a convenient way to reach our target population. Morris et al. [17] found that the Facebook posting rate of new mothers remained relatively constant, following a sharp drop off in pre-birth post per day median. Based on these findings, we concluded that the mothers who met our inclusion criteria would be ready to participate in our study.

MacLeod et al. [13] recommended targeting either a homogeneous population for this method or creating several separate, but internally homogeneous groups. Following this suggestion, we created three private Facebook groups where we posted study activities. The first group consisted of women who were pregnant for the first time, hereafter referred to as "New Pregnancy," or NP ($N = 10$). The second group consisted of women who were pregnant, but had at least one child, referred to as "Experienced Pregnancy," or EP ($N = 20$). The final group consisted of women who had recently given birth, but were not currently pregnant, referred to as "Moms," or M ($N = 18$). Recognizing that first-time mothers would have different experiences from experienced mothers, we planned to create separate groups for them, however only six first-time mothers met our inclusion criteria (a baby < 4 months old). We know from MacLeod et al.'s paper that participants leave or lurk, thus, we combined the first time mothers (6 participants) with the experienced mothers (12 participants) to ensure there was ample participation. The three groups were separate, closed groups, where participants in one group could not see the activities in another group.

Building from MacLeod et al.'s [13] observation that participants often missed notifications of posts, and that multiple approaches are needed to ensure activities are seen, we asked participants to add the group to their Facebook "Favorites" to receive posting notifications. This may have resulted in the high "Seen by" percentage for the study activities as shown in Table 1. It does not necessarily mean that the participant saw a post because Facebook counts it as "seen" when it is open in another browser window or tab. We also added the researchers to all three Facebook groups. Whenever a new study activity

#	W	Activity	Response Visibility	M	T	New Preg. (NP) (N=10)		Exp. Preg. (EP) (N=20)		Mothers (M) (N=18)	
						Unique Responses	Seen By	Unique Responses	Seen By	Unique Responses	Seen By
A1	1	Participant Introductions	Shared	FT	Rt	100%	100%	85%	95%	90%	100%
A2	1	Preferred Activity Post Time	Shared	P	Rt	90%	100%	90%	75%	89%	100%
A3	1	Things I Wish I knew	Shared	FT	Rf	90%	100%	90%	95%	90%	94%
A4	2	Edinburgh Postnatal Depression Scale	Private	S	Rf	100%	100%	95%	95%	89%	94%
A5	2	Circle Network Diagram	Shared	Md	C	80%	100%	50%	95%	90%	94%
A6	3	Talk About Support Network	Shared	FT	Rf	80%	100%	56%	95%	83%	94%
A7	3	Interactions Today/ Yesterday	Shared	FT	Rt	80%	100%	90%	95%	94%	94%
A8	4	Social Support Communication	Private	S	Rf	90%	100%	90%	95%	94%	94%
A9	4	Advice Columnist - Anxiety	Shared	FT	C	80%	100%	70%	95%	78%	94%
A10	4	Advice Columnist - Intimacy	Shared	FT	C	80%	100%	60%	95%	56%	94%
A11	5	Ask me Anything	Shared	FT	C	80%	100%	60%	95%	50%	94%
A12	5	Issues/Worries with Pregnancy/ last Baby	Shared	FT	Rf	40%	100%	70%	95%	72%	94%
A13	5	Helpful Resources to Prepare	Shared	FT	Rt	70%	100%	85%	95%	62%	94%
A14	6	Physical Help Needed	Shared	FT	Rf	80%	100%	75%	90%	72%	94%
A15	6	Technology Use	Private	S	Rf	80%	100%	65%	90%	67%	94%
A16	7	Edinburgh Postnatal Depression Scale	Private	S	Rf	80%	80%	90%	90%	72%	94%
A17	7	Support Needs	Private	S	Rf	80%	80%	95%	85%	82%	94%
A18	8	Google Search History	Private	Md	Rt	20%	80%	15%	90%	6%	94%
A19	8	Why Reluctant to Ask for Help	Shared	FT	Rf	60%	90%	65%	85%	62%	94%

Table 1: Participation in Study Activities. W indicates the week of Study. Activity mediums (M) include free text (FT), surveys (S), media (Md), and polls (P). The types of activities include reporting information (Rt), reflective responses where participants think about their information or experience (Rf), and creative (C) where people use media to share their experience. Response visibility indicates if participant responses were shared to the group or privately collected and stored.

was posted, the researchers made sure to "like" the post so that the participants would receive multiple notifications on their Facebook page.

Study Activities

We prepared a set of activities inspired by [13] prior to the study. We also developed additional activities to suit the aims of our particular study. As the study progressed, we added additional activities to clarify confusing results from earlier activities, and to triangulate based on the responses. We did not use some activities from the original study (e.g., the diary study, Mad-lib, design personas, and writing a movie scene script) which may have increased the time commitment of our participants. The study activities are broadly categorized into free text (FT), survey (S), media (Md), and poll (P). They took the form of a report (A1, A2, A13) where participants reported factual information, reflective response (A3, A4, A6, A12, A14, A15, A16, A17, A19) where participants thought about their information or experience, or creative activity (A5, A9, A10, A11) where participants used media to share their experiences. Table 1 shows a list of activities used in the study, and the characteristics of each.

There were a mix of private and shared activities in the study. For example, individual responses to survey results and Google search history were kept private. Other activities required individual responses, but the responses were shared with the group, and anyone could comment on them. An example is A13, where we asked the participants to share resources, such as online forums, groups, people, and apps, that they found useful during pregnancy or after delivery. There were group activities, such as "Ask Me Anything" (A11) and Advice Columnist (A9, A10), where the responses were shared, and everyone was encouraged to respond and comment.

We used the same activities for all three closed Facebook groups, but we tailored the questions appropriately for each group. For example, in A14 we asked the Moms group,

"During the first two weeks after your baby was born, what kind of physical help would have made your life easier?"

For the pregnancy group we modified the question as follows,

"What kind of physical help do you think you would need to make your life easier during the first two weeks after your baby is born?"

New Activities

We added five new types of activities to the original ARC method: a poll (A2), validated instruments (A4 & A16), Ask Me Anything (A11), Advice Columnist (A9 & A10), and sharing one's Google search history (A18).

The Poll

Building from MacLeod et al.'s suggestion that we take time to obtain information to decide when and how often we should post the study activities, we used the poll feature from Facebook (A2) early in the study to find out which days of the week would be best for posting study activities.

Validated Instruments

Since we were interested in how social support structures impact a pregnant or new mother's mental health, we used the Edinburgh Postnatal Depression Scale [3] for A4 and A16 as a pre-post status survey. The instrument has 10 questions used by health professionals to assess postnatal depression. We scored the surveys based on the instrument instructions. If any participants were found to be possibly depressed, we sent them an email encouraging them to contact a health professional. We also included links to relevant resources. This procedure was agreed upon by the IRB.

Advice Columnist

Informed by participants' prior activity posts, we created two types of Advice Columnist scenarios for them to respond to, in an attempt to continue triangulating our methods to identify participants' social networks. The first advice columnist activity (A9) asked participants to give a fictitious character, Maria, advice on how to deal with her anxiety:

*"Dear moms, My name is Maria and I am 34 weeks pregnant with my 2nd child. On the outside, it appears I have everything under control. My nursery is ready; I re-read the books; I remember the classes so I'm good there; my hospital bag is packed; I have someone who will watch my son; but I am getting increasingly anxious. My partner assures me that everything is fine. But I am feeling unsettled about what is going to happen next. Is this normal? What should I do?
Maria."*

Since the results from A9 were in contrast to our initial support network findings (A8), we designed another advice columnist scenario (A10) that dealt with intimacy with one's partner to continue to probe how much participants communicated with their partners about sensitive issues. We prompted them with the following:

*"Dear moms, Here is a question from Haley. What advice will you give her? My name is Haley and my baby is 4 weeks old. My partner has been super supportive, but he says I am not paying enough attention to him. He wants to have sex, but I am feeling uncomfortable, exhausted, and touched out (because I am holding the baby most of the time). I really don't want to jeopardize my relationship, so what do you think I should do?
Maria."*

Ask Me Anything

The Ask Me Anything activity (A11) was modeled after online forums where participants ask questions to the group and respond to any question or comment. We posted the following message in each group.

"Ask Me Anything - Now, we are going to open up to you asking anything - literally ANYTHING. This is a safe space. You can post any question here or message Anna, she will post it anonymously. Feel free to comment and reply to questions from other group members."

This activity was not designed as an expert-moderated forum, such as WebMD-moderated communities, in which only health professionals answered questions from community members.

Google Search History

Based on the work by Fournery et al. [6], where they used an existing proprietary search query data set and found they could identify one's gestational experience and concerns, we wanted to collect participants' search logs to continue our attempt to triangulate data. We planned to see if there were any concerns participants had, that we were missing in our needs assessment. We created a Facebook poll to identify which search engine participants used, and then posted detailed information on how participants could access their search history, delete anything

they did not want the research team to access, and then share the search history with us. Participants had the choice of either emailing the archived search history file or sharing the Google drive folder of their search history.

Post-Study

After the eight-week study, we administered a post-study questionnaire, and offered participants the opportunity to take part in a Google Voice¹ audio interview. Twenty-eight (NP=6, EP=12, M=10) participants (58%) completed the post-study questionnaire. Thirteen (27%) participants participated in the interview. Participants received a \$50 Amazon electronic gift card for taking part in the Facebook study, regardless of their level of participation.

Iterating on the ARC Method

The original ARC method [13] provided a set of *lessons learned* and suggestions, in Table 2 (L1-L11), based on their own experiences. We applied many of the lessons learned from the original ARC method in our study and briefly discuss the areas in which our study is similar or different from the original work. Overall, we confirmed several lessons from the original ARC study as shown in Table 2. In the following sections, we will also point out the new lessons (Lesson 12-17) we learned from adapting the original ARC method.

Our recruitment method (Table 2 - L1) is largely different from the original study, which recruited exclusively through Facebook support groups. MacLeod et al. had been members of many rare-disease communities, building rapport, which made it possible for them to comfortably recruit participants. Because we were not existing members of pregnancy or parenting Facebook groups, we did not recruit as suggested. Instead, we worked with representatives of relevant organizations or websites, leveraging them as a bridge to connect with potential participants.

With respect to informed consent (Table 2 - L2), we worked with our ethics board to make it easier for participants to respond via email. But unlike MacLeod et al.'s study, we did not confirm participants read and understood the informed consent.

In the feedback survey and the post-study interview, participants confirmed that other people's posting encouraged and reminded them to complete the activity (Table 2 - L4).

As MacLeod et al. recommended in L6 (Table 2 - L6), we polled participants (A2) about what times of the day and which days they would like to see activities. Before enrolling participants, however, we decided that only one member of the research team would post activities to decrease participant confusion on what posts were study activities and what posts were from fellow study participants. Our findings show that independent of what days or times we posted, the nature of the activity impacted participation, not necessarily the timeframe.

We encouraged participants to "Favorite" our page so that they would be more likely to see the posts (Table 2 - L7). We were unable to confirm with participants if they all Favorited the

¹www.voice.google.com

Lesson #	Lesson from MacLeod et al. [13]	Used?	Confirmed?
L1	Building a strong rapport with members of groups used for recruiting before, during, and after the study. <u>Note:</u> The researchers were not part of any pregnancy or new mothers groups.	N	N/A
L2	Allowing participants to consent electronically so that participants with limited physical abilities are not excluded, but require them to pass a short quiz on the highlights of the document. <u>Note:</u> Participants consented electronically without a quiz. 82.5% of interested women enrolled.	Partial	Y
L3	Encouraging participants to provide feedback and build on each other's creative contributions. <u>Note:</u> The main purpose of the study was to understand the social support connections of individual participant.	N	N/A
L4	Encouraging participants to post directly to the group, even submissions still in progress. Seeing other participant's contributions can give inspiration to people.	Y	Y
L5	Exercising caution when planning the study and selecting activities; conducting research asynchronously and online means researchers do not have the same chance to assess how a method is going as it is happening.	Y	Y
L6	Taking time to understand potential participants' Facebook behavior to inform decisions about when and how often to post and the overall study duration. <u>Modification:</u> We polled participants about time preferences.	Y	N
L7	Adopting multiple approaches to ensure activities are seen by participants. <u>Modification:</u> We asked participants to add the Facebook study group to their Favorites.	Y	N
L8	Discouraging activities that build on one another where sequence is important. <u>Note:</u> The study did not include sequential activities.	Y	Y
L9	Providing opportunities for socialization between participants that are separate from formal study activities. <u>Note:</u> Majority of our participants were new mothers, any additional activities would have inconvenienced them.	N	N/A
L10	Giving careful consideration to the makeup of the group when recruiting, targeting either a highly homogeneous population or targeting several homogeneous groups.	Y	Y
L11	Being mindful of the number of input mechanisms. Structuring activities to capture data from a range of different sources adds to the richness of the data but means data will be distributed in different locations and needs to be collected and organized. Each additional input mechanism introduces additional overhead.	Y	Y

Table 2: Lessons from MacLeod et.al and any modifications we made for our study. Used?=if we used in the study; Confirmed?=If our study confirmed the lesson; Note=Reasons for not using.

page. The high number of "Seen by" percentages in Table 1, may indicate that participants did Favorite the page. However, we acknowledge that Facebook may log that someone "saw" a post, but it does not necessarily mean that the participant saw a post. They may have had Facebook open in another browser window or tab.

We recruited 48 participants in three different groups as L10 (Table 2 - L10) notes. However, without a heterogeneous group for comparison, we cannot authoritatively say if this had any impact on participation or data sharing. We did have one somewhat heterogeneous group - the moms - which included first-time moms and experienced moms with multiple children. However, initial qualitative analysis does not show any differences in responses or participation in this group compared to the homogeneous Experienced Pregnancy group as seen in Figure 4.

Based on L11 (Table 2 - L11), we limited the number of input mechanisms in the activities. A18 required participants to email us their search history, and the survey results (A4, A8, A15-A17) were collected in Google sheets. Response to all other activities were entered as posts in the Facebook groups.

ANALYSIS

We used meta-data from all of the activities in the study to evaluate the effectiveness of the study method. MacLeod et al. reported the difficulties they faced with large amounts of study data. To avoid this issue, we assigned one researcher to each Facebook group, tasked with checking activities and copying Facebook comments into Dedoose², a qualitative data analysis tool. The first author led weekly meetings to iterate on meta-data needed for analysis (e.g., in week 2, we added descriptors - sets of information to identify and categorize data - in Dedoose). We collected the actual comments as well as the timestamps, "seen by" counts of Facebook posts, and the counts of participants' responses for each activity. We also collected the timestamps from survey responses. Timestamps were used to evaluate how quickly participants responded to each activity and how long it took participants to complete the study. We categorized activities (Table 1) to understand participants' attitudes and preference for different types of activities. To understand the participation rate, we divided the eight week study into four quarters of two weeks each. We then computed the average days it took for all of the participants to complete the study activities posted in each quarter. To understand the response rate for each activity, we looked at

²www.dedoose.com

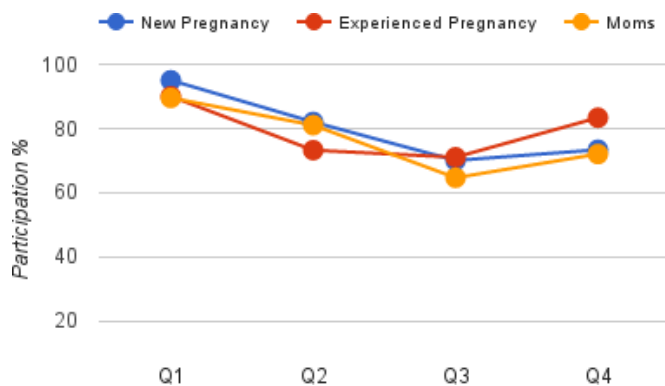


Figure 1: Percentage of participants who completed the activities in each quarter. NP(N=10), EP(N=20), Mom(N=18)

how quickly the participants responded after a new activity was posted. We used Tableau³ to analyze and visualize the data collected. We used Google Voice to conduct and record the post-study interviews, and then transcribed these interviews.

FINDINGS

In this section we summarize findings related to study participation, activities, and interaction characteristics.

Informed Consent

MacLeod et al. [13] had a similar number of participants who were interested in the study and received an informed consent (53 potential participants [13] vs. 63 potential participants). However, our study had a higher enrollment rate - 76% vs. 26%. In their study, potential participants were instructed to review the consent document, print it, sign it, scan/photograph the signature page and return it by email or Facebook post. We extended the ARC lesson on informed consent by allowing participants to reply by email with the following consent statement, "I (participant name) got the copy of the informed consent. After consideration of all the information provided in it, I give my consent to participate in this research study on (date)." We increased enrollment by providing an easier way to consent.

Participation

Figure 1 shows a slight decrease in participation over the four quarters of the study, but the participation rate at the end of the study was still reasonably high (72–83%). This was somewhat similar to MacLeod et al.'s study, where they observed a big burst in participation early in the study and a levelling off for the remainder. Although their study was longer (22 weeks vs. 8 weeks), we see a similar trend of a high participation rate near the beginning of the study, with a small drop in Q2, but a mostly consistent level of participation overall. We also saw that the average amount of time it took for participants to complete an activity did not drastically increase between quarters. In fact, participants completed activities in the fourth quarter quicker than in the others (Q1=1.44 days, Q2=2.64 days, Q3=3.02 days, Q4=1.03 days).

³www.tableau.com

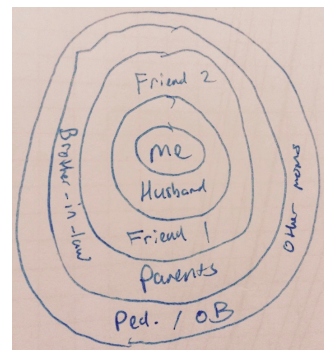


Figure 2: Mom participant M-P31 posted this circle diagram with the comment, "Forgive the circles. 1-year-old helped by climbing on me while drawing. :)"

Preferred Activities

In the post-study debrief interview and feedback survey, we asked participants what activities they preferred. We found that they enjoyed surveys and open-ended questions, instead of media tasks that were more time intensive. For example, the media activity, the social circle diagram (A5, Figure 2), and downloading and emailing their Google search history (A18) were not rated highly because of the extra effort it took outside of the Facebook groups.

M-P48 (Mom-Participant 48) said:

"... the surveys were definitely the easiest for having the time to do them, especially the short ones, but others I sometimes had to set time aside to actually sit and think about it and type it all out. But the surveys were the easiest quickest thing for me."

M-P41 explained why she disliked the media activity, social circle diagram.

"I disliked that I had to write it out on paper (again lazy of me). It was nice that the study was on FB so I could just do responses while I was sitting around pumping or something. Sounds ridiculous, but adding in the extra bit of having a pen and paper nearby was a bigger inconvenience, so it took me a lot longer to respond to that activity."

For participants with children, activities presented additional challenges as shown in Figure 2. The amount of effort was also reflected in how long they took to respond (Figure 3 - Md).

Reluctance to share personal data was the main reason participants did not respond to the Google search history activity. EP-P16 (Experienced Pregnancy-Participant 16) said:

"I didn't feel comfortable answering the one with the Google history just because my husband and I use the computer for work and that has a lot things. Just doing a complete 'here's all the things that you're searching for' was kind of going above and beyond what we needed to share. I understood the idea of getting what you're

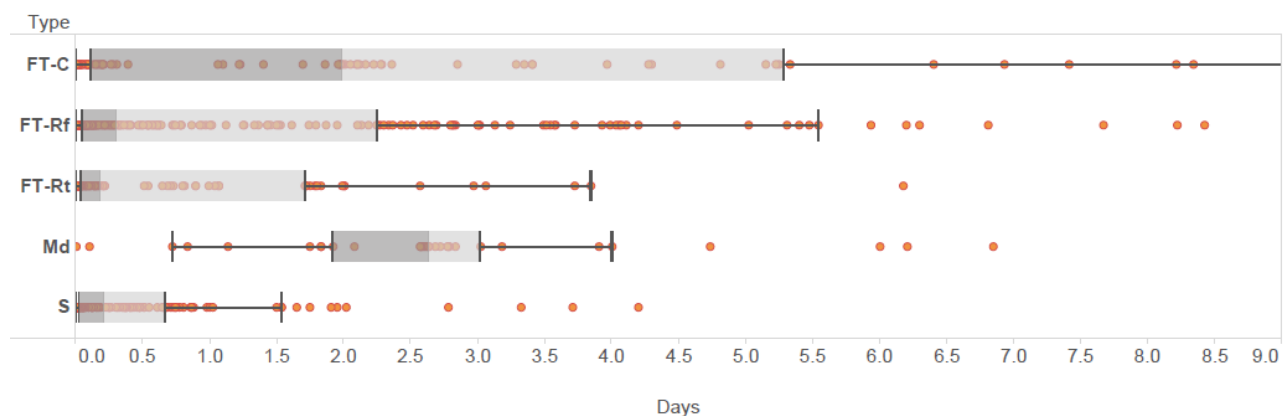


Figure 3: Activity completion delay grouped by activity types. FT=Free Text; C=creative (2 activities); Rf=Reflective (6 activities); Rt=Report (2 activities); Md=Media (1 activity-Circle diagram); S=Survey (4 activities); Google search activity is excluded because of very low participation.

searching for, but [pause] that is just a little bit too much information that I didn't feel like sharing".

Figure 3 shows the response delay for different types of activities. Participants' preference of activities played a role in how quickly they completed them. Their preferred activities, survey, and free text activities, were completed faster than the least preferred media activity, which required extra resources, such as paper, pencil, taking a picture, and posting it. Surveys and free text took less response time (FT-C- $\bar{x} = 1.99$ days. FT-Rf- $\bar{x} = 0.33$ days. FT-Rt- $\bar{x} = 0.16$ days. Survey- $\bar{x} = 0.16$ days) compared to media activities ($\bar{x} = 2.63$ days).

Whenever a new activity was posted, some participants went back and completed activities they did not already complete. This was also observed in the original ARC method. Our analysis of participants' posting times shows that 18.6% responded to more than one activity within 60 minutes of each other, thus indicating cluster participation.

Our study featured activities that needed participants to only type the responses (e.g., scenarios) or to select the options (e.g., surveys) using their devices. The study also had activities that required additional steps (e.g., circle diagram and search history) rather than just typing responses. In the latter case, there was longer delay for the circle diagram responses and low response rate for the search history activity. Participants' feedback about these activities suggested that, in addition to input mechanism, the number of steps to complete an activity also influenced participation. So we recommend that researchers **be mindful of the number of steps needed to complete an activity when selecting activities for the ARC method (Lesson 12)**. Based on the moms' preference for using mobile phones to complete study activities, we would go a step further to suggest that researchers who utilize the ARC method **should consider participants' technology preferences, while developing activities based on their research questions, ethical obligations, and the need to triangulate data to establish a ground truth (Lesson 13)**.

Participant Response to New Activities

The new activities we introduced in our study worked well except for the Google search history activity.

A majority of participants responded to validated instrument (EPDS) activities (First instance (A4) - NP 100%, EP 95%, M 89%; second instance (A16) - NP 80%, EP 90%, M 72%).

Participants gave empathetic advice (NP 90%, EP 70%, M 78%) in response to the first advice columnist activity (A9). In comparison with A9, participation decreased slightly for A10, the second advice columnist activity (NP 80% EP 60%, M 56%).

In response to the Ask Me Anything activity, mothers and experienced pregnant participants were less likely to post (EP 60% and M 50%). However, the participants who did respond continued engaging in the conversation by commenting multiple times for this activity. Although the newly pregnant participants were more likely to participate (NP 80%), no one responded to each others' posts. For experienced moms, topics ranged from tips for comfort and healing postpartum to veins popping out on breasts.

Mothers asked about dealing with exhaustion; understanding when one is sad or depressed; and caring for their babies with respect to feeding and sleeping. Judging from the range of topics discussed in this activity, it seems mothers felt comfortable discussing difficult and taboo topics freely in this particular activity. Newly pregnant mothers were most interested in what they could change before the baby comes, and how life will change after their baby arrives. Since none of them responded to each other, the researchers who are mothers responded. This activity allowed us to understand unique concerns of first-time pregnant women.

In response to search history activity, only six participants were able to access and send their search data - two of the search histories received did not contain any usable data. The few participants who did respond in the comments section of

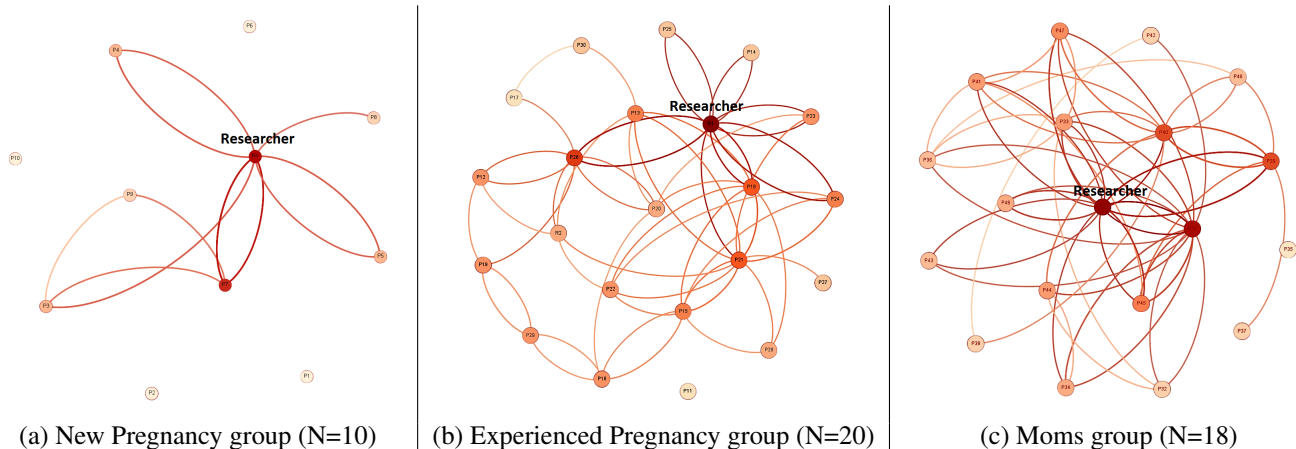


Figure 4: Group Interactions

the Facebook post expressed confusion and privacy concerns about the activity.

Overall, the new activities were well received, except the search history.

Group Interactions

Group interactions (measured as the number of comments between participants) in our study were markedly less than the rare-disease group in the original ARC study. Figure 4 shows interactions within each group for the 11 free text activities. Responses to free text activities were visible to everyone in the group. The average number of interactions for each activity was seven for the Moms group, five for the Experienced Pregnancy group, and two for the New Pregnancy group. Interactions were primary with the researchers.

Figure 4 shows high interactions in two out of the three groups. However, as shown in Table 1, participation rate of all three groups, including the one with low interactions, was high. This suggests that when using the ARC method, high interactivity among participants may not be necessary to elicit valuable research findings.

Activity Triangulation

Based on the prior ARC study [13], we did not introduce activities that built on one another where a response to one activity relies on having completed a previous activity (Table 2 - L8). Instead, we triangulated the data [20] using multiple methods to assess a given phenomenon and enhance the validity of the findings. For example, when data from a self-reporting instrument and an external observation converge, the overall results are more likely to be valid and credible [7]. We verified the validity of our participants' perceived social support source by triangulating three activities: a social support diagram (A5), a survey (A8), and an open-ended question (A6). In each of these methods, we asked participants to identify their most trusted, valued, and frequently used support person(s).

In A5, participants drew a diagram of their social support network as a series of concentric circles, placing themselves in the center and gradually building the circles out to indicate

	Survey (S)	Scenario (FT)	Search History (Md)	Open Ended (FT)	Circle Diagram (Md)
Prep Time	◐	◐	●	○	◐
Response Time	○	◐	●	◐	●
Analysis Time	◐	●	●	●	◐
Usefulness	●	◐	○	◐	●
Worth it?	Y	Y	N	Y	Y

Table 3: Relative Merits of Activity Types. Filled circle=High; Half circle=Medium; White circle=Low. Response time: Filled circle=Long duration; Half circle=1-2 days; White circle=Immediate.

how much they depend on people in each ring. We next posted an open-ended question (A6) asking who they turn to when they need help. The third activity was a survey (A8) about communication with their social support network. The aim of each activity was to identify their most trusted, valued, and frequently used support people in their lives. However, the activities differed in terms of the media used and the amount of creativity or reflection needed to complete. **The ARC method provided an easy platform to design and add triangulation activities as needed and gave researchers time to think about upcoming activities.**

Relative Merits of Activities

Table 3 shows the summary of the merits of the activity types based on our experiences, participation characteristics, and the feedback from participants. For example, a half circle for "Prep Time" for the Circle Diagram means that we spent a few hours planning the activity, formulating the instructions

on how to complete the activity, and thinking about how to analyze the data in real time based on an exemplar we created. A full circle for "Response time" means that it took 2-3 days (Figure 3) for participants to respond to the activity, which is relatively high for activity response. A half circle for "Analysis Time" means it took 1-2 days for us to analyze participants' completed circle diagrams for quantitative (number of connections; number of circles; visualizing the collective data) and qualitative (people in the circle, comparison with the survey data in terms of connection; triangulating with open-ended questions) perspectives. A full circle for "Usefulness" is based on its significant contribution to help us triangulate with other data sources, and the large amount of information it gave us about participants' connections. Yes on "Worth it" means that we would do it again based on our experience and the other metrics in Table 3.

Even though media activities such as the circle diagram require more effort from participants, they capture rich information about the mothers' social connections. Except for the Google search history activity, we find it worthwhile to use the original as well as the new ARC activities in future studies.

Please note that we developed four out of five surveys (A8, A15-A17) for the study that contributed to assigning half circle for "Prep time" for surveys

We encourage researchers to find balance between the ease of use for participant and the usefulness of the data collection activities and tools, while engaging participants through social media platforms (Lesson 14).

Data Collection Tools and Methods

Adapting data collection methods and instruments that are effective in interviews or focus groups can be difficult to use and manage, in an online environment. An example in our study is the circle diagram activity (Figure 2). Writing down their support people in appropriate circles would have been an easy task for participants in a face-to-face study, but printing it, and then filling, scanning and posting it to the group, proved to be difficult for our participants, and it reduced the response rate for that activity. During the post-study interview NP-P5 said:

"I liked it. I liked activities that were self contained, ones that didn't require me to use additional supplies, anything where all of the resources I needed to participate were provided (open-ended questions, surveys, advice). Maybe if a fillable circle diagram had been provided in a link it would have been easier to do on the fly."

We encourage the research community to devise ways to adapt commonly used data capturing mechanisms used in face-to-face focus groups to use in online, asynchronous research methods (Lesson 15). An example, as P5 suggested, would be presenting the circle diagram as clickable regions in which participants can type, so that they don't have to use additional resources outside of their preferred device to complete the activity.

Although online tools can increase the participation rate, it may cause preparation overhead. The researchers are encour-

aged to decide if the increased response rate would balance with the increased prep time. **We also encourage the CHI community to be forthcoming in sharing any online tools they developed.**

Technology Preference

We asked participants which device they used to respond to the study activities the most. We found that 77 percent of the participants used their mobile phones instead of a computer, to access Facebook and perform the activities. They also commented on the convenience of filling out surveys on a phone as opposed to free text or media activity. The ease of filling out surveys using phones likely impacted the fast response times for surveys compared to other activity types.

DISCUSSION

In this section, we discuss the suitability of the ARC method as an online focus group.

ARC as an Online Focus Group

Focus groups allow researchers to study people in group settings, using conversational exchanges between participants [15]. In this section, we discuss the suitability of the ARC method as an online focus group to study populations facing constraints. The common characteristics of a traditional focus group that we considered for comparison are (1) sustained participation, (2) immediate responses, (3) emergence of new discussion topics, (4) interactivity, (5) use of multiple data collection instruments, and (6) sense of group and camaraderie.

Sustained Participation

Typically, a focus group meets at a location agreed upon by participants for a specific duration of time. Participants engage in discussion led by researchers over the duration. Being at the same place and time gives the focus group participants opportunities for sustained engagement with the group. As evidenced by the relatively high participation rate (>60%) throughout our study (Figure 1), we conclude that the ARC method enabled participants in our study to be involved with the group activities throughout the duration of the study, similar to a focus group.

Immediate Response

In focus groups, participants interact with each other seamlessly and their questions can be answered immediately. This is different in asynchronous methods such as the ARC method, but by enabling the notification feature for posts, participants and researchers can receive alerts that will prompt them to respond to the activities immediately. In our study, some participants responded as soon as a new activity was posted (Figure 3).

Emergence of New Discussion Topics

Similar to focus groups, adapting the ARC method allowed the researchers and participants in our study to ask for clarifications and to bring up new topics. As described earlier, we used triangulation to confirm or clarify any emergent topics or themes.

Interactivity

In the original ARC study, interactions between participants were high, but in our study, interactions were limited (Figure 4). However, the ARC method provides the ability to interact with each other in the group.

Multiple Data Collection Instruments

In a face-to-face focus group, researchers can involve the participants in different data collection activities, such as surveys, scenarios, creative activities, and personal reflections. Using the ARC method, we were able to administer surveys, solicit personal reflections, and facilitate group discussions. Although creative activities required multiple steps and the use of external artifacts that resulted in low participation rate, this platform helped facilitate different kinds of data collection methods, similar to a face-to-face focus group.

Sense of Group and Camaraderie

In our study, like in a face-to-face focus group, participants had the opportunity to get to know each other. Our first group activity was an introduction from all participants, including the researchers, where they shared personal information about themselves, if they choose to do so. All participants contributed to this activity. When participants posted questions, others answered them. Overall, the ARC method provided a sense of group. NP-P6 expressed her feeling about the group as follows:

"I thought all of the women showed up as very supportive of one another and truly interested to help in any way."

Using the ARC method enables researchers to mimic the activities and data collection methods of a face-to-face focus group, without requiring participants be co-located. The ARC method, therefore, is especially useful for conducting research with populations that are hard-to-reach due to time, location, and resource constraints. The method also helps researchers to collect data over time, giving time to reflect on past activities and to think about future activities.

Implications of Recruiting Participants Online

The purpose of our study was to understand the social support needs of pregnant women and new mothers. Recruiting pregnant women and mothers who are already active in online groups, to study the social support needs may look inherently biased. However being active online does not translate to having good social support offline. For example, in the rare disease study, participants were very active in the Facebook groups to which they belonged, but they lacked social support as evidenced by the findings [14].

Ethical Obligations

Administering the Edinburgh Postnatal Depression Scale was the most controversial activity we undertook. Even though we knew going into the study that 10-20 percent of mothers experience postpartum depression [12], as researchers, we felt somewhat helpless when 33 percent of participants scored in the depression risk category at some point during the study. All of them were responding to study activities, and their responses did not indicate they were having symptoms of depression. We worked carefully with the ethics board to ensure

our responses to participants were prompt (within 48 hours), and provided encouragement to seek care from a medical professional with appropriate resources. We sent emails to 18 participants encouraging them to seek help. However, none of them responded, but all continued to participate in the study.

Unlike much of the mental health research that the health community has engaged in [16, 2], where researchers are either providing a mobile health intervention [16] or working with a health professional [2], we simply recorded data and sent out a generic email.

Through this process, **we learned that in the future, we must carefully consider the activities we choose. When possible, we must provide meaningful and helpful interventions (Lesson 16).**

LIMITATIONS

The main limitation of using the ARC method as opposed to a synchronous, co-located focus group is the need for an internet connection to participate in the study. In addition, only the people with Facebook accounts could participate, and they had to be familiar with navigating social media. These limitations may exclude participants living in remote and low-resource locations. Another limitation, as opposed to face-to-face focus groups, is the lack of opportunity for researchers to gauge the facial expressions and display of emotions by participants during the study.

Another limitation is the potential for resource overhead in collecting and organizing study data, as mentioned in L11. **We encourage researchers who plan to use the ARC method to be proactive about using strategies to make data collection and organization easier (Lesson 17).**

CONCLUSION

We adapted the ARC method to study a different population, pregnant women and new mothers. Using this method, we tailored the study to our population, and added triangulation activities to validate our data. Based on our adaptations, participants' feedback, and the participation data, we present recommendations for others using the ARC method as a platform for conducting online focus groups. We encourage the CHI community to continue to adapt this method to study different populations, especially those with time, mobility, and availability constraints.

The original ARC study and our application of it show that the ARC method is agile enough to be used for answering user-needs oriented research questions with hard-to-access populations. We hope that the CHI community will continue to use the ARC method to provide insights to its suitability in answering different types of research questions.

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