

Taking Stock of Studies Using Asynchronous Remote Communities (ARC): A Scoping Review

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Asynchronous Remote Communities (ARC) is a versatile research method that has grown in use since its introduction to the HCI community in 2016. Especially useful for engaging underrepresented populations, the ARC method engages participants in a remote, online space through activities over a period of time, often encouraging social interactions and community-building among participants. We conduct a comprehensive analysis of the current state of ARC by reviewing 33 unique studies published in 40 papers that adopted this method. Our evaluation includes an in-depth account of the justifications for using ARC, study designs and activities, analytical approaches, and participants' demographics. Additionally, we reflect on activity selection, study preparation, and platform selection. We identify existing gaps in the current literature and provide recommendations to support the further development of ARC by broadening its application and establishing best practices in reporting. Our study contributes to the growing body of HCI literature that aims to develop and enhance research methods within the field. By fostering a better understanding of the current state of ARC, we aim to assist HCI researchers in improving the design of future ARC studies.

RESEARCH HIGHLIGHTS

- ARC is a flexible research method that facilitates remote, asynchronous engagement, particularly suited for addressing challenges related to stigma, privacy, geography, and mobility.
- Future ARC studies should broaden participant diversity beyond WEIRD populations and explore application across all design stages to unlock the method's full potential.
- Researchers are encouraged to diversify ARC activities beyond predominantly reflective tasks, incorporating creative, social, and real-world engagements to enrich data and enhance triangulation.
- Researchers should involve community members in the design of ARC studies to ensure cultural appropriateness and better support marginalized participants through community-based participatory design methods.
- To improve methodological rigor and enable future synthesis, ARC researchers should share detailed study documentation—including activity design, participant engagement metrics, and compensation structures—in appendices or supplementary materials.

Keywords: *Asynchronous Remote Communities; qualitative research; health informatics; scoping review.*

1 INTRODUCTION

Asynchronous Remote Communities (ARC) is an emerging design research method since its introduction in 2016 (MacLeod *et al.*, 2016a,b) that has received growing attention from the HCI community due to its unique flexibility. Through the ARC method, researchers engage participants in a remote and asynchronous online community (e.g., a private Facebook group) by assigning prompts or activities over a period of time and, typically, asking participants to post their responses in the broader group for other participants to see and engage with. Although the community must be remote and primarily asynchronous, the study design may also incorporate synchronous elements, such as focus groups or interviews (Maestre *et al.*, 2018).

ARCs are especially useful for research scenarios that require building a sense of community among participants while allowing flexibility in data collection. For instance, ARC can be beneficial when engaging with communities that are geographically dispersed (Alqassim *et al.*, 2022, Kresnye *et al.*, 2021, MacLeod *et al.*,

2017a), when participants' schedules and mobility are barriers to participation (Bhattacharya *et al.*, 2019, 2021b, Maestre *et al.*, 2018), and when privacy and anonymity is required (Kornfield *et al.*, 2022). The asynchronous nature of ARC allows participants time to compose thoughtful responses without feeling the need to respond immediately. Additionally, the community aspect creates opportunities for participants to build on one another's contributions (Kruzan *et al.*, 2022, Meyerhoff *et al.*, 2022), enhancing collective insights and making the social dynamics within a population more visible (MacLeod *et al.*, 2016a). Examples of ARC applications include exploring shared experiences, such as coping with medical conditions (Maestre *et al.*, 2021) or navigating stigmatized identities and topics (Augustaitis *et al.*, 2021, DeVito, 2021, DeVito *et al.*, 2021, Liang *et al.*, 2020, Ril *et al.*, 2023), where community support and asynchronous interaction contribute to richer insights. Additionally, ARC has been effectively used in studies involving pregnant people (Prabhakar *et al.*, 2017a,b) and teens (Bhattacharya *et al.*, 2019, Liang *et al.*, 2020), where

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mobility or scheduling may be a concern, making remote and asynchronous participation more feasible and accommodating. The method also proves advantageous when privacy and anonymity are crucial, such as in research with stigmatized communities or people who do not want to be in-person (Meyerhoff et al., 2022), allowing participants to share experiences in a supportive, yet secure environment. ARC shares similarities with other methods, such as online focus groups (Stewart & Shamdasani, 2017, Stewart & Williams, 2005); however, its flexibility extends beyond these individual methods. By allowing researchers to adopt various methods in study activities, ARC enables researchers to develop an enriched understanding of participants' experiences. The ARC method is particularly beneficial when prolonged engagement or peer-to-peer interaction can provide depth to the research findings, such as understanding the dynamics of social support or collective meaning-making within a community (MacLeod et al., 2016a, Maestre et al., 2018).

The importance of proper development and evaluation of methods in HCI has been long discussed (Cox et al., 2008, Dickson & Stolterman, 2016, Maestre et al., 2018). HCI research methods often require flexibility in observing and interacting with participants. Therefore, it is common to see HCI researchers adjust previously established methods to meet the needs and requirements of their studies. However, a lack of consistency in using methods challenges the evaluation of scientific rigor and hinders knowledge sharing in the community (Maestre et al., 2018). The flexibility to align with participants' diverse contexts is one of the unique characteristics of ARC that has enabled researchers to use the method in a variety of settings. Exploring the diversity of approaches to employing a method like ARC enables the community to establish consensus on best practices while still allowing flexibility for researchers to adjust methods to their specific needs without sacrificing rigor. Therefore, the purpose of this study is to take stock of the current ARC literature through a scoping review of ARC studies. We analyzed 40 ARC papers describing 33 unique studies and extracted elements of study design, participant populations, data analysis techniques, and methodological reflection, with particular attention to commonalities and differences across studies. To this end, the research questions guiding our literature review were:

- How are researchers designing ARC studies?
- What populations are researchers using the ARC method to engage with?
- How do researchers motivate or justify their application of the ARC method?
- What activities, data collection methods, and analysis methods are used in ARC studies?

Overall, this scoping review consolidates current applications of the ARC method to help inform the development of future ARC studies, identifies gaps and opportunities for improved methodological rigor, and provides open questions to guide further evaluation and implementation of ARC.

2 METHODS

We curated a list of seven core ARC Papers (MacLeod et al., 2017a, 2016a, 2017b, 2016b, 2015, Maestre et al., 2018, Prabhakar et al., 2017b) as the first papers to use the ARC method. We defined ARC based on the criteria described by Maestre et al. (2018) wherein studies require, "at minimum, an asynchronous, remote, community," as outlined in red in Figure 2. Based on research team discussions and Maestre et al. (2018) noting, "We

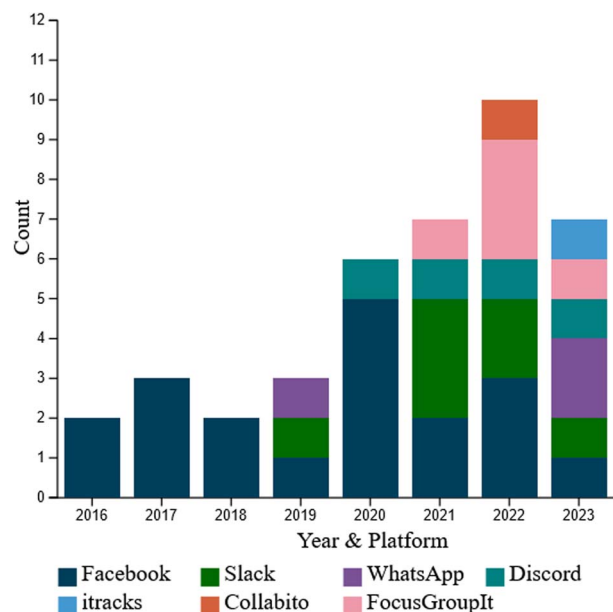


FIGURE 1. Paper count across publication years, color-coordinated by primary platform used for the ARC environment (N=40).

constrain ourselves to only methods where a researcher is actively involved throughout the study and data is collected in response to some prompt or task given by the researcher," we added, *Researcher created and facilitated* to the ARC minimum definition. Thus, our ARC definition criteria included (1) a researcher-created online space where they (2) facilitated activities in an (3) online community or forum. Using this definition, we included studies that met these criteria even if they did not explicitly identify as using ARCs. For instance, Lawton et al. (2022) described their study as a "Facebook intervention," and Seguin et al. (2022) invited participants to "join a private Facebook group where they were instructed to accomplish asynchronous activities and engage in group discussions." Although they do not specify they conducted an ARC study, both do cite a core ARC paper as a similar study method.

Next, we utilized the forward citation tracking feature in Google Scholar to identify papers that referenced at least one of the core papers. The search resulted in a total of 409 papers, including 234 unique and 175 duplicates. We subsequently screened the unique papers based on the following inclusion criteria:

- The study was written in English.
- The study was peer-reviewed.
- The study used the ARC method (as described in Maestre et al. (2018)).
- The study reflected on the outcome of their ARC activities.

Of the 234 unique papers, 36 papers were not peer-reviewed, five papers were not written in English, and two papers did not cite any of the core papers (erroneously marked by Google Scholar). Additionally, 151 papers did not meet the ARC criteria described by Maestre et al. (2018) or did not report on the outcome of an ARC study—82 papers referenced the topic of the cited core paper (e.g., stigma, rare disease, pregnancy, etc.), 26 papers were method discussion and comparison, and 43 papers referenced ARC as a method but did not use it in the presented study. Figure 3 describes our screening process. Upon completion, we identified 40 papers that met the inclusion criteria.

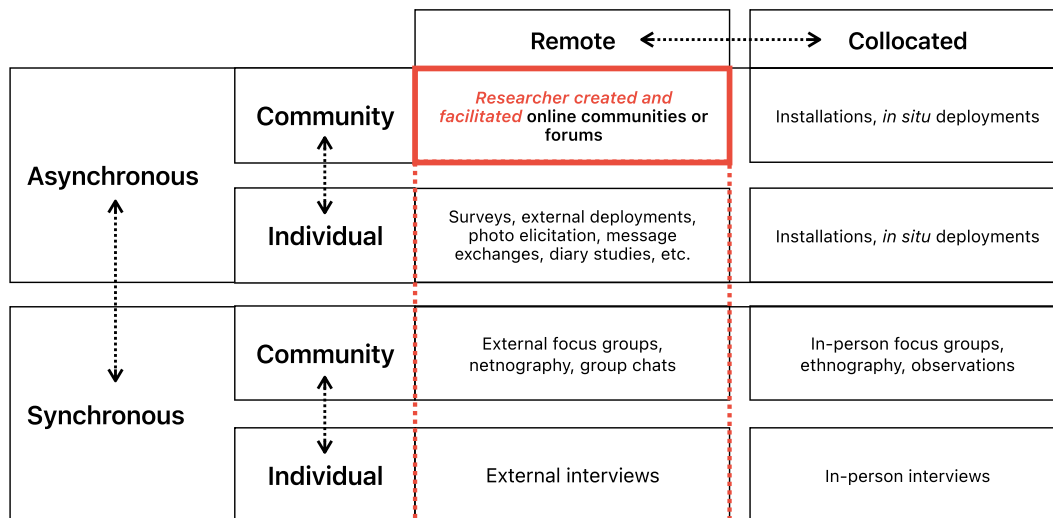


FIGURE 2. Examples of Research Methods in HCI adapted from Maestre et al. (2018). ARC requires, at minimum, a *researcher created and facilitated* asynchronous, remote, community (solid red outline). Italics indicates an addition to criteria in Maestre et al. (2018). ARC may also draw from synchronous or individual methods (dashed red outline) and in some cases, include collocated research methods.

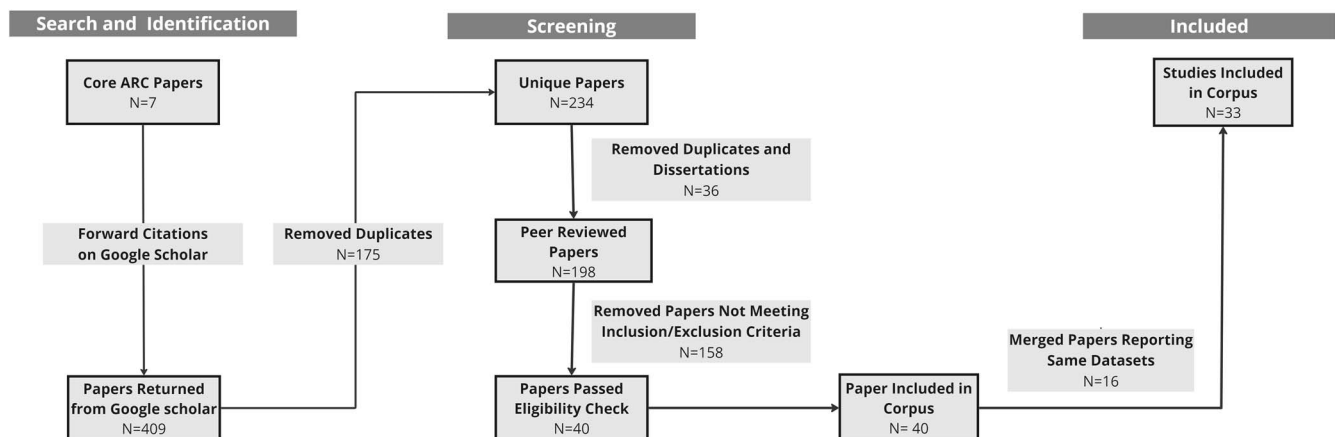


FIGURE 3. PRISMA flow chart for identifying papers in our corpus. Some datasets are shared between 2 and 4 papers resulting in 33 studies in our corpus. See section refSec:PapersVsStudies for more information.

Our research team iteratively coded a subset of the papers to extract information and metadata that informed our research questions. We met regularly to discuss the application of existing codes and the emergence of new codes while reviewing these papers. After three rounds of group discussion, no new items were added or removed and the team had reached an agreement on the definition and application of each code. Tables 2-4 show our extraction codes and definitions, organized by research question. We used these codes to extract information from the remaining papers. We curated these codes to inform our analysis of both the current state of ARC studies and to guide the design of future ARC research. Specifically, these codes encompassed details such as participants' demographics, research topics, and the justification for using the ARC method. Additionally, we coded for elements relevant to the design of future ARC studies, including group structure, the number of participants, study duration, and the types of activities employed. Each paper was coded by two researchers to ensure a consistent application of the codes.

2.1 Positionality

Our research team includes a diverse group of people with intersectional identities, including people of color and people who

TABLE 1. Publication venues of papers that met inclusion criteria (N=40).

Publication Venue	Count
CHI	16
CSCW	7
IDC	3
JMIR Formative Research	3
Pervasive Health	3
Behaviour Research and Therapy	1
BMC Medical Research Methodology	1
BMC Women's Health	1
CHI Play	1
DIS	1
Int. J. Environ. Res. Public Health	1
Pilot and Feasibility Studies	1
Sexualities	1

were born in and outside of the United States. All team members obtained their higher education and research training within the United States. Five researchers had used the ARC method prior to joining this project. One researcher had not conducted an ARC study, but joined with an expressed interest in learning

TABLE 2. Extraction Codes for: How are researchers designing ARC studies?

Extraction Codes	Description
<i>Paper Information</i>	
Publication Year	Year paper was published
Publication Venue	Conference, proceedings, or journal that paper was published in
Author(s)	List of the authors of paper
<i>Inclusion Criteria</i>	
Paper Type	Full paper, journal article, case study, short paper
Publication Category	Archival, non-archival
<i>ARC Criteria</i>	
Mode	Asynchronous, synchronous, mix
Remote	Was the study conducted in person or remotely?
Platform	Platforms used during the ARC Study (e.g., Facebook, WhatsApp, Discord)
Synchronous Component	If there is a synchronous component, what was it? (e.g., Zoom interviews)
<i>Recruitment</i>	
Survey	Participants were recruited using a survey.
Fliers	Participants were recruited through physical fliers.
Social Media Account	Researchers posted study advertisements on personal social media accounts.
Relevant Online Forums or Groups	Researchers posted study advertisements in relevant online forums or groups.
Paid Social Media Ads	Researchers paid for study advertisements on social media.
Other	Recruitment method that has not been mentioned
<i>Study Design</i>	
Participant Number	Number of participants included in the ARC study
Groups	Number of groups included in the ARC study
Duration	Length of study
Activity Number	How many total activities were completed
Activities per Week	How many activities were completed per week
Missed Activity Follow-Up	Did researchers follow-up with participants on missed activities?
Platform	The platform used for the study
Code of Conduct	Did researchers provide rules on engaging with other participants in ARC?
<i>Stage of Design Process (Adapted from Dam (2025))</i>	
Discovery	Study researches users' needs
Defining	Study finds users' needs and problems
Ideation	Study challenges assumptions and creates ideas
Prototyping	Study starts to create solutions for users
Testing	Study tests out solutions on users
<i>Compensation</i>	
Categories	Yes, No, Not Reported
Compensation Value	Value of compensation
Compensation Vehicles	Gift cards, vouchers, cash, local currency, class, credit, food, beverage, crowdwork platform
<i>Ethics Review</i>	
Ethics Review Mentioned	Yes, No, Not Reported
<i>Funding</i>	
Sources	University, Industry Funding, Foundation, Federal Grant, Not Reported

more about the method for an upcoming study. Collectively, our team has research experience engaging a variety of populations, including stigmatized health experiences, LGBTQ+ identities, older adults, and religious cultural identities. We engaged with our data and findings critically, while frequently screening our data extraction, analyses, and internal team discussions for inclusivity. As such, we also acknowledge the potential impact of our team's identities and backgrounds on the direction of this project.

3 RESULTS

We identified 40 papers that fit our inclusion criteria. There is a growing trend in the adoption of the ARC method over the last

eight years (2016 through 2023), as shown in [Figure 1](#). Studies were published across 13 publication venues (See [Table 1](#)). Although HCI publications including Conference on Human Factors in Computing Systems (CHI) (n=16) and Computer-Supported Cooperative Work (CSCW) (n=7) were the primary publication venues, ARC studies have also appeared in health-related publications, such as BMC Women's Health, Journal of Behaviour Research and Therapy, and International Journal of Environmental Research and Public Health.

3.1 Papers vs. studies

During the extraction and coding process, we realized that some papers referred to the same study, as shown in [Table 5](#). For example, papers [Alqassim et al. \(2022, 2019\)](#), [Kresnye et al. \(2021\)](#) all

TABLE 3. Extraction Codes for: What activities, data collection methods, and analysis methods are used in ARC studies?

Extraction Codes	Description
ARC Activities	
Introductions	Participants were prompted to introduce themselves with or without an ice breaker; typically at the start when people join the digital community
Pre-Survey	Any survey administered during recruitment or as the first activity
During ARC Survey	Participants completed a survey or poll in the middle of the ARC study
Post-Survey	Any feedback survey administered after the ARC study has been completed or as the last ARC activity
External Deployment	Participants were prompted to use an app/system/prototype other than the platform being used for the ARC
Media Elicitation of Personal Experiences	Participants took pictures/video/audio/media of their everyday life/experience and posted it to the group
Upload of a Created Artifact	Participants created an artifact (e.g., uploaded a drawn image)
Private Message Exchanges	Researchers exchanged private messages with a participant or encouraged participants to exchange with each other as an activity. Does not include follow-ups
Diary Studies	Participants were prompted to keep a diary and/or participate in a diary study
Virtual Diagramming/Organizing	Participants brainstormed or organized ideas on a shared space
External Focus Group	Participants engaged in a synchronous, external focus group where the research team facilitated questions
Discussion Prompts - Creative	Participants responded to creative discussion prompts (e.g., write a movie script, madlib, etc.)
Discussion Prompts - Recount Experiences	Participants responded to reflective discussion prompts (e.g., reflect on your experience, what do you think about [item/concept] based on your personal experience?)
Artifact/Interface Critique	Researchers solicited feedback on a prototype artifact geared toward the study population (e.g., co-design, interface critique)
Response to Media Artifact	Participants responded to a media artifact (e.g., video, picture, persona)
Netnography	Activity used digital traces of naturally occurring public conversations recorded by contemporary communications networks
Group Chats	Researchers exchanged private messages with a subgroup of participants or prompted participants to exchange private messages with a subset of other ARC participants
External Interview	A research team member facilitated a synchronous external interview with individual participants
Evaluation	
Participant Engagement	Study shared results about participant engagement (e.g., 90% of participants completed all activities)
Qualitative Analysis of Data	Researchers qualitatively analyzed data from ARC study
Methodological Reflection	Researchers reflected on ARC methodology or made suggestions on how to improve ARC

analyzed a dataset collected from 42 women who had experienced miscarriage. Although the data was the same, the individual papers offered different contributions—the short paper [Alqassim et al. \(2019\)](#) engaged in methodological reflection, while the journal paper [Alqassim et al. \(2022\)](#) focused on social support, and the conference paper [Kresnye et al. \(2021\)](#) developed a timeline based on participants' experiences. We also found that papers reporting on the same study often described differing levels of study design details (e.g., one paper might provide more detail on their recruitment methods than another paper analyzing the same data). Likewise, three papers wrote about more than one ARC study ([Bhattacharya et al., 2021a](#), [Maestre et al., 2020](#), [2021](#)), as shown at the bottom of [Table 5](#). [Table A1](#) in the Appendix organizes papers by study ID and provides high-level information about their participant populations and study design.

We systematically identified papers with shared studies and merged the extracted information, inclusively, to prevent the double-counting of extracted ARC elements and to clarify the presentation of our findings. The impact of this merging was most evident for extracted variables, such as “ARC Justification” and study design details, likely due to research teams having to make content exclusions decisions according to publishing restrictions (e.g., page limits).

We identified papers with shared studies by (1) looking for common authors; (2) comparing participant demographics; (3) comparing study details, such as number of participants, number

of activities, and length of study; and (4) comparing the list of named activities. Identifying and merging this information led to thirty-three unique studies. All analyses in this scoping review were based on these unique studies, except for publishing details (authors, paper type, publishing venue, publishing year) and methodological recommendations, which varied greatly across individual papers, even those referring to the same study data.

3.2 Justification for conducting ARC studies

The initial justification for the ARC method was to study populations with rare conditions ([MacLeod et al., 2016a](#)) and overcome barriers of face-to-face group-based research ([Maestre et al., 2018](#)). Our analyses suggest the rationale behind using ARC as a research method included stigma (45.5%, $n=15$), privacy concerns (36.4%, $n=12$), geographical constraints (33.3%, $n=11$), mobility constraints (21.2%, $n=7$), chronic health conditions (15.2%, $n=5$), disabilities (12.1%, $n=4$), and rare diseases (6.1%, $n=2$). Most studies mentioned at least one of these justifications for ARC (93.9%, $n=31$), however, two studies did not explicitly justify why ARC was used. These two studies engaged vulnerable populations, including Filipino Migrant communities in Australia ([Seguin et al., 2022](#)) and mental health in Latinx youths ([Agapie et al., 2022](#)).

Approximately 20% of studies ($n=6$) indicated more than two rationales for utilizing the ARC method. These studies centered around vulnerable populations ([Michelson et al., 2021](#)) and health conditions, such as HIV ([Maestre et al., 2018](#)), miscarriage

TABLE 4. Extraction Codes for: What populations are researchers using the ARC method to engage with?; How do researchers motivate or justify their application of the ARC method?

Extraction Codes	Description
<i>Participant Demographics</i>	
Population	Population of study within inclusion/exclusion criteria
Gender	Women, men, transfeminine, transmasculine, nonbinary, not reported, other
Race	White, Asian, Arab, Hispanic, Native American, Black, Multi-Racial, Participant did not disclose, Not reported
Percentage White	Percentage of participants that are white
Mean Age	Mean of participant ages
Age Range	Range of youngest to oldest participant age
Country	Geographic location(s) of participants, organized by continent
LGBTQ+ Reported	LGBTQ+ identities have been reported by study
Educated Reported	Participant education has been reported by study
Income Reported	Participant income has been reported by study
<i>Justification of ARC</i>	
Limited Mobility Status	The paper explicitly mentions limited mobility with the study population
Rare Disease Status	The paper explicitly mentions rare diseases with the study population
Chronic Illness Status	The paper explicitly mentions chronic illness with the study population
Disability status	The paper explicitly mentions disability with the study population
Stigma	The paper explicitly mentions stigma with the study population
Geography	The paper explicitly mentions geography as justification for ARC
Privacy	The paper explicitly mentions privacy as justification for ARC

(Alqassim *et al.*, 2019), Amyotrophic Lateral Sclerosis (ALS) (Genuis *et al.*, 2023), Coronavirus Disease 2019 (COVID-19), rare diseases (MacLeod *et al.*, 2016a,b), and mental health (Bhattacharya *et al.*, 2021a). For example, Michelson *et al.* (2021) used ARC during the COVID-19 pandemic to engage with “shelter-in-place vulnerable populations” (Michelson *et al.*, 2021).

3.3 Study design

We investigated the way that authors designed their studies to help future researchers understand the strengths and limitations of various design choices and make informed decisions about how to effectively apply the ARC method in different contexts. We paid particular attention to the activities (pre-determined tasks assigned to participants by researchers) and the construction of groups (subsets of participants engaging in the same activities on the same platform, but in separate spaces and/or at different times). The following subsections detail aspects of ARC study design, including ethics approval, platforms, number of participants, participant groups (number of groups and number of participants per group), activity frequency, follow-ups on missed activities, and study duration. Most studies (93.9%, $n=31$) provided data on five or more aspects of study design. Follow-ups on missed activities were the least reported aspect (21.2%, $n=7$).

3.3.1 Ethics approval

Thirty-one studies (93.9%) explicitly mentioned receiving approval from an Institutional Review Board (IRB) or ethics board. We did not find a noticeable trend based on population, year, or venue for studies that did not explicitly report their ethics approval (Jean *et al.*, 2023, Lambton-Howard *et al.*, 2019, Ril *et al.*, 2023).

3.3.2 Platforms

Among the studies reviewed, Facebook emerged as the most frequently utilized platform (36.4%, $n=12$), followed by Slack (24.2%, $n=8$). Additionally, FocusGroupIt and Discord were both used equally frequently, each appearing in four studies (12.1%, $n=4$). Other platforms, including WhatsApp, Collabito (Quallie), and

TABLE 5. Papers that reported on the same study and papers that reported on multiple studies. Each study was assigned a unique study ID and only counted once during analysis.

Paper (s)	Study ID (s)
Beltzer <i>et al.</i> (2023), Kruzan <i>et al.</i> (2022)	6
MacLeod <i>et al.</i> (2017a 2016ab)	9
Maestre <i>et al.</i> (2020 2018 2021), Salib <i>et al.</i> (2018)	23
Maestre <i>et al.</i> (2020 2021)	33
Prabhakar <i>et al.</i> (2017ab)	15
Alqassim <i>et al.</i> (2022 2019), Kresnye <i>et al.</i> (2021)	26
Maestre <i>et al.</i> (2020)	23, 33
Maestre <i>et al.</i> (2021)	23, 33
Bhattacharya <i>et al.</i> (2021a)	20, 3

itracks, were also used for data collection. Table A1 details the platforms used in each study, and Figure 1 displays the platform usage in ARC studies over time. Several studies employed additional technologies, such as Figma (Jean *et al.*, 2023), Google Slides, and Facebook Messenger (Alqassim *et al.*, 2022) for data collection processes in addition to the primary platform.

3.3.3 Number of participants

The number of participants ranged from 5 Agapie *et al.* (2022) to 487 Lambton-Howard *et al.* (2019) participants with a mean of 39.8 participants (see Table 6 for average calculations). One study Michelson *et al.* (2021) was excluded from average calculations because the number of participants was reported in family units (30 families).

3.3.4 Participant groups

Some ARC studies assigned participants to different groups—subsets of participants assigned activities on the same platform, but within separate spaces (e.g., workspace, channel, server) and/or on different timelines. Motivations for assigning participants to separate ARC groups often involved participants' roles, relationships, and personal and environmental factors. In studies

TABLE 6. Overview of average metrics across study designs. Number of studies (N=#) fluctuates due to some studies not reporting this particular information.

Study Design Metric	Mean	Median	Mode	Range
# Participants (N=33)	39.8	25	25	5-487
# Groups (N=31)	5.2	2	1	1-100
Study Duration (N=32)	49.4 days	56 days	70 days	3 days - 6 months
# Activities (N=25)	11.3	9.5	8	3-31

that investigated social relationships, such as between caregivers and care recipients (Bhattacharya et al., 2021a) or families (Yu & McDonald, 2023), participants were placed in separate groups based on roles to protect their privacy and reduce their influence on one another. In studies that explored an experience, participants were grouped according to shared experiences (Alqassim et al., 2022), health condition (Buelo et al., 2020), or living conditions (Tan et al., 2022). Additionally, other studies created study groups based on the recruitment period (Beltzer et al., 2023).

Thirty-one studies (93.9%) reported the number of participant groups in the study. The number of groups ranged from 1 to 100 groups, with a median and mode of one group per study. Data on number of groups were unavailable for two studies (Meyerhoff et al., 2022, Ril et al., 2023). Additionally, 20 studies (60.6%) reported the number of participants assigned to each group, which ranged from 4 to 31 participants per group, with a mean of 15.3 participants—several studies reported number of participants per group in a range (e.g., Augustaitis et al. (2021)).

3.3.5 Activity frequency

Participants are typically assigned multiple activities throughout an ARC study—activities being pre-determined tasks assigned to participants by researchers. Twenty-five studies (75.8%) reported the number of activities, which ranged from 3 to 31, with a mean of 11.3 activities (see Table 6 for average calculations). Some studies also had several groups of participants where they conducted concurrent or follow-up studies. The majority of these groups followed the same amount and type of ARC activities; however, Kruzan et al., (2022) had an imbalanced number of activities between groups which were treated as separate values in mean calculation (Kruzan et al., 2022). Similarly, Beltzer et al. had an imbalanced number of activities between groups, as they used the findings from their first ARC group to refine their activities and “probe deeper” into participants’ experiences with the second ARC group (Beltzer et al., 2023). This demonstrates the benefit of sequential groups in the ARC environment.

Additionally, 25 studies (75.8%) reported the frequency at which researchers shared a new activity with participant groups. Frequency ranged from 1-2 activities per day (Buelo et al., 2020) to one per week (e.g., Bhattacharya et al., 2019, Yu & McDonald, 2023). The most common activity frequency was one per week (n=12). Notably, in Buelo et al. (2020) the authors shared 1-2 activities per day; however, they included a 2-day gap in the middle of the study to allow participants to catch up with the activities. Augustaitis et al. (2021) staggered activities across days and nights to accommodate participants’ schedules (Augustaitis et al., 2021). Section 3.5 provides more insight into the type of activities used in ARC studies.

3.3.6 Follow-ups on missed activities

Seven studies (21.2%) reported implementing procedures to encourage activity completion and increase participant engagement. These procedures included preemptively notifying users

via platform-generated emails when new activities were posted (Augustaitis et al., 2021), and follow-ups with participants regarding incomplete activities via private chat (Maestre et al., 2023), tagging participants (Garg, 2021), posting reminders to the group (Maestre et al., 2018), and pinning activities within the group (MacLeod et al., 2016a). Developing protocols to follow up on missed activities, including the number and frequency of reminders, and delivery mechanisms could enhance participants’ engagement throughout the study (MacLeod et al., 2016a).

3.3.7 Study duration

Duration of studies ranged from 3 days (Augustaitis et al., 2021) to 6 months (Yu & McDonald, 2023) with an average of 56 days for the 32 studies that reported study duration (see Table 6 for more details). We conducted a t-test analysis between reported study duration and number of activities. The results suggested a significant positive correlation between the number of activities and the duration of the study ($p < 0.01$).

3.3.8 Code of conduct

Out of 33 studies, ten (30.3%, n=10) reported including a code of conduct for participants to abide by while participating in the ARC. The papers that included a code of conduct focused on individuals with mental health conditions (9.1%, n=3) (Beltzer et al., 2023, Bhattacharya et al., 2021a,b, Kornfield et al., 2022, Kruzan et al., 2022, Meyerhoff et al., 2022), teenagers (6.1%, n=2) (Bhattacharya et al., 2019, 2021a), LGBTQ+ individuals (6.1%, n=2) (DeVito et al., 2021, Walker & DeVito, 2020), parents (3%, n=1) (Lawton et al., 2022), and gamers (3%, n=1) (Bhattacharya et al., 2021b). Those with mental health conditions may be more sensitive to negative experiences in the ARC environment; therefore, it is not surprising that the majority of studies with a code of conduct focused on populations with mental health conditions. For instance, in Kruzan et al. (2022) and Beltzer et al. (2023), researchers included a code of conduct developed with clinical psychologists to create a safe ARC environment. A few of the studies had to enforce code of conduct rules—for example, removing a participant for not following rules (Lawton et al., 2022) or removing a post due to inappropriate content (MacLeod et al., 2017a, 2016a,b).

3.4 Stage of design

We categorized studies into five stages of design, adapted from Dam (2025) and defined in Table 2. A majority of studies were categorized as *discovery* (63.6%, n=21) stage, followed by *ideate* (15.2%, n=5), *define* (12.1%, n=4), and *prototype* (9.1%, n=3). No studies were categorized under the *test* stage. Augustaitis et al. (2021) was categorized into the *discovery* stage because it explored the experiences of transgender people accessing health information online (Augustaitis et al., 2021). If there was more than one stage of design included in the study, researchers chose the more advanced stage. For instance, the study by Walker & DeVito (2020) was categorized in the *defining* stage because it aims to determine the conflicts and

Module	Discover Phase	Design & Build Phase	Test Phase
Module 3: plan SMART goals	<p>Prototype: Survey format for individually planning a SMART goal, mini steps, and setting reminders. Illustrated screenshot mock-up of chatbot format. Evaluated direct messaging format in which participants pair up with a peer and a researcher moderator. Participants were asked to share SMART goals and provide feedback on each other's goals.</p> <p>Takeaways: -preference for interactive format of chatbot vs survey - Consideration of what to do when direct messaging falls through</p>	<p>Prototype: ActivatTeen programmed with Interactive chatbot that allowed teens to generate a SMART goal and ministepts. Included suggestion cards to help generate SMART goals.</p> <p>Takeaways: - Include a visual explanation of what a SMART is that includes an example -Include more support when choosing and setting SMART</p>	<p>Prototype: Added visual example of SMART goal that defined SMART acronym. Added prompt to direct message with clinicians the week after planning their SMART goal and ministepts</p> <p>Takeaways: - Clinicians said quality of SMART goals would be improved by synchronous support to help teens plan SMART goals ahead of time</p>

FIGURE 4. Example of an ARC study activity from [Jenness et al. \(2022\)](#).

harms bi+ individuals face in LGBTQ+ online spaces ([Walker & DeVito, 2020](#)). The study by [Maestre et al. \(2023\)](#) was categorized as *ideate* because of their focus on redesigning existing social media to address HIV disclosure and stigma ([Maestre et al., 2023](#)). Finally, a different study by [Maestre et al. \(2020\)](#) was categorized as *prototype* because the study investigated early prototyping of design interventions to assist with medication adherence for those living with HIV ([Maestre et al., 2020](#)).

3.5 Activities

We found 15 common ARC activities across a majority of studies and several unique activities, such as the option to use a one-way rant-line ([MacLeod et al., 2017a, 2016a,b](#)) and a role-playing activity ([Seguin et al., 2022](#)) (see [Figure 4](#) for an example activity).

We organized the activities into five categories: *Reflective*, *Creative*, *Social*, *External*, and *Real World*. [Table 7](#) provides definitions for these activity categories and their average breakdown across all studies. For 21 studies (63.6%), about half of the activities were *Reflective*. In addition to calculating averages of activity types across all studies, we calculated the proportion of each activity type for every study, presented in [Table A2](#) in the Appendix. On average, each study included about 4.8 types of activities. The most popular type of activity was *Reflective*, with 77 (48.4%) activity instances out of 159 total activity instances, followed by *Creative* (20.1%, $n=32$), *Social* (17.6%, $n=28$), *External* (7.5%, $n=12$), and *Real World* (6.3%, $n=10$). The most popular activity across all studies was the “recount experience discussion prompt,” as shown in [Table 7](#).

Studies within the *discovery* ($n=21$) and *define* ($n=4$) stages of design had similar activity type compositions as the average breakdown (see [Figures 5a](#) and [5b](#)), while studies in the *ideate* ($n=5$) stage of design included more *Reflective* (56.3%) and *Social* (21.9%) activities on average. All studies in the *ideate* stage did not include *Real World* or *External* activities (see [Figure 5c](#)). Additionally, studies in the *prototype* ($n=3$) stage of design included fewer *Creative* activities (13.6%) and more *External* activities (18.2%) than on average, likely due to the use of tools outside of the ARC environment and external focus groups for participants to complete

design-based activities (see [Figure 5d](#)). For instance, in [Seguin et al. \(2022\)](#), participants worked on Google Slides during an external focus group.

Furthermore, we examined the impact of participant demographics on activity types by comparing demographic characteristics to the average breakdown of activity types displayed in [Table 7](#). Our findings suggested studies that focused on adolescents (30.3%, $n=10$) employed a smaller proportion of *Creative* activities (25.5%) than on average. Additionally, studies that reported disability status (15.2%, $n=5$) tended to have a higher proportion of *Creative* activities (30%) and a lower proportion of *Reflective* (40%) and *External* activities (10%) than on average. Finally, we also found that studies which included a code of conduct (27.3%, $n=9$) for the ARC environment had a lower proportion of *Creative* activities (15.2%, $n=5$) than on average. There were no discernible differences between the overall average activity type breakdown for studies that reported mobility status, chronic illness status, sexual minorities, geographical location, or stigma among their explicit justification for using the ARC method.

3.6 Participant demographics

3.6.1 Age

Thirty-two studies (97%) reported participants' age. Nineteen (57.6%) studies reported the mean age of participants. Using this data, we found the mean of means for participants' age to be 28.1 years old. Twenty-six studies (78.8%) reported participants' age range. Participant ages ranged from 13 to 70+. We used the age categories described by [Stroud et al. \(2015\)](#) to categorize the age ranges into four distinct categories: adolescents (under 18 years old), young adults (age 18–26), adults (age 27–64), and older adults (age 65 and older). Of the 26 studies, ten (30.3%) included adolescents, while 22 studies (66.7%) included young adults, 17 studies (51.5%) included adults, and three studies (9.1%) included older adults. Most studies (63.6%, $n=21$) included participants from at least two age categories. The most common combination of categories was young adults and adults (36.4%, $n=12$), followed by adolescents and younger adults (15.2%, $n=5$).

TABLE 7. Overview of 15 common ARC activities, organized by activity type and paired with examples from our study dataset. The n (%) column indicates the number and proportion of studies that implemented each activity (N=33).

Category	Activity	n (%)	Example
Reflective (50.1%): Activities that require participants to reflect on past experiences	Recount experience discussion prompt	24 (72.7)	Discussion prompts asked participants to reflect on experiences related to being a lesbian or bisexual woman during pregnancy Ril et al. (2023)
	Survey during ARC	14 (42.4)	Participants completed Perceived Stress Scale upon joining the group Bhattacharya et al. (2019)
	Post-ARC Survey	14 (42.4)	End-of-study survey that asked participants about the mental health app they engaged with Agapie et al. (2022)
	Interface/artifact critique	11 (32.4)	Participants gave feedback on a prototype created by researchers Seguin et al. (2022)
	Response to media artifact prompt	10 (29.4)	Prompted discussion in response to photos and vignettes (media artifacts) Maestre et al. (2021)
	Diary studies	5 (15.2)	Participants recorded diary entries each week Bhattacharya et al. (2019)
Creative (20.2%): Activities where participants create something new	Participants upload media of artifact creation	15 (45.5)	Participants drew on a concentric circle template to visualize the importance of different technologies in managing their HIV Maestre et al. (2020)
	Creative discussion prompt	11 (33.3)	Participants wrote descriptions of futuristic designs that would help them cope with HIV-related stigma Maestre et al. (2023)
	Affinity diagramming	3 (9.1)	Participants collaborated in a virtual co-design session Liang et al. (2020)
Social (14.2%): Activities that encourage participants to engage with other participants or researchers	Introductions	19 (57.6)	Introductory icebreaker for participants at the beginning of the ARC study Lambton-Howard et al. (2019)
	Private message exchanges	6 (17.6)	Allowed participants to submit their ARC activity responses through private message DeVito (2021)
	Group chats	2 (5.9)	Participants completed collective role-playing exercise within group chats Seguin et al. (2022)
External (9.2%): Activities that require participation outside of the ARC environment	External focus groups	6 (17.6)	Conducted synchronous focus group over Zoom Seguin et al. (2022)
	External interviews	4 (11.8)	Interviewed participants over Facebook Messenger in the last 2 weeks of the study Walker & DeVito (2020)
	External deployments	2 (5.9)	Participants engaged with the app ActivaTeen (not the ARC environment) throughout the study Jenness et al. (2022)
Real World (6.2%): Activities that prompt participants to post media or data from their everyday life	Media elicitation of personal experiences	10 (29.4)	Participants built a small photo/screenshot album representing their relationships as a bi+ person Walker & DeVito (2020)

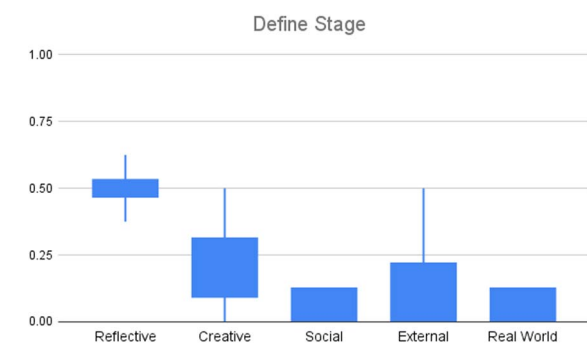
3.6.2 Gender and sexual orientation

Thirty-one studies (93.9%) reported the gender distribution of participants. Women were the most represented gender category (87.9%, n=29) followed by men (69.7%, n=23). Two pregnancy and motherhood-related studies ([Buelo et al., 2020](#), [Prabhakar et al., 2017a](#)) presented their sample groups as women; however, it was not explicitly stated whether gender information was collected during recruitment or if identifying as a woman was an inclusion criterion. Some ARC studies included sexual and gender minority (SGM) participants, including transfeminine, transmasculine (15.2%, n=5 each) (e.g., [Augustaitis et al., 2021](#), [Liang et al., 2020](#), [Walker & DeVito, 2020](#)), and non-binary (36.4%, n=12) (e.g., [Bhattacharya et al., 2019](#), [Garg, 2021](#)). Eight studies (24.2%) only recruited men and women. One study focused solely on the transgender community, including transfeminine, transmasculine, and non-binary individuals ([Augustaitis et al., 2021](#)). Eighteen studies

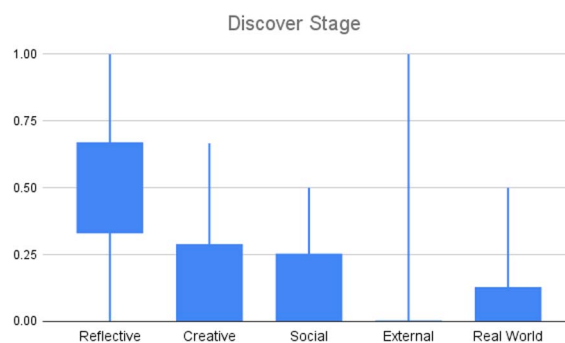
(54.5%) reported gender distribution across three or more gender categories. Additionally, 9 studies (27.3%) reported on the sexual orientation of participants, specifically sexual minorities (e.g., [37, 54]), and six studies (18.2%) centered LGBTQ+ individuals in their research questions (see Table A1).

3.6.3 Participant education

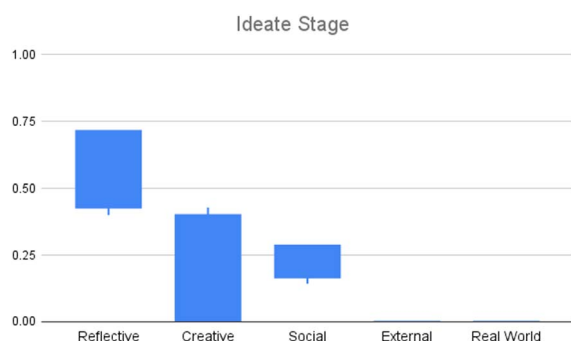
Eleven studies (33.3%) reported the education level of participants, which we categorized into four groups: less-than-high school, high school, college, and higher-than-college. The most represented categories were high school and college (24.3%, n=8). Seven studies (21.2%) included participants with higher-than-college education, and three studies (9.1%) included participants with less-than-high school education. Notably, several studies focused on adolescent and young adult age groups, which impacts the education level distribution (see Table A1).



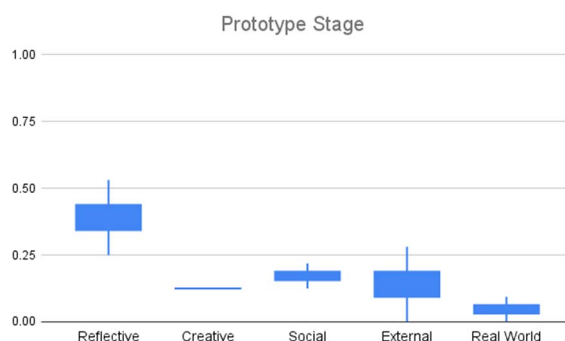
(a) Average breakdown of activity types for all studies in the **define stage**



(b) Average breakdown of activity types for all studies in the **discover stage**



(c) Average breakdown of activity types for all studies in the **ideate stage**



(d) Average breakdown of activity types for all studies in the **prototype stage**

FIGURE 5. Average proportion of activity types for studies in each design stage.

3.6.4 Race and ethnicity

Twenty-six studies (78.8%) reported race and ethnicity of participants. White individuals were the most represented in ARC studies (69.7%, $n=23$), followed by Black individuals (42.4%, $n=14$), Asian individuals (39.4%, $n=13$), and Hispanic individuals (36.4%, $n=12$). Other represented races and ethnicities included: Arab (e.g., Kresnye et al., 2021, Michelson et al., 2021), Native American (e.g., DeVito, 2021, DeVito et al., 2021, and Multi-racial (e.g., Bhattacharya et al., 2019, Jenness et al., 2022). On average, studies that reported race and ethnicity included participants from three different racial and ethnic backgrounds. Twenty studies (60.6%) reported the race and ethnicity distributions via percentages. In studies that reported race distribution of participants via percentages (60.6%, $n=20$), White individuals made up 61.3% of participants on average. Notably, White participants made up over 50% of participants in at least 15 studies.

3.6.5 Country

Thirty studies (90.9%) reported the countries where participants were recruited from. There were 17 countries represented in our corpus of ARC studies. The majority (72.7%, $n=24$) of studies included participants from a single country. The remaining nine studies (27.3%) included participants from two to seven different countries. The United States was the most frequently cited country in studies (69.7%, $n=23$) followed by the United Kingdom (15.2%, $n=5$), Australia (9.1%, $n=3$), and Kenya, South Africa, Philippines (6.1%, $n=2$ each) (e.g., Lambton-Howard et al., 2019, Maestre et al., 2023, 2018). Other represented countries included Mexico (Maestre et al., 2020, 2018, 2021, Salib et al., 2018), Canada

TABLE 8. Recruitment methods ($N=33$).

Recruitment Method	# Studies That Reported Method n (%)
Posted in relevant online forums or groups	20 (60.6)
Survey	14 (42.4)
Research team posted to personal social media	10 (30.3)
Flyers	5 (15.2)
Social media ads	5 (15.2)

(Genuis et al., 2023), Finland and Bulgaria (Lambton-Howard et al., 2019), India (Tam et al., 2023), Hong Kong (Lambton-Howard et al., 2019), Indonesia and Thailand (Maestre et al., 2023), Brazil and France (Ril et al., 2023), and Uganda (Maestre et al., 2023). Table A1 details the list of countries for each study.

3.7 Recruitment methods

Posting in relevant online forums or groups (e.g., support forums for people living with HIV) was the most common recruitment method for ARC studies, followed by surveys. Outside of the recruitment methods listed in Table 8, ten (30.3%) studies also mentioned collaboration with community organizations, such as clinics, centers, and non-profits (e.g., Agapie et al., 2022, Genuis et al., 2023, Glick et al., 2022, Liang et al., 2020, Prabhakar et al., 2017b, Tam et al., 2023). A few studies described their methods for building trust and rapport with participant pools, such as volunteering at a community organization leading up to a study (Maestre et al., 2020), contacting online forum moderators

to obtain permission before posting advertisements (Maestre et al., 2023, 2020), and engaging in online communities prior to recruitment (MacLeod et al., 2016a). A majority of the 33 studies reported more than one of these recruitment methods. We explored the relationship between these recruitment methods and participant demographics that we expected to influence researchers' recruitment strategies, including stigmatized populations, youth participants, and categorical residential density (i.e., urban vs. suburban vs. rural).

Stigmatized populations Fifteen studies (45.5%) specifically mentioned stigma as a motivation for using the ARC method. These studies engaged with LGBTQ+ and gender-diverse identities (Augustaitis et al., 2021, DeVito, 2021, DeVito et al., 2021, Liang et al., 2020, Tam et al., 2023, Walker & DeVito, 2020), mental health (Jenness et al., 2022, Kruzan et al., 2022, Meyerhoff et al., 2022), pregnancy and miscarriage experiences (Kresnye et al., 2021, Prabhakar et al., 2017a), people living with HIV (Maestre et al., 2023, 2020, 2018), and rare diseases (MacLeod et al., 2017a). We found no distinct pattern between specific recruitment methods and studies that specifically mentioned stigma as a motivation for using the ARC method.

Youth populations Beyond aggregated age distribution of participants, we also examined the recruitment strategies of studies that specifically centered on younger participants as their population of interest. This subset included ten studies that engaged adolescents (see Table A1 in the Appendix) and three studies that recruited only young adults (Beltzer et al., 2023, Kornfield et al., 2022, Kruzan et al., 2022, Meyerhoff et al., 2022), as these focused on "young adult" experiences, unlike other studies that engaged young adults in combination with older age brackets. Within these thirteen youth-focused studies, surveys (61.5%, $n=8/13$) and community collaboration (46.2%, $n=6/13$) were slightly more common for recruitment, while posting in relevant forums was less common (38.5%, $n=5/13$), compared to the entire corpus.

Urban, suburban, rural Thirteen studies (39.4%) reported categorical residential density for their participants' locations. Of these studies, 12 (92.3% of 13 studies) reported participants from urban areas, seven (53.8%) from suburban areas, and nine (69.2%) from rural areas. Six studies (46.2%) reported participants from all three areas (Bhattacharya et al., 2019, 2021a, DeVito, 2021, DeVito et al., 2021, Garg, 2021, Tam et al., 2023). We found no noticeable pattern between participants living in urban/suburban/rural areas and recruitment methods; however, this may be a result of the small sample size of studies that reported this information, rather than the actual lack of a correlation.

3.8 Compensation

Most studies (72.7%, $n=24$) reported some form of compensation for participants. Compensation was primarily delivered through two vehicles: cash/local currency (33.3%, $n=11$) and gift cards/vouchers (39.4%, $n=13$). Nine studies (26.5%) did not explicitly report any compensation for participants—either participants were not compensated, or the researchers did compensate participants, but excluded it from the writing in their publication. A majority of studies compensated participants by a lump sum amount (e.g., Alqassim et al., 2019, Bhattacharya et al., 2021b), while others compensated per activity (e.g., Bhattacharya et al., 2021b, Garg, 2021), per week (e.g., Tan et al., 2022, Liang et al., 2020), or per response (e.g., Kruzan et al., 2022), as shown in Figure 6. Using available information within studies, weekly compensation ranged from \$1.50 to \$7.50 USD. We found no pattern between participants' reported countries and compensation vehicles or compensation modes.

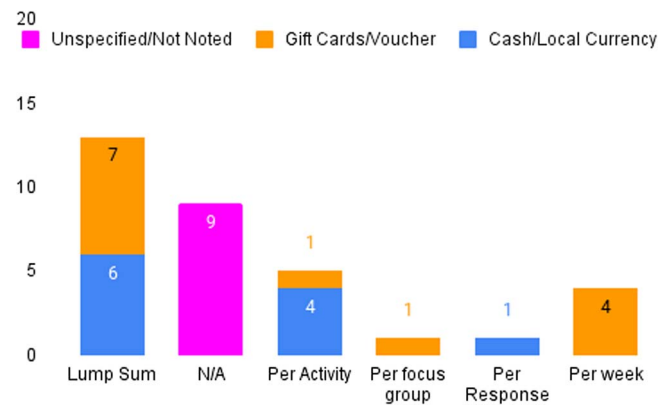


FIGURE 6. Compensation methods across all studies (N=33).

3.9 Analysis methods

ARC studies were analyzed in three different ways—a quantitative overview of participation, a qualitative analysis of what participants shared during the study, and a reflection on how the ARC process worked for their research questions, study design, and study population. In this section, we report on papers ($N=40$) because we found that sometimes the same study was reported in multiple papers, but different analysis was used, highlighting the way that researchers may change the framing of a study to highlight different contributions depending on the publication venue. Overall, all but three publications reported qualitative data (92.5%, $n=37$). These three publications focused more on activity participation (Lambton-Howard et al., 2019, Maestre et al., 2020, 2018) and methods reflection (Maestre et al., 2020, 2018). Activity participation (67.5%, $n=27$) and reflecting on how ARC as a method worked or its limitations for their specific research questions, study design, and study population (55.0%, $n=22$) were also highly used to analyze data. Ten papers reported one type of analysis—qualitative (20%, $n=8$) and activity participation (5%, $n=2$). Most papers reported on two (37.5%, $n=15$)—qualitative and activity participation (20%, $n=8$), qualitative data and methods reflection (12.5%, $n=5$), or activity participation and methodological (5%, $n=2$). Fifteen papers reported all three kinds of analysis (Agapie et al., 2022, Alqassim et al., 2019, Bhattacharya et al., 2019, 2021a, Buelo et al., 2020, Garg, 2021, Genuis et al., 2023, Jenness et al., 2022, Lawton et al., 2022, MacLeod et al., 2016a,b, Maestre et al., 2023, Prabhakar et al., 2017b, Salib et al., 2018, Walker & DeVito, 2020).

Activity participation reporting was most commonly reported in the form of a table (e.g., DeVito et al., 2021, Kresnye et al., 2021) or within the text (e.g., Augustaitis et al., 2021). Some publications reported on the number of comments and word counts (Glick et al., 2022), per participant activity completion with time delay (Maestre et al., 2020), and how long participants were enrolled in the study (Michelson et al., 2021). In Agapie et al. (2022), the study discontinued ARC activities that were used between in-person sessions because of low participation (Agapie et al., 2022). In terms of ARC method reflection, some papers provided study design justification in methods (e.g., DeVito (2021) discusses a "protected ARC" in the methods (DeVito, 2021)), whereas others integrated it into the results (e.g., Prabhakar et al., 2017a) or compared their lessons learned with other research in the discussion section (e.g., Maestre et al., 2018, Prabhakar et al., 2017b). We provide more insights into reflections in Section 4.3.

3.10 Funding

Twenty-seven studies (81.8%) reported funding—primarily from federal funding agencies (48.5%, $n=16$), followed by universities (42.4%, $n=14$), industry (21.2%, $n=7$), and foundations (9.1%, $n=3$). Of the studies that reported funding, 15 (45.5%) had a single funding source, 11 (33.3%) had two funding sources, and one (3%) had three funding sources. Six studies did not report any funding mechanisms. We did not find any statistical significance between reporting funding and providing compensation. Indeed, 20 out of the 24 studies that reported compensation also reported having funding, whereas four studies that reported compensation, did not report funding. We acknowledge that this section is based on reported information in the acknowledgment or funding section of publications, thus there may have been funding sources not reported and funding may have been for a specific researcher's time.

4 REFLECTIONS AND CONSIDERATIONS FOR USING ARC

Twenty papers, including four core papers (MacLeod et al., 2016a,b, Maestre et al., 2018, Prabhakar et al., 2017b), reflected on the ARC method and suggested considerations for future research. We distill these considerations into a guide of questions in Tables 9 to 12 for researchers to consider when designing future ARC studies.

4.1 Platform selection

When selecting a platform, researchers should consider not only what they will need for their own research requirements, but also participant expectations from a platform. Researchers should carefully consider what platforms potential participants already use and how participating in a study may impact participants' experience using that platform. In addition, depending on the population or research topic, researchers should consult with their ethics boards who may add platform requirements (e.g., ensuring data is kept private and secure by allowing researchers to post on Facebook, but collect data in Qualtrics (DeVito, 2021)).

Identity Participant identity and privacy are paramount, especially when working with vulnerable populations. Within our corpus, researchers considered how participants could anonymize or partially disclose their identity (e.g., via Slack (Bhattacharya et al., 2019, 2021a, Liang et al., 2020), WhatsApp (Tam et al., 2023), or itracks (Genuis et al., 2023)) with the understanding that in some cases, the researchers would need to know the identity of participants (Meyerhoff et al., 2022) (e.g., if participants needed medical assistance). Maestre et al. (2023) gave participants the option to join the study using a fake Facebook profile (Maestre et al., 2023). Independent of anonymization practices, sometimes researchers may need the ability to hide identifying information if a participant discloses too much information in a post that could put them at additional disclosure risk (Bhattacharya et al., 2021a, Maestre et al., 2020). Researchers also discussed the need to verify participant identities (Buelo et al., 2020, Maestre et al., 2018) so that participants would feel comfortable and safe that they were disclosing information to people with similar experiences. Verifying that participants meet study requirements is important given the possibility of fraudulent participation with online studies and the need to protect participants, as well as research integrity (Krawczyk & Siek, 2024, Panicker et al., 2024).

Privacy Researchers discussed the need to carefully consider who "owns" and has access to the data (Buelo et al., 2020, Maestre et al., 2018), and clearly communicate this to participants so they

are aware of how data could be used and disclosed. Researchers explicitly warned participants about the research team's inability to control confidentiality on third-party social media platforms (Maestre et al., 2020). Some platforms, such as focusgroupit.com, provide end-to-end encryption, thus the data is only accessible to the research team and participants (Meyerhoff et al., 2022). Depending on the research questions and participants, some researchers may need to investigate platforms that comply with federal laws and regulations. For example, Microsoft Teams currently has the ability to comply with the U.S. Health Insurance Portability and Accountability Act (HIPAA) for medical data and the European Union's General Data Protection Regulation (GDPR) (Bhattacharya et al., 2021a).

Access Individuals' access to participating in a study may be impacted by the platform that researchers select and the technology available to them. Technology (e.g., mobile phones, computers) and internet access may impact participants' ability to engage with study activities (e.g., using a computer with free internet in a public library (Lawton et al., 2022)), thus some researchers advocate for platforms that work on mobile and computer technology (Bhattacharya et al., 2021a). Ideally, researchers should know participants' technology preferences (Prabhakar et al., 2017b) and communicate technology requirements during recruitment (Maestre et al., 2018).

While researchers may select a platform based on the presence of a study's target population already on the platform or participants' preferences (Garg, 2021, Liang et al., 2020) and Agapie et al. (2022) suggest taking into account the platform's community norms and the researcher team's ability to set new norms for the purpose of the study (Agapie et al., 2022).

Researchers should also consider how notifications and research interactions may impact participant usage. Depending on the platform and set-up, notifications may get "lost" in participants' feeds (Alqassim et al., 2019) or the platform algorithm may not promptly show research activity posts (Buelo et al., 2020). Some platforms make "threads" or posts and replies difficult for researchers to maintain (Bhattacharya et al., 2019). If the platform is not typically used by participants, then onboarding time may be needed with readily available support (Genuis et al., 2023). If studies have intervention components or work with populations that may need more moderation—either because of health implications (Bhattacharya et al., 2021a, Genuis et al., 2023) or behavior (Lawton et al., 2022)—researchers should set guidelines on access expectations (Genuis et al., 2023), moderator availability (Bhattacharya et al., 2021a), and implications for not following guidelines (Lawton et al., 2022). Depending on the activities the research team uses, researchers may want to consider platforms that can decrease the burden of participation. For example, Ril et al. (2023) used WhatsApp for its robust voice messaging capability to reduce the burden for busy mothers in their study (Ril et al., 2023).

Scalability Researchers discussed scalability in two ways—(1) handling the number of groups and participants (Bhattacharya et al., 2021a) and (2) how the ARC study data could be easily downloaded for analysis (Bhattacharya et al., 2021a, Garg, 2021). Some researchers emphasized the need to be mindful of how many ARCs or participants they worked with at once because of the moderation and research overhead (Garg, 2021). In one case, a research team attempted to use a bot to update participants, however, they found that when a human research team member posted, participants provided more updates (Agapie et al., 2022). Independent of the number or size of ARCs, researcher teams will have to access data. Papers discussed scraping data by hand (e.g.,

TABLE 9. Overview of platform considerations with references to papers that discussed the issue.*Platform Considerations*

What platforms are the participants already using? (Garg (2021), Liang et al. (2020), MacLeod et al. (2017a), Walker & DeVito (2020))
 Would participants be comfortable using another platform?

Identity

Would participants want to be anonymous in some way (e.g., pseudonyms)? (Bhattacharya et al., 2019 2021a, Genuis et al., 2023, Tam et al., 2023)
 Do researchers need to see participant identities, even if anonymized? (Meyerhoff et al., 2022)
 Do participants' identities need to be verified? (Buelo et al., 2020, Maestre et al., 2018)
 Do researchers have the ability to hide identifying information? (Bhattacharya et al., 2021a, Maestre et al., 2020)

Privacy

Who "owns the data? What third parties may have access to the data even if the group is "secret? (Buelo et al., 2020, Maestre et al., 2020)
 What are the confidentiality needs for the study? (Buelo et al., 2020, Maestre et al., 2018) Does the study require end-to-end encryption (e.g., focusgroupit.com)? (Meyerhoff et al., 2022)
 Does data need to be protected based on federal laws or regulations (e.g., HIPAA, GDPR)? (Bhattacharya et al., 2021a)

Access

What technology is needed to access the platform and participate in activities? (Bhattacharya et al., 2021a, Lawton et al., 2022, Maestre et al., 2023, 2018, Prabhakar et al., 2017b)
 What are the platform's current norms and can the research team set new norms, if needed, for the study? (Agapie et al., 2022)
 What are the expectations of access to the platform or resources (e.g., healthcare professionals, moderators) by participants and researchers? (Bhattacharya et al., 2021a, Genuis et al., 2023)
 How is the platform typically used by participants? If participants already use the platform in their everyday life, how will possible notifications "blur the line of usage" between research and personal activities? (Alqassim et al., 2019)
 If the platform is not used by participants, how much time must be built into the study for onboarding? (Genuis et al., 2023)
 How can the platform reduce the burden of participation for researchers? (Ril et al., 2023)
 How will platform algorithms impact the visibility of posts? (Buelo et al., 2020)

Scalability

Can the platform handle the amount of participants per group or the amount of groups being facilitated concurrently? (Bhattacharya et al., 2021a)
 Can the data be easily downloaded/scraped/accessed via an Application Programming Interface (API)? (Bhattacharya et al., 2021a, Garg, 2021)

exporting text and images to PDFs and using color codes to de-identify the data, Maestre et al., 2020), downloading and deleting data from the source (e.g., Liang et al., 2020 deleted Discord data to protect privacy), and encouraging the use of Application Programming Interfaces (APIs) to efficiently access study data (Bhattacharya et al., 2021a).

4.2 Study preparation

Similar to other human-computer interaction design methods, the research team has to *know* about the target population—including terminology. The research team should also be aware of terms they should not use to avoid stigma or possibly offend participants. Ideally, the research team has connections with a community leader from the target population who they can consult with (Maestre et al., 2020, 2018). When first thinking about an ARC study, researchers have to address logistical and informational support issues. For example, although ARCs are *asynchronous*, some studies had synchronous activities, such as chat-based interviews (Walker & DeVito, 2020) or synchronous video conferencing sessions (Maestre et al., 2023). Integrating synchronous activities provided researchers with the opportunity to follow-up on past posts, triangulate data, and recruit a diverse sample of participants (Maestre et al., 2023).

Similar to choosing a platform, Maestre et al. (2020, 2018) strongly recommended learning about how the target population uses the platform, interacts with others, and how often they use the platform to get a sense of the study design and duration (Maestre et al., 2020, 2018). For instance, (Alqassim et al., 2019) surveyed participants on their social media behaviors to get a sense of how often participants log on and engage with social media platforms. Depending on how participants currently use the platform,

researchers should provide a code of conduct at the beginning of the study and be readily available throughout the study (Maestre et al., 2020) to clearly articulate the norms and expectations for participants throughout the study (Bhattacharya et al., 2021a).

Logistics After observing participant behaviors on the platform, the research team should think about how participant groups are created—especially if there is a possibility that some information disclosure may make participants uncomfortable. For example, when there are power differentials (e.g., teens and caregivers (Buelo et al., 2020, Garg, 2021)) or one's experience may be taxing on another. Researchers who investigated miscarriage separated people who experienced a miscarriage according to whether they had a live birth since their miscarriage, addressing the concern that some people who had not had a live birth may not want to hear about fellow participants' birth experiences (Alqassim et al., 2022, Kresnye et al., 2021).

Overall, studies indicated that participants appreciated the structure provided by an activity schedule (Bhattacharya et al., 2019, Maestre et al., 2020, 2018). Most researchers indicated they posted activities on the same day each week (Maestre et al., 2020, 2018). Some researchers sent reminders—either via email, outside of the selected study platform (Bhattacharya et al., 2019), or at the end of each week to participants who had not completed activities (Maestre et al., 2020, 2018). In addition to *when* to post, researchers may want to consider *who* should post. Some papers explicitly mentioned that one research team member posted activities (Kresnye et al., 2021, Prabhakar et al., 2017b), while another study created a generic profile with the aesthetic of a chatbot for posting (Agapie et al., 2022).

Informational Support Researchers should consider how they will communicate with participants—either through

TABLE 10. Overview of study preparation considerations with references to papers that discussed the issue.*Study Preparation*

What terms should not be used to avoid stigma and possibly offend participants? Who in potential participant pools could the research team consult with? (Maestre et al., 2020 2018)

Will the study be all asynchronous or will there be synchronous activities? (Maestre et al., 2023, Walker & DeVito, 2020) How do participants currently interact on the platform? What norms must be created to facilitate the study? (Agapie et al., 2022, Bhattacharya et al., 2021a, Maestre et al., 2020)

Logistics

How should participants be grouped? (Buelo et al., 2020, Garg, 2021, Kresnye et al., 2021) Is there a chance information disclosure could make some participants uncomfortable? What structured activity schedule would be appropriate for the target population? (Bhattacharya et al., 2019, Maestre et al., 2020 2018)

Who will post activities? (Prabhakar et al., 2017b) How will activities be posted? (Kresnye et al., 2021)

Informational Support

How will study materials be communicated and shared with participants? (Bhattacharya et al., 2021a, Jenness et al., 2022)

How will informed consent be obtained? (MacLeod et al., 2016a, Maestre et al., 2020) What, if any, platform-specific privacy considerations should the research team communicate to participants? (Buelo et al., 2020)

written documentation (e.g., pinned posts with help information (Bhattacharya et al., 2021a) or codes of conduct—see Section 3.3.8) (Agapie et al., 2022, Maestre et al., 2020)), chat, or video tutorials (Bhattacharya et al., 2021a, Jenness et al., 2022). These materials should be easily accessible to novice platform users throughout the study. For example, to obtain informed consent, research teams have used email (Prabhakar et al., 2017b) or chat with participants - either before they reviewed the informed consent (Maestre et al., 2018) or section by section with participants (MacLeod et al., 2016a, Maestre et al., 2020). Alternative suggestions include requiring a short quiz for participants on the informed consent where researchers will reach out to participants who did not pass the quiz to re-review the informed consent (MacLeod et al., 2016a, Maestre et al., 2018). Researchers are also encouraged to consider how they can advise participants on privacy settings related to the selected platform. For example, helping participants restrict their profile so that fellow participants cannot see identifying information (Buelo et al., 2020).

4.3 Activity selection

Before selecting specific activities, researchers may want to consider if they are willing to receive data from participants in alternative ways. For example, if a participant is uncomfortable sharing to the ARC group, participants could be given the opportunity to share data in a private channel, send data via email to a researcher, or post anonymously (Garg, 2021, Maestre et al., 2020). Garg (2021) found providing alternative sharing channels especially helpful when studying teen-caregiver dyads where participants could share “controversial feelings” (Garg, 2021). This decision will impact the research team’s expectations for participant-participant interactions and data collection for analysis. For instance, if multiple participants respond via a private channel, how may that impact activities which require participants to respond to each other? Ultimately, providing alternative input mechanisms is worthwhile—especially to build trust with participants.

Community Building If a research team envisions an ARC study where participants respond to each other’s posts, they may want to foster a sense of community through researcher and participant-driven conversations. Researchers should pilot and explore what types of questions can foster conversation among participants to build community (Maestre et al., 2020). Would the group be amenable to an ice breaker (e.g., (Kresnye et al., 2021)

asked participants about a superpower they wish they had) or would posts about related news (e.g., Maestre et al., 2020 posted about a health-oriented research popular press piece that encouraged participants to post similar articles) be of interest? Maestre et al. (2020) found that participants had the most discussions about elicitation artifacts (e.g., photos from their everyday lives) shared during the study (Maestre et al., 2020).

Activity Logistics Initially, researchers encouraged standalone activities for ARC (MacLeod et al., 2016a, Maestre et al., 2020, 2018); however, Garg successfully implemented two activities that built on each other. They attribute this success to the creative nature of the free-text activity, participant interest, and timing—the first activity was earlier in the study and there was time for participants to complete the activity before the follow-up activity (Garg, 2021). Indeed, two studies report higher completion rates for activities that came earlier in the study (Garg, 2021, Maestre et al., 2020). Researchers should also consider what activities will appeal to participants and their schedules. For example, Prabhakar et al. found participants appreciated less time-intensive activities, such as surveys and free text reflection questions (Prabhakar et al., 2017b). When working with teens, (Bhattacharya et al., 2019) similarly found that participants preferred writing instead of drawing for creative activities (Bhattacharya et al., 2019). For all activities, the research team should readily assess how the activity is being received and what the research team will do in the event that an activity is not well received (MacLeod et al., 2016a, Maestre et al., 2018). This is sometimes more challenging in an asynchronous environment since it may be unclear why participants are not completing activities. MacLeod et al. (2017a) discussed how during a diary activity tracking participant interactions with people about their disease, a participant noted how lonely they felt because they did not have to document any conversations (MacLeod et al., 2017a).

All ARC activities should be piloted with a convenient sample to assess how long the activities will take to complete. Researchers have found that participants preferred activities that took less than an hour each week (Maestre et al., 2023). When participants had a week to submit activities, participants appreciated the additional time for reflection (Garg, 2021). Research teams should consider how many input mechanisms participants may need (e.g., email, survey platforms, prototyping platforms, brainstorming boards, etc.) to complete activities (MacLeod et al., 2016a, Maestre et al., 2018). For each input mechanism, think about

TABLE 11. Overview of activity selection considerations with references to papers that discussed the issue.**Activity Selection**

If participants are uncomfortable sharing with the ARC, are there alternative ways to participate? (Garg, 2021, Maestre et al., 2020)

Community Building

What questions can foster conversation among participants to build community? (Maestre et al., 2020)

What type of elicitation artifacts (e.g., images, sketches) can be used to encourage discussion? (Maestre et al., 2020)

Activity Logistics

Which activities are unique/standalone (MacLeod et al., 2016a, Maestre et al., 2020 2018)? Which activities build on each other (Garg, 2021)?

What activities should have a higher completion rate? (Garg, 2021, Maestre et al., 2020)

What activities will appeal to participants? (Bhattacharya et al., 2019, Prabhakar et al., 2017b)

How will the research team assess how an activity is being received by participants? What actions will the research team take in the event the activity is not being well received? (MacLeod et al., 2016a, Maestre et al., 2018)

How much time will participants have to complete activities? (Maestre et al., 2023) When will activities be posted? (Bhattacharya et al., 2019, Maestre et al., 2023, Prabhakar et al., 2017b) How will life events be accounted for? (Bhattacharya et al., 2019, Buelo et al., 2020, Yu & McDonald, 2023)

How many input mechanisms do the activities require? (MacLeod et al., 2016a, Maestre et al., 2018) How many steps are required for each input mechanism? (Maestre et al., 2018, Prabhakar et al., 2017b) How will the input mechanisms increase the participation burden on participants and data collection overhead for researchers? (MacLeod et al., 2016a, Maestre et al., 2018)

How can the activities help ensure validity among participants? (Prabhakar et al., 2017b) Can the activities be used to triangulate and confirm data from participants? (Prabhakar et al., 2017b)

how many steps are required (Maestre et al., 2018, Prabhakar et al., 2017b). The input mechanisms and steps will increase the interaction burden for participants (Maestre et al., 2018, Prabhakar et al., 2017b) and researchers as they collect the data (MacLeod et al., 2016a, Maestre et al., 2018). Moreover, each additional platform increases the privacy considerations for participants and research data.

Research teams should also consider the flow of their study (how often will activities be posted?) and time granularity (does time of day matter?). Prabhakar et al. (2017b) polled participants to identify a preferred posting time (Prabhakar et al., 2017b), whereas researchers who worked with teens took into consideration teen participant schedules and timezones before deciding when to post (Bhattacharya et al., 2019) and how many activities per week (Buelo et al., 2020). Maestre et al. scheduled activities two-weeks apart so that the research team could create design concepts for participants to discuss (Maestre et al., 2023). In addition, researchers should plan for participants' life events—unaccounted and accounted. For example, when working with teens, researchers may want to consider pausing (Yu & McDonald, 2023) or giving activity deadline extensions (Bhattacharya et al., 2019) during school exams and breaks.

4.4 Recruitment

The research team should identify online and in-person communities to recruit from and consider if there are opportunities to be part of or serve the community (MacLeod et al., 2016a, Maestre et al., 2020, Prabhakar et al., 2017b). Serving the community can help build rapport and trust with the community (Unertl et al., 2016) and identify community leaders who can assist in understanding the community and consult on the study design. Some community leaders may see their role as gatekeepers to protect the community, thus working with them to gain buy-in is critical to ensure that the study is safe and mutually beneficial. All study and ethics board materials should be discussed with community leaders (MacLeod et al., 2016a, Maestre et al., 2020, 2018).

Researcher Verification For initial recruitment outreach to participants, researchers may want to have a lab account (Panicker et al., 2024) to avoid possible harassment from fraudulent participants (Krawczyk & Siek, 2024). At the same time, community leaders and enrolled participants need to be able to identify

and verify the research team. Maestre et al. recommended using personal social media accounts for recruitment (Maestre et al., 2020, 2018).

Participant Groups Similar to focus group creation, researchers should carefully consider the make-up of groups when recruiting. Past work on focus groups has encouraged recruiting a strongly homogenous population (Feeman, 2013); however, based on research questions, several homogenous groups that vary on other factors may be better for research questions (MacLeod et al., 2016a). For example, Maestre et al. (2018) recruited people from the same support group, however, they came from diverse cultural backgrounds, impacting their experiences (Maestre et al., 2018). Garg highlighted that within-group diversity can be beneficial to participants as parent-teen dyads from diverse geographic areas considered the ARC an educational experience (Garg, 2021).

4.5 In-study tips

Researcher-Participant Interactions If the selected platform uses algorithms to prioritize posts in users' feeds, the research team should investigate how their activity posts can be better seen (MacLeod et al., 2016a, Maestre et al., 2018). When researchers used Facebook, they encouraged the research team to "like" posts (Prabhakar et al., 2017b) to show up on participant feeds. In WhatsApp, researchers created post images (Tam et al., 2023) to take up more space on the feed and hopefully get participants' attention. Some researchers found that posts with images had more comments than other posts (Buelo et al., 2020). Researchers also "tagged" participants in posts where they had not participated yet (Maestre et al., 2018). Once activities are posted, researchers should determine how they will assess participant activity and interactions. For example, in Facebook, researchers set up notifications on posts to know when and how often participants commented (Maestre et al., 2020). Some platforms, like Slack, automatically show what a researcher has missed since last logging on. The research team should set up a schedule so that they are prepared to respond to questions promptly and promptly intervene if there is a misunderstanding in the ARC (Maestre et al., 2020, 2018).

Participant-Participant Interactions Researchers may encourage participants to build on each other's contributions (Bhattacharya et al., 2019, MacLeod et al., 2016a)—even if it means posting "in-progress" thoughts (MacLeod et al., 2016a,

TABLE 12. Overview of recruitment considerations with references to papers that discussed the issue.**Recruitment**

Where will participants be recruited from? (MacLeod *et al.*, 2016a, Maestre *et al.*, 2020, Prabhakar *et al.*, 2017b)

What opportunities exist to help build rapport and trust with the community? (MacLeod *et al.*, 2016a, Maestre *et al.*, 2020)

Who are the leaders/gatekeepers of community groups? How can study information be communicated with community leaders? (MacLeod *et al.*, 2016a, Maestre *et al.*, 2020 2018)

Researcher Verification

How will potential participants verify research teams?

How will enrolled participants verify researchers? (Maestre *et al.*, 2020 2018)

Participant Groups

How will participant groups be created?

Maestre *et al.*, 2018) or contradicting participants (Garg, 2021) to help them reflect on their stances. Depending on the study design and demographics, research teams may want to set expectations about socializing outside of ARC activities. Initially, ARC researchers encouraged socialization between participants (MacLeod *et al.*, 2016a, Maestre *et al.*, 2018). Researchers reported that posts initiated by participants had higher interactions—possibly because participants appreciated learning from each other (Lawton *et al.*, 2022) and socializing. Researchers should clearly communicate how information participants learn within the study can be shared outside of the study. Buelo *et al.* (2020) encouraged participants to not share participant experiences outside of the group to engender mutual trust and confidentiality (Buelo *et al.*, 2020), whereas for other studies, sharing information learned (e.g., healthy eating recommendations, Lawton *et al.*, 2022) or anonymized experiences (e.g., Chatham House Rule) could benefit communities outside the study. Some ARC studies suggested creating specific channels for socialization (Bhattacharya *et al.*, 2019), whereas other studies' participants created their own separate channels for discussion (Garg, 2021). Liang *et al.* had in-person activities for their study and reported that participants connected socially online via Discord (Liang *et al.*, 2020). Researchers may consider explicitly asking participants about social interactions, possible “private” channels, and DMs if it could possibly impact their study.

Moderation Researchers recommended including a plan for moderation and a set of rules for the ARC environment (code of conduct) that participants must follow (Bhattacharya *et al.*, 2021a, Garg, 2021, Lawton *et al.*, 2022, Maestre *et al.*, 2023). The code of conduct often serves as community guidelines that ensure respectful conversations throughout the study, particularly in sensitive areas such as mental health research (Lawton *et al.*, 2022). Both moderation and a code of conduct outline expectations for participant behavior, fostering an environment of mutual respect and understanding (Kruzan *et al.*, 2022). Lawton *et al.* (2022) explained their rules in an introductory post to participants—general group rules were “prohibition of strong language/cursing, not selling goods and services, and keeping the content of posts relevant to the discussion, etc.”. They also included that if a participant violated a rule, they would be sent a warning via email; at the second warning, they were removed from the study (Lawton *et al.*, 2022).

The level of moderation varied among studies. Garg (2021) suggested that moderation responsibilities for researchers should be established before the study (Garg, 2021). Similarly, Bhattacharya *et al.* (2021a) shared that participants should be given set expectations about moderators' hours and response times at the beginning of the study (Bhattacharya *et al.*, 2021a). Genuis *et al.* (2023) informed participants that researchers would

read and respond to each posted comment within 24 hours in order to determine distress or confidentially breaches. They also had a hands-on approach to moderation, recommending that moderators should address participants by name, actively engage with posts from participants, and encourage interaction by inviting input on posts from participants (Genuis *et al.*, 2023). Additionally, safety-related monitoring is fundamental to ensuring the well-being of participants, especially in studies that involve potentially distressing topics (Kruzan *et al.*, 2022). Safety-related monitoring could include identifying and addressing any concerning behavior or mental health issues and potentially bringing in clinician researchers or clinical support, should a participant require crisis response (Bhattacharya *et al.*, 2021a).

Few studies reported misconduct among participants, although, Lawton *et al.* removed a participant from the study for posting inappropriate content, showing the need for moderation systems (Lawton *et al.*, 2022). At the same time, Bhattacharya *et al.*, (2021), Genuis *et al.*, (2023), Lawton *et al.*, (2022), Liang *et al.*, (2020) indicated a “moderation burden” due to the time and effort required to monitor participants. Both Lawton *et al.* (2022) and Bhattacharya *et al.* (2021a) felt it would be advantageous to explore automated monitoring to reduce the load on researchers (Bhattacharya *et al.*, 2021a, Lawton *et al.*, 2022).

4.6 Data analysis prep

Researchers should implement strategies for data organization and management before beginning data collection due to the differing types of data throughout the ARC study (Maestre *et al.*, 2018). Numerous studies report difficulties in analyzing a large amount of ARC data, some reaching data saturation before the completion of the study (Buelo *et al.*, 2020, Prabhakar *et al.*, 2017b). Additionally, ARC studies have implemented different techniques for data extraction and analysis to manage data.

Data Saturation Prabhakar *et al.* (2017b) reported difficulties in analyzing a large amount of ARC study data as they used meta-data from all the activities in the study to evaluate the effectiveness of the ARC method (Prabhakar *et al.*, 2017b). Buelo *et al.* (2020) struggled with more data than necessary, observing data saturation was achieved after the first eight activities (Buelo *et al.*, 2020). Researchers should consider the number of activities and duration of the ARC study to decrease unnecessary data collection (Buelo *et al.*, 2010, Maestre *et al.*, 2018).

Data Extraction The large volume of data in ARC studies can also lead to difficulties around data extraction (Maestre *et al.*, 2018, Prabhakar *et al.*, 2017b). There are many strategies to account for this. Bhattacharya *et al.* (2021a) recommended that the ARC environment should have a public application programming interface (API) that allows researchers to create apps and bots to

TABLE 13. Overview of in-study considerations with references to papers that discussed the issue.*Researcher–Participant Interactions*

If the platform uses algorithms to prioritize posts, how can study posts be better seen? (Kresnye et al., 2021, MacLeod et al., 2016a, Maestre et al., 2018, Prabhakar et al., 2017b)

How can researchers easily assess participant activity and interactions? (Maestre et al., 2020)

How will questions and misunderstandings be promptly dealt with? (Maestre et al., 2020 2018)

Participant–Participant Interactions

Should participants build on each other's contributions? (Bhattacharya et al., 2019, Garg, 2021, MacLeod et al., 2016a, Maestre et al., 2018)

Should participants have the ability to socialize outside of ARC activities? (Bhattacharya et al., 2019, Buelo et al., 2020, Garg, 2021, Lawton et al., 2022, Liang et al., 2020, MacLeod et al., 2016a, Maestre et al., 2018)

How can participants use information shared in ARCs outside of the study? (Buelo et al., 2020)

How will participant-participant social interactions be studied? (Garg, 2021, Liang et al., 2020)

help export data (Bhattacharya et al., 2021a). They highlighted that Slack was a helpful tool, but recommended exploring alternatives such as Microsoft Teams, Discord, GroupMe, or a custom-built internet-based platform that is both anonymous and intuitive. Jenness et al. (2022) created a smart diary system for participants, simplifying data collection by focusing analysis on the smart diary content (Jenness et al., 2022). Other extraction methods include Prabhakar et al.'s (2017b) method of assigning a researcher to each ARC Facebook group where they checked activities and copied comments into a qualitative tool, Dedoose¹. Similarly, Liang et al. (2020) pulled data from each Discord group, anonymized the content, and then deleted each server at the end of the study.

Data Analysis Tools and Methods There are many tools that can be used to analyze data from ARC studies. Maestre et al. (2018) recommend using similar tools to in-person focus groups that assist researchers in analyzing data through thematic coding (Maestre et al., 2018). For instance, Prabhakar et al. (2017b) used Dedoose to help analyze the data and held weekly meetings to coordinate metadata, descriptors, and data categories. The authors also collected timestamps to determine how quickly participants responded and the amount of time it took participants to complete each activity (Prabhakar et al., 2017b).

5 DISCUSSION

Our findings suggest that ARC effectively fulfills its intended purpose as a research method, extending researchers' reach beyond the geographical and social limitations of similar group-based in-person methods. Our analysis of studies reporting geographic information indicates recruitment from diverse locations, including urban, suburban, and rural areas. Additionally, our findings suggest that researchers frequently employ ARC to study stigmatized conditions (45.5%, $n=15$), with most studies (93.9%, $n=31$) citing at least one of the initial recommendations for using ARC as their justification for utilizing the method (Maestre et al., 2023, Michelson et al., 2021, Ril et al., 2023). Furthermore, ARC is being applied across various age groups, although there is a notable scarcity of studies involving adolescents and older adults. This highlights a potential avenue for future research in designing engaging ARC studies specifically targeted at adolescents and older adults.

Nevertheless, our findings also reveal that ARC studies predominantly involve populations that are WEIRD—Western, Educated, Industrialized, Rich, and Democratic—and primarily white. This underscores a significant need for further efforts to diversify

the participant demographics in ARC research or to understand the rationale for why this method is not adopted in research beyond the WEIRD population.

5.1 Our recommendations for future work

Our analysis of the current state of ARC has led us to develop three key recommendations for future ARC studies: broadening the application of ARC through diversifying study populations and expanding study designs, a clear stance on AI, and establishing best practices for reporting. These recommendations aim to enhance ARC's contributions to HCI research and support its future development as a robust HCI research method.

5.1.1 Broadening ARC

To broaden the application of ARC, future research must carefully consider both the purposes for which they use ARC and the study design. First, as discussed in section 5, current ARC studies tend to focus on WEIRD populations. Diversifying the target populations in ARC studies provides an opportunity to further assess the affordances and limitations of the method while aligning with the HCI community's values of engaging with underserved and marginalized communities. Furthermore, researchers using ARC could expand the application of the method by considering its utilization in other stages of the design process. Our findings suggest that the majority of studies are concentrated in the discovery stage. Although some work has been done in the define, ideate, and prototype stages, more research is needed in these areas to identify activities and low-overhead tools that can effectively engage participants. Notably, no ARC studies have been used for testing. However, one could envision a concurrent field deployment with ARC to gather feedback and ideate on alternative designs and interactions. If a research team considers this approach, they should regularly assess the participation in both the technology and the ARC study to ensure it does not impose excessive overhead (e.g., Agapie et al., 2022 observed a lack of participation in ARC between in-person activities and consequently discontinued the ARC study). Moreover, diversifying the types of activities used within ARC studies can significantly enhance the method's utility and validity. ARC enables researchers to engage participants in reflective, creative, and social activities. However, our findings indicate that reflective activities dominate most studies. We recommend that future ARC researchers adopt a broader range of activity types. This approach provides opportunities for triangulation around a topic, thereby enhancing the validity of their findings and offering richer, more nuanced insights (Maestre et al., 2018).

² www.dedoose.com

5.1.2 Clarify stance on AI

Furthermore, with the rising popularity of generative AI, we recommend that future ARC researchers explicitly discuss their stance on the use of generative AI with both participants and the research community. Our analysis indicates that it remains unclear to what extent AI tools are currently being utilized by participants in ARC studies. However, considering the prevalence of reflective and creative activities in ARC—typically involving the generation of free-text and artifact responses—engagement with AI tools is a reasonable consideration. Researchers should be empathetic to the experiences of participants, particularly those who may not typically express themselves in written form, and acknowledge their power and privilege when interacting with participants who may experience the Hawthorne effect (Adair, 1984). This transparency and empathy can help ensure that participant responses are authentic and meaningful, thereby enhancing the quality of the data collected.

5.1.3 Establishing best practices

Based on the use of ARC with stigmatized and marginalized communities, we encourage researchers to go beyond *knowing about* study communities and instead *involve community members in the design of ARC studies*. Ideally, researchers could investigate how to integrate community-based participatory design (Unertl et al., 2016) methods with ARC where community members are involved throughout the research process. Involving community members early in the study design would ensure that cultural norms (e.g., institutional or religious holidays) and language preferences are seamlessly integrated into the study structure and activities. Additionally, researchers may want to consider their positionality in relation to the communities they work to and carefully consider if disclosure is appropriate to mitigate potential harms (Liang et al., 2021).

Given the in-depth data collection facilitated by ARC, it is imperative for researchers to provide comprehensive details to support future knowledge sharing (Ibrahim et al., 2024). We recommend that future ARC researchers share detailed accounts of their study designs, including information on target population demographics, activity details, codes of conduct, risk mitigation protocols, and data analysis approaches. This practice could guide the design of similar studies, support the development of best practices, and create valuable resources for systematic reviews. Utilizing the appendices and supplementary materials sections of publications (e.g., Genuis et al., 2023, Jenness et al., 2022) can enable researchers to contribute to the further development of the ARC method without detracting from the main content of the paper.

Our analysis was limited by gaps in the reporting of study designs, particularly concerning participant compensation mechanisms and participant engagement. Based on the available data, we estimated weekly compensation ranging from \$1.50 to \$7.50 USD. This raises questions about whether participants are receiving fair compensation for their contributions, especially in light of inflation. There remains an open question regarding what constitutes fair compensation in such studies. Researchers need to consider the metrics used to assess compensation, whether it is a lump sum, weekly payment, or per-activity payment.

Furthermore, participant engagement with the activities throughout the study is a critical aspect of evaluating activities in ARC studies. Additionally, participants' interactions within the group can offer valuable insights into group dynamics. However, at present, few studies provide detailed accounts of participant

engagement and interactions. We recommend that future ARC researchers provide context on how participants engage in ARC studies. For example, studies such as (DeVito et al., 2021, Kresnye et al., 2021) provide activity-level participation data that help orient readers regarding participant engagement and can support the further development of ARC by offering insights into how different populations and study contexts impact participation.

6 LIMITATIONS

Perhaps the biggest limitation of our paper is also inherent to scoping reviews—the fact that papers in our corpus followed a variety of conventions and, therefore, reported varying types and levels of information. As such, many of our observations are founded on subsets of the 40 papers (33 studies) that happened to report comparable data. We address this limitation throughout the main text, as well. Similarly, we acknowledge that reporting on funding mechanisms was based on acknowledgment sections and may not provide an accurate picture of study funding, since funding may refer to co-author time compensation. While studies reported compensating participants, the details on compensation rates were unclear, making it challenging to determine the weekly payment amounts. In reporting findings, as Ibrahim et al. (2024) recommends, researchers could consider reporting more detail on compensations and study design to support future research synthesis, such as systematic reviews. In addition, we did not extract or code for papers that used ARC studies as a probe or intervention (e.g., Bhattacharya et al., 2021a), but instead coded them as qualitative studies that reported participant outcomes because the results and design considerations aligned with past ARC work. Although out of scope for this review, we acknowledge that online focus groups have been used in social science (Stewart & Williams, 2005) and business research (Stewart & Shamdasani, 2017), reporting similar study design considerations for ethics, identity (Stewart & Williams, 2005), and synchronicity (Stewart & Shamdasani, 2017, Stewart & Williams, 2005). Indeed, MacLeod et al. (2017b) built on Stewart & Williams (2005) online focus group guidelines to enhance them for “HCI research methods” because online focus group research in these fields “do not necessarily take into account the specific goals of needs assessments in HCI or the types of activities conducted in design research” (MacLeod et al., 2017b). Future work could investigate the differences in ARC and online focus groups (e.g., study duration; number of participants; activities).

7 CONCLUSION

ARC is a versatile and dynamic research method, especially applicable to engaging underrepresented populations, such as communities that are stigmatized or geographically separated. This paper provides insights into current study duration, number of activities, and recruitment practices in ARC studies. We acknowledge that the diversity in how methods and data are reported makes it challenging to provide concrete data, thus we instead investigate how the ARC method has been applied across a wide variety of populations, with particular attention to granular methodologies and differences across participant populations and demographics. Our scoping review of 40 papers and 33 unique ARC studies provides a consolidation and comparison of research team methodologies, from recruitment to study design to data analysis. Our analysis provides a high-level guide for researchers looking to implement their own ARC study, identifies gaps and opportunities

to improve methodological rigor, and proposes open questions to guide further evaluation and implementation of ARC.

DATA AVAILABILITY

The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request. Additionally, supplementary material for this article contains the data underlying this study is available at https://osf.io/6ga2x/?view_only=8358ec55aa6e4fadade4387e694af0f4.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest related to this work.

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Study Information

TABLE A1. Abstracted information about each ARC study in our corpus

Study ID	Paper(s)	Abstracted Population	Participant Locations	# Participants	Duration	# Activities	Primary Platform
1	(Augustaitis et al., 2021)	LGBTQ+, young adults, adults	United States	26	3 days across 3 months	NA	FocusGroupIt
2	Lambton-Howard et al. (2019)	adolescents, young adults, adults	Finland, Bulgaria, Hong Kong, Kenya, Australia	487	11 days	3	WhatsApp
3	Bhattacharya et al. (2021a)	mental health, adults	United States	10	10 weeks	10	Slack
4	Maestre et al. (2023)	HIV, young adults, adults	United States, United Kingdom, Philippines, Indonesia, Thailand, Uganda, South Africa	25	9 weeks	11	Facebook
5	Walker & DeVito (2020)	LGBTQ+, young adults, adults	United States	25	8 weeks	8	Facebook
6	Beltzer et al. (2023), Kruzan et al. (2022)	mental health, young adults	United States	50	18-24 days	6-8	FocusGroupIt
7	Buelo et al. (2020)	reproductive health, young adults, adults	United Kingdom	21	15 days	18	Facebook
8	DeVito (2021)	LGBTQ+, young adults, adults	United States	25	7 weeks	7	Facebook
9	MacLeod et al. (2017a 2016ab)	health condition, adults, older adults	United States, Australia	13	22 weeks	11	Facebook
10	Liang et al. (2020)	LGBTQ+, adolescents, young adults	United States	16	3 weeks	3	Discord
11	Garg (2021)	families, adolescents, adults	United States	44	2 months	9	Slack
12	Bhattacharya et al. (2019)	adolescents, young adults	United States	23	10 weeks	10	Slack
13	Glick et al. (2022)	disabilities, caregivers	England	17	14 days	NA	Collabito (Quallie)
14	Lawton et al. (2022)	families, adults	United States	25	3 weeks	31	Facebook
15	Prabhakar et al. (2017ab)	reproductive health, young adults, adults	United States	48	8 weeks	19	Facebook
16	Tam et al. (2023)	gendered health, young adults, adults	India	35	2 weeks	NA	WhatsApp
17	Jenness et al. (2022)	mental health, adolescents, adults	United States	13	10 weeks	17	Slack
18	Kornfield et al. (2022)	mental health, young adults	United States	22	24 days	8	FocusGroupIt
19	Meyerhoff et al. (2022)	mental health, young adults	United States	29	18 days	6	FocusGroupIt
20	Bhattacharya et al. (2021a)	mental health, adolescents, young adults	United States	8	10 weeks	10	Slack
21	Jean et al. (2023)	adolescents	NA	7	8 weeks	NA	Discord
22	Bhattacharya et al. (2021b)	mental health, gaming	NA	7	1 month	NA	Discord
23	Maestre et al. (2020 2018 2021), Salib et al. (2018)	HIV, young adults, adults	United States, Mexico, United Kingdom, Philippines, Kenya, South Africa	19	8 weeks	8	Facebook
24	Agapie et al. (2022)	Latinx, adolescents, young adults	NA	5	NA	NA	Discord
25	DeVito et al. (2021)	LGBTQ+, young adults, adults	United States	31	11 days	5	Facebook
26	Alqassim et al. (2022, 2019), Kresnye et al. (2021)	reproductive health, young adults, adults	United States, United Kingdom	42	8 weeks	16	Facebook
27	Ril et al. (2023)	reproductive health, LGBTQ+, young adults, adults	Brazil, France	6	10 days	NA	WhatsApp
28	Michelson et al. (2021)	families, adolescents, young adults, adults	United States	30 families	10 weeks	10	Slack
29	Tan et al. (2022)	young adults, adults	United States	16	2 months	6	Slack
30	Seguin et al. (2022)	Filipino migrant community organization members	Australia	12	10 weeks	NA	Facebook
31	Genuis et al. (2023)	health condition, caregivers, families, young adults, adults, older adults	Canada	100	14 weeks	27	itracks
32	Yu & McDonald (2023)	health condition, caregivers, families, adolescents, young adults	United States	32	6 months	20	Slack
33	Maestre et al. (2020 2021)	HIV, young adults, adults	United States	8	8 weeks	8	Facebook

Activity Categorization by Study

TABLE A2. Proportion of each activity category for every ARC study in our corpus

Study ID	Creative	Reflective	Social	Real World	External
1	0	0	0	0	100
2	0	50	50	0	0
3	0	71.43	28.57	0	0
4	42.86	42.86	14.29	0	0
5	25	37.5	12.5	12.5	12.5
6	0	50	0	0	50
7	25	75	0	0	0
8	25	37.5	25	12.5	0
9	25	50	12.5	12.5	0
10	50	50	0	0	0
11	50	25	25	0	0
12	11.11	66.67	11.11	0	11.11
13	0	50	0	0	50
14	0	50	0	50	0
15	12.5	37.5	25	12.5	12.5
16	0	100	0	0	0
17	16.67	50	16.67	0	16.67
18	50	50	0	0	0
19	0	100	0	0	0
20	0	71.43	28.57	0	0
21	33.33	33.33	0	33.33	0
22	33.33	50	16.67	0	0
23	12.5	62.5	12.5	12.5	0
24	0	75	25	0	0
25	50	0	50	0	0
26	28.57	28.57	14.29	14.29	14.29
27	0	100	0	0	0
28	40	40	20	0	0
29	66.67	0	0	33.33	0
30	12.5	25	25	0	37.5
31	20	60	20	0	0
32	25	50	25	0	0
33	12.5	62.5	12.5	12.5	0