Recruiting older adult participants through crowdsourcing platforms: Mechanical Turk versus Prolific Academic

Anne M. Turner, MD, MLIS, MPH[1,2], Thomas Engelsma, MSc[3,4], Jean O. Taylor, PhD[1], Rashmi K. Sharma, MD, MHS[5], George Demiris, PhD[6]

[1]Department of Health Services, School of Public Health, University of Washington, Seattle, WA; [2]Department of Biomedical Informatics and Medical Education, School of Medicine, University of Washington, Seattle, WA; [3]Center for Human Factors Engineering of Health Information Technology, Amsterdam, The Netherlands; [4]Department of Medical Informatics, Amsterdam UMC, Amsterdam, The Netherlands; [5]Division of General Internal Medicine, University of Washington; [6]Department of Biostatistics, Epidemiology and Informatics, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA.

Abstract

Background: Recruiting older adults (OA) into research is challenging. Objective: To assess the feasibility of using two crowdsourcing platforms, Amazon's Mechanical Turk (MTurk) and Prolific Academic (ProA), as efficient and low-cost venues for recruiting survey participants aged 65 and older. Methods: We developed an online survey to investigate and compare the demographics, technology use, and motivations for research participation of OA on MTurk and ProA. Qualitative responses, response time, word count, and recruitment costs were analyzed. Results: We recruited 97 OA survey participants on both MTurk and ProA. Participants were similar in terms of demographics, technology usage, and motivations for participation (topic interest and payment). Conclusion: Both crowdsourcing platforms are useful for rapid and low-cost recruitment of OA. The OA recruitment process was more efficient with ProA. Crowdsourcing platforms are potential sources of OA research participants; however, the pool is limited to generally healthy, technologically active, and well-educated older adults.

Introduction

There are a growing number of older adults (age 65 and older) in the US and worldwide. Older adults are the most frequent users of health services and account for the largest portion of healthcare spending.[1] However, older adults are under-represented in health-related research studies because of age exclusion criteria, and the increased time and costs for recruiting this harder to reach population.[2-9] In addition, recruiting older adults for research studies can be difficult because of barriers associated with aging, such as social isolation, transportation limitations, perceived vulnerability to predatory solicitation, and less participation online and on social media[10-12]. The American Geriatrics Society recognizes the negative impact and missed opportunities resulting from older adults' underrepresentation in research, and has responded by creating guidelines for increasing older adult participation in National Institutes of Health funded studies.[13] An example of a recent attempt to encourage older adults to participate in clinical research is the "Recruiting Older Adults in Research" project, which is the combined effort of several federal agencies.[14]

One emerging online strategy to gain access to research participants is crowdsourcing.[15] Crowdsourcing is defined as "the practice of obtaining needed services, ideas, or content by soliciting contributions from a large group of people and especially from the online community."[16] Online crowdsourcing platforms provide access to individuals from a wide geographical region who have signed up to complete online tasks for payment. Online crowdsourcing platforms have been used increasingly to conduct health and bio-behavioral surveys.[17-19] The advantages of the crowdsourcing approach include the ability to quickly recruit a large number of participants at relatively low cost, the opportunity to promote cross-cultural comparisons, and the potential to access hard-to-reach populations. Reported challenges include potential sampling bias, as participants need to have internet access, as well as potential exposure to study-related information prior to participation (e.g. potential participants may communicate about the research in web forums).[20, 21]

Although older adults tend to lag behind younger adults in the adoption of online technologies, recent Pew research indicates that 67% of older adults use the internet.[22] Older adults are also the fastest growing population to adopt smart phone technologies, and 40% report using a smart phone.[22] As online tools become more widely utilized for recruitment and data collection in research studies, these platforms introduce new opportunities for engaging older

adults in research studies. Behrend et al. found that compared to participants recruited through university pools, participants recruited for behavioral surveys through crowdsourcing respondents were older, more ethnically diverse, and had more work experience.[23]

Despite its tremendous potential, the use of crowdsourcing platforms for reaching older adults remains largely unexamined.[24] In this study, we sought to investigate the use of crowdsourcing platforms to solicit older adult participants for user-centered informatics research studies. We specifically explored two crowdsourcing platforms: Amazon's Mechanical Turk (MTurk), the largest, most established crowdsourcing platform, and Prolific A (ProA), a relatively new platform created by academicians for the purpose of recruiting research participants, to gain information regarding decision-making around transitions in living facilities as individuals age.[25,26] Given ProA's goal of engaging research participants, we sought to investigate whether there were differences in demographics, motivations, and attitudes between older adults recruited through ProA and older adults recruited through MTurk, which does not have a specific research focus. The study presented here has two aims: to 1) assess the feasibility of using these two crowdsourcing platforms to recruit older participants for research studies and 2) understand and compare participant characteristics between those recruited through MTurk and ProA.

Methods

Crowdsourcing Platforms

MTurk was established in 2005 as a business platform to bring together "workers" (responders) and employers (requesters).[27] Requesters post human intelligence tasks (HITs) on the MTurk website that responders complete for a specified monetary payment. More recently, MTurk has been used for research studies in multiple disciplines, including healthcare.[17,28] Although MTurk reports to have more than 500,000 responders, the estimates of actual responders ranges from 7,300 to 200,000.[29,30] Notably, most participants on MTurk are younger and more technologically savvy than the general population.[31] MTurk charges the requester a percentage of the HIT reward: an initial 20% of the reward for 9 or fewer assignments, and another 20% of the reward for 10 or more assignments. If the requester would like to use qualifications to restrict participants, additional fees are charged. MTurk provides an age stratification, with the oldest age category being 55 and older. They charge $0.50 per worker for this qualification.

Prolific Academic (ProA) is a more recent online crowdsourcing site established in 2014 in order to connect researchers with potential research participants. ProA gathers data about participants, including age. At the time of this writing there are reported to be over 80,000 individuals worldwide signed up for ProA who have been active in the last 90 days. Of those participants, only 1,138 are aged 65 and over. Unlike MTurk, ProA mandates a minimum payment based on expected time for completion of the task. ProA charges 30% of the reward, with no extra charges for qualifications.

Survey Development

The research team designed a survey using REDCap (Research Electronic Data Capture), a secure, web-based application designed to support data capture for research studies[32], delivered on the two crowdsourcing platforms. Structured questions focused on demographics, technology use, opinions about research participation, and rating of factors involved in considering transitions of care. Open-ended questions were added to assess the motivations for taking the survey, participating in research, and factors important to decision-making about transitions in care. Several questions regarding demographic characteristics were added to check for consistency of responses. The survey was pre-tested manually and online with four older adult volunteers to gain feedback on the clarity of the survey questions, the appropriateness of the question flow, and the time required to complete the survey. The University of Washington IRB approved all materials and procedures for this study.

We administered the REDCap survey at two different time points through MTurk and ProA (Figure 1). MTurk only provides an option to screen for respondents older than 55. We dealt with this limitation using two different strategies. First, we recruited persons aged 55 and above and then only included the participants that were 65 years and older, as identified through responses to our demographic question, in the data analysis (Method 1). For the second method, we developed a small prescreen survey with ten questions to filter for older adults 65 years and older. To prescreen, we asked about birthdate, gender, education level, and past participation and motivation for participating in research. We then posted a HIT for only those participants who had completed our screener and were 65 years of age or older (Method 2). For ProA we did not need a two-step process as we could screen immediately for participants 65 or older.

For both platforms, we specified that participants were included if they spoke/read English, could see and process visual images, and resided in Canada or the US. Once participants clicked on the survey link, they were taken to a

consent form, which they reviewed and completed prior to taking the survey. Participants were instructed that the survey would take about a half an hour, but that they had an hour to complete it. Each participant was required to give their MTurk or ProA ID at the beginning of the survey and to answer each question. At the end of the survey, they were provided a code to receive payment for their work.

To identify possible duplication of participation across platforms, we asked ProA participants and MTurk participants in Method 2 if they had previously completed the survey on the other platform. They were informed that their answer would not impact their compensation.

Analysis plan

Responses to demographic questions were summarized for participants 65 years and older. We used the Wilcoxon signed-rank test (for ordinal variables such as age) and the Fisher's exact test (for categorical variables such as relationship status) to assess significant differences in the demographics between both groups. One of the researchers (TE) reviewed text responses to open-ended questions and categorized them into themes through an iterative process in consultation with the rest of the research team. Text responses were coded by theme with many responses being assigned more than one code.

Results

Recruitment

In this study, two recruitment methods were utilized to recruit from MTurk and one for ProA, which led to various numbers of recruited older adults aged 65 and over (Figure 1).

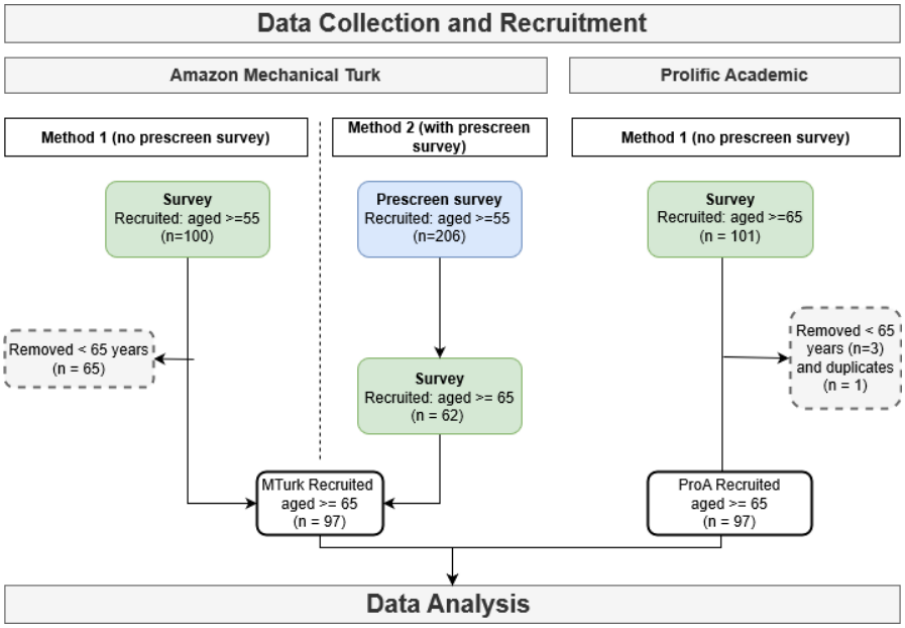

Figure 1. Data collection and recruitment phases of the crowdsourcing study.

MTurk Recruitment

Of the 100 MTurk participants that responded to our survey using Method 1 (55 years and older), 35 were 65 and older. Conducting this method took almost two days. Method 2, including the prescreen survey, took almost sixteen days. We recruited 206 respondents with the prescreen survey of which 62 (aged 65 and over) participated in the survey. In total, 97 participants aged 65 and older were recruited from MTurk. Almost 11% reported being currently active on ProA as well as MTurk, but no one reported previous participation in this specific survey.

ProA Recruitment

We directly recruited 101 participants aged 65 and older in the first session, using ProA's pre-existing age categories. Recruiting these participants took approximately seven days. Of these 101, four were excluded: three participants who were categorized as 65 and older by ProA reported ages lower than 65 in our survey and one participant had also participated in the MTurk survey. Almost 30% reported active participation in MTurk as well as ProA, but only one reported previous participation in this specific survey. This participant was excluded in the ProA analysis.

Sample Characteristics

Table 1 describes the demographic characteristics of participants 65 years and older recruited from MTurk and ProA. On both platforms, the greatest number of respondents were within the 65-69 age group. The vast majority of participants were from the US, non-Hispanic white, well-educated, and living independently. There was a statistically significant greater number of Canadian participants in ProA compared to MTurk (p=0.03).

Table 1. Participant Demographics by Crowdsourcing Platform

Demographic		**MTurk (n=97) (n (%))**	**ProA (n=97) (n (%))**	**p-value**
Age	65-69	62 (64%)	60 (62%)	0.82
	70-74	26 (27%)	27 (28%)	
	75-79	8 (8%)	9 (9%)	
	80+	1 (1%)	1 (1%)	
Gender	Female	63 (65%)	51 (53%)	0.11
Country of Residence	United States	96 (99%)	89 (92%)	0.03
	Canada	1 (1%)	8 (8%)	
Race	White	92 (95%)	93 (96%)	1.00
	Black / African American	3 (3%)	4 (4%)	
	American Indian or Alaska Native	1 (1%)	0	
	Other	1 (1%)	0	
Relationship Status	Married / partnered	48 (49.5%)	53 (55%)	0.84
	Divorced / Separated	25 (25.8%)	21 (22%)	
	Single, never married	10 (10.3%)	11 (11%)	
	Widowed	14 (14.4%)	12 (12%)	
Highest level of education	High School degree	8 (8%)	11 (11%)	0.47
	Some college	24 (25%)	26 (27%)	
	Associate degree	9 (9%)	7 (7%)	
	Bachelor's degree	29 (30%)	29 (30%)	
	Graduate degree	27 (28%)	24 (25%)	
Health Status	Excellent	14 (14.4%)	7 (7.2%)	0.32
	Very Good	30 (30.9%)	27 (27.8%)	
	Good	36 (37.1%)	41 (42.3%)	
	Fair	15 (15.5%)	16 (16.5%)	
	Poor	2 (2.1%)	6 (6.2%)	
Living Situation	Private Residence	90 (93%)	91 (94%)	1.00
	Nursing home	1 (1%)	1 (1%)	
	Retirement community	4 (4%)	3 (3%)	
	Other	2 (2%)	2 (2%)	
Employment status	Retired	63 (65%)	69 (71%)	0.16
	Employed full or part time	33 (34%)	23 (24%)	
	Not employed	1 (1%)	4 (4%)	
	Other	0	1 (1%)	
Total Combined Household Income	$0 - $24,999	24 (25%)	23 (23.7%)	0.45
	$25K-$49,999	34 (35%)	32 (32.9%)	
	$50K-$74,999	23 (24%)	16 (16.5%)	
	$75K - $99,999	7 (7%)	15 (15.5%)	
	$100,000 and up	8 (8%)	9 (9.3%)	
	Prefer not to answer	1 (1%)	2 (2.1%)	

Technology Use and Research Participation

With respect to technology use, both groups frequently used a computer and smartphone (Table 2). More than 70% of participants reported previously participating in a university research study, and nearly all reported being willing to participate in research surveys. In general, more MTurk than ProA participants reported they were willing to participate in multiple types of research studies including observational studies and clinical trials.

Table 2. Technology Usage and Research Participation by Crowdsourcing Platform

Demographic		**MTurk (n=97) (n (%))**	**ProA (n=97) (n (%))**	**p-value**
Frequency of computer use in a week	Once or twice a week	1 (1%)	0	0.39
	Every day or so	11 (11%)	6 (6%)	
	Several times a day or more	51 (53%)	58 (60%)	
	Constantly	34 (35%)	33 (34%)	
Have a smart phone	Yes	81 (84%)	85 (88%)	0.54
	No	16 (16%)	12 (12%)	
Frequency of smart phone use in a week	Not at all (*have, but don't use*)	3 (3.1%)	2 (2.1%)	0.83
	Once or twice a week	5 (5.2%)	5 (5.2%)	
	Every day or so	15 (15.5%)	21 (21.6%)	
	Several times a day or more	44 (45.4%)	46 (47.4%)	
	Constantly	14 (14.4%)	11 (11.3%)	
	Empty (No smartphone, no use)	16 (16.5%)	12 (12.4%)	
Past participation in a university research study	Yes	72 (74%)	77 (79.4%)	0.08
	No	20 (21%)	10 (10.3%)	
	Unsure	5 (5%)	10 (10.3%)	
Interest in participating in following types of studies	An interview about aspects of your life and activities	43 (44%)	50 (52%)	0.39
	Observation of aspects of your life and activities	37 (38%)	35 (36%)	0.88
	A survey (online or written) of aspects of your life and activities	90 (93%)	91 (94%)	1
	A clinical trial involving treatment for a condition you might have	35 (36%)	32 (33%)	0.76

Reasons for Participation

In open-ended responses, participants described multiple reasons for participating in the survey. More than half of participants stated an interest in the topic of transitions in living situations as a reason for participating in the study (MTurk: 54.6%; ProA: 61.9%). Some stated this as a primary motivator, while others saw interest in the topic secondary to another motivation. Participants were interested because they had experience with the topic or felt that the topic could be something they will experience in the future. Earning money was the second most commonly reported reason for participating. On both platforms about 14% stated money was their sole motivation for participating; others stated it alongside other motivators. Table 3 shows the major categories of reasons for participating in the study by crowdsourcing platform along with quotes selected to illustrate responses.

Table 3. Reasons to participate by crowdsourcing platform

Category	**MTurk (n=97)**	**ProA (n=97)**	**Representative Quotes**
Interest in survey topic	54.6%	61.9%	"*My age, what I can learn and makes me think of options. Good study. Thank you*." (MTurk) *"Because I am getting to the age that with my medical conditions these kinds of decisions are coming soon...*" (ProA)
Earn Money	28.9%	28.9%	"*I mainly do these studies to make the extra money. It really comes in handy*" (MTurk) "*I am supplementing my income*" (ProA)

Eligibility	15.5%	17.5%	"*You accepted me and I did not do all the five I allow myself each day*." (MTurk) "*Came up on Prolific studies page. I'm old*." (ProA)
To support research	14.4%	14.4%	"*I thought it was important for researchers to understand the aging process*." (MTurk) "*It seemed like I had something to offer about the subject you are researching*." (ProA)
Other	13.4%	11.3%	"*Something to do on a cold winter when you can't go outside*" (ProA)

Response Time, Completion Time, Word Count, and Cost

The total cost of recruiting participants in Method 1 (Figure 1) on MTurk was $340 ($3.40/per person: $2 to the participant and $1.40 to the platform per participant). The response time, measured as the difference in time from opening the survey till the final survey was completed, was almost two days. Use of a pre-screener (Method 2 in Figure 1) resulted in less cost for recruiting, but a much longer response time of almost 16 days (Table 4). As shown in Figure 1, 206 participants responded to the prescreen survey and 62 to the actual survey. Total payment to participants was calculated as 206*$0.25 plus 62*$2. Fees to the platform were calculated as 206*$0.85 for the prescreen survey plus 62*$0.80 for the actual survey. For ProA, the costs to participants were higher ($3.25 per participant), but the fees were lower ($0.98 per participant). Even though costs per participant 65 and over were higher on ProA, the overall costs were lowest.

Table 4. Costs and time for survey responses.
[a] time is measured from the opening of the survey to final completion in days

Cost and Time / Methods		MTurk No Prescreen (n= 100, **35 aged 65+)**	MTurk With Prescreen (n= 206, **62 aged 65+)**	ProA (n = 101, **97 aged 65+**)
Costs	Payment to participant	$200	$175.50	$328.25
	Fee to platform	$140	$224.70	$98.98
	Total	$340	$400.20	$427.23
	Per participant 65+	*$9.71*	*$6.45*	*$4.40*
Response Time [a]	Total (days)	1.98	15.71	7.2
	Per 100 participants 65+ (days)	*5.65*	*25,34*	*7.4*

Both platforms provided information regarding the amount of time each participant took to complete the survey. On average, MTurk participants took 23.7 minutes to complete the survey and ProA participants took 25.9 minutes (p=0.12).

MTurk participants wrote on average 216 ± 136 words (95% CI [189, 243]) in their responses to the thirteen open-ended survey questions. ProA participants used 186 ± 114 words (95% CI [163, 209]). The average number of words per question ranged from 13 to 25 for MTurk and 11 to 22 for ProA. On average, MTurk participants who stated money as a motivator, completed the survey in 22.2 minutes, using 178 words. For ProA, the average time to completion for participants who stated money as a motivator was slightly lower than the overall average (26.2 minutes), but the average word count was higher (208 words).

Discussion

The era of citizen science, namely the extensive and ongoing public participation in research, introduces many opportunities to promote inclusion of citizens regardless of age, race, geography, or other biological or social factors. Crowdsourcing platforms offer a promising way to enhance recruitment of older adults for health-related research studies. Our study findings demonstrate that use of crowdsourcing platforms to recruit older adults for a study about transitions in living situation was a feasible, quick, and inexpensive way to obtain survey responses from participants 65 years and older. At the same time, our study identifies some of the shortcomings associated with using these platforms. For example, the majority of respondents on both MTurk and ProA were retired, well-educated, non-Hispanic white individuals with high technology usage. Almost all of them reported using the computer several times a day or more, and most owned a smart phone. Few participants reported having poor health status. Although our participants were not necessarily representative of the broader older adult population, they represent a unique group whose input could be important for overcoming some barriers to study recruitment and guiding human centered health technologies for a technologically comfortable older adult population.

Looking at those motivated by interest in the topic or payment to participate in this study, it seems that those who stated interest spent more time on the survey compared to those motivated by payment. For MTurk, those motivated by money used fewer words on the survey and finished it faster. Those motivated by interest used more words than the average participant but finished it in a time equal to average. ProA participants motivated by money or interest elaborated more than average on the questions. However, the ones motivated by money were slightly faster than the average and those motivated by interest took more time. Comparing the averages of MTurk participants with the ProA participants, it seems that MTurkers work faster but use more words in responding to the open-ended questions. Even though we have found those slight differences, essentially motivation did not seem to impact participant responses.

Although participants from both MTurk and ProA were similar in terms of their demographics and motivations to participate, we did find some differences between the two platforms. MTurk has a very large participant population (estimated by some to be between 100,000 and 200,000 workers), but 80% of workers were born after 1980[30] and the platform does not provide a filter to screen by age. As a result, we tested out two strategies. Firstly, we invited all adults over 55 and excluded responses from those under 65, which resulted in some unnecessary expense for these relatively younger participants we did not wish to include. Secondly, we used a two-step method that included a pre-screening survey. Although this second approach was less expensive than the first, it took much longer to gather enough participants. ProA, on the other hand, has a smaller participant pool than MTurk, but it does allow researchers to more efficiently filter for participants aged 65 and above.

There were additional challenges when soliciting participation of older adults on multiple crowdsourcing platforms. Because crowdsourcing workers sign up to participate in each platform separately, it is possible that participants could take part in a research study more than once. Although we were able block previous participants within each platform through their participant ID, we had to rely on the honesty and good will of our respondents in answering our question of whether they were workers on the other platform and whether they had taken the survey more than once. Previous research found that 22% of ProA participants also worked on MTurk and 14.5% of MTurk participants worked on ProA.[33] Although our study suggests that up to 30% of the participants signed up for more than one crowdsourcing platform, only one participant reported taking the survey twice.

We also found that the stated motivations for participating in the survey were similar for respondents on both platforms even though ProA is focused on academic research studies. In a recent comparison of general crowdsourcing demographics, ProA participants showed a greater diversity, research naiveté, and higher quality answers than MTurk participants.[33] About half of participants on both platforms reported a household income of less than $50,000 which is similar to the median income for older adults according to the 2015 US Census ($38,515).[34] We found that many respondents on both platforms reported earning money as their primary motivation for completing the survey. Despite the motivation for money, most participants provided thoughtful, carefully reasoned answers to open-ended questions. The meaningful responses to questions about factors associated with transitions in living situations in our survey and responses related to an interest in the research topic suggest that crowdsourcing and its payment methods may be reliable methods for recruiting older adult study participants.

Based on our findings, both MTurk and ProA provide an efficient method of recruiting approximately 100 older adults to respond to online research surveys over a relatively short amount of time. Given the limited diversity of older adults on these platforms, crowdsourcing may be most useful for pretesting research instruments and obtaining rapid and low-cost input from a technologically savvy older population. This input could be especially helpful for rapid design prototyping and human-centered design.

4.1 Limitations

This pilot study had several limitations. First, a limitation of both platforms is the inability to validate the demographic data from the participants. MTurk and ProA both use self-reported participant data to filter access to HITs. However, for most research studies participant enrollment is based on self-reported qualifications. Second, the participant sample was mostly white, well-educated, and frequent technology users, and thus there may be limited generalizability to the broader older adult population in the US. At this point in time crowdsourcing does not appear to be an effective method for reaching older adults from underrepresented minority populations. Barriers to online access, historic mistrust of research and lack of outreach to minority groups may contribute to underrepresentation. Focused effort by platforms to encourage a diverse participant pool through targeted outreach, marketing and incentives could improve the participation of underrepresented minorities in crowdsourcing activities. Third, we excluded non-English speaking participants and our recruitment sample was primarily from the US, limiting generalizability to older adults in other countries and those with limited-English proficiency in the US.

Conclusion

The two crowdsourcing platforms provided quick and easy access to participants aged 65 and older. Participant responses from MTurk and ProA were similar in terms of their demographics and motivations to participate in research studies. Soliciting participants from crowdsourcing platforms such as MTurk and ProA can be an efficient and inexpensive method of reaching older adult participants, particularly those who are technologically-savvy, for participation in a research survey. The following summarizes our key conclusions:

- ProA has a much smaller participant pool than MTURK, however, the ability to directly filter by age in ProA allowed for a more efficient process to recruit older adult participants.
- Despite the stated research focus of ProA we did not find differences in the demographic characteristics or motivations of participants.
- Crowdsourcing tools were useful for gathering a rapid response from 50-100 primarily healthy, non-Hispanic white, technologically comfortable older adults.
- Care must be taken to avoid duplicate responses given a portion of respondents participate in both platforms.
- Given the strong monetary motivation for using these platforms, the issue of coercion should be discussed through some formal means.
- Although income was a major reason for involvement in this study, it was clear that many participants were also motivated by interest in the topic and did their best to answer the questions. This mode of accessing research participants has potential.

Acknowledgments

We would like to thank Alyssa Bosold for her assistance in editing this manuscript. This work was supported by funding from the Agency for Healthcare Research and Quality (AHRQ) #R01HS022106. The findings and conclusions expressed here are those of the authors and do not necessarily represent the views of AHRQ. REDCap is supported by the National Center for Advancing Translational Sciences of the National Institutes of Health under Award Number UL1 TR002319.

References

1. Zayas CE, He Z, Yuan J, Maldonado-Molina M, Hogan W, Modave F, et al. Examining healthcare utilization patterns of elderly middle-aged adults in the United States. Proc Int Fla AI Res Soc Conf. 2016:361-366.
2. Herrera AP, Snipes SA, King DW, Torres-Vigil I, Goldberg DS, Weinberg AD. Disparate Inclusion of Older Adults in Clinical Trials: Priorities and Opportunities for Policy and Practice Change. American Journal of Public Health. 2010;100(Suppl 1):S105–S112. DOI: 10.2105/AJPH.2009.162982
3. Konrat C, Boutron I, Trinquart L, Auleley G-R, Ricordeau P, Ravaud P. Underrepresentation of Elderly People in Randomised Controlled Trials. The Example of Trials of 4 Widely Prescribed Drugs. PLoS ONE. 2012;7(3): e33559. DOI: 10.1371/journal.pone.0033559
4. Shepherd V, Wood F, Griffith R, Sheehan M, Hood K. Protection by exclusion? The (lack of) inclusion of adults who lack capacity to consent to research in clinical trials in the UK. Trials. 2019;20(1):474. DOI: 10.1186/s13063-019-3603-1
5. Jancey J, Howat P, Lee A, Clarke A, Shilton T, et al. Effective Recruitment and Retention of Older Adults in Physical Activity Research: PALS Study. American Journal of Health Behavior. 2006;30(6):626–635. DOI: 10.5555/ajhb.2006.30.6.626
6. McCarthy VL, Cassidy K. Multisite recruitment and data collection among older adults: exploring methods to conserve human and financial resources. J Nurs Meas. 2012;20(2):142–152. DOI: 10.1891/1061-3749.20.2.142
7. Dibartolo MC, McCrone S. Recruitment of rural community-dwelling older adults: barriers, challenges, and strategies. Aging Ment Health. 2003;7(2):75–82. DOI: 10.1080/1360786031000072295
8. Weil J, Mendoza AN, McGavin E. Recruiting older adults as participants in applied social research: Applying and evaluating approaches from clinical studies. Educational Gerontology. 2017;43(12):662-673. DOI: 10.1080/03601277.2017.1386406
9. Renert H, Russell-Mayhew S, Arthur N. Recruiting Ethnically Diverse Participants into Qualitative Health Research: Lessons Learned. The Qualitative Report, 2013;18(12):1-13. Available from: https://nsuworks.nova.edu/tqr/vol18/iss12/1

10. Cudjoe TKM, Roth DL, Szanton SL, Wolff JL, Boyd CM, Thorpe RJ. The Epidemiology of Social Isolation: National Health and Aging Trends Study. J Gerontol B Psychol Sci Soc Sci. 2020 Jan 1;75(1):107–13.
11. Meshi D, Cotten SR, Bender AR. Problematic Social Media Use and Perceived Social Isolation in Older Adults: A Cross-Sectional Study. Gerontology. 2019 Sep 13;1–9.
12. Ige J, Gibbons L, Bray I, Gray S. Methods of identifying and recruiting older people at risk of social isolation and loneliness: a mixed methods review. BMC Med Res Methodol. 2019 Aug 29;19(1):181.
13. Vaughan CP, Dale W, Allore HG, Binder EF, Boyd CM, Bynum JPW et al. AGS report on engagement related to the NIH inclusion across the lifespan policy. J Am Geriatr Soc. 2019;67(2):211–217. doi:10.1111/jgs.15784.
14. Recruiting Older Adults into Research (ROAR) Toolkit. National Institute on Aging. Available from: https://www.nia.nih.gov/health/recruiting-older-adults-research-roar-toolkit
15. Harms PD, DeSimone, JA. Caution! MTurk workers ahead - fines doubled. Ind Organ Psychol. 2015;8(2):183-190. DOI: 10.1017/iop.2015.23
16. Crowdsourcing [Internet]. Merriam Webster. 2019. Available from: https://www.merriamwebster.com/dictionary/crowdsourcing
17. Ranard BL, Ha YP, Meisel ZF, Asch DA, Hill SS, Becker LB, et al. Crowdsourcing—Harnessing the Masses to Advance Health and Medicine, a Systematic Review. Journal of General Internal Medicine. 2014;29(1):187–203. DOI: 10.1007/s11606-013-2536-8
18. Chandler J, Shapiro D. Conducting Clinical Research Using Crowdsourced Convenience Samples. Annu Rev Clin Psychol. 2016;12:53–81. DOI: 10.1146/annurev-clinpsy-021815-093623
19. Créquit P, Mansouri G, Benchoufi M, Vivot A, Ravaud P. Mapping of Crowdsourcing in Health: Systematic Review. J Med Internet Res. 2018;20(5):e187. DOI: 10.2196/jmir.9330
20. Wexler MN. Reconfiguring the sociology of the crowd: exploring crowdsourcing. Int J Sociol Soc Policy. 2011;31(1/2):6-20. DOI: 10.1108/01443331111104779
21. Strickland JC, Stoops WW. The use of crowdsourcing in addiction science research: Amazon Mechanical Turk. Exp Clin Psychopharmacol. 2019;27(1):1–18. DOI: 10.1037/pha0000235
22. Tech Adoption Climbs Among Older Adults. [Internet] Pew Research Center. 2017. Available from: http://www.pewinternet.org/2017/05/17/technology-use-among-seniors
23. Behrend TS, Sharek DJ, Meade AW, Wiebe EN. The viability of crowdsourcing for survey research. Behav Res Methods. 2011;43(3):800–13. DOI: 10.3758/s13428-011-0081-0
24. Rouse SV. A reliability analysis of Mechanical Turk data. Comput Human Behav. 2015;43:304-307. DOI: 10.1016/j.chb.2014.11.004
25. Amazon Mechanical Turk, 2019. Available from: https://www.mturk.com/
26. Prolific Academic, 2019. Available from: https://prolific.ac/
27. Hitlin, P. Research in the Crowdsourcing Age, a Case Study. Pew Research Center. 2016 Available from: http://www.pewinternet.org/2016/07/11/research-in-the-crowdsourcing-age-a-case-study/
28. Wazny K. Applications of crowdsourcing in health: an overview. J Glob Health 2018;8(1):010502. DOI: 10.7189/jogh.08.010502
29. Stewart N, Ungemach C, Harris AJL, Bartels DM, Newell BR, et al. The average laboratory samples a population of 7,000 Amazon Mechanical Turk workers. Judgm Decis Mak 2015;10(5):479-491
30. Difallah D, Filatova E, Ipeirotis P. Demographics and dynamics of Mechanical Turk workers. Proc Int Conf Web Search Data Min. 2018:135-143. DOI: 10.1145/3159652.3159661
31. Paolacci G, Chandler J. Inside the Turk: Understanding Mechanical Turk as a Participant Pool. Curr Dir Psychol Sci 2014;23(3):184-188. DOI: 10.1177/0963721414531598
32. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap) – A metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform 2009;42(2):377-81. DOI: 10.1016/j.jbi.2008.08.010
33. Peer E, Brandimarte L, Samat S, Acquisti A. Beyond the Turk: Alternative platforms for crowdsourcing behavioral research. Journal of Experimental Social Psychology. 2017;70:153–63. DOI: 10.1016/j.jesp.2017.01.006
34. Proctor BD, Semega JL, Kollar MA. U.S. Census Bureau, Current Population Reports. Income and Poverty in the United States: 2015. 2016.