Comparing Output from Two Methods of Participatory Design for Developing Implementation Strategies: Traditional Contextual Inquiry vs. Rapid Crowd Sourcing

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Abstract

Background

Participatory design methods are a key component of designing tailored implementation strategies. These methods vary in the resources required to execute and analyze their outputs. No work to date has examined the extent to which the output obtained from different approaches to participatory design varies.

Methods

We concurrently used two separate participatory design methods: 1) field observations and qualitative interviews and 2) rapid crowd sourcing (an innovation tournament). Our goal was to generate information to tailor implementation strategies to increase the use of evidence-based data collection practices among one-to-one aides working with children with autism. Each method was executed and analyzed by study team members blinded to the output of the other method. We estimated the personnel time and monetary costs associated with each method to further facilitate comparison.

Results

Observations and interviews generated nearly double the number of implementation strategies ($n = 26$) than did the innovation tournament ($n = 14$). When strategies were classified into clusters from the Expert Recommendations for Implementing Change (ERIC) taxonomy, there was considerable overlap in the content of identified strategies. Strategies derived from observations and interviews were more specific than those from the innovation tournament. Nine strategies (23%) reflected content unique to observations and interviews and 4 (10%) strategies were unique to the innovation tournament. Only observations and interviews identified implementation strategies related to adapting and tailoring to context; only the innovation tournament identified implementation strategies that used incentives. Observations and interviews required more than three times the personnel hours than the innovation tournament, but the innovation tournament was more costly overall due to the technological platform used.

Conclusions

There was substantial overlap in content derived from observations and interviews and the innovation tournament. However, each yielded unique information. To select the best participatory design approach to inform implementation strategy design for a particular context, researchers should carefully consider what each method may elicit and weigh the resources available to invest in the process.

Trial Registration

N/A

Contributions To The Literature

- This study advances our understanding of the strengths and limitations of different approaches to participatory design to inform implementation strategy generation.
- The two methods of participatory design – observations/interviews and an innovation tournament – yielded substantial overlap in the information obtained, but there was unique output generated by each method.
- The innovation tournament required less time investment to complete; however, its electronic platform was expensive, making its overall cost higher than that of observations and interviews
- Results can guide researchers to carefully consider what each method offers and weigh the resources available (e.g., personnel time vs. money) to invest in the process.

Introduction

Implementation strategies, the methods used to improve the use and sustainment of evidence-based practices (EBPs), are the backbone of implementation science (1). Carefully selecting implementation strategies that target theorized implementation mechanisms (2), guided by contextual inquiry to identify implementation determinants (3), is de rigueur for implementation efforts. There are several published methods for selecting and tailoring implementation strategies (2), all of which emphasize the importance both of collaborating with stakeholders, or “end-users,” of the intervention being implemented, and of drawing on methods from participatory design to do so. Because implementation is context dependent, implementation strategies will be more successful if those leading implementation efforts learn from those on the front line who will use the intervention of interest. Outputs from contextual inquiry ideally identify implementation determinants, which then drive which implementation strategies strategy selection (4,5).

Participatory design approaches have a long history in many fields but their adoption as a method for selecting and tailoring implementation strategies is more recent. Participatory design originated as a collaborative method of product design that engages end users in designing new products (6). Participatory design methods can include observation of product use in the field, story boarding, interviews, and focus groups (7). Implementation science has borrowed from other disciplines to add concept mapping and intervention mapping as important tools; both rely heavily on inputs obtained through rigorous contextual inquiry, using methods such as field observations and qualitative interviews (8,9).

Many approaches to participatory design are time intensive and costly. It is not clear which participatory design approach an implementation scientist should pick when engaging end users in implementation strategy development for a target EBP, nor is it known whether different approaches will lead to varying results. To our knowledge, no one has compared the results of using different approaches of participatory design on the resultant implementation strategy output (10)

This study compared output from two participatory design approaches: (1) a traditional contextual inquiry approach (i.e., field observations and qualitative interviews with stakeholders) versus (2) a more recent addition to the panoply of participatory design tools, an innovation tournament. Innovation tournaments are a more rapid approach to participatory design that involve a kind of crowd sourcing – a competition in which members of a group can submit ideas about how to address a challenge. These ideas compete with one another through several rounds of vetting. Other members of the group can vote for and comment on participants’ different ideas. In the last round, experts work with the originators of the most popular and promising ideas to refine them for a last round of voting. Innovation tournaments have become particularly popular in health care and other industries (11–13). Stewart and colleagues recently used one to identify potential implementation strategies to increase the use of evidence-based practices in outpatient mental healthcare, demonstrating their feasibility and potential utility in generating tailored implementation strategies in behavioral health (14). As innovation tournaments are designed to be conducted much more rapidly and inexpensively than traditional contextual inquiry approaches, with less burden on stakeholder partners, identifying whether their output produces comparable results to those of more traditional approaches has important implications for how we use participatory design in implementation science.

Our secondary aim was to categorize the resources involved with executing and analyzing the data obtained from each participatory design approach. Given the breadth of potential implementation strategies that emerged from Stewart and colleagues’ innovation tournament, we hypothesized the innovation tournament would produce output comparable to that obtained from observations and qualitative interviews, with less burden on stakeholders and research staff.

Methods

This work was conducted as part of a larger study that integrated behavioral economics and implementation science principles to increase data collection among behavioral health technicians (BHTs) working one-on-one with children with an autism spectrum disorder in schools (15). Quantitative data collection on child response to intervention and progress monitoring is a core EBP component of applied behavioral analysis (ABA) for children with autism yet is poorly implemented in practice (16). To inform implementation strategy design, our team concurrently: (1) engaged in observations of and interviews with BHTs and interviews with their supervisors and (2) conducted an innovation tournament inviting behavioral health paraprofessionals, including BHTs and their supervisors, to participate. We synthesized data obtained from each method using a systematic, iterative processes to identify implementation strategies.

To avoid cross-contamination of output from each method, the research team divided into two separate groups for the duration of data collection and synthesis so that each team was unaware of outputs or information obtained from the other method of participatory design. We briefly describe the participatory design strategy and data analysis below. The City of Philadelphia and University Pennsylvania Institutional Review Boards approved the study.

Observations and Interviews

We recruited 9 BHTs and 7 BHT supervisors from four different agencies in Philadelphia (63% female; 31% White; 44% Black; 6% Asian; 19% Hispanic/Latinx). Recruited BHTs had to be working with a school-aged child with autism. BHTs allowed us to observe their data collection practices in the field and participated in a subsequent qualitative interview over the phone. Two BHTs completed a qualitative interview only due to COVID-19 social distancing restrictions put into place midway through data collection. Recruited BHT supervisors participated in phone interviews only. We obtained informed consent from each participant prior to any research activities.

Prior to observations, author HJN trained research team members in a structured observation coding system adapted to document barriers and facilitators to BHT data collection (17,18). After obtaining BHT consent and formal approval from the school in which the BHT worked, research staff traveled to the BHT's work site for a one-hour field observation. Two research team members (EBH and BR) attended the first two observations to ensure reliable use of the structured field observation form; one team member completed the remaining observations and debriefed with the second team member immediately after. During each observation, research staff observed BHT data collection practices from the back of the classroom using the structured form. Research staff noted, in real time, perceived barriers to data collection they observed. At the conclusion of the one-hour observation, staff spent approximately 5 minutes asking the BHT to expand on observed barriers (e.g., *"I noticed you didn't take data in X interval. What, if anything, got in the way of you doing so?"*). After their observation, BHTs scheduled their qualitative interview.

Qualitative interview guides for BHTs and BHT supervisors were designed to assess data practices BHTs used, assess barriers to engaging in quantitative data collection, and elicit recommendations on how quantitative data collection could be made easier for BHTs. BHTs additionally answered standard belief elicitation questions and questions adapted from a theory-guided interview created by Potthoff and colleagues (19,20). Copies of the interview guides are available upon request. Thematic saturation was reached after the 9th BHT interview and the 7th BHT supervisor interview.

The interviewer audio-recorded the interview and a member of the research team transcribed the recording. The researchers who conducted the field observation (EBH or BR) analyzed the interviews, so that information learned via observations could guide interpretation of qualitative responses. The research team developed a structured codebook via iterative review of three transcripts and applied it to the remaining transcripts. The *a priori* code of "barriers and facilitators to quantitative data collection" was the primary code of interest for this study. Coders met regularly to review codes and resolve discrepancies.

From the coded transcripts, we amassed a list of identified barriers across BHTs and BHT supervisors. The same two staff members systematically reviewed each identified barrier and generated one or more discrete implementation strategies that would address each barrier, drawing on their review of all

qualitative data and field observation notes collaboratively and systematically, guided by the Expert Recommendations for Implementing Change (ERIC) taxonomy and the Behavior Change Wheel (21,22). To ensure comprehensiveness, a third team member who had administered qualitative interviews but was not involved in the coding process (KAZ) then reviewed the list of barriers and independently generated corresponding implementation strategies. This third team member did not identify any additional implementation strategies. This process resulted in a final set of 26 discrete implementation strategies.

Innovation Tournament

Our innovation tournament procedure was guided by the one Stewart and colleagues used. It was developed through the Penn Medicine Center for Health Care Innovation (12,14). We invited behavioral health professionals working with children with autism in Philadelphia schools ($n = 21$), including BHTs and their supervisors, who had provided us their email addresses at previous in-person site visits. We sent them email invitations to participate in an innovation tournament titled “Your Idea Matters! The Data Collection Improvement Challenge.” We also asked behavioral health agency leaders ($n = 27$) and team meeting leaders at in-person site visits ($n = 5$) to forward recruitment invitations to their staff. Some paraprofessionals may have received the invitation more than once (i.e., from a direct email from our team, from their agency leader, and from their team meeting leader). We sent agency leaders a priming email approximately 2 weeks prior to the start of the tournament, as advance contact aligns with recommendations in survey design (23). We then sent the first invitation email to agency leaders, team meeting leaders, and paraprofessionals, which included the link to participate, and 5 reminder emails over the course of 5 weeks. During the second week of reminders, we contacted agency leaders to participate and invited their staff to participate by phone.

We made the web link to the innovation tournament available for 5 weeks in October 2019. We hosted the online tournament on the “Your Big Idea Platform,” that facilitates crowdsourcing for ideas and solutions. Innovation challenges are posted to the platform, and participants can submit an idea and comment and rate ideas submitted by other participants. Participants opened the link and provided consent before participating.

Developing the right tournament prompt (i.e., the question for participants) is critical to the success of an innovation tournament (14). We iteratively designed the prompt for this study. The research team generated the question language via email and in weekly meetings, and then sought feedback from 2 BHTs on the wording and design of the prompt. The final prompt asked, “What would make data collection about children with autism easier, more useful, and more motivating for you?” Participants could submit and rate as many ideas as they liked.

Eleven individuals submitted 14 ideas. Procedures for reviewing, rating, identifying “winning ideas,” and categorizing output followed established procedures (14). Briefly, the research team formed a Challenge Committee consisting of an expert panel of stakeholders to vote on the submissions. The committee included two city administrators, two agency stakeholders, one autism content expert, and one behavioral science expert. The committee rated the 14 ideas on their potential impact as an implementation strategy.

Participants with the top three ideas were considered “winning participants;” these participants were later celebrated at a community event.

To categorize information shared through the innovation tournament platform into clear implementation strategies, three members of the research team (JEB, RES, DSM) met and applied aspects of the NUDGE (Narrow, Understand, Discover, Generate, Evaluate) framework to extrapolate the discrete implementation strategies from the information submitted by innovation tournament participants. See (24) for a detailed description of how the NUDGE framework is applied to analysis of innovation tournament data. Briefly, this is an iterative process of: (1) generating hypotheses about behavioral barriers that interfere with EBP delivery through structured brainstorming that links the reported barriers to core principles from behavioral science (e.g., cognitive biases and heuristic thinking), (2) de-duplicating hypotheses, and (3) rapidly validating hypothesized barriers through expert consultation, review of the literature, and confirmation by core stakeholders. This output then informs generation of tailored implementation strategies to directly address the behavioral barriers identified.

Resources & Cost of Each Method

To capture resources involved with each method, we captured the time and costs associated with each method, guided by principles of time-driven activity-based costing, a method increasingly employed in implementation science (25). Researchers who executed each participatory design method estimated the time and money spent throughout the process of data collection and synthesis.

Results

Table 1 shows the implementation strategies that each participatory design approach generated. To facilitate comparison, the first author (EBH) classified all implementation strategies across the two approaches using the ERIC taxonomy, using the clusters identified by Waltz and colleagues (22,26). An independent reviewer (HJN) double coded 50% of all strategies, with 100% concordance.

Table 1
Output from Innovation Tournament Compared with Observations/Qualitative Interviews

Identified Implementation Strategies		
Implementation Strategy Domain ¹	Innovation Tournament (n = 14 strategies)	Observations/Qualitative Interviews (n = 26 strategies)
<i>Adapt and Tailor to Context</i>	<i>None</i>	1. Adapt data collection processes to make them easier to do within the chaotic school environment* 2. Eliminate Wi-Fi dependency of electronic data record* 3. Ensure that data required for tracking is of behaviors that can reasonably be tracked from a short distance*
<i>Change Infrastructure</i>	1. Change the way BHT feedback is integrated into treatment planning 2. Changes the forms or templates used to collect data 3. Digitize data collection to reduce effort 4. Integrate data collection into course of day 5. Make forms simple to use 6. Rely on drop down menus and tallies*	1. Advocate for adapting the timing of treatment plan regulations to link to changes in behavior rather than calendar months 2. Consult with software developers to address limitations of current data collection capture systems in the electronic health record 3. Eliminate redundancies in data collection processes by eliminating paper forms and conducting direct data entry into the required electronic health record 4. Redesign data capture software to allow for the flexibility required to capture the range of data for specific client 5. Utilize mobile electronic data tracking platform that builds in time clocks to facilitate monitoring across environments or supply all BHTs with watches 6. Ensure that mobile electronic data tracking platforms are light and easy to transport 7. Provide supplies to ameliorate the strain caused by heavy laptops and notebooks (e.g., a small standing desk)* 8. Reposition students, teachers, and BHTs in classroom to better facilitate intervention and data collection* 9. Assess the strengths and limitations of current data collection system*
<i>Engage Consumers</i>	<i>None</i>	<i>None</i>
<i>Evaluative & Iterative Strategies</i>	1. Give feedback to BHTs on treatment plans*	<i>None</i>

Identified Implementation Strategies		
<i>Provide Interactive Assistance</i>	<ol style="list-style-type: none"> 1. Offer in vivo coaching 2. Provide immediate feedback on data collection 	<ol style="list-style-type: none"> 1. Provide on-site coaching to BHTs on how to balance data with intervention in response to challenging behaviors 2. Enhance channels of communication between BHTs and supervisors 3. Increase the amount of supervisory support available to BHTs, particularly as it relates to direct observation in the field 4. Hold regular supervision meetings in which the BHT and supervisor troubleshoot around limitations of current data collection system* 5. Hold regular supervision meetings in which the BHT discusses examples of competing demands and/or role-plays data collection during problem behaviors*
<i>Support Clinicians</i>	<ol style="list-style-type: none"> 1. Show the BHTs how their data is used with visuals 	<ol style="list-style-type: none"> 1. Enhance perceived utility of data collection (e.g., through feedback of client progress) 2. Provide regular reminder mechanism for clinician, e.g., hourly text message*
<i>Training & Educate Stakeholders</i>	<ol style="list-style-type: none"> 1. Improve training 2. Provide skills training in functional analysis 	<ol style="list-style-type: none"> 1. Conduct best data collection practices training for active and outdoor times 2. Conduct training on best practices for data collection while clients display problem behaviors 3. Include definitions of target behaviors for data collection on data record sheet 4. Provide portable educational materials to remind BHTs on best practices for collecting data on client problem behaviors 5. Provide targeted skills training to BHTs on how to balance data collection with intervention in response to challenging behaviors 6. Provide targeted training for BHTs in defining behaviors for data collection 7. Train BHTs in data collection interface, including each feature's function and use
<i>Utilize Incentive Strategies</i>	<ol style="list-style-type: none"> 1. Acknowledge BHT for collecting data* 2. Increase rewards for data collection* 	<i>None</i>

Identified Implementation Strategies

¹ Clusters from Waltz and colleagues 2015.

* Implementation strategy content not reflected in output from the opposing method.

As seen in Table 1, observations and interviews resulted in nearly double the number of implementation strategies ($n = 26$) than did the innovation tournament ($n = 14$). Both methods combined identified implementation strategies spanned eight of the nine clusters of implementation strategies identified by Waltz and colleagues (26). No implementation strategies from either method were generated in the cluster of engaging consumers (e.g., involving children and their families). Although the observations and interviews generated more strategies than the innovation tournament did, much of the additional content from observation and interviews overlapped with innovation tournament data. Specifically, when examined by implementation strategy cluster, 27 of the 40 total identified implementation strategies (68%) reflected comparable content obtained from each method. Areas of overlap were observed in the following implementation strategy clusters: changing the infrastructure (e.g., adjusting physical structures and equipment, changing record systems), providing interactive assistance (e.g., enhancing clinical supervision), supporting clinicians (e.g., reminding clinicians), and training and educating stakeholders (e.g., enhancing training and consultation practices).

Within each of these areas, however, findings from the observations and interviews tended to yield more specific implementation recommendations than the innovation tournament did. For example, the innovation tournament identified the importance of “improving training” and “providing skills training in functional analysis.” In contrast, observation and interview data yielded 7 specific recommendations to improve training in response to specific implementation barriers to data collection that BHTs reported, for example, training on best data collection practices, training for active and outdoor times, and training on best practices for data collection when clients display problem behaviors.

More than a third of identified implementation strategies were unique to one approach. In three of the nine implementation strategy clusters, only one participatory design approach generated a potential implementation strategy. Specifically, only data from the observations and interviews identified implementation strategies related to adapting and tailoring to context (e.g., promoting adaptability). Only data from the innovation tournament identified implementation strategies that used incentives or evaluative and iterative strategies.

Table 2 shows the estimated costs of each participatory design method, separated by preparation costs, data collection costs, and data synthesis costs. Overall, personnel time was substantially higher for the observations and interviews (~263 hours) than for the innovation tournament (~68 hours). However, the overall cost of the innovation tournament, which relied on an electronic platform to power idea submission and allow participants to comment on and rate ideas submitted by other participants, was much higher than that for observations and interviews.

Table 2
Estimated Costs Associated with Each Participatory Design Approach

Innovation Tournament			Observations/Qualitative Interviews		
Activity	Personnel Time (hrs)	Cost (\$)	Activity	Personnel Time (hrs) ^a	Cost (\$)
Preparation					
Generate innovation Tournament prompt	10	200	Develop recruitment materials	12	240
Set up “Your Big Idea” platform	10	200	Recruitment outreach (e.g., agency visits, travel costs, communication with potential participants)	32	720
Recruitment outreach (e.g., phone calls, emails)	10	200	Obtain letters of support (includes travel to sites and car rental fee)	20	426
			Training in observation and interview procedures	20	400
Total Time & Cost for Preparation	30	600		84	1,786
Data Collection					
Operating innovation tournament on the “Your Big Idea Platform”	12	14,594	Conduct observations ($n = 7$)	42	840
Innovation tournament activities (notify winners, set up meetings, discuss ideas)	10	200	Conduct interviews ($n = 17$)	18	160
			Interview transcription	60	1200
Total Time & Cost for Data Collection	22	14,794		120	2,200

Innovation Tournament				Observations/Qualitative Interviews		
Data Synthesis						
	Behavioral diagnostics data analysis	16	320	Develop and train on qualitative coding guide	21	420
				Code interviews	20	400
				Analyze barriers and generate implementation strategies	18	360
Total Time & Cost for Data Synthesis		16	320		59	1,180
Total Overall Cost		68	15,714		263	5,166
a Some tasks involved more than one person; in these instances, personnel time was multiplied accordingly. Cost was calculated based on a rate of \$20/hour/person across all activities to facilitate comparability across the two methods.						

Discussion

To our knowledge, this is the first effort to directly compare the output of two distinct methods of participatory design and their resultant implications for implementation strategy design. Data suggested a high degree of convergence in output across the two strategies. This suggests that use of an innovation tournament can yield information comparable to that obtained from the more traditional observations and qualitative interviews. However, we also noted some important areas of divergence. The innovation tournament required substantially less time investment from both the research team and stakeholder participants to complete; however, its electronic platform was expensive, making its overall cost higher than that of observations and interviews. While the two methods generated recommendations in most domains of implementation strategies, observations and interviews generated both more recommendations overall, and more specific recommendations.

Results do not paint a clear picture for the advantage of one method over the other. Rather, researchers must carefully consider the potential information gaps (e.g., strategies relating to adapting and tailoring to context vs. incentives) that may occur from using one participatory design method and weigh the resources available (e.g., money vs. personnel time) to invest in the process when deciding which method to use. It is also important to note that these data do not suggest that the output one participatory design method is more effective than another. An important next step in this line of research will be to share the resultant strategies from each method with stakeholders and evaluate their perception of each strategy's acceptability and feasibility. Whether stakeholder perceptions vary as a function of the chosen participatory design approach it was derived from is an important question to explore in future research.

There are several reasons why output may differ between the two methods we studied. Observations and interviews allowed for the “up close and personal” examination of the BHT workflow and environment, as well as opportunities for follow-up questions; this may have facilitated obtaining information about adapting and tailoring to context that did not emerge from the innovation tournament. In contrast, the innovation tournament may have been more likely to identify incentive-related strategies because the prompt allowed for emotional “distancing” on the topic from respondents. Specifically, innovation tournament participants were asked to report on what would make data collection for BHTs easier and more motivating broadly (in contrast to speaking specifically to the barriers and facilitators they faced in data collection in the qualitative interview). Participants may have been more likely to think that their colleagues would be motivated by rewards or other incentives to engage in data collection, even if they perceived that they had their own intrinsic motivation to do so, and that the innovation tournament was more likely to elicit this type of information. Participants also may have felt more comfortable sharing ideas about monetary rewards in a more anonymous setting like the innovation tournament, rather than face-to-face during interviews.

Finally, it is possible that the fundamentally different approach to the framing of the inquiry in each approach led to the divergence in findings. During the qualitative interviews, research staff asked open-ended questions barriers and facilitators to data collection and then deduced potential solutions to the information shared in the generation of implementation strategies. In contrast, the innovation tournament asked respondents to report directly on suggested solutions to the challenge of how to make data collection easier and more motivating and then the research team refined the offered strategies. Therefore, in many ways, the implementation strategies generated from the observations and interviews incorporate the researchers’ experience and expertise in a way that the innovation tournament does not.

There are also likely common disadvantages to both methods that are important to note. In general, people tend to be inaccurate reporters on what would change their own behavior (27). Outputs from both methods may suffer from biased sampling, as all data comes from participants amenable to collaborating with researchers. This may have contributed to the lack of implementation strategies from both methods related to engaging consumers; had we included youth and their families in each participatory design process, results may have differed.

We note several study limitations. First, for both participatory design methods, we had relatively small samples sizes. While our observations and interviews reached thematic saturation, our sample for the innovation tournament was lower than others’ (12). BHTs comprise a largely independent contractor workforce and they often work independently at schools, which may have contributed to our difficulty engaging them. Second, we did not evaluate the acceptability, feasibility, or success of any of the identified implementation strategies, so we are unable to evaluate the fit or effectiveness of each participatory design approach, only to highlight points of convergence and divergence. Finally, as noted above, we did not interview youth and families in this study, nor did we invite them to participate in the innovation tournament, which may have led to a gap in identified implementation strategies. This

underscores the potential for exclusion of select stakeholder groups to greatly impact the output of a participatory design approach.

This study also has some notable strengths. Our use of two separate and blinded research teams to execute each participatory design method concurrently allowed us to be confident in the independence of the findings from each method. Importantly, this study represents the first effort to compare the results that emerge from two methods of participatory design, setting the stage for future research to refine selection and execution of participatory methods to optimize the design of effective implementation strategies.

Conclusions

This study indicates that two methods of participatory design – observations/interviews and an innovation tournament – yield substantial overlap in the information obtained that can be used for implementation strategy development, but that importantly, there is also unique output generated by each. Given the time and resources required to engage in comprehensive contextual inquiry, selecting the best participatory design approach to inform implementation strategies necessitates that researchers carefully consider what each method offers (strategies relating to adapting and tailoring to context vs. incentives) and weigh the resources available (e.g., personnel time vs. money) to invest in the process. This study advances our understanding of the strengths and limitations of different approaches to participatory design, which is critical for helping implementation researchers and policy makers select the approach best suited to address their implementation question.

Abbreviations

EBP = Evidence Based Practice

BHT = Behavioral Health Technician

ABA = Applied Behavior Analysis

Declarations

Ethics approval and consent to participate: All procedures have been approved by the City of Philadelphia and University of Pennsylvania IRB.

Consent for publication: Not applicable

Availability of data and materials: Data will be made available upon request. Requests for access to the data can be sent to the corresponding author

Competing interests: The authors declare that they have no competing interests

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Authors' contributions: All authors substantially contributed to the conception, design, and analysis of the work. EBH, DSM, and JEB drafted the initial manuscript. EBH, BR, KAZ, and HJN analyzed the data from interviews and observations. JEB, DSM, and RES analyzed data from the innovation tournament. All authors read and approved the final manuscript.

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