IMPACT

Design Probes

TOOLKIT ON USING THE DESIGN PROBE METHOD IN IMPLEMENTATION RESEARCH

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Getting Started

What are design probes and what do they produce?

Design probes are a packaged set of prompts and data collection tools (e.g., journal, camera) that invite implementation partners and community members to capture data about their subjective experience, in a creative way that differs from survey responses and interviews. The materials generated from the design probe provide unique insights that can guide implementation planning and research.

Who is this toolkit for?

This toolkit is for researchers and practitioners who want alternative ways to understand the perspectives and lived experiences of individuals engaging with an intervention or system, and how those experiences may inform strategies to implement that intervention within a system. For instance, one might use a design probe to "see" (through photographs taken by a participant) an office where a school-based therapist delivers therapy, or to read a participant's narrative journal response about their experiences trying to use a standardized treatment in a community-based setting.

Why use design probes?

In most circumstances, researchers and/or practitioners cannot experience what it is like to work or live in certain places or conditions. Design probes offer contextualized insights about lived experiences of individuals that may be impacted by an intervention or implementation effort. This "through their lens" experience enables researchers to understand spaces and experiences in ways they otherwise would not be able to. Design probes can also build rapport and engagement across teams that include researchers, practitioners, and community members. The interactive, tangible nature of design probes aim to delight research participants, offering a unique contribution to the implementation research method landscape.

When do I use this toolkit?

Design probes have value at various stages of the implementation process, depending on their purpose. Some potential purposes of design probes are to stimulate creativity and engagement in design processes, understanding implementation context (e.g., barriers and facilitators), or to evaluate an intervention or implementation effort. It is important to make sure your stated purpose for design probes matches the stage of implementation. For example, a researcher may use design probes to stimulate creativity and engagement when developing or designing an intervention or process. In this case, it is important to use design probes early, while design activities are still underway.

Purpose	Timing
Stimulate creativity and engagement in design of interventions or implementation strategies	Pre-implementation
Evaluate implementation context	Pre-implementation; Implementation
Evaluate implementation strategies	Implementation; Sustainment

What is included in this toolkit?

This toolkit includes a description of design probes, rationale for using them for implementation research, and general decision-making guidance on developing prompts for design probes and selecting elements to include in design probes. The toolkit also provides templates for creating design probe materials such as participant instructions and data collection prompts.

How should I use this toolkit?

This toolkit will help you understand why and how to develop a design probe and provide resources for creating customized design probe materials for your implementation project. It is meant to be a basic guide on building design probes with intention. You are ultimately encouraged to make your own decisions about when and how design probes might meet the needs of your project and community.

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SECTION 1: INTRODUCTION

> *"Their motivations come from art and design…probes embody a different set of sensibilities than other methods."*
>
> *-Susan Wyche*[3]

Implementation researchers face several challenges when engaging clients, practitioners, and other partners due to competing time and resource demands.[1] Hospital-based and community health systems are often over-burdened and under-resourced, making it difficult to find time to conduct in-person data collection activities that generate research insights while minimizing disruptions to clinical operations.[2] Remote engagement is more common than ever, yet may not allow for the tangible benefits of being on site–such as observation of workspaces, patients, and practitioners. Implementation research tools that can be used remotely and asynchronously can help address these challenges.

Practical, accessible methods are needed that elevate community member perspectives while enhancing accessibility and engagement.[3] Research methods that foster creativity and innovative solution development, like those grounded in human-centered design approaches, meaningfully advance the science and practice of implementation by enabling researchers and implementation partners to co-create new knowledge.[4] An increasing number of implementation research approaches are using design- and participatory-originated methods to bring fresh perspectives, engagement, and appeal to their research processes and intervention features. [5,6] Finally, person-centered research methods grounded in health equity and inclusion are critical to leverage implementation research for eliminating health disparities.

What's in this section?

- Purpose of this toolkit
- Design probes – a brief overview
- Additional resources to learn more

Purpose of this toolkit

This toolkit introduces design probes, a participatory research method, which fill a unique niche in implementation research. Design probes are used commonly by design researchers; however, they have not been applied commonly in implementation research.

IMPACT Center

We developed this toolkit for the IMPACT Center, a National Institutes of Mental Health-funded ALACRITY center that focuses on developing methods and tools to optimize evidence-based practice implementation for improving youth mental health outcomes in under-resourced communities. IMPACT Center scientists and pilot project leaders were eager to equip themselves and other independent researchers with practical guidance about methods to engage implementation partners and surface critical insights to guide their research.

In this toolkit, we will provide:

- Background information about the origins of design probes that help orient the reader
- Insights from a literature scan, pilot experience, and community engagement activities that inform our application of design probes to implementation research
- Practical guidance for researchers interested in using design probes in their implementation activities
- Additional learning resources for a deeper dive into design probes

Design probes: A brief overview

> *"The probes…address a common dilemma in developing projects for unfamiliar groups. Understanding the local cultures was necessary so that our designs wouldn't seem irrelevant or arrogant, but we didn't want the groups to constrain our designs unduly by focusing on needs or desires they already understood. We wanted to lead a discussion with the groups toward unexpected ideas, but we didn't want to dominate it."*
> *-Gaver, Dunne, and Pacenti*

Design probes consist of a packaged set of prompts and data collection tools (e.g., journal, camera) that invite users to asynchronously capture information about their subjective experience (e.g., perceptions, experiences). The type of information captured is quite different than survey responses, and even qualitative interviews. For one, *what* is captured is driven by the participant. How they capture information is also largely driven by the participant (e.g., do they want to write a short note in the journal? Do they want to take a picture of their physical space?). Design probes allow participants to share what they think researchers need to know—that researchers might not always ask about. In an IMPACT pilot, the design probe method illustrated unique barriers that weren't fully characterized by other methods.[7]

Materials generated from the design probe are called "returns" and subsequently serve as data artifacts that can provide insights that guide a design initiative. Design probes have been described as "ambiguous stimuli that designers send to people who then respond to them,

providing insights for the design process" (Sanders, 2008, p. 3). A common element of design probes is the use of a series of activities that serve the purpose of "imaginative prompting" (Savig, 2016, p. 26) as a vehicle to gather data that (1) are inspirational for designing or refining a product and (2) help to understand users in a specific context [10]. Design probes, also known as cultural probes, involve open-ended prompts (e.g., "Take a picture of what being healthy means to you") to elicit daily experiences, thoughts and feelings that provide the research team, prioritizing inspiration for design over information about participants. [11]

Probes were first described by Gaver et al. (1999) when conducting a design research study to increase older individual's participation in local community activities.[12] The design team in this study gave participants a package that included instructions, a disposable camera, a map with guidance to annotate specified locations, and a series of postcards. The goal of the probe study was to "understand the local culture so that [subsequent] designs wouldn't seem irrelevant or arrogant" (Gaver et al., 1999, p. 22). The postcards, each containing an image on one side, and a question on the back, prompted participants to reflect on topics relevant to their daily lives and transmit their reflections to the research team over a specified time period.

Since first described in the 1990s, design researchers have continued to apply and refine design probes, experimenting with a range of stimuli or prompts designed to elicit participant perspectives for data collection. [13,14]

Design probes have evolved to serve three primary purposes:

(1) Understanding and accounting for end-users' individual circumstances, judgement, and exploration,

(2) Exploring new aspects and angles of a challenge or research question to discover solutions, and

(3) Establishing empathy among designers or design researchers for end-users [14]

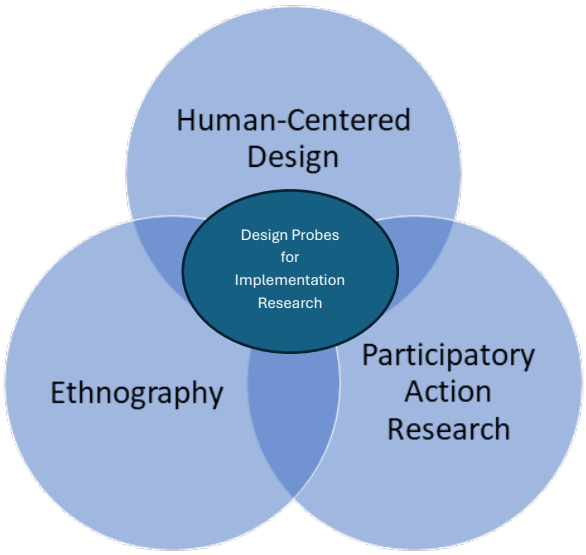
Design probes are intended to inspire users to express and interpret their own behaviors as they complete descriptive and exploratory tasks. Using probe methods can help both research teams and participants expand their creativity and interpretation. Some researchers have speculated that design probes may also have an interventional nature, to the extent to which probe stimuli encourage users to engage in reflection and perspective-taking on the topic of study. [15] Of note, it is important to distinguish between design probes from technology probes, which typically present users with a technology-based prototype and delivers a series of provocations to elicit responses that help the design team better understand the user and refine the prototype.

See appendix for Additional Learning resources to dive deeper into descriptions and evidence supporting use of the design probe method.

Figure 1. *Photo by Dariusz Sankowski on Unsplash*

Application of Design Probes to Implementation research

Over the past 10 years, implementation research has purposively integrated methods from participatory-action research, ethnography, and human-centered design. Human-centered design aligns intervention and implementation development with the needs of the people and the settings where those innovations will be used. [4,16] Participatory action research empowers constituents to record and reflect on their communities' strengths, promote dialogue and knowledge about important issues, and create insights that reach and resonate with decision makers such as policymakers. [17] Ethnography provides an "insider's perspective" about their culture and cultural knowledge. [18] Design probes, which seek to deeply understand a context (ethnography), empower participants and partners to co-create data (participatory action research), and identify user needs (human-centered design), represent a natural fit for implementation research.



What Informed this toolkit

We used a multi-informant, multi-method approach to explore the application of design probes to implementation research, focusing on 3 goals: (1) To explore the potential usefulness of design probes for implementation research, (2) To describe the experiences of a research team and participants using a design probe for implementation research, (3) To explore how design probes might enhance engagement and creativity among youth and other implementation partners. For the first goal, we undertook a literature scan and elicited expert input. For the second goal, we pilot tested the method in an implementation research project exploring barriers and facilitators to implementing measurement-based care in community mental health settings. For the third goal, we held focus groups with youth and clinicians. We have published additional details about our methodologic approach and key findings in a prior manuscript.

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SECTION 2: PLANNING A DESIGN PROBE STUDY

DETERMINING THE GOALS OF YOUR DESIGN PROBE

Design probes can meet a range of goals in an implementation science project, and the development of the probe (including prompts and data collection tool) will depend heavily on the determined goal. Informed by a literature scan and expert brainstorm, we outlined the following potential opportunities for probes to inform an implementation research effort.

> Probes allow participants to 'show' rather than 'tell' the research teams what matters most to them.
> -IMPACT symposium participant

Potential opportunities for design probes in implementation research

- Promote buy-in and engagement among implementation partners
- Include perspectives of less accessible (or hard-to-reach) populations
- Understand more about the implementation context
- Identify potential determinants of implementation among practice and community
- Optimize and/or evaluate implementation strategies

We describe these opportunities in more detail below and specify example research questions that could be explored in a probe study.

Promote buy-in and engagement among implementation partners

Probes are intended to engage and delight the user.[15] Expertise and resources are required to ensure that the prompts and data collection tools used in design probes are relevant and appealing to participants.[19] However, this investment may boost buy-in and ongoing engagement across implementation partners and community members by giving them the opportunity to guide the project with their unique insights.[20] This may be particularly valuable if probes are used at the kick-off stage, priming the project for sustained engagement and a sense of ownership across all project partners.[21] Further, returns from the probe provide tangible and visual data that may support empathy and commitment among research team members to keep participant needs and perspectives at the center of an implementation effort.[9]

SAMPLE RESEARCH QUESTION: What supports, barriers, and meaning-making processes influence how individuals engage with this intervention in their daily lives? What would need to change in their environment or routines to make engagement more feasible and meaningful?

Include Perspectives of Less Accessible (or Hard-to-Reach) Populations

Because probes provide an asynchronous, remote way to collect data, they enable researchers to include populations that may face barriers to other in-person research methods.[9,22] These populations could include individuals with disabilities,[23] those living in rural communities, those with transportation barriers (including young people)[20] currently housed in inaccessible settings where ethnographic methods like direct observation might not be feasible or acceptable (i.e., inpatient healthcare units[24] carceral settings, workplaces. [25] Design probes can provide valuable insights into the implementation context and implementation strategy development by connecting with specific populations and elevating their perspectives to understand factors that may be overlooked by other data collection methods.

SAMPLE RESEARCH QUESTION: What gaps in the implementation team's awareness might impact how implementation strategies are developed for this population? What unique challenges will this population face when engaging with our effort?

Improve Understanding of Implementation Context

Understanding the implementation context is a critical function of implementation research (Elwy et al., 2020). Design probes can be used as part of a project kick-off to increase a research teams' understanding of context, with returns from the probes providing insight to organizational culture and climate, leadership approach and structure, and daily life in the homes, neighborhoods, and communities of implementation partners.[26] Prompts can explore specific topics about context (e.g., what does your typical commute look like?) or expansive topics (e.g., what matters to patients/clients and practice partners?).

SAMPLE RESEARCH QUESTION: How may this implementation strategy interact with implementation partners' (and/or intervention recipients) home life or life outside of work?

Identify Potential Determinants of Implementation Among Practice and Community Partners

Design probes may elevate unique determinants through open-ended approaches to self-reflection and participant-generated insights that are not captured in interviews, site visits, or surveys. [27] The asynchronous, private nature of probes may help participants be more candid, reflective, and generative in their responses than they might be when engaging in traditional qualitative data collection methods, particularly those where power dynamics may influence what individuals choose to share (e.g., focus groups).[15]

SAMPLE RESEARCH QUESTION: What are the unspoken barriers and facilitators to implementing our intervention in this context?

Inform, Adapt, or Tailor Interventions or Implementation Strategies

Community members have valuable insights about whether and how implementation strategies may be successful or unsuccessful. Probes might include specific prompts to gather insights to guide implementation strategy selection and tailoring.[27,28] Probes can also be used later in an implementation project to gather input on how previously selected strategies are experienced by patients and/or clinical teams. Additionally, insights from the probes may inform adaptations to the intervention itself to better meet community members' needs and preferences.[29]

See Table 1 in the appendix for exemplar studies summarizing design probe activities for each of these distinct goals.

SAMPLE RESEARCH QUESTION: How aligned are current strategies with participants' routines, workflows, values, or physical environments? What adaptations would improve fit?

CONVENING A TEAM

Teams must first determine whether design probes are an appropriate method based on study goals, as outlined in the prior chapter. Then they must specify a research question for which the adapted probe method is appropriate and convene a team with necessary perspectives and expertise. An ideal research team will include individuals who represent the population of study members to inform how the team might approach and engage with participants. Additionally, the team should include individuals with expertise in design, participatory action research, qualitative methods, and/or ethnography.

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SECTION 3: BUILDING YOUR DESIGN PROBE

Now that you have determined that design probes will meaningfully contribute to your implementation effort, you are ready to design and build your probe package and data collection plan. Every research context and goal is unique. This section offers general guidance about how you might proceed with your design probe study.[10]

> "Designers view the conceptualization and crafting of design probes as integral to their research. The materiality of design probes, supported by the handcrafting of physical objects, constitutes a powerful element of this research forming.
> -Aysun Aytaç[10]

Key decision points

- Determining your study population
- Recruitment and retention
- Developing and refining prompts
- Selecting data collection tools and other materials
- Data management

Determining your study population

In traditional design research, research activities are designed to generate insights from end-users, or the individuals who are directly or indirectly impacted by a tool, intervention, etc. The same is true for implementation research, where efforts are typically made to elicit multi-level perspectives related to an implementation effort. Users may include patients/clients, practitioners, implementers, other staff (e.g., custodial, administrative), decision makers, and other researchers. The research team should consider how the perspectives, experiences, and needs of varying user types involved in their implementation effort will be elicited through various methods, including observation, interviews and/or focus groups, surveys or other more traditional approaches. User types that are particularly appropriate for a design probe study are those that may be difficult to reach or engage through more traditional data collection approaches. This might include users that experience geographic, logistical, language, or physical access barriers to other data collection approaches, and/or those receiving care or working in settings that are challenging for research team members to access.

Then teams should identify study population(s). The more known about the study population in terms of accessibility, time constraints, the more effectively the probe activities can be curated to

their needs and circumstances. A limited number of key informant interviews can (and we argue should) inform this process.

Sampling should follow basic principles from qualitative and design research, ensuring heterogeneity of a participant characteristics and lived experiences that will allow for the most impactful insights to inform implementation. In determining an appropriate study population, the study team should consider whether potential participants have a safe and secure space to store their materials (i.e., students in a school, patients on an inpatient mental health unit or individuals in a carceral setting may not be permitted access to materials in a kit). Some guidance on what may not be appropriate for photos may also be needed (e.g., list of client appointments with names, for the day, showing how busy a clinician's day might be; pictures of participant's peers, colleagues, or classmates). Additionally, if the returns generated contain sensitive information, participants also need a secure place to store them where others in their household or workplace will not access the contents.

Advice from IMPACT community

- Engage in a formal "user identification" activity to identify potential end users,[30] which can including: (1) brainstorming a preliminary list of users, (2) articulating user characteristics, (3) describing and prioritizing main user groups, (d) selecting typical and representative users from those groups, and (5) gathering information form users to inform the redesign of the user group descriptions. (See Hackos and Redish, 1998 for more details)[31]
- Start with a small sample for your first probe study
- Ensure ongoing communication channels to participants throughout study timeline
- Consider how prospective participant characteristics might influence who can participate (e.g., language spoken, access to a safe, private space to store probe package, ability to send and receive mail)

Recruitment and retention

Recruiting individuals to participate in a design probe study warrants close attention to where and how your team will advertise the study opportunity and invite potential participants. Partnering with organizations that serve your population of interest (e.g. health system, community-based organization) can facilitate optimal recruitment. It is also important to consider appropriate incentives for participation, which can include monetary compensation but also potential benefits of probe package completion, such as getting to keep the gift or data collection materials, having the opportunity to build community with other study participants (e.g., through icebreaker activities or sharing a meal), and the perceived benefits of contributing to a system or initiative that impacts them or their community. These "intangible" incentives are often particularly salient for special groups of participants, like youth. Adolescents more than adults also express an

interest in acknowledgement and recognition for participation (e.g., a certificate) AND they are more likely to participate if they will learn new information, gain skills or experience or it is aligned with their personal values of making friends or contributing to a cause. This is where participatory methods like probes have great potential to engage with and develop youth research team members over time, but thinking through what other experiential or skill incentives a more passive research participant can gain is important.

Substantial research coordination is often needed to ensure that participants complete activities as expected and that probe packages are returned within the instructed timeframe. It is important to collect multiple types of contact information and plan for contingencies (e.g., knowing if it is ok to leave a message on a respondent's answering machine). Designing an ongoing engagement plan for participants to overcome barriers to completing probe activities or returning their package will ensure that all participant perspectives are captured and able to be represented. These engagement activities require extra staffing resources, so it is important to plan for that at the outset of the study.

Figure 1. *Photo by Meredith Spencer on Unsplash*

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Given that design probes are often selected for populations who face disproportionate barriers to accessing research opportunities, community-engaged, person-centered research recruitment principles are recommended, such as creating options for how to obtain probe materials (have them mailed or pick them up for a local study site). It is also important in the planning stages to consider the most appropriate consent process that balances safeguarding with supported access to research participation, confidentiality measures to ensure (if needed) participant anonymity and security of data, and participant-centered communication practices. This includes appropriate materials and adaptations for multilingual participation if possible.

Advice from IMPACT team

- Ensure adequate staffing for project management
- Anticipate attrition/lack of returns (oversample)
- Engage community members in recruitment and retention planning
- Develop a "process" or "experience map" to identify potential failure modes (i.e., when participants are facing barriers to completing design probes as expected)
- Plan reminders through multiple communication methods (text, e-mail)
- Ensure participants know potential risks (e.g., return lost or opened accidentally in the mail)

Developing and refining prompts

Prompts guide participants through activities in which they will generate "returns" for the research team. Prompt detail and length will vary by participant type, but it is generally recommended that a design probe package have between 3-7 prompts. Each prompt should be written in clear language, offering examples if appropriate and estimate amount of time a participant should spend on an activity.

Advice from IMPACT team and participants

1. Develop and refine prompts that are curious, open-ended, and encourage personal reflection and narrative building.
    a. For example, instead of asking, "What is the first thing you did when you started work today?" ask, "Take a photo of something that makes the beginning of your workday better" or "Write a brief note of encouragement to yourself to read when you start your workday."
    b. Consider prompts that minimize collecting information or images of non-research participants.
    c. Pilot your prompts and instructions with target members of your study population to ensure clarity of language and appropriate cultural and contextual considerations.

d. The prompts should be simple. Avoid including multiple questions in a single prompt or multi-step prompts, as this can feel less like a fun, reflective activity and more like homework. For example, instead of, "Describe your home environment," ask, "Take a picture of a space in your home that feels special to you and tell us why."
e. Give users choice of how they respond – text, photos, drawings – to ensure they feel most comfortable responding to the prompts.

Prioritize the well-being and safety of participants. This includes including connections to resources if any of the prompted activities may generate emotional distress, such as exploring prior lived experiences that were challenging or future fears.

Selecting data collection tools and other materials

The original probe package developed by Gaver and colleagues contained a journal, map, postcards, and disposable camera. The team was designing solutions to increase older individuals' participation in local community activities.[12] While the contents of probe packages vary widely, there are some key components that appear in most. These components include a container, instructions for the study participant, prompts, data collection tools, and a gift. (Table 1)

Table 1. *Description of Typical Components of Design Probes.*

Component	Purpose	Examples
Container	Holds contents of design probe elements. Should be aesthetically pleasing and can match the theme of the context to create a cohesive/curated collection.	Box (cardboard, reusable plastic) or bag (tote bag, reusable zip)
Instructions	Enables the user to understand the overall purpose of the design probe and details instructions to complete design probe activities. Should include research objective	Timeframe, return instructions, any support resources
Prompts	Guides/stimulates the user to generate content using the recording tools. Ideally with choices, provocations, and/or	Cards, text messages, a calendar or map

	reminders (templated post-its, button?) Accessibility considerations	
Recording tools	Allows users to record outputs of prompts with various media. Way to capture the data (e.g., participants' perceptions and expressions). This can be written, verbal, or other forms of expression.	Text recording (journal, calendar, text field of app) Photo recording (disposable camera, instant printing camera (e.g., Polaroid), phone app) Audio recording (recorder), Video recording (phone app), Art media (watercolors, clay, adult coloring), maps, calendars
Gift	This is intended to thank participants for completing design probe. Should be tailored to audience.	Food/drink, Self-care items, Vessel/cup "swag", toys, fidgets

While digital probes have been used effectively,[10] the tangible/physical nature of design probes often can be appealing and promote engagement by users. This may be particularly true for individuals who interact frequently with digital devices, making the tangible/analogue tools more of a novelty. It is important to note that this process of conceptualization and crafting of design probes is integral to the success of the project and can generate insights from preliminary feedback from pilot participants.[32]

Advice from IMPACT team and participants

1. Provide a "digital option" for physical probe activities (e.g. allow users to use a provided camera or their personal device to capture and upload pictures). This can also provide opportunities for customization, such as larger print or language translation.
2. Your probe package contents should be uniquely tailored to your participants and include activities and gifts that are appropriate and appealing for their circumstances.
3. Consumables (including disposable cameras; stress balls) can expire. Take note of this in planning procurement of your design probe materials.
4. Seek feedback through pilot testing the fully packaged probes, including a test run of any shipment activities to ensure materials remain intact
5. Use Microsoft Word to check the reading level of your prompts and materials

Durability matters! Probes are often mailed, carried around by participants, and potentially exposed to the elements. Ensure you account for ways to safeguard your materials (padded packaging, a waterproof contained, etc.)!

Data management and other operational considerations

While probe returns are multimedia in nature, they can be digitized and sorted to facilitate interpretation. However, it is useful to consider how the returns in their original form might be used to create a gallery for team members to reflect on, take the perspective of, and build empathy for the participants who created the returns.

Like any qualitative study, steps to de-identify and catalogue the data will facilitate subsequent interpretation and ensure an accurate and searchable database of the probe returns is maintained.

Advice from IMPACT team and participants

1. Early in your project, develop a protocol to tag/catalogue returns to ensure high quality data management and interpretation.
2. Strive for a balance between a summative synthesis of common insights from probe returns and inspirational examples that may capture a unique, uncommon perspective by a participant that is critical to subsequent design decisions.
3. Select a qualitative analysis approach early to guide how you will manage returns.

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SECTION 4: INTERPRETING DESIGN PROBE RETURNS

Probes, on account of their participatory and open-ended nature, will create a corpus of data that likely includes text/written content by participants, transcribed audio from participant-recorded audio or video, and visual content from photographs, drawings, maps or other participant-generated visual materials.

A common practice as a first step in synthesis is to conduct an interview with the participant (or focus group with multiple participants) to review the probe returns in depth, clarify any questions about what was generated, and create an opportunity for the participant to reflect upon the experience of completing the probe. This "member-check" process not only allows the research team a more in-depth understanding of the motivations of the participants and contextual factors that influences the returns that were generated but can also create a subsequent data record (the transcribed interview data) that can be integrated into synthesis and/or analyzed as a qualitative interview.[33]

Participants will likely vary widely in terms of the degree to which they engage with the probe activities and the extent to which they reflect on the returns in a subsequent focus group or interview. Research teams should design a synthesis process that accounts for this variability. A design probe participant who did not engage heavily in probe development may have more insights to share in the follow-up interview, or may need modifications to the probe activity to allow for successful completion of all the activities (e.g., will we allow more time?).

Inspiration, not information

As described above, design probe returns can offer rich, detailed insights into the lives of participants, but by nature, the raw returns are ambiguous and personalized by their nature of being interpretive and participant-led. At its core, analysis should focus less on rigorous, replicable quantitative synthesis and more on deriving meaning from the returns, identifying information that may not show up from other methods, especially if there are patterns across participants. Returns might suggest opportunities to address problems or pain points through implementation strategies.

This chapter offers some general step-by-step guidance for deriving insights from creative, deeply personal (and potentially messy) probe returns. There is no specific recipe, and every research team should tailor this guidance to align with the goals of the project and the capacity and skills of the analysis team.

Step 1: Preparation

The key goal of this first step is to take stock of what "raw data" (probe returns) you have and how to organize them. This involves first (1) **collecting and cataloguing** all returned materials, including photographs, diaries, collages/drawings/other creative materials, and recordings. Cataloguing includes labeling every data point with an anonymous participant ID and (if relevant) date and time of completion. Next, (2) **generate a digital archive** by converting any physical artifacts into a digital file, again labeling each file with participant ID, date and time of completion. Finally, (3) **organize an inventory (spreadsheet) of the digital data points** that allows sorting the data by participant, probe activity, type of artifact, or key insights/notes that will facilitate synthesis in future steps.

This step is primarily about getting organized, not generating interpretations or sweeping conclusions. But it is useful to keep analytic memos at every stage to capture.

Break it down

- Collect and catalog returns
- Generate a digital archive
- Organize and sort your data inventory

Step 2: Data immersion

The key goal of second step is to take a big-picture tour through your data to start to step inside the worlds of your participants to gain a deeper understanding of their experiences and build empathy. Having empathy for your end-user is a critical strategy for designing solutions that are human-centered (feasible, desirable, viable). Data immersion is a personal task, but typical strategies include: (1) reading, watching, or listening to every piece of raw data once without taking notes and then (2) re-visiting the data a second time to take notes on early reactions, such as key emotions evoked, elements that were particularly surprising or worrisome. (3) Take note of note-worthy data elements, such as a particularly rich diary entry or evocative image, unexpected patterns among certain participants that are notable from this big picture view.

Useful tools at this step include a digital whiteboard such as Miro or Mural or a physical workspace with sticky notes as well as a log to record narrative reflections (memo). Rather

Some prompts to encourage deeper thinking:

- What emotions do you detect behind this return?
- What does this return tell you about what matters to this person?
- What of our assumptions has this return challenged?
- What is missing? What is not present that we expected to see?
- What does this return tell you about what the participate is navigating? Negotiating, balancing?

than focusing on explicit description of the content, this step focuses on larger concepts like tone, spaces/frames, and symbolism.

Break it down

- Review the raw data in total
- Re-review the data and log key insights
- Document note-worthy data elements and big-picture reflections

Step 3: Coding

The key goal of this step is to assign descriptive labels to each data element to facilitate synthesis of key themes. Like any qualitative project, the coding may follow tenets of inductive, deductive, or a hybrid approach, although most often, probe studies utilize an open, exploratory inductive approach rather than establishing *a priori* a code book of key codes to apply to the data. In contrast to formal qualitative coding, the labels can be looser and more interpretive, which is expected given that different members of the research team will describe a data element such as a photograph differently depending on their own perspectives and lived experiences (see Positionality Exercise box).

Specifically, for each artifact, assign "codes" (short descriptive labels) that can range from "a person taking a walk" or "a ritual of reflection" The codes can be both descriptive and interpretive. Whenever possible, center the participants own words, imagery and meaning

Break it down

- Determine coding approach (inductive, deductive, hybrid)
- Assign codes for each data element
- Prioritize the participants' own words, imagery, and meaning wherever possible

Step 4: Grouping codes into themes

The key goal of this step is to move from specific, granular observations about each data element to broader themes that data elements may have in common or in contrast with each other. A practical approach to this is called affinity mapping,[34] in which each code is placed on a sticky note, codes that appear to be related are grouped into clusters, and each cluster is named with a tentative theme such as "Health is a process" or "Challenges with resources." As a team, revisit and rename themes as all of the data is sorted and more patterns emerge. At this stage, it is useful to maintain a reflective memo to document where tensions or contradictions in the data appear, what themes feel most significant or relevant to the goals of the study, and where further clarification from a participant or research team member who did the initial inventory might be necessary.

Break it down

- Place each code on a digital or physical sticky note
- Group similar codes into clusters and iteratively name and describe them
- Keep a reflective memo alongside the thematic clustering

Step 5: Generation of Key Design Insights and Opportunities

The goal of Step 5 is to derive actionable design insights from the themes generated in the affinity mapping activity. This is often an activity that most heavily relies on group discussion and consensus generation among the research team, in order to be the most generative and universally reflective of the returns generated by participants. A key design insight can either be a statement about a user group, using the format People [motivation/behavior] because [underlying reason] which leads to consequence or design implication] E.g. Clinicians avoid asking their patients about health-related social needs because they may not be able to efficiently offer them immediate solutions, which leads patients to experience social needs-related barriers to adhering to treatment plans. Alternatively, these insights can be a more clarified design challenge or actionable direction, using the "How might we…" approach. How might we [the research team] build a system that identifies and addresses health-related social needs among patients without requiring a clinician-patient interaction.

Step 6: Dissemination of findings

The goal of this final step is to generate a product that will enable the research team to share key findings with engaged partners. This may take the form of a power point presentation or report document for key partners, or may also be included in a manuscript or academic platform or poster presentation for peer review. It is important that the research team has obtained and documented informed consent from participants if any findings (images of returns, quotations from interviews, or other participant-specific insights) are shared beyond the research team.

A basic structure for reporting on a probe study includes:

- A statement of study purpose
- Description of participants
- Details about the probe kit and activities (including how they were developed and pilot tested)
- Description about the data inventory
- Summary of key themes
- Insights statements and design opportunities with exemplary visuals (photographs, participant quotations
- Diagrams of any key theoretical frameworks that emerged from connections across themes).

Offering participants an opportunity to review and give feedback on a draft report or other dissemination product will further ensure that the findings are reflective of the experiences of participants.

Advice from IMPACT team and participants

1. Engage an analysis team that represents diverse perspectives.
2. There is rarely one "correct" interpretation of a probe return. Their key role is to surface meaning, rather than quantify an issue or test hypotheses.
3. Ambiguity in returns is expected and welcomed, not a problem to be solved. Use this to stimulate generative solutions among the research team or to use some of your other methods (qualitative interviews, surveys) to learn more.
4. Ensure that you have obtained consent to share any individual-level data (e.g. a photograph taken by a participant) in publicly-shared reports.

Key decision points

- What is our approach to data synthesis?
- Who will contribute to data synthesis? (i.e., research team members? Participants or other community members?)
- What training do these team members need?
- How are we ensuring reflexivity in our analysis?
- What tools will be used to support data synthesis activities? (i.e. spreadsheet software, physical sticky notes and a white board? Digital whiteboard?)
- What reflexivity exercises will ensure the team takes steps to understand how their positionality plays a role in interpretation?
- What kind of report will be generated? (e.g., a report for key projects? manuscript for peer review? something else??)

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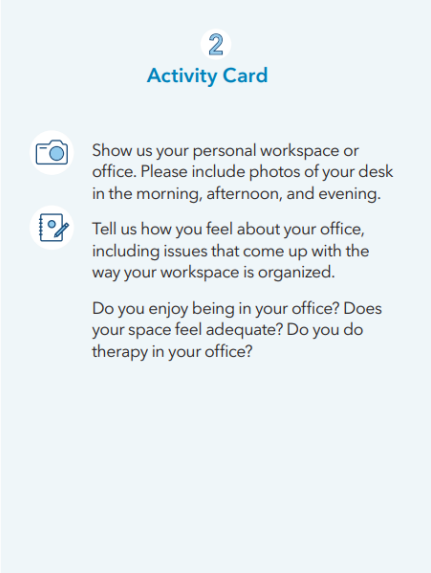
SECTION 5: BRINGING IT ALL TOGETHER: A CASE EXAMPLE

> "[Completing the design probe] did help me be a little bit more aware of my environment, not just for myself, but like working with the client
> -NIMBLE focus group participant

Reflecting on applied experience with design probes in implementation research can offer unique insights to teams hoping to integrate a design probe study into their implementation project. Here we present a case example from an IMPACT-funded implementation research study known as the Novel Methods for Implementing Measurement-based Care in Low-Resource Settings (NIMBLE). Design probes in NIMBLE were used to explore the implementation context and identify key barriers and facilitators of implementation of measurement-based care in community mental health centers. The NIMBLE team partnered with an interdisciplinary team of methodologists and dissemination/communication experts to develop and evaluate the design probes.



Design probes were completed by N = 13 NIMBLE participants. A total of n = 12 were clinicians and n = 1 was a supervisor/clinical leader. The NIMBLE Probes included a journal, pen, 7 activity prompts that asked about different aspects of MBC (e.g., physical space), a stress ball, and a snack (2 pieces of chocolate). All 7 design activity prompts can be viewed in the Appendix.

Synthesis. One research team member transcribed written text from journals into Microsoft Word. Two coders independently developed summary memos that outlined key points verbatim.

Be mindful of practitioner workload and their capacity to complete "one more thing." Consider blocking independent or group meeting time for completion of probe activities.

Experiences of design probes in NIMBLE

To evaluate the perceptions of design probe users, focus groups were conducted with community mental health center providers and staff who were enrolled in the study to identify opportunities to refine or improve design kits. The focus groups started with a brief reminder about the purpose of design probes in the NIMBLE study. The 5 journal prompts were displayed for participants to review the language and image associated with each prompt. Then facilitator led a discussion of participants' experiences responding to the prompts and their general thoughts about other facets of the design probes (which included chocolate, a pen, and a stress ball). Finally, the group discussed the probe experience more broadly, including the process of completing it, motivations for completing it, and the package in the context of the clinical setting.

Feedback on NIMBLE design probe prompts

Focus group participants noted that some of the prompts were too wordy or complicated, emphasizing the importance of **clear and concise instructions**, particularly because they were completing tasks in between seeing clients. In some cases, participants reported that the prompt itself caused them to **reflect on** their environment and **spontaneously make improvements**. For instance, one participant reported that the prompt, "tell us how you feel about your office, including issues that come up with the way your workspace is organized," inspired them to start using dual monitoring screens to allow for better patient-practitioner interaction when discussing an online item (e.g. an outcome questionnaire). Multiple participants appreciated the prompt, "tell us about a time when you or your clients felt excited or positive about using or discussing measurement-based care, preferably in the last week," noting that it created an opportunity to reflect on a positive interaction with a client in the past week.

Feedback on NIMBLE design probe contents

Focus group participants noted the importance of **having high-quality materials** and inclusion of **items and tasks explicitly intended to engage and delight**. They appreciated the inclusion of a treat (chocolate) and the stress balls, which they reported they could use themselves or with patients. Negative feedback about the contents included one observation that the stress ball had

gotten hard over time and was no longer usable and another participant noted that they did not like the pens that the research team selected. The use of a disposable camera yielded mixed results. In some cases, participants noted that they like the disposable camera because it was "retro." However, because **clear instructions** were not provided regarding how to use the camera flash, many of the photos were too dark to be usable in our analysis.

Other feedback from NIMBLE participants

Overall participants generally liked engaging with design probes, but they also reported concerns that the design probes could be time sensitive or emotionally activating. One participant reflected, "I feel like I can only do this…maybe once a week." Participants shared that they do not typically have the capacity to reflect on their work experiences, **as practitioners have other competing responsibilities**. One participant noted that completing the design probe, "did help me be a little bit more aware of my surroundings with my environment, not just for myself, but like, working with the client." Another participant said, "I thought it was unique and a good way to get people moving and thinking."

Research Team Reflections

Designing and deploying design probes required significant planning and investment. First, we spent substantial time developing and revising the prompts to be**: (1) readable, (2) salient to respondents, (3) brief enough to engage in without causing significant burden, (4) and aligned with project goals.** To do this, we developed prompts iteratively with a team of dissemination and accessibility experts, youth and practitioner volunteers in our network, and the IMPACT project's methods core faculty. Additionally, the pilot surfaced several logistical challenges with design probes. Receiving the probe returns was challenging given that the clinics were not in the vicinity of the research team, requiring that they be returned by mail. We mitigated this by providing pre-labeled envelopes that fit the journals and cameras; however, one design probe package was lost in the mail. An additional challenge was analyzing the dim photographs, given participant's varying use of flash and the dim lighting in clinics. Finally, there is no established consensus on how to analyze the data to identify barriers. For that reason, we employed rapid qualitative analysis (Gale et al., 2019) approach consistent with other qualitative methods used in NIMBLE (e.g., rapid ethnography). The analysis categorized key insights about implementation barriers by ecological level (organization, clinical team, patient).

Despite these challenges, our experience highlights the unique advantages of the design probe method. First, upon dropping off the design probes for practitioners, the research team was able to see the excitement at their "unboxing." Additionally, the research team noted that reading journal entries elicited significant emotions and insights within the researchers. Several participants described navigating challenging scenarios that highlighted their internal experiences related to the practice we were evaluating and the environment in which the practitioners were

operating. We noted experiencing several emotions when reading entries: anxiety, distress, confusion, and joy. Reading these entries undoubtably helped us align more closely with respondents and build empathy toward their unique lived experience.

Key lessons learned

- Designing the probes is a valuable process and the first opportunity to elicit feedback and generate insights about end-users
- Be mindful of the operational complexity of sending and receiving probe packages and ensure appropriate resources/staffing for this project management
- Don't forget to give instructions for the tools you provide for participants. For example, many disposable photographs were unusable because participants did not use flash
- Consider your own emotions as researchers, and ensure that you have a structured process for ensuring reflexivity

Comparing insights about implementation determinants across methods

A focus of the IMPACT center has been building the evidence base for effective, accessible methods for identifying implementation determinants. The NIMBLE study used 3 methods, including design probes, rapid ethnography, and rapid evidence synthesis. Rapid ethnographic assessment uses site visits, interviews, and observations to develop an insider's perspective. Rapid evidence synthesis involves a targeted review of empirical literature. More details about this can be found in the published manuscript.7

In brief, the NIMBLE research team compared convergence of determinants identified by each method using a Jaccard plot and pairwise Jaccard indices.

The use of 3 methods combined generated a list of 42 determinants of implementation. Rapid evidence synthesis surfaced 29 (69%) determinants, including 8 solely identified by this method. Rapid ethnographic assessment surfaced 35 (83%) determinants, with 4 solely identified by this method. Design probes surfaced 23 (66% determinants) and did not surface any unique determinants. A total of 14 (33%) determinants were identified by all methods. Pairwise Jaccard indices indicated the strongest convergence between rapid ethnographic assessment and design probes (J = .66) and rapid evidence synthesis and rapid ethnographic assessment (J = .52). Convergence between rapid evidence synthesis and design probes (J = .37) was more modest.

Table 1. Determinants by Consolidated Framework for Implementation Research (CFIR) and Identification Method

CFIR Domain	REA	RES	DP	Determinant
Individual (patient)	✓	✓	✓	Resistance to or concerns with completing measures
	✓		✓	Lack of clarity on measures/MBC process
	✓	✓		Clinical presentation
		✓		Insurance status
		✓		Attendance
		✓		Turnover
	✓			Youth patients do not want to involve parents in treatment
Individual (clinician/staff)	✓	✓	✓	Attitudes toward measures, MBC
	✓	✓	✓	Knowledge, self-efficacy, and skill
	✓		✓	Avoidance/anxiety/discomfort related to MBC
	✓	✓	✓	Competing demands/lack of time in session
	✓		✓	Clinicians/staff forget to administer or review measures
	✓	✓		Resistance to change
	✓	✓		Stress & burnout
		✓		Clinicians decide who does/does not get MBC
Inner Setting	✓	✓	✓	Organizational norms, culture, and climate
	✓	✓	✓	General administrative burden (competing demands outside of session)
	✓	✓	✓	Lack of built-in time to do administrative MBC (review scores)
	✓		✓	Inconsistent measurement/documentation of measurement
	✓		✓	Clinicians have variable access to measures
	✓	✓	✓	Lack of reminders
	✓	✓		System/Organization lacks clarity on utility of MBC
	✓	✓		Clinician/staff turnover
	✓			No discussions within or between teams about MBC process
	✓		✓	Intra-agency cross talk re: policies, procedures
	✓	✓		MBC data are challenging to aggregate at the organizational level
	✓	✓		Administrative leadership support
		✓		Clinics lack technological infrastructure to support MBC or MBC program
		✓		Low baseline MBC use
Outer Setting		✓		Organizations do not have guidance on selecting self-report measures
Implementation Process	✓	✓	✓	No initial or continued training on measures, MBC process and system
	✓	✓	✓	Lack of centralized policies, procedures, communications related to MBC
	✓			Therapists do not receive feedback on MBC (supervision or administrative)
	✓		✓	Logistical challenges for providers who are not onsite or embedded
	✓	✓		Lack of incentives
Innovation	✓	✓	✓	MBC system or workflow is cumbersome to patients and/or clinicians
	✓	✓	✓	Cultural and linguistic relevance of measures
	✓	✓	✓	Clinicians and/or patients cannot easily access scores/clinical cutoffs
	✓	✓	✓	MBC is a complex process with a steep learning curve
	✓		✓	Measure construction/quality
	✓		✓	Utility of screening tools as outcome questionnaires
	✓			Frequent changes to MBC process/system

Note. CFIR = Consolidated Framework for Implementation Research. REA = Rapid Ethnographic Assessment. RES = Rapid Evidence Synthesis. DP = Design Probes.

Key learnings

- The NIMBLE research team found substantial overlap between implementation determinants surfaced by 3 methods
- Despite overlap, each method added unique insights
- Design probes highlighted participant-driven perspectives that overlapped substantially with rapid ethnographic assessment
- Findings reinforce the complementary nature of multi-method determinant assessment while highlighting tradeoffs researchers must weigh when selecting determinant identification methods.

Give your team plenty of time to develop high-quality prompts!

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Appendix

Table 1. *Exemplar studies summarizing design probe activities for each of these distinct goals.*

Component	Example study from literature scan	Study Description
Promote buy-in and engagement among implementation partners	Using Cultural Probes in the Sensitive Research Setting of Informal Caregiving. A Case Study (Hensely-Schinkinger et al., 2018)	Study used design probes to understand routine care and coordination work of elderly informal caregivers. Probes were delivered in the context of site visits to 20 participants (10 in Austria, 10 in Germany), left behind with participants to complete over the course of 2-4 weeks. All participants engaged with the probe activities, which included a diary, time and mood tracking activity, polaroid camera, social contacts, and picture cards to reflect on. Participants appreciated the experiences of self-reflection and the process of "making the invisible visible."
Include the perspectives of less accessible (or hard-to-reach) populations	Design Research on the Core Needs of Children and Families during Stem Cell Transplantation (Savig, 2016)	Study used design probes to elicit perspectives of children receiving stem cell transplant services and their families regarding experience in isolation for stem cell transplant. 19 individuals participated in probe activities, that involved a gift box personalized to gender, age, a set of idea cards that served as activity prompts, and a variety of craft, art, and office

		materials to respond to the prompts. Research team was able to capture unique insights about the needs of children and families without being present in a hospital setting.
Contextual Inquiry	Investigating Daily Practices of Self-care to Inform the Design of Supportive Health Technologies for Living and Ageing Well with HIV (Claisse et al., 2022)	This study used design probes to establish a context for research dialogue and reflection with study participants. 7 participants completed a daily self-care diary featuring both daily and weekly prompts designed to be visually engaging and quick to respond to. Research team was able to understand the challenges and barriers to practicing self-care and how that shapes coordination of whole-person care.
Identify potential determinants of implementation among practice and community partners	Identifying Barriers and Facilitators to Diet and Physical Activity Behaviour Change in Type 2 Diabetes Using a Design Probe Methodology (Cradock et al., 2021)	Study used design probes to encourage participants to reflect on their emotions and lived experiences to understand perceived barriers and facilitators to healthy diet and physical activity behaviors. 18 participants with type 2 diabetes completed a design probe, which included a workbook, pens, calendar, and fridge magnets. The research team was able to identify key themes across barriers and facilitators as well as design ideas generated by participant for behavior change ideas.

Inform and tailor implementation strategies, including adaptation of interventions	Use of cultural probes for representation of chronic disease experience: Exploration of an innovative method for design of supportive technologies (McCarthy et al., 2017)	Study used a cultural probe as a preparatory activity for young people with type 1 diabetes who were recruited for a participatory design workshop. The cultural probe activities included writing and drawing prompts that helped inform the goals of the workshop related to reducing strategies to reduce stigma related to medical devices for people with diabetes. The research team was able to identify key drivers of stigma among this population to design strategies specifically to address them.

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Example Participant Instructions from NIMBLE

INSTRUCTIONS FOR DESIGN KIT*

Thank you for doing a design kit! With your clinic, we are working to improve [goal of study] by centering voices like yours. Design kits like this one help us understand your experience with [intervention of focus]. With this kit, you will write about your experiences and take photos that help us understand how we can make your [goal of study] better. Just so you know, nothing you share with us will be shared with your clinician.

How to complete your design kit

Everything you need is in this box! You will interact with the design kit over 7 days. Some activities will ask you to write in a journal, others will ask that you take a photo, and for some, you can choose which you prefer. Each activity will take about 10-15 minutes. After you return the design kit to us and participate in a short follow-u interview, you will receive [incentive value and format].

The Instruction Card tells you how to complete the design kit. The Activity Cards have guidance for how to complete each activity. If taking photos is part of an activity, you will see the photo icon. If using the journal is part of the activity, you will see the journal icon. If you can choose, you will see both icons.

What kind of information should you not include in your journal and photos?

You should not include some kinds of information:

(1) Anything that would identify you. For example, your face, name, date of birth, address, or other information that could be used to identify you, like a school or street name.

(2) Identifying information about you family or friends. This includes:

a. Your family's names, dates of birth, or health information

b. Faces of others

c. Stories that would contain potentially identifying information such as a school name or neighborhood.

If you realize that you included something that might identify you or someone else, please tell us in a journal entry, and we will delete the photo or black out the words. If we see that you have something potentially identifying in your journal or pictures, we will get ride of the information.

Returning the kit

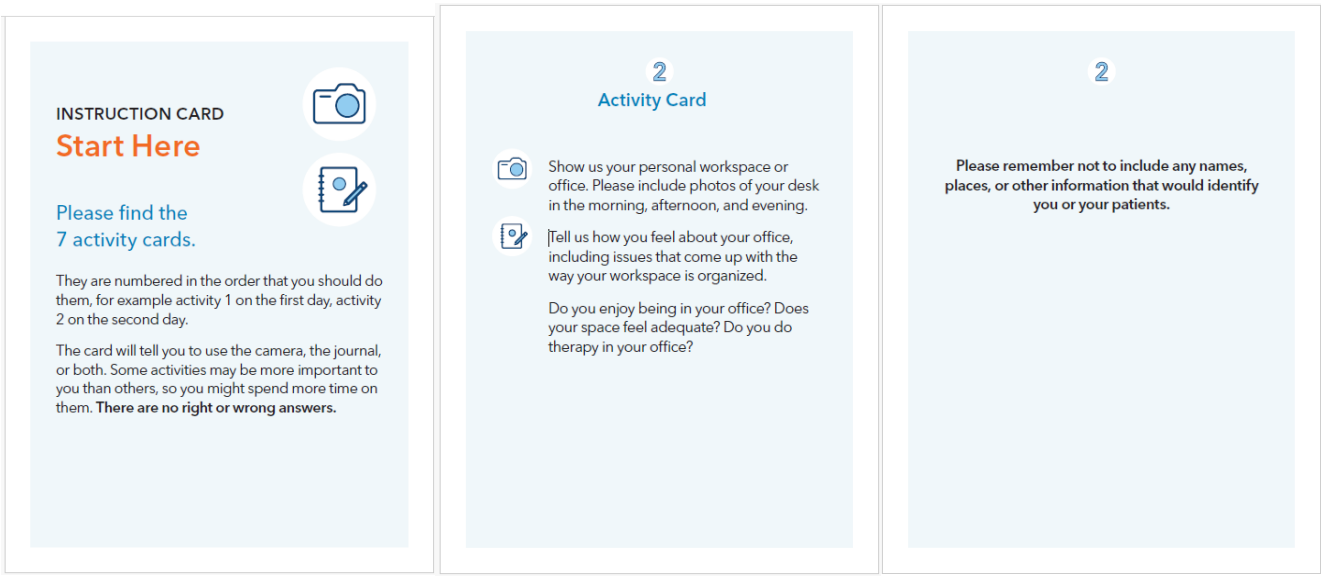
When you have completed the activities, please put the journal and camera in the included envelope, seal it, and leave it at a post office or your home mailbox.

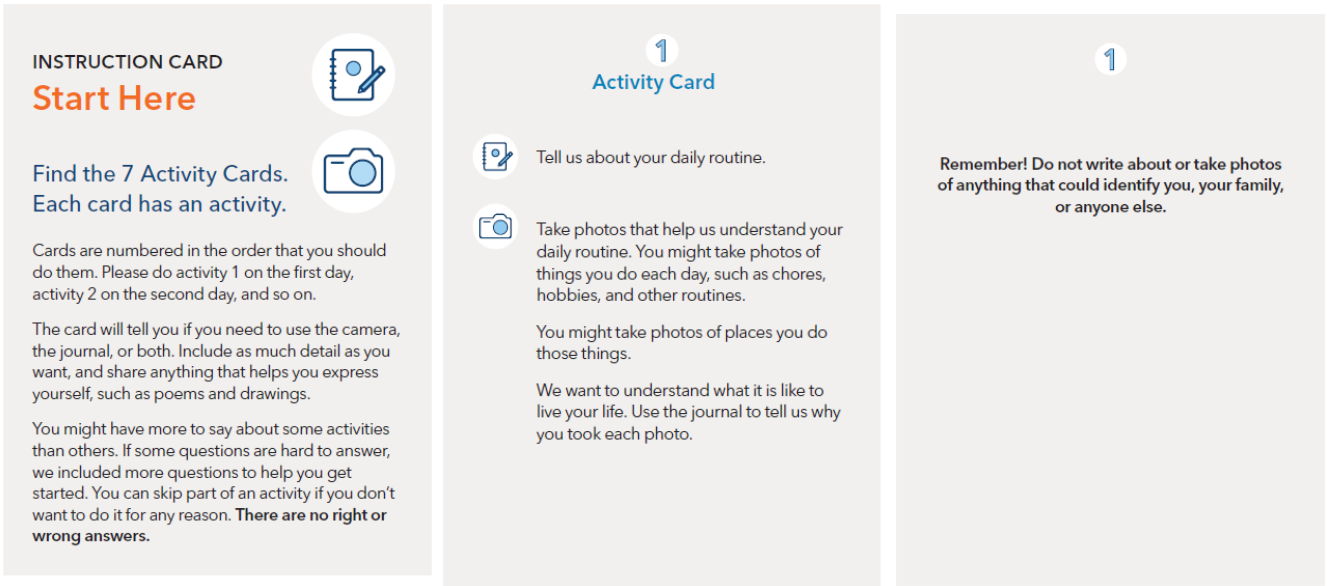
Questions?

If you have any questions, please contact the [study team contact] at [include multiple modes of contact if possible.]

*Note we suggest modifying participant-facing language from “Design Probe” as appropriate

Example clinician and youth participant prompts from NIMBLE





Example Design Kit box from NIMBLE

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