Conducting Home-Based Usability Tests of Home Healthcare Devices

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As life expectancy increases and medical technologies become more advanced, medical devices are being used more often at home by lay users—individuals without formal medical training. Lay users might be patients or nonprofessional caregivers, such as relatives or friends, who operate a device on someone else’s behalf. When developing medical devices for lay users, it is important to evaluate users’ ability to interact with the device safely and effectively in the home environment.

Conducting home-based usability testing provides a unique opportunity to achieve this goal, understand the home environment, and see firsthand how the environment affects the lay users’ ability to use a device appropriately. This article focuses on unique aspects of home-based testing rather than providing suggestions and input regarding conducting usability tests in general.

Home healthcare device usability tests can be conducted in various locations, including a usability lab, a conference room, a hotel suite, and of course, the patient’s home. Selecting the most appropriate test environment depends on the stage of device development and the test goals, as well as the importance of conducting testing in a controlled and consistent environment.

It is valuable to conduct formative (i.e., exploratory) testing in the home to gain as many insights as possible regarding the actual use environments and whether users are likely to comply with prescribed device use when at home. Home-based testing enables researchers to learn about a device’s portability and placement inside, and sometimes outside, of the home. For example, if testing a respiratory therapy system that must be used continuously, the moderator could ask the participant to demonstrate how s/he positions the system when commuting or grocery shopping. The moderator might also want to learn how the user positions and uses the system while sleeping.

However, it might be best to conduct a summative (i.e., validation) usability test—a test intended to validate device use-safety—in a more controlled environment, such as a usability lab or conference room set up to simulate the home environment. By testing in a controlled environment, the possibility of unexpected conditions and distractions that might arise in a home are removed, so tasks can be presented consistently and devices validated in a “cleaner” manner.

Notably, the controlled environment should still represent the home environment and consist of more than a table and two chairs in an otherwise empty room. The home can be simulated by introducing realistic distractions, setting up certain pieces of furniture (e.g., a refrigerator and kitchen table; or a bed, dresser, and nightstand), and setting lighting levels to simulate daytime and/or nocturnal use.
It might seem antithetical to conduct a summative usability test in a controlled setting, given that the most realistic use environment for a home healthcare device is, after all, the home. However, because an effective (and successful) summative test is the capstone to any device development effort, the advantages and disadvantages of each potential test environment should be carefully considered prior to making a decision.

If the decision is made to conduct testing in the home, whether during device development or validation, consider these tips when planning the test, recruiting participants, and conducting the sessions.

Planning the Usability Test
When planning the usability test, decide first how long the usability test sessions should last, and whether participants will use the device during a single test session or over an extended period of time. Most usability tests involve a single test session that might last one to three hours. However, to understand longer-term device use, participants can be asked to use the device independently (i.e., without researchers present) for several days, making notes about particular device interactions in a paper- or web-based diary.

Extending testing over several days increases the likelihood that participants will interact with the device in different areas of their home and outside of the home. This extended usability test can be initiated by delivering the device to the participant’s home, introducing the device and research goals, and collecting the participant’s initial impressions of the device. After the participant uses the device independently as planned, the test can be concluded by having the participant perform specific tasks with the device and provide his/her summary impressions of the device (much as during a traditional usability test session).

Regardless of the usability test’s duration, it is safe to assume that participants will deviate from the test activities or tasks, or encounter unexpected distractions such as a phone call, a visitor, or children coming home from school.

Recruiting Usability Test Participants
In addition to identifying the test session duration and developing the moderator’s guide, test planning involves identifying appropriate test participant characteristics (e.g., age, education level, experience with similar devices, relevant impairments). Then comes recruiting—perhaps the most daunting aspect of conducting a home-based usability test. Thinking critically about how to access prospective participants is key.
Although posting online advertisements and printed flyers will facilitate recruitment of adolescents and adults, these strategies may be less effective when recruiting elderly individuals, who are often the target of fraudulent solicitation. Instead, consider recruiting elderly individuals by reaching out to trusted leaders, including directors of assisted and independent living centers and senior centers.

There are a few basic steps that can increase the likelihood that prospective participants are interested in, rather than intimidated by, the research opportunity:

• Provide a one-page summary of the test session activities and research goals so individuals can discuss the opportunity with their families. Emphasize that the research is a product evaluation rather than a sales presentation or solicitation.
• Leave ample time for individuals to consider whether they want to participate in and host the usability test.
• Encourage individuals (and their relatives and/or caregivers) to call with any questions or concerns.

When speaking with interested individuals, describe all planned activities in detail so the individuals understand and become comfortable with what you intend to do in their home. Explain how many people will attend the session, whether you will video record and/or take still photos, what activities you might ask the participant to perform, and where in the home you would like to conduct the session.

Also, describe what materials or equipment, if any, you would like the participant to provide. For example, ask the participant to be prepared to show his/her blood sugar testing materials (e.g., glucose meter, test strips, sharps container). Providing this information in advance ensures participants don’t need to hunt for items of interest during the test session.

Although you might engage a third-party firm to recruit participants, the moderator or data recorder should call the participant a few days before the test session to introduce himself/herself and begin gaining the participant’s trust. When speaking with the participant, it’s best to refer to the research as a “product evaluation” or “interview.” The term “test,” although accurate, might intimidate the participant and increase his/her anxiety about the session.

Conducting the Usability Test

By the time you arrive at the participant’s home, you should be familiar with the usability test goals and activities and feel comfortable hosting the research. Even so, you should make the best effort to minimize the perception that you are intruding into the home. One way to accomplish this is to limit the number of people who attend the usability test session. For example, suggest that only one or two clients or stakeholders observe testing in real-time and join the researchers in the home.

Involving a two-person test team is ideal as it provides safety and security for the researchers and the participant, and enables the moderator
to focus on leading the session while the data recorder documents observations and feedback. Although you want to minimize the number of clients, stakeholders, and researchers present, you might invite the participant to have a relative or friend observe the test session, thereby providing an added degree of emotional support and reducing the likelihood that the participant feels vulnerable in the presence of strangers. That said, it is good to clarify upfront that the goal is to understand the participant’s interactions with and opinions about the device. At the end of the session, invite the other person to share his/her perspectives and impressions of the device. Taking this approach ensures a focus on the participant while also respecting the participant’s relationship with the other person who might be present.

The data collected during summative testing will serve as strong evidence that the devices are safe and usable in the home, which, after all, is the ultimate goal.

Some of the data collected during home-based usability testing will be identical to the data collected during lab-based usability testing. However, in addition to documenting the participant's feedback and device interactions, you might want to document particular characteristics of the home environment, for example, take photos in areas of the home where the participant might use the device, and measure lighting and sound levels. Some homes will be cleaner, quieter, better lit, and more spacious than others (or, conversely, messier, noisier, darker, and more cramped).

Last but not least, as previously suggested, embrace unplanned distractions. Expect that participants might receive phone calls or visitors. Although you can ask participants to limit the duration of these events, it is valuable to see how a participant handles the device amid realistic distractions.

Conclusion
Conducting usability testing of home healthcare devices in lay users’ homes can yield special insights into users’ ability to interact with devices safely and effectively in the home. However, these insights might not come easily. You need to establish trust and rapport with test participants and put them at ease. It is also important to be flexible and “expect the unexpected.” Taking these steps and putting yourself in the right mindset will enable you to conduct effective home-based usability tests.

The insights gained through formative testing will serve as important design inputs to help manufacturers develop safe and usable home healthcare devices. The data collected during summative testing will serve as strong evidence that the devices are safe and usable in the home, which, after all, is the ultimate goal.