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How Do Health Care Providers Perceive Technologies for Monitoring Older Adults?

Hilaire J. Thompson Stephen M. Thielke

***Abstract*--Monitoring and assistive technologies for the older adults, by sensing and recording activities and status, provide an objective record of a patient's functioning within natural environments. Yet the data derived from these technologies do not directly address the clinical aims of health care providers. We conducted focus groups with health care providers who work with older adults to elicit their perspectives on monitoring technologies. Identified themes centered around the benefits and risks of technologies, patient needs, the clinical utility of information, and specific monitoring domains that might improve the health care of older adults. Providers highlighted the primary importance of involving families and caregivers, and of sustaining human interactions. They explored the difficulties with how to use information for clinical ends, and challenged the notion that more objective information would automatically improve their heath care. Designers, developers, and researchers might improve the utility and uptake of health-related technologies for older adults and their families by eliciting the viewpoints of clinical providers.**

I. INTRODUCTION

Health-related technologies for older adults have promised to improve clinical practice by providing objective information to practitioners about patients' status and behaviors. For instance, technologies can identify that a patient was not taking medications as prescribed, had lost weight, or was not active; this information would be expected, when communicated, to result in a change in clinical management[1]. Most of the development of such technologies has been directed either by practitioners seeking to monitor a specific domain of health or behavior, or by experts in technology who envision that their systems would have clinical utility. Less attention has been paid to the views of providers who might use such monitoring information within their clinical practices [2, 3].

We sought to understand how health care providers perceive the potential of technologies to monitor older adults, particularly what clinical problems technologies would able to address, how information could be communicated to providers, what its clinical utility would be, how families and patients should be involved, and what concerns exist around using such technologies for health care. Because these questions have not been previously explored through research, we conducted focus groups with various health care providers who work with older adults in order to elicit their perspectives and to identify themes.

II. METHODS

We conducted a formative, qualitative study using focus group methodology. Subjects were health care providers engaged in the care of older adults. Participants were recruited to participate via email sent to three geriatric and technology-centered listservs. The volunteers had expertise in the clinical care of older adults in the disciplines of nursing, medicine, physical therapy, psychiatry, psychology, physical therapy, and massage therapy. Following written informed consent, three separate digitally-recorded focus groups were conducted using a semi-structured script. Questions included "What is the problem with the current way that you assess [medication adherence, activities of daily living, etc]"?, "How do you think monitoring or assistive technology could be used to provide this information?" The digital recordings were transcribed verbatim along with detailed notes of the observer. Data were then evaluated and coded independently for overriding content themes by the two co-investigators using qualitative descriptive methods[4].

III. RESULTS

A. Anticipated Benefits and Risks of Technologies

Theme #1: Current technologies are suited more to patient and family needs than to clinical problems: While most of the questions in the focus group script centered around how providers could use information from technologies in clinical settings and for clinical decision-making, the participants mainly discussed ways of improving the lives of patients, family members, and caregivers outside the scope of clinical care. A clear theme was the ability to improve upon subjective data provided by patients and families as self-reports were often misleading or did not match family reports: "I have to rely on verbal report and its really often times the family will often times say this is not the case. Or what they are reporting to us is not meaningful clinically".

There was little discussion of how current monitoring technology could enhance the work that providers do, or of how providers' decisions would be modified by information derived from technologies. When asked directly, participants were able to think of scenarios in which technology could change their clinical practice

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(such as knowing if a patient had been preparing meals, was eating and drinking regularly, or was safe at the kitchen), but qualified their speculations by noting that such cases would be uncommon, because the level of detail currently provided by technologies would be a barrier to their use. One participant summed this up by stating: "we could help them maximize their functioning and manag[e]…their environment…[with a] better measure of how are they truly functioning at home rather than saying 'do you do your own cooking?'…yes, but [what I need is] how often do they cook? What time frame are they cooking"… if I had something that was given to me where there was a much more sensitive…person-specific description of what they do… yeah, actually they can cut the onions, and cut the vegetables…and so actually what I mean is that those broad brush assessments don't really help me to maximize a care plan for a person at all."

Theme #2: Technologies should enhance human interaction: Participants in all the focus groups discussed the goal of increasing human interaction for their patients. They stressed that whatever technology is applied, meaningful human contact is the desired goal. This took several forms, from children calling parents to remind them to take their medications, grandparents text-messaging with their grandkids, families having video-phone calls, or caregivers talking about their experiences on chatrooms. "The solution is a human one," noted one participant in talking about how technologies could enhance care. Participants were wary of approaches that circumvented or reduced human contact, as by montitoring-and-feedback systems; as one stated, "Technology is not a cheap substitute for humane valuation." Another participant noted that the cost-benefit ratio must be considered: "most of technology is prosthetic, trying to replace what the individual would do if they were at full function and that is so easy to conceptualize, but so expensive to do. When basically someone coming in and putting their hands on their shoulder may have as much impact..."

Theme #3: There are potential risks in monitoring technologies: Participants described a number of concerns about using technologies in the process of care for older adults, mostly related to effects on human interactions. One participant suggested that using technologies rather than human contact risked worsening the isolation, loneliness, and morale of older adults, and could create a scenario where a "wire mother" (alluding to the work of Harry Harlow's research with monkeys and bonding[5]) is substituted for a real person. Even if technologies could improve safety by monitoring behaviors and generating alerts, they might unintentionally erode the role of "human technologies" in observing and caring for patients. There was also concern that technologies could add burden to caregivers and providers, who would be expected to track and act on information. As one participant noted, even 30 seconds of added time to review monitoring data could be too much in the process of care. More theoretically, one participant expressed doubts that objective technologies would add order or predictability to our understanding of human behavior, and that monitoring older adults could lead instead to the recognition that many adverse events happen randomly, and thus cannot be prevented.

B. What Matters for Patients

Theme #4: Patients are deeply connected: The focus group participants reiterated the importance of considering the patient's environment, family and social contacts, and cultural milieu. They suggested that measuring *only* the patient misguides evaluation and assessment. "A person who lives alone and is mildly demented and is taking fourteen medications is at far greater risk than a person who lives alone and is mildly demented and is taking two medications. And having a caregiver or somebody they live with…makes it safer for both of those people…." The role of families and caregivers in patients' lives surfaced repeatedly. Families were described as being the primary monitors of health status and medication use, and the main agents for sustaining them. As one participant described in the setting of improving medication-taking, "a family member is the key person in that process". The challenges created by using technologies to monitor the patient's status but not the broader environment were addressed in all of the focus groups. For instance, one participant discussed how a patient with dementia suffered from low blood pressure because an overly solicitous family member checked her blood pressure too often and thus gave her too many pills to lower it, noting that a system that monitored only the patient would never reveal the real cause. In another group, participants equally enthusiastic about technologies to monitor the patient's physical environment (light, temperature, sound) as about technologies to monitor what a patient was doing.

Theme #5: Different patients have different needs: Participants reported that the capacity to improve patients' lives through technologies would depend largely on their current unmet needs. If there is no problem with health-related behavior, then no technology is needed to address it. Many patients, including those with dementia, were felt to have no problems that would need to be addressed – one participant stated that about 70% of the patients in her practice would have no need for objective monitoring because their families and caregivers had already learned how to provide appropriate care using human intermediaries. Another participant noted that the presence or absence of a caregiver would completely change the relevance of monitoring, since the types of actions that could be considered would be different: "I think there are two issues. One is monitoring whether people are taking it correctly, but then the other thing is, is there a way to remind people to take it? And to really kind of guide them to the specific kind of medication that they should be taking at that time….It's just that combination of the comprehension and the reminder system and the monitoring, that I think making all of those things come together is what would be really new and different from what's already out there." The type of monitoring appropriate for assisted living or nursing home settings would thus be quite different than that for older adults who are living at home. Participants also noted that there is no way to predict in advance which type of technology would help any individual patient, and that considerable trial and error is involved.

C. The Relative Utility of Information

Theme #6: Information is valuable only if it can be acted on meaningfully. Participants discussed the challenges of using information in clinical work and caregiving. Generally, the theme arose that the reasons for wanting to know something are very important in deciding if and how to measure it. For instance, the various goals for monitoring older adults included reassurance (knowing that a loved one is well), clarifying assessment (identifying how someone is really taking pills), monitoring changes (seeing that someone's status is declining), improving prognosis (saying how a patient will do in the future), selecting level of care (recognizing that there are unmet needs), or making specific decisions (telling a family member to provide more care at specific times). As one participant noted, it would be particularly helpful to identify: "the [data elements] to define the slope…the trajectory, which is obviously given to quantification, and then you can identify sort of the appropriate interval …and to try to put this together with the plan, it's the plan that is the labor intensive and the hard part. The information is relatively easy, but we spend so much time on it now, don't even get the full information…a way to make that more efficient… a way to make it more accessible and more dynamic from the home, from the point of evaluation and implementation and this translates to the care plan". The idea of a trajectory was confirmed as being important "because so much of what we are doing is trying to anticipate what will come next".

Information from monitoring systems was described as more useful for family members and caregivers than providers, with providers informed only if there was a pattern of problematic behavior, for instance multiple missed doses of medications: "I only want to know if there's something wrong." The contrast between monitoring for clinical practice and monitoring for ongoing care was stressed, with different roles for providers and families or caregivers: "if it's just a skipped dose of medication one time, that might just go to the caregiver, who could then call and follow up, but if it's a consistent pattern that starts to develop over time, maybe that would go to the clinician, who would then contact the caregiver because, obviously, it's obviously not just a matter of forgetting – there's something else going on."

Some behaviors were described as not worth knowing for clinical practice, for instance brushing teeth. One participant noted that there must be a direct benefit for any particular type of information to be clinically meaningful, but that otherwise it would be better not to know it: "Unless I as a provider can see how the application of this measure will not only improve my care but make it more efficient, and actually make a better economic model, well then that is where I think [provider] behavior will change. " The participant stressed that the most useful monitoring relates to reversible causes: if no action can be taken to correct the problem, there is no reason to gather the information: "To me, built into whatever one comes up with has to be a way of evaluating it that is objective and real in order for it to be applied. And so the question is then reversibility for some of these sorts of things. Can a person benefit from being able to walk faster?" Other participants noted that information is valuable only if there is an action step attached to it, and if the patient intends to change in the way that the information directs (e.g. a reminder to drink more water would not work if a patient were intentionally not drinking in order to limit trips to the bathroom while away from the house).

Theme #7: Information should be filtered and "pulled". The health care providers in the focus groups unanimously felt that information from technologies should be shared with family members and caregivers, but with a few important qualifications. It was noted that information should be presented in a format that the family members or caregivers could understand, and be "easily readable and accessible". For example, the spouse of a patient may be the primary caregiver, but may have difficulty reading small type or using a computer. One participant noted that there is an "art" to providing information about functioning or clinical status to families, and that it should be presented at the "teachable moment". Another participant felt that a "pull" model for sharing information was more appropriate than a "push" one: information should be available for family members or caregivers to access when they are ready to receive it, rather than expecting them to receive, interpret, and act on it as it is generated. Other participants described the importance of "advance level of filtering" and "individualization" for providing information back to providers because "that is what you try to do clinically." This was confirmed across groups: "Most clinicians don't want those detailed level of, every day, what are you taking and how much. But I think the ability to distill the information into a higher level – running averages or so. So I think that [you need to] hav[e] the ability for … organizing your data in a way that different audiences can use it effectively."

D. Desired Domains and Recommendations for Technologies

In addition to the areas previously discussed, the participants described a number of specific ways that technologies could be used to monitor older adults objectively, each with some anticipated benefits for clinical care. For instance, several participants noted that cell phones could issue alarms and reminders, but that people did not use them for this purpose. Specific ideas for new and continuing domains of monitoring development included:

-Frailty indicators (e.g. walking speed, grip strength)
-Ambient environmental variables (temperature, humidity, light, pollen count, mold), integrated with symptom and behavioral (e.g. sleep, activity) reporting
-Visual field and hearing monitoring (camera or microphone on the patient)
-Feedback for appropriate use of different types of medications (e.g. inhalers)
-Location (using GPS), or whether a trip outside the home has been completed
-Driving patterns and safety
-Ambulation activity, what surfaces are walked on, whether shoes are worn, whether assistive devices are used
-"Feeling tone": the patient's or family's receptivity to feedback about functional status (used to identify the "teachable moment" for providing information)
-Aggression
-Wandering
-Boredom, loneliness

In addition to discussing these specific domains to be monitored, participants made recommendations for how technologies could be designed and implemented most successfully, in order to aid both health care providers and patients, families, and caregivers. About clinical ends, participants noted that providers are busy, and do not have much extra time to interpret and act on monitoring data; as noted above, a process that took an additional 30 seconds might be deemed too long. One participant stressed the great difficulty in getting practitioners to change their practices, and compared it to the slow and difficult process of switching to the electronic medical record. With regard to patients' and families' uses of technologies, participants stressed building systems around technologies that currently have some value to patients, and not expecting patients to accept an entirely novel monitoring system. The example given was that patients who used text messaging with their grandchildren would be much more likely to accept health-related feedback from text messaging than those who did not use it for other purposes. Participants also felt that many technologies were cumbersome and liable to break, and that simpler devices would be more successful. Several described cell phones as being simple enough (compared to the complexity of computers), and one thought that a cell phone with a computer monitor would be useful. Participants envisioned communication devices that had only one button to press while others emphasized that older adults often have physical limitations with using electronics, such as reading small type or pressing small buttons. Several participants noted that alerts and reminders can easily be ignored, and that they should be tailored to the individual needs of the patient. Finally, the investigators noted that most participants had limited familiarity with currently available technologies, which is congruent with previous findings [3]. However, a few selected participants commented to the group that in many instances that these technologies were currently available, but were not being broadly applied so there is both a lack of dissemination of the availability of these technologies and disconnect with their integration at present.

IV. CONCLUSIONS

This exploratory research shows that health care providers see considerable potential in, but also have considerable reservations about, using technologies in the clinical care of older adults. Providers seek to improve the human interactions of their patients, and believe that technologies could enhance this process in their patients, if applied in a thoughtful and individualized manner. There were no global or revolutionary benefits expected from health-related technologies. Providers stressed the importance of considering how information about patients could be used, and challenged the notion that more objective information would automatically improve health care. Designers, developers, and researchers might improve the utility and uptake of health-related technologies for older adults and their families by eliciting the viewpoints of clinical providers.

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