

Nurse perspectives on the implementation of routine telemonitoring for high-risk diabetes patients in a primary care setting

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Aims: The purpose of this qualitative evaluation was to explore the experience of implementing routine telemonitoring (TM) in real-world primary care settings from the perspective of those delivering the intervention; namely the TM staff, and report on lessons learned that could inform future projects of this type. **Background:** Routine TM for high-risk patients within primary care practices may help improve chronic disease control and reduce complications, including unnecessary hospital admissions. However, little is known about how to integrate routine TM in busy primary care practices. A TM pilot for diabetic patients was attempted in six primary care practices as part of the Beacon Community in Western New York. **Methods:** Semi-structured interviews were conducted with representatives of three TM agencies ($n = 8$) participating in the pilot. Interviews were conducted over the phone or in person and lasted ~30 min. Interviews were audio-taped and transcribed. Analysis was conducted using immersion-crystallization to identify themes. **Findings:** TM staff revealed several themes related to the experience of delivering TM in real-world primary care: (1) the nurse–patient relationship is central to a successful TM experience, (2) TM is a useful tool for understanding socio-economic context and its impact on patients' health, (3) TM staff anecdotally report important potential impacts on patient health, and (4) integrating TM into primary care practices needs to be planned carefully. **Conclusions:** This qualitative study identified challenges and unexpected benefits that might inform future efforts. Communication and integration between the TM agency and the practice, including the designation of a point person within the office to coordinate TM and help address the broader contextual needs of patients, are important considerations for future implementation. The role of the TM nurse in developing trust with patients and uncovering the social and economic context within which patients manage their diabetes was an unexpected benefit.

Key words: development; diabetes mellitus; evaluation; primary healthcare; telemedicine

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Introduction

Telemonitoring (TM) has been widely used in the United States, Europe, and parts of Asia to

improve monitoring and care for a wide variety of medical conditions (Meystre, 2005; Pare *et al.*, 2007; Bashshur *et al.*, 2014), in particular cardiopulmonary diseases, such as congestive heart failure and chronic obstructive pulmonary disease (Meystre, 2005) and other chronic diseases, such as diabetes (Bashshur *et al.*, 2014). In addition to studying the clinical effectiveness of TM for improving disease-specific

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indicators, TM has also been examined from an economic standpoint as a cost-effective initiative to improve access and quality of care for patients with chronic disease (Bashshur *et al.*, 2014) and help prevent hospitalizations among high-risk patients (Cherry *et al.*, 2002; Jaana and Pare, 2007; Pare *et al.*, 2007; Polisen *et al.*, 2009b; Bashshur *et al.*, 2014). A recent review cited several studies, conducted across a wide range of international settings, demonstrating the effectiveness of TM interventions for improving chronic disease management and reducing service use, mostly within the context of highly controlled randomized controlled trials (Bashshur *et al.*, 2014).

Diabetes is a global health problem, affecting millions of patients in countries around the world. In the United States, diabetes affects nearly 26 million people and is responsible for \$174 billion in healthcare costs each year (C.F.D.C.A Prevention (Centers for Disease Control and Prevention), 2011). A total of 511 407 diabetes-related preventable hospitalizations were reported in 2006, an increase of 18% since 1998 (Wang *et al.*, 2009). Of these hospitalizations, 36% were caused by short-term complications and uncontrolled diabetes (Wang *et al.*, 2009). Better outpatient management of diabetes in primary care settings could help prevent many of these hospitalizations (Dagogo-Jack, 2002; Greisinger *et al.*, 2004).

Research on TM effectiveness specifically for diabetes has demonstrated mixed results (Farmer *et al.*, 2005; Pare *et al.*, 2007; Costa *et al.*, 2009). Some studies report little to no effect on glycemic control or hospitalization rates (Farmer *et al.*, 2005; Costa *et al.*, 2009; Lin *et al.*, 2012; Takahashi *et al.*, 2012; Wakefield *et al.*, 2014). Others report that tele-health interventions are effective for improving glycemic control, patient education, reducing hospitalization rates among diabetic patients (Cherry *et al.*, 2002; Gomez *et al.*, 2002; Chase *et al.*, 2003; Jaana and Pare, 2007; Pare *et al.*, 2007; Polisen *et al.*, 2009b; Weinstock *et al.*, 2011; Stone *et al.*, 2012) and potentially reducing cost (Cherry *et al.*, 2002; Chase *et al.*, 2003).

TM has been proposed as a method to enhance primary care provision by filling patient information gaps between clinic visits and alerting clinicians to potential problems (Davis *et al.*, 2014; Koopman *et al.*, 2014; Wakefield *et al.*, 2014). Implementing TM into routine primary care (ie, outside of the context of a controlled experimental trial) must be

carefully considered, due to increased practice staff workload, concerns over data integration and clinical relevance, and, in the US context, limited reimbursement from insurance companies for care provided between office visits (Davis *et al.*, 2014; Koopman *et al.*, 2014; Wakefield *et al.*, 2014).

In 2010, Western New York was selected as one of 17 Beacon Communities nationwide by the United States Office of the National Coordinator for Health Information Technology. The Beacon Community Cooperative Agreement Program provided funding for three years to enable these communities to build and expand on regional health information technology (IT) infrastructure and demonstrate how health IT could advance patient-centered care, while achieving better health, better care, at lower cost (Ricciardi *et al.*, 2013; Des Jardins *et al.*, 2015). As part of this regional quality improvement initiative, a community organization implemented a TM pilot program with three homecare agencies to target primary care diabetic patients deemed to be at high-risk of hospitalization. The project was intended to provide monitoring and day-to-day management of high-risk patients in order to identify problems and intervene in the primary care setting, before patients presented to the emergency room or hospital.

The purpose of this qualitative evaluation study was to explore the experience of implementing routine TM in busy primary care settings from the perspective of those delivering the intervention; namely the TM staff, and report on lessons learned that can inform future projects of this type.

Program description

In this community project, the routine TM model was implemented with three homecare agencies and six primary care practices. The overall goal of the TM program was to demonstrate the effectiveness of TM as part of routine primary care for preventing hospitalizations among high-risk patients in real-world settings. In the context of the privatized US healthcare setting, this meant engaging with three different homecare agencies with slightly different equipment and procedures and a variety of practice settings. Each homecare agency provided patients with equipment (differed by agency; see Table 2) and educated patients on how to test themselves daily for weight, blood pressure and glucose. The TM agencies received patient

readings on a daily basis; nurses reviewed the patient data and responded to any numbers that were outside of predetermined limits (set in collaboration with the patients' provider), by calling the patient and/or the provider. In addition to TM, glucometers and test strips were provided for some patients with financial difficulties. The six primary care practices enrolled in the pilot identified diabetic patients (Type I or Type II, regardless of insulin use) meeting the following criteria: (1) between the ages of 18 and 75; (2) have congestive heart failure or chronic kidney disease in addition to diabetes and at risk (as determined by each practice) for hospitalization or re-hospitalization; (3) signed a consent to have data shared electronically; (4) expressed desire to participate in a TM program and follow TM guidelines; and (5) deemed likely that TM will improve care and patient outcomes, based on physician assessment. While practices were asked to enroll patients using these criteria, in this real-world implementation pilot, practices developed their own systems for identifying eligible patients and physician judgment was used to determine whether diabetes was uncontrolled or whether the patient was at risk for hospitalization. Specific parameters in terms of type of diabetes and hemoglobin A1c levels were left flexible, and each practice used different criteria for enrolling patients. Between May 2011 and August 2013, 144 patients were enrolled across the six participating primary care providers (PCPs) and 99 patients remained in the program for at least six months.

Evaluation methods

Qualitative interviews were conducted with staff from the TM vendors (nurses and administrators) to identify key factors affecting the implementation of TM in the primary care practices and the experience of day-to-day TM.

Data collection

Between February and June of 2013, semi-structured qualitative interviews were conducted with nurses and administrators from the three TM agencies participating in the pilot. The same set of questions was used for both nurses and administrators, and in some cases they were interviewed jointly (Table 1). TM staff were asked about their

experiences with the Beacon TM pilot including, their daily roles and activities, the nature of their interactions with patients and providers, and their thoughts on using TM to prevent hospitalizations. These participants were chosen to gain insight into the interface between the TM agency and the primary care practices, from the perspective of the agencies providing the intervention. Interviews were conducted by a medical anthropologist (BMV) over the phone or in person and lasted ~30 min. Interviews were audio-taped and transcribed. The study protocol was approved by the Social and Behavioral Sciences Institutional Review Board at the [University at Buffalo]. All participants provided informed consent to participate in the interviews; written consent was used for in-person interviews and verbal consent with the provision of a study information sheet was used for telephone interviews. Participants received a \$20 gift card as a thank you for their participation.

Data analysis

Two researchers (a medical anthropologist (BMV) and an RN/MPH (VMH)) independently reviewed the transcripts and identified themes. Analysis was conducted by means of immersion-crystallization (Borkan, 1999), an iterative process of data analysis whereby the researchers immerse themselves repeatedly in the data to identify emerging themes. Analysis was content-driven, allowing the data to 'speak' for itself without being guided by a theoretical model. Themes were identified based upon repeated ideas that emerged across interviews. After independent review, the researchers met to compare identified themes and resolve any discrepancies. Because the interview questions were the same, the nurse and administrator transcripts were analyzed as a collective, and the themes cut across both participant groups. While a small sample, the eight interviews represent all TM agency staff engaged in this implementation pilot, and therefore, all experiences and perspectives were captured in the analysis. Data analysis was based upon all individuals participating in the pilot, rather than on theoretical saturation. Nonetheless, analysis of the transcripts revealed remarkably consistent responses, perceptions and experiences across all participants, indicating probable saturation.

Table 1 Telemonitoring (TM) staff interview questions

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1. How long have you worked as a telemonitoring nurse?
 - a. What is your background, degree?
 2. What do you know about the Beacon telemonitoring program?
 3. Describe your process for utilizing the Beacon telemonitoring data and responding to alerts from the system.
 4. What types of contact or interactions do you have with the patients?
 - a. How often are you in contact with the patients?
 - b. How long does this contact usually last?
 5. What is the most common trigger for contact with your patients?
 - a. How do you handle these situations? Which steps do you take?
 6. Do you provide patient education?
 7. Which types of patient education do you provide to the patients?
 - a. How often do you do patient education?
 - b. Are you sending anything back to the patients?
 8. How often are you in contact with the patients' practice?
 - a. Who is your main contact?
 - b. What most commonly triggers this contact?
 9. What are your perceptions of the patient experience with the Beacon telemonitoring?
 10. What are your perceptions of the practices' experience with the Beacon telemonitoring program?
 - a. What differences do you see between the practices you work with on the Beacon program?
 - b. What differences do you see between this telemonitoring program and other telemonitoring programs?
 11. How effective do you feel the Beacon telemonitoring is for patients?
 - a. Examples of improved cases?
 12. Do you believe that the preventive telemonitoring has helped reduce hospital admissions?
 13. Do you believe that preventive telemonitoring has improved patients' health overall?
 - a. Could you provide examples?
 14. What suggestions do you have for improving the Beacon telemonitoring program?
 15. Is there anything else about your experiences with Beacon you would like to share with us that we haven't already talked about?
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Results

Interviews were conducted with eight staff from the TM agencies; five TM nurses and three agency administrators. One administrator and at least one nurse from each of the three agencies were interviewed. TM nurses were responsible for working with the patients each day. The administrator from each agency was responsible for overseeing all TM, including the set-up and coordination of the Beacon TM program within their agency. All of the administrators had previously worked as nurses in direct patient care and in TM before shifting into an administrative position at their respective agencies. All of the nurses had some experience working in the TM field (range 2–12 years) and had worked several years in other areas of healthcare before beginning work with TM. These TM nurses were not dedicated solely to the Beacon project, and were simultaneously assigned to other patients within their organization. Each agency reported ~25–50 patients enrolled in the Beacon TM program, but were monitoring hundreds of patients across multiple programs daily.

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From the perspective of the TM staff, they conducted the same daily procedures and activities related to the Beacon patients as for other TM patients (see description below). TM staff described the main difference between the Beacon TM and other TM programs as the emphasis on diabetes, and the length of time patients were on the TM program (up to two years as compared with 60–90 days of TM that would normally be covered under other programs).

The interviews revealed variation in the TM intervention provided by each of the agencies. The TM agencies varied in their approach to providing TM services, such as: the equipment used with patients, the amount of patient education provided by the TM device, the process for setting the patient up with TM, and the protocols for when and how to contact patients and providers (Table 2).

Although considerable variation existed in the TM modality used by the three agencies, there was an overarching consistency among the TM agencies in how they conducted their daily TM responsibilities. Patients tested blood sugar,

Table 2 Variation across telemonitoring agencies (information based on interview responses from participants)

TM agency	TM system	Other equipment	No. of nurses	No. of patients (at most on Beacon)	Patient education through TM device	TM device asks health symptoms	Initial set up/ face to face with patient	Patient contact	Physician contact	If no testing
T1	Health Buddy by McKesson Wired and some wireless option	None provided	Two nurses (share all patients)	~22	Education specific to disease	Daily health/ symptoms	Separate installer sets up equipment	Only contacts patients if alert	Only if there is a problem	Call patient that day if no test, after two days of no testing notify doctor and patient every day
T2	Android-based Smart phone/ bluetooth system	Patients provided with glucometer and initial supply of test strips	One nurse	49	No education through TM device	None	TM nurse does all installation and meets patients face to face in their home	Tries to maintain weekly contact with all patients, even if normal results	As needed for problems, send reports on all patients at intervals	Call patient after one day of non-use
T3	Cardio Com Wired (must plug into unit once/day)	Unknown	Two nurses (each assigned one practice and its patients)	~45	Limited education for first 60 days, then 'drops off'	Daily health/ symptoms	Separate nurse sets up equipment, one nurse reported meeting all patients at the practice before TM	Only contacts patients if alert	As needed for problems, send reports on all patients at intervals	Don't necessarily call if just miss one day – call after three days of non-use

weight, and blood pressure daily, and sent these results to the agency. If any of these measures were outside of predetermined parameters established by the patients' doctors, the first course of action by all nurses was to contact the patient to assess the situation. The patients' physicians were notified after this point, though the mechanisms and timing of the notification varied depending on TM agency policy, practice preferences, and the patient situation. Nurses would generally fax an update to physicians if the problem was resolved, or call if a more immediate response was needed.

Analysis of the interview transcripts identified four themes: (1) the nurse–patient relationship is central to a successful TM experience, (2) TM is a useful tool for understanding and addressing patient context, (3) TM staff anecdotally report important potential impacts of TM on patient health, and (4) integrating TM into primary care practices needs to be planned carefully. Each theme is described in the text; exemplary quotations and additional details are provided in Table 3.

The nurse–patient relationship is central to a successful TM experience

The TM nurse–patient relationship was a predominant theme, highlighted as important to three areas of the TM program; (1) patient education, (2) generating trust, and (3) providing patients with a sense of security.

Patient education

TM staff cited patient education as a significant portion of their role. This education was provided in several different formats. Two of the three agencies used TM systems that delivered disease-specific education through the device itself, in the form of generalized daily 'quiz' questions about diabetes self-management. All of the agencies provided patients with educational materials. TM staff reported providing verbal education individualized to each patient's needs throughout each encounter and indicated that the form of education evolved over the course of the project, from more intense education at the beginning, to 'refreshers' as the project progressed and patients became more familiar with their disease and its management.

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Generating trust

TM staff described excellent rapport with patients over the phone, as they built trust and learned about their patients. The continuity in the relationship was important in finding out what was really happening in patients' lives. Trust enabled the TM staff to uncover social and economic factors affecting patients' test results.

Providing a sense of security

TM staff explained that patients appreciated the relationship; the sense that someone cares and 'has their back.' Compliance was facilitated by the reassuring feeling that someone cared about them and their health.

TM is a useful tool for understanding and addressing patient context

TM staff noted that they were involved in the full context of patients' lives, assisting with a wide range of social, financial, and non-diabetes-related health concerns affecting patients' ability to manage their diabetes. For example, contact prompted by reviewing patients' TM data led to TM staff learning about contextual factors that impacted patients' ability to manage their diabetes, such as difficulties with insurance coverage for certain medications or testing supplies and financial difficulties related to low-income status, such as eating poorer quality foods at the end of the month when resources were low. As one staff member said, TM 'opens the door' to a whole range of other issues that impact patients' health.

TM staff anecdotally report important potential impacts of TM on patient health

TM staff reported improvements they observed in patients who adhered to TM, including: losing or maintaining their weight, decreases in HbA1c, and increased discipline. TM enabled staff to comprehensively address patients' health needs beyond diabetes, such as discovering undiagnosed hypertension and providing wound care.

In addition, they were able to expedite care for urgent health needs while avoiding unnecessary office visits. Although they had no quantitative data to substantiate this, TM staff reported an impression that TM was effective for preventing hospitalizations and emergency department visits, because

Table 3 Telemonitoring (TM) Staff identified lessons learned and example quotations

Theme	Sub-theme	Quotation
Nurse–patient relationship central to successful TM	Patient education	When we talk with them, we're always in how-can-I-help-you-to-learn mode and help them to know how to best handle their process, their disease process.... They might have questions on their new insulin, 'the doctor put me on this, is it long-acting, is it short-acting. They went so fast in the office I didn't get it...' (Participant T1-2 ^a)
	Generating trust	...they'll tell you that they just had a cheeseburger, a small fry and a diet pop when they really had a whopper, a large fry, an apple pie and a regular pop and you just build up the rapport with them. You have to tell them, 'well that wouldn't make your blood sugar real high so what else did you have?' 'Oh well I'm lying' and then come out and tell you the truth. Great rapport over the phone with many of them. (Participant T3-2) Or they run out of their money, so for five, six days they don't have any medications... That's sad and it takes a while before they will admit to you that, that's a problem for them... You have to be very careful how you speak to them and eventually they trust you and say, 'yeah, I don't have the money.' (Participant T2-2)
	Providing a sense of security	I think that when clients feel that they're being cared for, somebody cares about them... their compliance with their medication and their... diet is enhanced. (Participant T2-1)
TM useful for understanding and addressing patient context		We have lots of people who have challenges just because of their insurances and different things happen in their lives; they lose their job, ... you see their blood glucoses increase and then you see that they're not taking their insulin, 'well, it's the beginning of the year, I can't afford my insulin.' We have depression, the nurses will give you examples of things like that, crisis, we had to call Crisis Services because of depression. (Participant T3-1)
TM staff perceive important potential impacts of TM on patient health		I have a patient that weighs over 400 pounds... [He] developed bilateral leg ulcers. With the help of some supervisors here at the [agency] and the provider he was affiliated with, we were able to get him out-patient wound care and insulin through charity care of the companies that manufactured the insulin.... The wounds all healed up in about a year's time... he never was hospitalized and he did phenomenal. His hemoglobin A1C went from being above average to right at normal, although his weight didn't change... (Participant T3-3)
		Say for instance, a patient has a small blister on their foot and it hurts and it bothers them, but they have an appointment two weeks from that time. Most patients in my experience, will wait for their appointment... Where now these things come up and... I say, 'do you truly have a wound?' and if they say yes, I explain to them how advocating for themselves right now is so beneficial to them as opposed for waiting two weeks... and making the problem bigger. (Participant T3-3)
Integrating TM into primary care practices needs to be planned carefully		I think in the beginning they really thought, 'holy cow, these reports are a lot and I can't believe we got ourselves into this.' And the phone calls that we made in the beginning and getting everybody set up... was a little much.... It takes probably four months to get things from infancy to where you're all comfortable. (Participant T3-2)
		I think both practices like having their clients being looked after. We have a better communication with one office than we do the other. P1 has a certified Diabetic educator on board and that obviously has been a big plus for this type of a grant when you're working with diabetics. We have access to her immediately. Sometimes with P2, we don't have the same type of response although I do believe that the physicians and the clients both enjoy being on the program. But we've had good response from both offices, different types of responses. (Participant T2-1)

^a Participant numbers refer to the TM Agency (T1, T2, or T3) and the Participant no. (1, 2, or 3) from that agency.

they were able to identify and arrange for treatment of health issues, such as those mentioned above.

Integrating TM into primary care practices needs to be planned carefully

TM staff reported a variety of elements affecting the integration of TM into primary care. Communication varied based on practice preferences. The frequency of reporting, the content of reports, and transmittal of reports (phone, fax, etc.) varied by practice. In most cases, the practice had identified a care coordinator or certified diabetes educator as the primary contact for the TM agencies. TM staff reported positive relationships with these individuals, and noted that communication was more difficult in practices without an identified point person. Project intensity for the practices varied over the course of the pilot. TM staff identified several factors at the practice level which they felt impacted the practice experience with TM, including: difficulties with designating staff to coordinate the program, implementing office workflows designed to optimize the use of TM while limiting extra work, and the level of physician buy-in and engagement – which they felt impacted patient engagement. TM staff stressed the importance of selecting appropriate patients for a TM program; based on their experience they reported that patients with uncontrolled diabetes and who were willing to use TM made the best candidates for the program. They also suggested that there should be physician incentives to use the TM data, and ease of use, such as a one-click, visual and easy to read format. Finally, in terms of communication, TM staff would have appreciated more information from the providers regarding care the patient received outside of the TM, such as lab results, medication changes, and appointment results.

Lessons learned

A TM program is one method by which PCPs can more closely monitor high-risk patients and collaborate with TM staff to identify key factors affecting patient health outcomes. Even though we had a small sample, our study uncovered many findings that confirm and add to previous studies, conducted both in the United States and

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internationally, on this topic (Davis *et al.*, 2014; Koopman *et al.*, 2014; Wakefield *et al.*, 2014). Our findings strengthen previous work by corroborating their findings from a previously unrepresented perspective, that of the TM staff. Identified themes illustrate important challenges and unexpected benefits of the TM pilot which translate into lessons learned for future projects of this type.

First, TM should focus on the nurse–patient relationship. Our findings underscore the importance of the nurse role in uncovering social determinants of health and acting as a support to patients. Kahn *et al.* observed this extension of the TM nurse in providing social support and addressing patients' needs to improve health outcomes (Kahn *et al.*, 2009). Our study builds on these findings by examining the role of the TM nurse in developing trust with patients and uncovering the social and economic context within which patients manage their diabetes. This was an unexpected benefit of the TM in this pilot, and one that may be critical to improving patient outcomes. Due to their daily involvement and understanding of patients' situations, TM staff can identify issues crucial to patient health that may be missed in the context of widely spaced office visits. Having a TM nurse who can fulfill this role complements and enhances the care provided in a primary care setting. Providing resources to help TM agencies and practices address the socio-cultural determinants of health uncovered during TM is an important consideration for future projects.

Furthermore, the TM staff in this study repeatedly emphasized additional non-clinical benefits to the patients, such as their appreciation for knowing that someone was monitoring their health. This supports other studies, which have documented the benefits of TM for the patient in terms of mental well-being and security as important, albeit non-quantifiable, positive effects of this type of intervention (Jaana and Pare, 2007; Kahn *et al.*, 2009; Johnston and Weatherburn, 2010; Pols, 2010; Pecina *et al.*, 2011; Fairbrother *et al.*, 2012), which are important considerations in an effort to provide patient-centered care. Further study is needed to determine if TM is the most effective way to provide this type of contact, or if other interventions, such as community health workers and peer models, might provide similar results. One possible advantage of the TM model might be the integration of this support with clinical information.

Similar to what has been reported in other studies (Jaana and Pare, 2007; Fairbrother *et al.*, 2012; Davis *et al.*, 2014; Koopman *et al.*, 2014), TM staff reported challenges encountered in the integration of TM into the routine workflow of real-world primary care offices, particularly around communication and coordination. From the perspective of the TM staff delivering the intervention, increased communication and integration between the TM agency and the practice are important – especially designating a point person within the office to coordinate TM and address patients' needs. However, TM staff indicated awareness that providing time for such functions remains a challenge for primary care practices in implementing this model. Some studies have reported that TM programs increase provider time for reviewing and responding to additional patient data (Jaana and Pare, 2007) and may also trigger more office visits (Polisena *et al.*, 2009a). Other studies have reported that TM systems that are not integrated with the electronic medical records create extra work, and that information flows and practice staff workflows need to be carefully thought out and defined (Fairbrother *et al.*, 2012; Davis *et al.*, 2014; Koopman *et al.*, 2014). Successful office integration of TM was enhanced by designated care coordinators who viewed TM care as part of their role (Koopman *et al.*, 2014). Our results support these findings and indicate that practices and TM agencies should work together to establish workflows that maximize the potential use of TM data while being mindful of provider time and efficiency.

Finally, TM staff in our study emphasized both disease control and patient buy-in and willingness to use the TM technology as key factors to consider in regards to how patients are identified for the program. Koopman *et al.* come to a similar conclusion, recommending that patients who were changing their regimen, were newly diagnosed or were uncontrolled – yet are motivated to make a change – may experience greater benefit from a TM program (Koopman *et al.*, 2014).

Limitations

The qualitative data presented here were collected from a small sample of respondents participating in one pilot program. However, many of the findings support what has already been

reported in the literature, corroborating their importance from the perspective of a different TM user group. Reports of improved patient outcomes as a result of the TM are anecdotal and may be subject to bias. Demonstrating improved outcomes was beyond the scope of this qualitative study. Rather, the goal of the qualitative evaluation was to understand the experiences and lessons learned from implementing TM into primary care practices from the perspective of the TM staff.

Another limitation is the absence of perspectives from the other parties (patients and PCPs) participating in the TM pilot. This may have resulted in a partial understanding of the overall experience of the TM program, providing the perspective of only one set of users. However, the findings from this study complement those conducted in other studies with other TM user groups (Davis *et al.*, 2014). We attempted to include staff from the PCP offices but were unable to identify a cohort of individuals across all participating practices that had consistently worked with the TM program for long enough to provide an informed and meaningful perspective and thematic analysis was fragmented. Additionally, consent agreements signed with the patients precluded evaluators from contacting patients enrolled in the pilot for their perspective. Hence we limited this study to the TM staff delivering the service to the patients. While a small sample, the eight individuals interviewed represent 100% of participating TM staff, so we believe that all experiences and perspectives were adequately represented.

The wide variation in TM implementation within the pilot is another limitation. It is not possible to determine the effects of this variation on the experience of the TM or the perceptions of interviewed TM staff. However, this variation is indicative of the real-world primary care landscape and likely circumstances surrounding the implementation of TM, which makes these findings potentially useful for a wide range of settings, both in the United States and internationally.

Conclusion

This qualitative exploration of the implementation of telemonitoring for high-risk diabetic patients in US primary care settings revealed several lessons learned. Telemonitoring may offer benefits for the

preventive monitoring of at-risk patients in the primary care setting. However, its implementation into the real-world setting of primary care practices needs to be planned carefully in order to maximize the benefits of TM and minimize additional burden on practices. TM staff are positioned to play a key role in the primary care management of high-risk patients by providing timely information about changes in patient health and by identifying contextual factors that impact patient self-management, contributing to more holistic patient-centered care.

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Conflicts of Interest

None.

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