

New Technologies to Advance Self-Management Support in Diabetes

Not just a bunch of cool apps!

The article by Walker et al. (1) in this issue of *Diabetes Care* highlights how new applications of existing modes of communication and the use of new technologies can improve the delivery of care for patients with diabetes. In this case, care was successfully brought to a poorly controlled patient group using the medium of live telephone calls. New types of technology-based interventions focus on the use of the telephone, Internet, mobile communicators, pagers, web-based programs, and email to assess and monitor patient health status, address symptoms and behaviors, and foster changes in various aspects of disease management—in this case better medication adherence and improved glycemic control.

The purpose of these emerging systems is to expand programs of self-management support (SMS), a generic term applied to strategies that provide patients with the information, tools, and support they need to take care of their health problems (2,3). The development and application of a spectrum of interventions that involve new media expand evidence-based methods of patient monitoring and intervention that traditionally have taken place within the clinical setting to real-world environments in ways that are congruent with patient lifestyle, age, and cultural setting (3,4). The underlying assumption is that such programs can be more successful, sustainable, and cost- and time-efficient than traditional approaches and that they have the potential to reach high risk patient populations that generally do not come to their doctor's office for regular care (3,5). These SMS programs vary in complexity, from simple telephone-based programs of symptom monitoring to highly elaborate, web-based programs with complex branching algorithms that assist patients with improving self-care over time (6). The increased popularity of these programs, coupled with real-world questions about their practical usability in clinical care, cost, sustainability, and effectiveness, cause us to reflect on how such pro-

grams should be translated for general use and integrated into care for patients with diabetes. Now that the field has matured by the variety of available evidence-based technological SMS programs currently available, the need to establish criteria for translation into the real-world of clinical care is apparent (4). Sadly, too often such programs are supported by time-limited external resources, and even if proven effective, they are shelved when the project is completed because they cannot easily be integrated and supported by ongoing care systems.

In this editorial, we provide a perspective for surveying this expanding field by reviewing a template of five inter-related questions that summarize the major translational issues for SMS programs based on new technologies (Table 1). Without such consideration, we risk not taking full advantage of the unique strengths and not avoiding the potential drawbacks of these programs to improve outcomes for patients with diabetes.

What is the specific purpose of the SMS program?

What is often missing in the selection and use of SMS systems in clinical care is the clear targeting of specific goals: what exactly is the target of the program and how will it be achieved? Are there multiple SMS goals to be addressed or is the focus more narrowly drawn? For example, the telephone-based intervention designed by Walker et al. was concisely focused on reducing A1C, as are many SMS systems for patients with diabetes. In this case, however, a specific proximal mechanism of change was designed into the intervention: enhancing medication adherence. Many existing SMS programs are developed without this kind of clear outcome targeting, meaning that a specific behavioral domain and a sequencing of behavioral change goals are not identified at the outset. SMS programs are often developed to address only the distal goal of improved glycemic control by using a proximal goal of weight reduction, in-

creased physical activity, or medication adherence. Proximal change goals, however, are rarely assessed comprehensively or seen as major outcomes in their own right, because the primary aim is change in A1C, the distal goal. This is an important consideration, because it is entirely possible that the proximal goal, in this case medication adherence, could have been achieved without being followed by achievement of the distal goal, in this case a reduction in A1C. When this occurs, the intervention is often deemed a failure, even though the actual behavioral change targeted was achieved. Many factors affect glycemic control, and changes in one potential influence may be insufficient to significantly affect A1C, especially over the course of time involved in clinical trials. As a general rule, it is crucial to judge the effectiveness and utility of a specific SMS intervention by observing changes to both proximal and distal targets, and not to rely solely on changes to a distal outcome that can be influenced by multiple factors, such as A1C.

A related issue is time frame: can the change targeted be achieved by a defined but time-limited intervention, or will it require a longer-lasting program that includes a greater investment in patient engagement, intervention, and support? For example, Walker et al. found that changes in medication adherence were achievable within the limited time frame of the study. In contrast, major reductions in body weight, the target of many SMS interventions with new technologies, require much longer time periods, supplemented by ongoing programs to maintain weight loss over time. Many SMS programs using new technologies demonstrate initial success and then stop, with a subsequent return to preintervention levels because they did not consider that achieving and maintaining behavioral change is not a one-time experience. Both diabetes and disease management are chronic conditions requiring ongoing support and intervention, which can be a major strength of new technologies if addressed and in-

Table 1—SMS Questions

1. What is the specific purpose of the SMS program?
 - a. What are the proximal and distal goals? Is the focus behavior change, clinical status, or symptom monitoring?
 - b. Can behavior change and maintenance be achieved in a time-limited way, or will it be gradual, requiring ongoing support?
 - c. Is the SMS goal comprehensive or highly targeted (intensive vs. extensive intervention)?
2. Which patients will be targeted?
 - a. Demographics: age, ethnicity, gender.
 - b. Severity of disorder or symptoms.
 - c. Level of risk.
 - d. Level of media experience and preference (personal and cultural).
3. Which media and media characteristics will be utilized?
 - a. Media (web, email, telephone, etc.)?
 - b. How many bells and whistles (level of program complexity).
 - c. Is this a stepped intervention, does one program fit all?
 - d. What is the ratio of human to technological contact (balancing the cost of human contact)?
 - e. How much emphasis is there on patient engagement and maintenance?
4. Will the SMS program be integrated into the patient's ongoing clinical care?
 - a. Where does the program come from (the practice, health plan, employer, or stand-alone source)?
 - b. To what degree is the program built around relationships between patients and HCPs or staff? Or is this a carved-out, stand-alone program?
 - c. How and by whom (clinicians, staff, patients) will the information generated by the program be used?
 - d. How will the program be framed for patients, clinicians, and practice staff?
5. Costs.
 - a. Who will support the program financially, e.g., clinical practice, health plan, patient, medical group?
 - b. What are the development costs?
 - c. What are the initial costs for customizing and implementing the program in each setting?
 - d. What are the ongoing costs of use over time (information technology staff to maintain the program, clinical staff to make use of the information, etc.)?
 - e. Are there patient costs?

incorporated into the SMS program at the outset. In the current example, it remains unclear if the documented improvement in medication adherence can be sustained and whether the SMS program will need to be altered to assist with maintenance of medication adherence over time.

Which patients are to be targeted?

The greater the effort devoted to defining the patient population of interest, the better the outcomes, the higher the acceptance rate, and the lower the attrition (7). Tailoring SMS interventions for specific patient groups increases the probability of obtaining positive results. For example, simply making a web-based program available to everyone may be beneficial because it is inclusive, but the lack of tailoring will often exclude many of the most needy or high risk patients who could profit most from the intervention. The criteria identified for inclusion in the program reported by Walker et al. were specific: these were patients who were

poorly controlled, rarely came for care, identified with a respected institution (their Union), and were generally from a single ethnic group. Much effort was devoted to using cultural cues to engage these patients, and the Union was used as a common, trusted institution to enhance reach. The success of these efforts was revealed by high patient uptake and relatively low attrition over time. Even the choice of media was carefully considered: this was a sample that might best be engaged via live contact through the telephone rather than, for example, through interactive voice recognition (IVR) technologies or web-based/email programs, even though they are far less expensive to deliver. A comparable program for patients from another ethnic group or from another education level might best be designed quite differently. One-size-fits-all SMS programs may be relatively inexpensive for an entire patient panel, but they are often highly inefficient with respect to high risk patients who need them the

most. At minimum, we suggest that the following patient characteristics should be considered when making use of new technologies: age, sex, ethnicity, education, severity of disorder or symptoms, level of risk, and experience with and preference for different media.

Which media and media characteristics will be utilized?

Many currently available SMS systems using new technologies are complex and sophisticated in terms of available options and ability to be customized both within and across different media. Some emphasize programs to engage patients in the process and to assist in the maintenance of gains over time (8). Still others allow for "stepped interventions," for different levels of intervention intensity based on patient need or preference, or for multiple interventions, with patients choosing the specific goals and subprograms (9). Although this sophistication is attractive, much of it will be often underused when the program is translated into clinical practice with a large, diverse panel of patients. Most patients access only a limited number of features in complex SMS programs (10,11). Although many programs are elegant, the usability, accessibility, and targeting of specific goals for both patients and care teams may be best (12).

Not all media are equally effective for all types of SMS programs, and careful consideration needs to be directed at deciding which medium is best for which intervention and for which patients. For example, IVR technology has been used successfully for symptom monitoring and for relatively short and simple communications between patient and care team, such as clinical status reporting (13). However, IVR programs can be tedious and repetitious for more complex tasks, where web-based audio and visual cues can be more helpful and patients can remain engaged for longer time periods. Consequently, there needs to be a careful match between each specific SMS program target, the clinical population identified, and the medium selected for use. A single intervention program cannot easily be translated across different media with the assumption that one can be substituted for another. And not all patients with diabetes will be equally attracted to the same program.

Another important issue concerns the amount of live versus automated patient contact included in the program. Although costs are generally higher with

more live than automated patient contact, deciding to utilize less live contact with some patient groups may not be cost-efficient. The ideal balance of live to technological contact is often based on the patient's cultural context, level of risk, age, and life context. To reduce cost, personal contact can be utilized initially and then decreased over time, depending on patient need, once a relationship with the live program representative has been established. And patient preference can be utilized in tailoring a program—some patients actually prefer fully automated systems, whereas others firmly do not. For example, one highly experienced computer user surprisingly rejected a web-based program: "I spend my entire day working on the computer and when I get home I don't even want to look at my PC." Although a totally automated program may be effective for a subset of the population, a well-balanced, flexible, patient-tailored level of live contact generally appeals to a wider audience and may prove to be most effective in terms of cost and clinical outcome.

How will the SMS program be integrated into the patient's ongoing clinical care?

How integrated and seamless is the SMS system with respect to the broader delivery of the patient's diabetes care? Most currently available SMS programs are free-standing; they are not easily integrated within office-based electronic health records and other automated clinical care systems, or patients seek them out on their own, which leaves the SMS activity completely separated from the care team. Still others are offered by an employer or a health insurance plan with no direct linkage to the diabetes care team. In the study reported by Walker, et al., the SMS program was designed to operate independently of the patient's regular care team. When translated into the real-world of clinical care, how would health care practitioners (HCPs) know about such a system and make effective use of it when caring for individual patients?

The growing interest in integrated systems of care, modeled after the Patient-Centered Medical Home (14–16), suggests a need to provide more coordinated and informed services in collaboration with patient need and preference. As these new models of primary care have gained acceptance and traction, practices are showing increased interest in integrat-

ing SMS programs of various types into their care. Free-standing or carved-out SMS programs stand in sharp contrast to these recent developments and raise concerns about the pitfalls of fragmented care, especially for high risk patients with diabetes. In general, patients are far more likely to continue with an SMS program over time when it is based on a positive relationship with their HCP and when it is viewed as an extension of their care (17). We argue that SMS programs for diabetes need to be linked to the broader system of patient care so that both patients and providers are fully informed about SMS activities and care can be fully coordinated and integrated.

Deciding upon the adoption of an SMS system that uses new technologies also requires careful consideration of work flow—how the information derived from the system will be collected, summarized, and used in the clinical setting. Who in the office will monitor patient SMS activities recorded by the program? How will the information be documented in the medical record? How will it be practically summarized for use during the next clinical encounter or red-flagged for a more immediate response? SMS information adds to already high staff demands to integrate a great deal of clinical information needed for good diabetes care (18).

What is the development and implementation cost and how will the SMS program be supported long-term?

The intervention reported by Walker et al. was funded by grants from National Institutes of Health and the Union pension fund. From a translation perspective, no information is provided about the overall costs of program development, implementation, and long-term use. In the real world of clinical care, it often remains unclear who will shoulder the various substantial costs of SMS programs: the clinic, the medical group, the health care plan, the employer, the patient? And how will the program be framed for the patient—is this their doctor's program, their health plan's program, their employer's program? This framing, based in part on who designs and pays for it, can have substantial effects on patient follow-through and outcome. It is important that SMS outcome studies track and report information regarding the cost of development, implementation, and maintenance to inform decisions regarding the optimal

deployment of the program on an ongoing basis.

CONCLUSIONS— SMS programs for patients with diabetes make use of the full range of electronic media, from simple automated telephone monitoring to more complex, web-based lifestyle change programs. Most of these programs have evolved outside of the traditional care system and others were developed internally but often lack the resources to be maintained over time. Care systems have been relatively slow to adopt SMS programs and to integrate them into more comprehensive care for patients with diabetes. The pressing need to deliver cost-effective, population-based care that reaches out to the individual needs of patients with diabetes calls for practitioners to become proactive in selecting and customizing efficient, semi- and fully automated SMS programs. The program described in the paper by Walker, et al. serves as an excellent model, but it also raises important questions. Using a variety of different media, these programs have the potential for expanding care from traditionally delivered office-based encounters to care that reaches into the patient's home and community. These programs require that clinicians engage in active and systematic consideration of the patients who might use it, the specific SMS behaviors that are targeted for change, the type of media that will be used, the time frame of the program, who will pay for it, and how the program will be integrated into a broader program of comprehensive diabetes care.

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