

Telemanagement of hypertension: A qualitative assessment of patient and physician preferences

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BACKGROUND: Prevalence surveys have consistently found that the blood pressure control rate among people with hypertension is less than 25%. Studies of telemedicine as a means of providing care to hypertensive patients have shown that this approach is effective in lowering blood pressure. Major design flaws and high operating costs, however, have hindered its adoption by physicians and patients.

OBJECTIVES: In the present commentary, the field of telemedicine, as it pertains to hypertension management, is reviewed, and the investigators' experiences in developing a new telemedicine system are outlined.

METHODS: An applied qualitative case study approach was used to determine the information needs for the design of a telemedicine system. Opinions were elicited separately from type 2 diabetic patients with hypertension (n=24) and family practitioners in active clinical practice (n=18).

RESULTS: Physician and patient focus group meetings provided key information that led to changes in the prototype system. The low level of computer and Internet use by patients in everyday life and by physicians in practice-related activities precluded their inclusion in the design of the system for information retrieval and receiving clinical alerts. For patients, the mobile phone appeared to be an acceptable alternative. The only practical, automated means to disseminate reports and alerts to physicians was by fax, which was the most universally available device in a doctor's office.

CONCLUSION: This tightly focused qualitative study led to the development of design principles for a prototype system, increasing the likelihood of user acceptance and improving its effectiveness.

Key Words: *Blood pressure monitoring; Diabetes; Hypertension; Mobile phone; Self; Self-care*

More than one in three Canadians have at least one chronic health condition, and this prevalence will continue to grow as the population ages (1-3). Chronic illness now accounts for almost three-quarters of our total national health care expenditures and has the potential to consume most health care budgets in the future (1,3). Equally disturbing is the finding that most chronic illnesses are inadequately treated (2,3). Among the many reasons for this poor result is the method of health care delivery itself. The current system is better suited to handle acute health problems than the nuances of

La prise en charge de l'hypertension à distance : Une évaluation qualitative des préférences des patients et des médecins

HISTORIQUE : Les études de prévalence révèlent constamment que le taux de contrôle de la tension artérielle (TA) chez les hypertendus est inférieur à 25 %. Les études sur la télémédecine comme moyen de soigner les hypertendus ont démontré que cette démarche est efficace pour abaisser la TA. Cependant, d'importants défauts de conception et des frais d'exploitation élevés ont empêché leur adoption par les médecins et les patients.

OBJECTIFS : Dans le présent commentaire, on examine le domaine de la télémédecine pour la prise en charge de l'hypertension et on expose les expériences des chercheurs dans l'élaboration d'un nouveau système de télémédecine.

MÉTHODOLOGIE : Une étude de cas qualitatifs appliquée a permis de déterminer les besoins d'information nécessaires pour concevoir un système de télémédecine. On a obtenu l'avis distinct d'hypertendus atteints de diabète de type 2 (n=24) et de médecins de famille en pratique clinique active (n=18).

RÉSULTATS : Des réunions des groupes de travail de médecins et de patients ont fourni de l'information capitale qui a suscité des changements au système prototype. La faible utilisation des ordinateurs et d'Internet par les patients dans leur vie quotidienne et par les médecins dans les activités reliées à leur pratique ont empêché leur inclusion dans le système afin d'extraire des données et de recevoir des avertissements cliniques. Pour les patients, le téléphone cellulaire semblait constituer une solution acceptable. Le télécopieur était le seul moyen pratique et automatisé pour diffuser les rapports et les avertissements aux médecins, l'appareil le plus universellement présent au cabinet du médecin.

CONCLUSION : L'étude qualitative bien circonscrite a donné lieu à l'élaboration des principes de conception d'un système prototype afin d'accroître la probabilité d'acceptation par l'utilisateur et l'amélioration de son efficacité.

chronic disease management. Moreover, primary care physicians often have to set priorities in dealing with medical conditions, which generally results in postponing decisions about more chronic or preventive matters when faced with an acute situation (3).

Hypertension is a major risk factor for cardiovascular and renal disease, and the health benefits of lowering blood pressure (BP) are well documented. Nonetheless, population surveys have consistently found that fewer than one-quarter of hypertensive patients have their BP under good control (4).

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Cited reasons for this poor result include patient-related factors such as nonadherence with prescribed treatment, health care system barriers such as difficulties in accessing health care (in Ontario, a growing shortage of primary care physicians) and physician-related factors (5). It is now well documented that physicians frequently fail to intensify therapy when therapeutic goals are unmet, a concept known as clinical inertia (6). This failure is not solely related to physicians' lack of knowledge about standard of care guidelines (7); it may also reflect their response to cues from patients of their unwillingness to accept more aggressive treatment (8).

It is encouraging that clinical trial data show that many barriers to good BP control can be overcome (9). Key components accounting for their success include constant surveillance of BP and other physiological parameters, feedback to patients on progress toward the goals of therapy and reminders to health care providers to treat to a target pressure. It is unclear, however, whether the lessons learned from these trials can be adapted to a primary care setting. Successful adaptation requires a willingness on the part of patients to become more actively engaged in managing their own care, improvement in home surveillance techniques, and parcelling the information gathered by patients in ways that are meaningful to them and clinically useful to health care providers.

Self-monitoring of BP at home has been extensively evaluated as a potentially useful tool to improve BP control and medication adherence in hypertensive patients (summary table available on request), and the results were mixed (10,11). A meta-analysis (10) of published trials showed that a greater reduction in BP and better BP control in hypertensive patients were achieved with home BP monitoring than with usual care. Overall, the effects were modest. Nonetheless, the results were more impressive when the home monitoring was linked to other behavioural strategies, such self-regulation, feedback and reinforcement (11,12), than when used on its own.

Information and communication technologies have the potential to improve the management of hypertension in many ways. Systems may be designed to longitudinally record the results of home BP monitoring. They may also be programmed to apply clinical rules for the BP monitoring schedule and BP alerts, deliver adherence reminders (when the monitoring schedule is not being followed) or clinical alerts (when hypertension is poorly controlled), send coaching messages to patients, and provide reports in tabular, graphic and summary formats to both patients and health care providers. There are many examples of the application of new communication systems to the delivery of care to hypertensive patients (13-16). Experience with these systems has not been encouraging thus far. While they have been effective in improving BP control, the systems had major design flaws or high operating costs that contributed to the low levels of adoption by physicians and patients. New solutions were required to improve acceptance.

To reduce the technological barriers and costs of commercially available platforms, we embarked on a process to develop a new hypertension telemanagement system. In a detailed search of the literature, we noted that Bluetooth technology, a universal short-range wireless data transmission protocol in the unlicensed 2.4 GHz frequency band (17), was beginning to be incorporated into home monitoring products. In April 2004, the A&D Company Ltd in Japan announced the preproduction prototype of a Bluetooth wireless BP monitor for home use. The device enables wireless transmission of BP readings to

a receiver, such as a mobile phone. The wireless feature greatly simplifies the operation of home systems for people uninterested in technology. We also found reports showing little support among patients and health care providers for the use of the Internet to improve health care delivery. Finally, we undertook a detailed assessment of a dozen commercially available hypertension telemonitoring systems. They revealed many drawbacks, including high capital costs, expensive operating fees, the need for wired connections that reduced patient mobility, requirements for personnel to interpret accumulated data, lack of a Health Canada license, the inability to add off-the-shelf peripherals, the requirement of the use of databases and using software that could not be modified to suit local needs and operating procedures that were relatively complex for patients. Based on this evaluation, we concluded that there was a need for a simpler, less costly and more flexible system.

In developing our own system, we made a list of design principles. First, personal computers and the Internet should not be used as the principal means for information input or retrieval of results by patients or physicians. Second, the system should be built using commodity devices to reduce hardware costs. Third, the use of health care personnel to triage BP readings should be eliminated to decrease operating costs. Finally, a series of physician and patient focus group meetings should be held to guide the development of the system.

Assessing patient and physician preferences

We conducted the focus group meetings in the fall of 2004 and spring of 2005 at the Centre for Global eHealth Innovation (Toronto, Ontario) using an applied qualitative case study approach to address the specific social context within which the system would be eventually used (ie, the office of the family physician and the home of the patient). Members of the multidisciplinary team who were present included engineers to explain the prototype of the hypertension telemanagement system, physicians to answer medical questions and a qualitative researcher to facilitate the groups in an interview room overlooked by an observation room equipped with one-way glass. Each focus group was audio and video recorded for transcription and analysis. One or two other team members observed through the one-way glass. Focus groups included a maximum of eight participants.

We used purposive sampling to elicit opinions separately from two groups: patients and family physicians. Patients had a diagnosis of both hypertension and type 2 diabetes mellitus, were between 30 and 85 years of age and were English speaking. Family physicians had an active clinical practice with English speaking patients who had type 2 diabetes and hypertension. These two groups constituted the users for the system, informing the design that would allow the engineering team to realize the creation of the intervention for eventual pilot testing.

From the 107 letters of invitation sent to patients attending the Hypertension Clinic, Diabetes Clinic or Family Medicine Centre at the Mount Sinai Hospital in Toronto, Ontario, 24 agreed to participate in the patient focus group meetings. There were seven male participants (age 55 to 70 years, mean age 61±6 years) and 17 female participants (age 55 to 81 years, mean age 69±8 years). We also invited 41 family physicians selected from a list of physicians at the University of Toronto's Family and Community Medicine Department, as well as 30 family physicians practising in Stratford, Ontario. Of these, 24 came to the physician focus group meetings. All

participants signed the consent form approved by Mount Sinai Hospital Research Ethics Board.

In total, there were four physician and four patient meetings, each lasting 2 h. A discussion was initiated in both groups with a broad question asking about their experience with home BP monitoring. Participants in the patient groups were also asked about their use of the Internet in everyday life, and those in the physician groups were asked about the use of computers and the Internet in their practices. An engineer then presented the proposed system and passed around the devices being considered for use in the system. In the ensuing discussion, the facilitator used a series of prepared, open-ended questions to cover different aspects of the system, including reports to physicians and messages to patients.

Following each session, the researchers who were present met to discuss, clarify and place into context the results of the meeting. Guided by the study, the analysis proceeded to identify significant, common themes across each group. Audiotapes were transcribed, and team members read transcripts verbatim, in whole and in part, to identify passages and present themes for consideration. NVDH read the substantive part of the coding and analysis, and CAR and MH read for inter-rater reliability. NVDH also identified preliminary categories, which were discussed with JAC and CAR. The coding scheme was developed and revised over the course of the study. All categories were compared to establish larger analytical categories. A series of questions were asked about the data to help create the design.

Patient preferences and views

Patients were enthusiastic about the concept of a hypertension telemanagement system, and during focus groups, they actively engaged in exploring prototypes. Approximately one-half of the group had a computer, and all had at least sent e-mail from a public or private terminal; one accessed a computer from a senior's club. The frequency of computer use was low, however, and most patients did not use computers or the Internet for more advanced applications, such as online banking and shopping.

Not all people had mobile phones, and some who had them only used the most basic functions. Initially, one participant did not want a mobile phone even in their home. Most were intimidated by personal digital assistants. We concluded that the mobile phone was more ubiquitous in this group than a personal computer or personal digital assistant.

The majority of patients had monitored their BP outside of the physician's office, and many had used or purchased a device for home BP monitoring. They were willing to engage in self-monitoring of their BP and measuring their BP frequently. They were pleased that the readings of the system were reliable and accurate, and they welcomed the system's ability to keep a record of their readings that could be downloaded and printed. Surprisingly, security of personal information was not a major issue.

Patients liked the idea of physicians being able to act on information when their BPs were high. They worried, however, that physicians may not be able to respond to this information because of their heavy workload. They were glad that this system may mean fewer trips to the emergency room. Patients were also concerned about being overmedicated, and they believed that this system would produce results that physicians and patients could trust, and that it would show a better picture than the current snapshots taken in a physician's office.

Patients stated that they had little knowledge about hypertension. They recognized their lack of working knowledge of the most basic terms related to hypertension and the health consequences of high or low BP. They identified this as a problem hampering their abilities to address their health concerns. They wanted more education, and they readily acknowledged responsibility for their own health. By becoming more knowledgeable, they thought that they would be in a better position to advocate for themselves, make responsible choices and develop collaborative relationships with physicians.

Physician preferences and views

Physicians had considerable experience with home BP monitoring. They reported more success using it in younger patients (younger than 45 years) than older patients (older than 60 years). They indicated that their patients were already monitoring their BP in health clubs, at a pharmacy or at home. Differences found by patients between the readings taken outside and those taken inside their physicians' offices were of concern to physicians. In-office readings were generally viewed as being more accurate. Physicians found that patients with lower out-of-office readings were more likely to resist taking additional medications when their in-office readings were high. Physicians were worried that some patients may become 'neurotic' and overfocus on BP readings, exacerbating the condition that they were treating.

Physicians expressed concerns that the system may increase their workload without providing any financial compensation in return. The current structure of the health care system requires patients to be seen in a physician's office for remuneration. A corollary issue was that most physicians were already working at maximum capacity, and any potential increase in the number of office visits would be undesirable.

Physicians liked the objectivity of the system and the idea of providing patients with immediate feedback on their response to treatment. They also thought that the readings generated by the patients would be valid. They expressed concern about the possible disruption of staff workflow, and indicated that it may not be applicable to patients with poor technical skills or those who were easily 'overfocused'.

Reports and alerts

Both patients and physicians wanted the information in reports to be available in multiple forms: graphic, tabular, numerical and text. Some physicians likened the system to a patient companion. If the BP readings were high, the device could be used to help patients figure out whether they needed to see their physician. Other physicians did not want patients to have access to the same level of information that they had.

The receipt of BP alerts from the hypertension telemanagement system appeared to be the most divisive issue between physicians and patients. The majority of physicians did not want alerts to go to patients, feeling that the information may frighten them and trigger requests for appointments for nonurgent incidents. Moreover, they wanted patients to follow the instructions of the physicians, not the system. The physicians also expressed concerns about a legal liability associated with receiving unsolicited BP alerts. The majority of patients, on the other hand, saw the information as a positive feature.

In the physician groups, the use of office computers was very low. Physicians generally did not use electronic health records, nor did they use any electronic form of prescribing or

requisitioning. Instead, they preferred only paper-based forms of reporting and alerting to avoid disrupting their existing workflows and the use of computers in the course of seeing patients. Telephone and fax appeared to be the only electronic means of delivering reporting and alerting information to physicians.

Synthesis of data

The information gathered at the focus group meetings led to additions and changes in the system that would likely increase its acceptance by patients and physicians, and improve its overall effectiveness. It was clear that the use of personal computers and the Internet for transmitting and receiving information was not a viable option. Approximately one-half of patients had a low income and, thus, no home computer system. Others had a lack of interest in the use of the Internet. Few patients articulated advanced Internet use, such as online banking or shopping. The older age demographic may have contributed to this.

Most physicians did not use computers in their practices for activities beyond scheduling and billing. In general, they were not amenable to using electronic health records during the course of seeing patients, because this would disrupt their workflow.

The lack of computer and Internet use meant considerable changes to the initial design of the system. For patients, the mobile phone, which most used to some extent in everyday life, appeared to be an acceptable alternative for data gathering, messaging and receiving alerts, as long as it did not involve operations beyond normal use. The only practical,

automated means to disseminate reports and alerts to physicians was by fax, which was the most universally available device in doctors' offices. Moreover, the provision of reports and alerts in paper form would least disrupt existing office workflow patterns.

Patients thought that the system, by improving BP control, would reduce the number of appointments to see their doctors, whereas physicians worried that it might add to their workload. Both patients and physicians liked the flexibility of the system, the fact that individual values could be recorded and the provision of summary data. Finally, with the current shortage of family physicians, patients saw the system as a way to potentially reduce the length of time of office visits. Nonetheless, they did not want to see the system replacing human contact.

CONCLUSIONS

The present study explored the patient and physician preferences of a telemanagement system for diabetic patients with hypertension. A user-centric approach, accomplished by conducting focus groups, supported the design of a system that would facilitate patient self-care, foster improved patient-physician communication, and respect existing workflow patterns of physicians and their methods of remuneration.

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