Impact of Automated Calls With Nurse Follow-Up on Diabetes Treatment Outcomes in a Department of Veterans Affairs Health Care System

A randomized controlled trial

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OBJECTIVE — We evaluated automated telephone disease management (ATDM) with telephone nurse follow-up as a strategy for improving diabetes treatment processes and outcomes in Department of Veterans Affairs (VA) clinics. We also compared the results with those of a prior ATDM trial conducted in a county health care system.

RESEARCH DESIGN AND METHODS — A total of 272 VA patients with diabetes using hypoglycemic medications were randomized. During the 1-year study period, intervention patients received biweekly ATDM health assessment and self-care education calls, and a nurse educator followed up with patients based on their ATDM assessment reports. Telephone surveys were used to measure patients' self-care, symptoms, and satisfaction with care. Outpatient service use was evaluated using electronic databases and self-reports, and glycemic control was measured by HbA_{1c} and serum glucose testing.

RESULTS — At 12 months, intervention patients reported more frequent glucose self-monitoring and foot inspections than patients receiving usual care and were more likely to be seen in podiatry and diabetes specialty clinics. Intervention patients also were more likely than control patients to have had a cholesterol test. Among patients with baseline HbA_{1c} levels ≥8%, mean end-point values were lower among intervention patients than control patients (8.7 vs. 9.2%, respectively; $P = 0.04$). Among intervention and control patients with baseline values ≥9%, mean end-point values were 9.1 and 10.2%, respectively ($P = 0.04$). At follow-up, intervention patients reported fewer symptoms of poor glycemic control than control patients and greater satisfaction with their health care.

CONCLUSIONS — This intervention improved the quality of VA diabetes care. Intervention effects for most end points replicated findings from the prior county clinic trial, although intervention–control differences in the current study were smaller because of the relatively good self-care and health status among the current study's enrollees.

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Abbreviations: ATDM, automated telephone disease management; VA, Veterans Affairs; SMBG, self-monitored blood glucose.

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A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

Nearly all diabetes management takes place during in-person encounters with clinicians in ambulatory care settings. Regular outpatient follow-up is important for all patients, and some need frequent attention because their health is unstable, their treatment regimen is complex, or their social supports are inadequate. However, many patients live with financial and nonfinancial access barriers that limit their use of outpatient services (1). Consequently, they fail to attend outpatient appointments (2) and experience worse outcomes than trials of aggressive management suggest is possible (3,4).

Telephone care programs are a viable strategy for bringing diabetes management services into patients' homes and improving their glycemic control (5,6). Automated telephone disease management (ATDM) systems can augment telephone care by providing frequent monitoring and health education to large patient panels while allowing clinicians to focus attention on individuals who need it most. ATDM systems use specialized computer technology to deliver messages and collect information from patients using either their telephone's touch-tone keypad or voice-recognition software. Findings from multiple studies indicate that chronically ill patients will participate in ATDM and that the information they report during ATDM assessments is at least as reliable as information obtained via structured clinical interviews or medical record reviews (7–9). Indeed, some patients are more inclined to report health problems during an automated assessment than directly to a clinician (10).

In a prior randomized trial, we evaluated the efficacy of ATDM calls with telephone nurse follow-up among 248 English- and Spanish-speaking diabetic patients treated in the general medical clinics of a county health care system. After 12 months, intervention patients reported more intensive self-care than usual-care

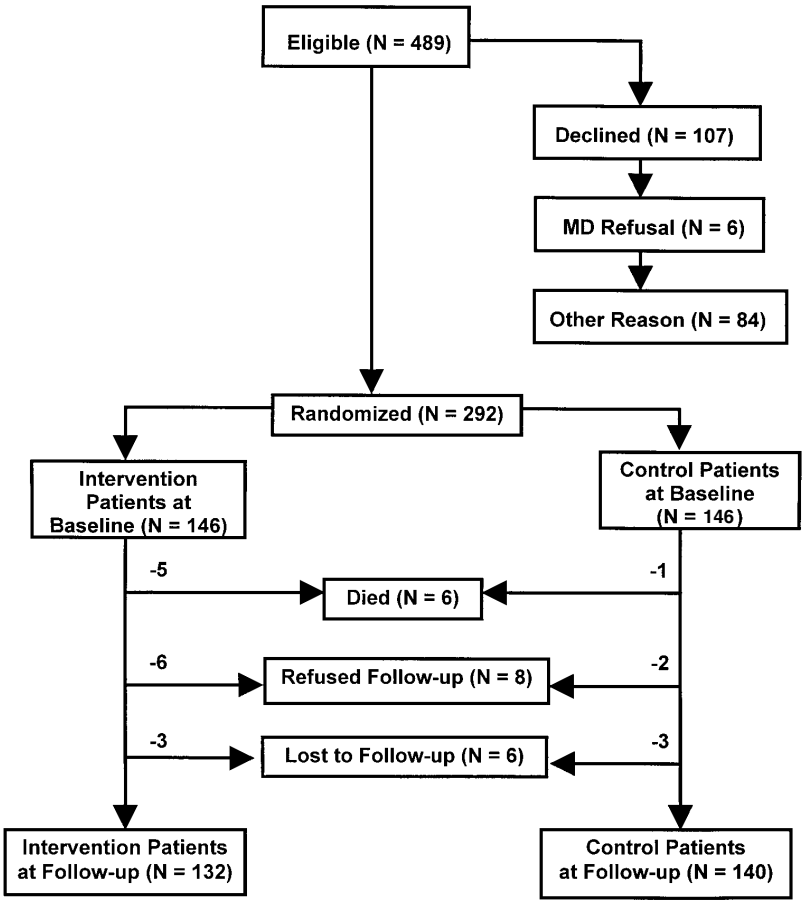

Figure 1—*Patient follow-up.*

control subjects (11). Intervention patients also had better glycemic control and reported fewer symptoms of hyperglycemia and hypoglycemia. Moreover, patients receiving the intervention were more satisfied with their health care than control subjects, especially with the technical quality and continuity of their care, their communication with providers, and the quality of their health outcomes (12).

We extended this work by conducting a similar study among patients treated in Department of Veterans Affairs (VA) outpatient clinics. VA patients face substantial nonfinancial barriers to accessing clinic-based diabetes care. In particular, travel distance poses a major barrier for many VA patients' follow-up and has been linked to decreased use of VA outpatient services, increased hospitalization rates, and increased mortality rates (13,14). Here, we report the results of this VA randomized trial of ATDM-supported diabetes care and compare them with results of the prior county clinic trial.

RESEARCH DESIGN AND METHODS

— Methods of patient enrollment, the characteristics of the intervention, and the measurement of outcomes in this study were similar to those in the prior county clinic ATDM trial. Each of these aspects of the design has been described previously (11,12,15) and is summarized below.

Patient enrollment

Participants were recruited from three general medicine clinics and one diabetes specialty clinic within a university-affiliated VA health care system. Research assistants reviewed online and paper-based medical records daily to identify adults with a diagnosis of diabetes and an active prescription for a hypoglycemic agent. Patients were excluded if they were >75 years of age, were mentally ill, had a life expectancy of <12 months, were newly diagnosed, planned to discontinue receiving services from the clinic within the 12-month follow-up period, or did not have a touch-tone telephone. Informed consent procedures were conducted according to a protocol approved by medical center and university human subjects committees. Patients were randomized using sealed envelopes containing group assignments and a sequence generated using a table of random numbers. Patients, their clinicians, and research staff were not aware of patients' group assignment until after they consented to participate and the envelope was opened.

Description of the intervention

Automated telephone calls. The automated calls consisted of hierarchically structured messages composed of statements and queries recorded in a human voice. All calls were outbound (i.e., patients received the calls), and each assessment lasted 5–8 min. During each ATDM assessment, patients used their touch-tone keypad to report information about their self-monitored blood glucose (SMBG) readings, other self-care activities, perceived glycemic control, symptoms, and use of guideline-recommended medical care. At the end of each assessment, patients were given the option of listening to health promotion messages (16).

Telephone nurse follow-up. Each week, the study nurse reviewed patients' ATDM assessment reports and followed up with them using an established protocol. During these follow-up calls, the nurse interacted with patients much like diabetes nurse educators in other medical settings. The nurse educated patients about appropriate self-care, discussed symptoms, monitored medication adherence, and promoted appropriate use of preventive medical care. The nurse also made periodic calls to follow up on issues discussed in a prior week or to check on patients who responded to the ATDM calls infrequently. Unlike the nurse in the prior county clinic trial, the VA nurse had the ability to schedule clinic appointments. Neither of the nurses had the ability to authorize medication changes, although both recommended dosage adjustments to patients' primary care physicians.

The nurse communicated with primary care providers using an established protocol created by the research team, with input by the VA facility's Chief of Endocrinology (F.B.K.) and clinic staff. The nurse called or e-mailed providers to discuss reported health problems and remind them regarding the need for preventive care (e.g., cholesterol testing).

Data collection and measures

At baseline and 12 months, patients were surveyed over the telephone regarding their self-care behavior, symptoms, and perceptions regarding telephone care. Patients' satisfaction with care was measured using the Employee Health Care Value Survey (17). Intervention patients also responded to a series of questions regarding their satisfaction with the ATDM calls. Data on patients' use of specialty outpatient services were obtained from electronic utilization databases and survey self-reports. HbA_{1c} and serum glucose levels were measured at baseline and 12 months in one laboratory by staff who were blinded to patients' experimental condition.

Statistical analysis

All analyses of intervention effects were conducted on an intent-to-treat basis, and all *P* values were two-tailed. Despite randomization, intervention and control groups were not equivalent at baseline with regard to patients' race and number of diabetes complications. To adjust end-point measures for these differences, as well as for baseline values of each end point, we fit multivariate least-squares and logistic regression models.

Table 1—*Sociodemographic and clinical characteristics of intervention and control patients at enrollment*

	Intervention	Control	*P*
n	132	140	
Age (years)	60 ± 10	61 ± 10	0.2
Male	95 (126)	99 (138)	0.1
Race			0.05
White	54 (71)	66 (93)	
Black	24 (32)	12 (17)	
Hispanic	14 (18)	11 (16)	
Other	8 (11)	11 (15)	
Married	55 (73)	57 (80)	0.8
Living alone	13 (17)	12 (17)	0.8
Annual income <$10,000	27 (32)	20 (26)	0.2
Insulin use	39 (51)	31 (43)	0.2
Diabetic complications	1.0 ± 1.0	0.7 ± 1.0	0.02
BMI (kg/m^2)	31 ± 7	31 ± 6	0.8
General health	2.8 ± 1.0	2.9 ± 0.9	0.6
Comorbidities	2 ± 1	2 ± 1	0.5

Data are means ± SD or % (*n*).

RESULTS

Patient characteristics and baseline values for end-point measures

A total of 489 eligible patients were identified, and 272 (93% of patients randomized) contributed outcome data at 12 months (Fig. 1). Intervention and control groups had similar characteristics at baseline (Table 1). However, intervention patients were more likely than control patients to be white and have somewhat more complications. Overall, only 44% of patients had baseline HbA_{1c} ≥8%, the level at which additional clinical intervention is recommended (18). Intervention patients were significantly more likely than control patients to be seen in ophthalmology clinics in the year before their enrollment; however, there were no differences between intervention and control groups in baseline measures of other end points (Table 2).

The intervention process

On average, intervention patients completed 15 ATDM assessment and self-care education calls and reported 12 SMBG readings (Table 3). Overall, 50% of intervention patients reported that they were very satisfied with the ATDM calls, and 31% reported that they were moderately satisfied. A total of 97% reported that the messages were mostly or always easy to understand, 76% reported that the calls mostly or always made them more reassured that their doctors knew how they were doing, and 67% reported that the calls reminded them to engage in self-care activities. Of the intervention patients, 79% reported that they would be more satisfied with their health care if ATDM calls were available to patients, and 73% reported that they personally would choose to receive such calls.

The nurse communicated with patients by telephone an average of 1.1 times per month. During these calls, adherence problems and side effects of hypoglycemic medications were discussed 66% of the time, and glucose self-monitoring was discussed 60% of the time. Nondiabetes medications were discussed 32% of the time, nondiabetes symptoms were discussed 37% of the time, and psychological problems such as depression and anxiety were discussed in 24% of follow-up calls.

Of all episodes of nurse–patient contact, 23% resulted in follow-up contacts with the patient's primary care provider. Although providers were not systematically surveyed to evaluate their satisfaction with the ATDM service, there were no complaints about the intervention, and none of the providers disenrolled a patient from the trial. Anecdotally, some providers expressed enthusiasm for the intervention, noting that it gave them greater confidence that their patients were being monitored and that self-care problems were being addressed.

Intervention effects

Impacts on processes of care. Patients receiving the intervention reported more frequent SMBG and foot inspections at 12 months than patients receiving usual care (both $P = 0.05$, Table 2). There were no differences between groups in the frequency of weight monitoring or the proportion of patients reporting one or more medication adherence problems.

Intervention patients were more likely than control subjects to be seen in podiatry clinics (62 vs. 42%, respectively; $P = 0.003$) and diabetes specialty clinics (61 vs. 25%, respectively; $P = 0.03$). Intervention patients also were more likely to report having had their cholesterol tested in the 6 months before their end-point interview (86 vs. 78%, respectively; $P = 0.05$) and to have been encouraged by their physicians to check their feet for cuts and sores (92 vs. 72%, respectively; $P = 0.0002$). The total volume of outpatient service use was slightly higher than what is typical for patients with diabetes (19), suggesting that nonclinical visits may have been counted in patients' estimates (e.g., visits solely for medication refills, eligibility determination,

Table 2—*Baseline and adjusted end-point measures for indicators of treatment effects*

	Baseline measures			Adjusted end-point measures		
	Intervention	Control	*P*	Intervention	Control	*P*
Self-care						
Home glucose monitoring*	4.4 ± 1.1	4.4 ± 1.2	0.7	4.6 ± 0.1	4.4 ± 0.1	0.05
Foot inspection*	4.3 ± 1.2	4.0 ± 1.5	0.2	4.6 ± 0.1	4.4 ± 0.1	0.05
Weight monitoring*	2.2 ± 1.7	2.3 ± 1.7	0.6	2.6 ± 0.1	2.5 ± 0.1	0.6
Any medication problem	56 (74)	46 (65)	0.1	45	39	0.4
Use of specialty services						
1 + podiatry visits	52 (69)	48 (68)	0.5	62	42	0.003
1 + ophthalmology visits	52 (69)	29 (41)	0.001	40	38	0.8
1 + diabetes clinic visits	37 (49)	34 (48)	0.6	61	25	0.03
1 + cholesterol test	85 (105)	87 (117)	0.8	87	78	0.05
1 + medical foot exam	87 (115)	82 (114)	0.2	92	72	0.0002
Diabetes-related severity of illness						
HbA_{1c} (%)	8.2 ± 1.7	8.1 ± 1.7	0.5	8.1 ± 0.1	8.2 ± 0.1	0.3
HbA_{1c} baseline ≥8% only (*n* = 122) (%)	9.5 ± 1.3	9.2 ± 1.3	0.3	8.7 ± 0.2	9.2 ± 0.2	0.04
HbA_{1c} baseline ≥9% only (*n* = 60) (%)	10.3 ± 1.2	10.2 ± 1.5	0.6	9.1 ± 0.3	10.2 ± 0.3	0.04
Serum glucose (mg/dl)	188 ± 94	168 ± 68	0.8	180 ± 9	172 ± 10	0.6
Diabetes-related symptoms						
All symptoms	4.3 ± 3.6	3.9 ± 3.4	0.3	3.7 ± 0.2	4.4 ± 0.2	0.04
Hyperglycemic symptoms	1.6 ± 1.5	1.5 ± 1.4	0.5	1.4 ± 0.1	1.6 ± 0.1	0.2
Hypoglycemic symptoms	1.3 ± 1.3	1.2 ± 1.6	0.6	1.1 ± 0.1	1.4 ± 0.1	0.06
Vascular symptoms	0.7 ± 0.8	0.6 ± 0.7	0.2	0.6 ± 0.7	0.7 ± 0.6	0.7
Other symptoms	0.7 ± 1.0	0.6 ± 0.8	0.5	0.6 ± 0.7	0.8 ± 0.7	0.04
Satisfaction with care†						
Summary scale	3.8 ± 0.7	3.8 ± 0.7	1.0	3.8 ± 0.05	3.7 ± 0.04	0.05
Access to care	3.6 ± 0.7	3.6 ± 0.7	0.9	3.6 ± 0.1	3.5 ± 0.1	0.2
Technical aspects of care	4.0 ± 0.8	3.9 ± 0.9	0.4	3.9 ± 0.1	3.9 ± 0.1	0.8
Choice of providers and continuity	3.3 ± 1.1	3.4 ± 1.1	0.5	3.3 ± 0.1	3.2 ± 0.1	0.5
Communication with providers	3.9 ± 0.9	3.9 ± 0.8	1.0	3.9 ± 0.1	3.8 ± 0.1	0.3
Interpersonal aspects of care	4.1 ± 0.7	4.0 ± 0.8	0.6	4.1 ± 0.1	3.9 ± 0.1	0.01
Quality of outcomes	4.0 ± 0.8	4.0 ± 0.8	0.9	4.1 ± 0.1	3.8 ± 0.1	0.002

Baseline data are means ± SD or % (*n*). End-point data are predicted means ± SEM or predicted %. *0 = never, 1 = less than monthly, 2 = monthly, 3 = weekly, 4 = almost daily, 5 = daily; †1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent.

or collection of specimens). At the time of their end-point interview, intervention patients reported more visits on average than control subjects (8.9 vs. 7.2 visits, respectively; $P = 0.006$).

In general, patients receiving the intervention were more favorably disposed to telephone care at follow-up than patients receiving usual care. Intervention patients were more likely than control patients to strongly agree that they could telephone a doctor or nurse for help with medical problems (69 vs. 55%, respectively; $P = 0.02$), that they could use the telephone to avoid office visits (33 vs. 18%, respectively; $P = 0.005$), and that their doctors could help them with a medical problem if they called them at home (36 vs. 26%, respectively; $P = 0.05$).

Impacts on outcomes. For the sample overall, mean end-point HbA_{1c} values were similar among intervention and control patients (Table 2). However, among patients whose baseline HbA_{1c} was ≥8%, adjusted mean end-point HbA_{1c} values differed by 0.5% between intervention and control groups (8.7 vs. 9.2%, respectively; $P = 0.04$). Among patients whose baseline HbA_{1c} was ≥9%, adjusted mean end-point values differed by 1.1% (9.1 vs. 10.2%, respectively; $P = 0.04$).

In the sample overall, intervention patients at follow-up reported fewer symptoms of poor glycemic control than patients receiving usual care ($P = 0.04$). There was a small but statistically significant difference between intervention and control patients' satisfaction with care. Overall differences in satisfaction mainly reflected differences in patients' satisfaction with the interpersonal aspects of their care and the quality of their health outcomes.

CONCLUSIONS — In this randomized controlled trial, ATDM calls with telephone nurse follow-up increased the frequency with which patients self-monitored their blood glucose and checked their feet for problems. The intervention increased the proportion of patients seen in podiatry and diabetes specialty clinics and the proportion of patients who had a cholesterol test and physician counseling about foot self-care. Although there was no impact on HbA_{1c} levels in the sample as a whole, statistically significant and clinically meaningful improvements in HbA_{1c} were observed among patients with relatively poor glycemic control at baseline. The intervention also decreased patients' diabetes-related symptoms, increased their receptivity to telephone care, and increased their satisfaction with care.

Comparison of nurse activity and intervention effects in the current VA trial and prior county clinic ATDM trial

Intervention effects were generally smaller in this VA trial than in the prior county clinic trial, a seemingly surprising result given that the VA nurse spent more time with patients and had access to a wider range of treatment resources (11,12). On average, the VA nurse made 13 contacts with each patient for a total of 3.8 h of contact time. In comparison, the nurse in the county clinic trial made an average of six contacts per patient for 1.2 h of total contact time. The nurse in the VA trial had access to the facility's Intranet and used it to review clinical records, schedule appointments, and e-mail providers. The nurse in the prior trial had no Intranet access because she was located outside of the county clinics. Thus, the clinical information available to her was limited to data collected at enrollment and her own progress notes, and communication with other providers was done exclusively via fax and telephone calls.

Both the VA and county clinic nurses discussed SMBG frequently (60 vs. 57% of all contacts, respectively), and, in both studies, non–diabetes-related medications were discussed during 32% of all contacts. Compared with the county clinic nurse, the VA nurse more frequently discussed hypoglycemic medications (66 vs. 45% of the time, respectively), diabetes-related symptoms (32 vs. 26%, respectively), and mental health problems (24 vs. 18%, respectively) but less frequently discussed non–diabetes-related symptoms (37 vs. 49%, respectively).

Although these differences in the content of nurse follow-up may have contributed to the different effect sizes in the two studies, a more likely explanation is that the relatively good self-care and health status among VA enrollees made it more difficult to demonstrate intervention impacts. Participants in the VA trial were better off at baseline than those in the county clinic trial with regard to their self-care, glycemic control, symptoms, and satisfaction with care. End-point values in the VA trial's intervention group were as good as or better than those in the intervention group of the county study. Nevertheless, intervention effects in the VA trial were smaller because of the better end-point values in the study's control group. Indeed, many end-point scores among control patients in the VA trial were better than end-point scores achieved among county clinic intervention patients.

Mean end-point HbA_{1c} levels in the intervention groups of the two studies were essentially the same. However, the VA intervention had a greater impact on HbA_{1c} relative to usual care among patients with baseline $HbA_{1c} \geq 8\%$ because of the worse control among usual-care patients in this VA patient subgroup. This exception to the general pattern of effects supports the interpretation that ceiling effects in the VA trial, rather than differences in the effectiveness of the two interventions, were responsible for the different magnitude of intervention–control differences in the two studies.

Table 3—*Amount of ATDM and nurse contact over the year among intervention patients*

	All patients (*n*)	Per patient (means ± SD)
ATDM contacts		
ATDM contacts of all types	2,026	15 ± 8
Assessment calls	1,900	14 ± 7
SMBG readings	1,589	12 ± 7
Health tip selections	586	5 ± 5
Dietary module selections	494	4 ± 5
Number of self-care education calls	126	1 ± 2
Telephone nurse contacts		
Contacts of all types		
Total episodes	1,685	13 ± 8
Total hours	504	3.8 ± 3.0
ATDM-initiated contacts		
Total episodes	1,023	8 ± 5
Total hours	316	2.3 ± 1.8
Nurse-initiated contacts		
Total episodes	545	4 ± 4
Total hours	154	1.2 ± 1.5
Patient-initiated contacts		
Total episodes	117	1 ± 1
Total hours	34	0.3 ± 0.6

Issues to consider when evaluating a potential ATDM service

Cost issues. Various options are available for purchasing ATDM services. The automated system used in the current study and the prior county clinic study was a Teleminder Model IV automated telephone-messaging computer produced by Decision Systems (Los Altos, CA). Vendors such as Decision Systems sell computer equipment to health care providers who then develop and manage the ATDM system with occasional technical support from the vendor. The cost for such a system is ~$15–25 per patient annually, including the costs of computer programming and database management but excluding the service's impact on nursing care costs. Other vendors develop Web-based automated telephone-messaging services according to a health system's specifications, manage patient calls, and process patients' health data for providers. These services often are priced in units of patient contact time. The cost of an intervention similar to the one evaluated in the current study would be in the range of $17–30 per patient annually (again, excluding the costs of nursing care). Still other businesses market comprehensive disease management programs that include automated telephone calls with initial follow-up by the company's clinicians. Because they include clinician follow-up, such services tend to be more costly than fully automated systems. Each of these methods of purchasing ATDM capacity is viable, and the choice for a health care system will depend on factors such as the organization's ability to manage the system in-house and its preference for capital outlays versus ongoing predictable service charges.

The intervention nurse in this study encouraged some patients to seek outpatient care for preventive screening or diagnostic evaluation, likely increasing usual-care costs in the short term. Because there are no estimates of the prognostic significance of ATDM-reported information,

the nurse sometimes erred on the side of patient safety when the implications of a given report were uncertain. In our ongoing research, we are evaluating the empirical relationship between ATDM health assessment information and subsequent health problems so that ATDM reports can be used more effectively to differentiate between patients who do need additional care and those who do not.

Over the long term, improvements in adherence to treatment guidelines associated with ATDM use may result in cost savings. As an illustration, we estimated the intervention's potential impact on VA treatment costs if it were implemented nationally, and the intervention had positive effects on glycemic control comparable with those in the current trial. Estimates of the cost savings associated with various levels of improvement in HbA_{1c} were taken from a prior study (20). The distribution of HbA_{1c} levels among VA diabetic patients as well as the prevalence of hypertension and heart disease in this population were taken from the current study's baseline data. These analyses suggest that nationwide implementation of this intervention could save VA >$100 million annually. Although crude, these analyses may be conservative because they assume that the relatively low baseline prevalence of HbA_{1c} levels ≥8% in the current study is typical in VA clinics nationally and that VA medical care costs are no greater than those of the private managed care organization from which cost estimates were obtained.

Patient targeting. Data from the current study suggest that ATDM services may be most effective for patients with HbA_{1c} levels ≥8%. Other eligibility criteria that reflect treatment problems more prevalent among patients in the prior county clinic study (e.g., multiple symptoms or medication nonadherence) also could be useful in identifying patients for whom these services could be most beneficial. Given that the sensitivity and specificity of ATDM health status reports remain undetermined, it is especially important that ATDM services focus on populations in which false-positive and false-negative errors will be minimized, specifically those in which the prevalence of management problems is relatively high.

Impacts on the organization of health services. Consideration should be given to the way in which ATDM information is reported to clinicians. In the current study, as well as the prior county clinic study, ATDM health status reports were reviewed by a single nurse who served as the interface between the intervention and patients' primary care teams. Other models of integrating ATDM into diabetes management are possible, such as delivering patients' reports directly to their primary care providers (21). If ATDM monitoring is subcontracted to an outside organization, consideration should be given to how patient data will be shared and who will be the patients' point of contact for administrative and clinical questions (22).

The extent to which ATDM implementation is intended to supplement or supplant in-person nursing care also is important. Investigators have examined a range of diabetes telephone treatment models, some being based almost exclusively on direct nurse–patient communication (5,6) and others relying on computer automation for the bulk of telephone contact (23–25). Because of differences in study design, eligibility criteria, and treatment settings, direct comparisons across these studies would be tenuous. More research will be needed before conclusions can be drawn about the best balance between automated follow-up and nursing care and the relative emphasis that should be placed on ATDM as a health-monitoring tool versus a means of increasing patients' access to self-care education.

In conclusion, this VA study and our prior county clinic ATDM trial included follow-up by various nurses working under somewhat different constraints. As a result, we cannot estimate the extent to which variation in outcomes of the two trials reflects differences in the nurses' skills versus differences in the potential impact of ATDM generally. Moreover, wide-scale implementation may result in less-consistent adherence to the intervention protocols and more variable outcomes. With these caveats, we conclude that ATDM with nurse follow-up improved the process and outcomes of VA diabetes care. Intervention effects for most end points replicated findings from the prior county clinic trial, although intervention–control differences in the current study were smaller because of the relatively good self-care and glycemic control, low frequency of symptoms, and high satisfaction with care among the VA enrollees.

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