

Spanish Diabetes Self-Management with and without Automated Telephone Reinforcement: Two Randomized Trials

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ABSTRACT

Objective: To determine (1) whether participants in a Spanish Diabetes Self-Management Program (SDSMP), when compared at six months to randomized controls, would demonstrate improvements in health status, health behaviors and self-efficacy; and (2) whether SDSMP participants receiving monthly automated-telephone reinforcement would maintain improvements at 18-months better than those not receiving reinforcement.

Research Design and Methods: 567 Spanish-speaking adults with type-2 diabetes were randomized to a usual-care control group or six week community-based, peer-led SDSMP. SDSMP participants were re-randomized to receive 15 months of automated-telephone messages or no reinforcement. HbA1c was measured at baseline, six and 18 months. All other data were collected by self-administered questionnaires.

Results: At six months SDSMP participants compared to controls demonstrated improvements in HbA1c (-.4%), health distress, symptoms of hypo- and hyperglycemia and self-efficacy. ($p < .05$) At 18 months all improvements persisted ($p < .05$). SDSMP participants also demonstrated improvements in self-rated health, communication with physicians, had fewer ER visits (-.18 visits in six months) ($p < .05$) and a trend toward fewer visits to physicians. At 18 months the only difference between reinforced and non-reinforced participants was increased glucose monitoring for the reinforcement group.

Conclusions: The SDSMP demonstrated effectiveness in lowering HbA1c and improving health status. Reinforcement did not add to its effectiveness. Given the high needs of the Spanish-speaking population, the SDSMP deserves consideration for implementation.

Type-2 diabetes affects 9.5% of the Latino population above the age of 20. Its prevalence is increasing.(1) While the need for self-management support is well documented, there are few long term studies indicating its effectiveness. We report on a randomized, controlled trial of a community-based, peer-led Spanish Diabetes Self-Management Program (SDSMP). As potential reinforcement, half of SDSMP participants were re-randomized to receive monthly automated-telephone messages.

Hypotheses

1. Participants receiving the SDSMP, compared to randomized controls at six months, would demonstrate improvements in:
 - A. health-status
 - B. self-management behaviors
 - C. self-efficacy
2. The benefits of the SDSMP would be better maintained after 18 months by participants receiving monthly automated-telephone reinforcement compared with participants with no reinforcement.

Background. The prevalence of diabetes is nearly three times greater among Latinos than non-Latinos,(2) and is also metabolically more severe.(3-5) The high rate of morbidity is likely to continue.(6)

In reviewing the self-management literature for Spanish speakers, four articles reported on the feasibility of a single community-based education and support program.(7-10) Findings appear promising with significant 12-month improvements in HbA_{1c}. This intervention may not be generalizable as it depends on Spanish-speaking health professionals, who are often not available to those patients.(11) Two other studies took place in Argentina and Cuba.(12,13) Neither reported positive outcomes for health status or health care utilization. Gerber used waiting room kiosks to offer diabetes education to a diverse population.(14) At one year, no difference

was found in HbA_{1c}. Rosal reported on a randomized diabetes self-management trial using a cognitive behavioral framework. At six months, participants demonstrated a greater decrease in HbA_{1c} than did controls.(15) Piette and colleagues found that low-income patients, including Spanish speakers, who received automated-telephone calls with nurse follow-up, when compared to controls not receiving calls, reported less depression, greater self-efficacy and fewer days in bed because of illness.(16,17) The reinforcement intervention in the present study was based on this finding.

METHODS

This paper reports on two studies: 1) a randomized six-month trial of the SDSMP, with an 18-month longitudinal follow-up, and 2) an 18-month randomized comparison of automated telephone reinforcement of the SDSMP versus the non-reinforced SDSMP.

Spanish Diabetes Self-Management Program (SDSMP). The SDSMP was developed based on needs assessments conducted with four groups of Latinos with diabetes and three groups of diabetes educators. It was then reviewed by diabetes nurse educators, nutritionists, and a diabetologist, and modified to be “translatable” for real world practice. The program protocol and all program material were originally written in Spanish. In a pilot study utilizing a pre-test/post-test design, participants demonstrated improvements ($p < .05$) in health behaviors (exercise, diet, practice of relaxation techniques, examining feet, communication with provider), and health status (self-reported health, fatigue, physical discomfort, health distress, and role/activity limitations).(18)

The SDSMP is a six-week program offered two and one-half hours weekly by two peer leaders. Programs were held in community settings in six San Francisco Bay Area

counties. Class sizes ranged from 10-15 including participants' family and friends. Spanish-speaking peer leaders (N=43) came from the same communities as the participants. Most had type-2 diabetes and were not health professionals. They received four days of training in the use of a detailed protocol.(19) The study was approved by the Stanford School of Medicine Institutional Review Board.

Automated-Telephone Reinforcement. Each monthly automated call had three parts. 1) Participants were greeted and asked to rate how certain they were that they could manage their diabetes in the next month. 2) They were given their choice of listening or not listening to two 90-second vignettes about various aspects of diabetes. Each of 15 vignettes was offered twice over 15 months. Participants might hear about how Alexandra solved problems eating with her family or how Jose talked to his doctor about impotence. 3) Participants were invited to leave a message. If necessary, a staff member responded to these messages.

Participants and Data Collection. Participants were 18 or over, not pregnant or in care for cancer, and had type-2 diabetes. There were no other inclusion or exclusion criteria. The study was advertised in the community by word of mouth, announcements in churches, through clinics and Spanish-language mass media. Potential participants contacted the study via a toll free Spanish telephone line, were told about the study and asked to complete consent and baseline questionnaires either by phone or mail. Participants' physicians verified their diagnoses. One week before the beginning of each program, metabolic data (HbA1c) were obtained by project staff at the program sites.

Following baseline data collection, most study participants were randomized to three groups: the SDSMP with monthly automated-telephone reinforcement, the SDSMP without reinforcement or to the usual-care wait-list

control group. Usual care ranged from community clinics to specialist care and was representative of care received by Spanish speakers in large urban areas.

Randomized Study. The randomized controlled study compared the SDSMP without reinforcement to the usual-care control group at six months. After six-month data collection, controls were offered the SDSMP. Those receiving reinforcement were excluded from the 6-month randomized study in order to avoid confounding the effects of the SDSMP and the reinforcement.

Longitudinal Follow-up. Participants in the randomized study were followed for an additional year and completed an 18-month questionnaire. This follow-up allowed us to test if improvements noted at 6 months would be retained at 18 months. The longitudinal participants included former controls who had subsequently taken the SDSMP. For the former controls, the six-month questionnaire from the randomized comparison was used as a baseline and a follow-up questionnaire was administered 18 months after enrolling in the program. Those who enrolled in the last 20 months were not included in the longitudinal follow-up, nor were former controls who had subsequently been randomized to reinforcement.

Reinforcement Study. Participants in the 18-month reinforcement study had all participated in the SDSMP and were randomized to receive monthly automated-telephone reinforcement or no reinforcement. Participants included:

1. SDSMP participants who were initially randomized to treatment plus reinforcement or
2. Controls from the randomized SDSMP study who then participated in the SDSMP. These controls were randomized to either reinforcement or no reinforcement when they completed the SDSMP.
3. At four sites, we were unable to recruit enough people to both hold a viable program

and to randomize to SDSMP or control status. These participants all enrolled in the SDSMP and were only included in the reinforcement study.

Thus most of the control group for the reinforcement study (i.e. SDMSMP without reinforcement) were also the treatment group for the randomized six-month study.

Measures. Health status, health behaviors, health care utilization and self-efficacy were measured at each time point. The specific measures were based on diabetes-related problems identified in participant focus groups, and self-efficacy theory.(20) The Spanish measures were translated; back translated and standardized using a consensus meeting of all translators. Measures then underwent standard psychometric testing including internal-consistency and test-retest reliability, item convergent and discriminate validity.(21) HbA1c was measured using self-administered BIOSAFE kits. These have an expected normal range of 3.8-5.9 compared to 4-6for NGSB (22). These assays have been shown to be reliable and valid.(23) Symptoms of hyper and hypoglycemia were measured using scales developed by Piette.(24) The activity limitation scale, which measures the impact of disease on role activities, was developed for an earlier study and validated in Spanish.(21) Fatigue was measured using a visual numeric scale.(25) Health-related distress was measured by the health distress scale adopted from the Medical Outcome Study.(26,27) A single item from the National Health Survey measured self-rated health.(28,29) Health behaviors were assessed by a physical activities scale measuring total minutes per week of aerobic and non-aerobic exercise,(27) and by weekly frequency of glucose monitoring. A four-item scale measured communication with physicians.(27) In a pilot study of Spanish-speaking people with diabetes, the communication-with-physicians scale had a

coefficient alpha of .80 (N=147) and a test/retest validity of .86 (N=20).

Self-efficacy was measured using the Spanish diabetes self-efficacy scale (alpha=.85) and a test/retest validity of .80 (N=20).

Health care utilization over the prior 6 months was measured by self-report. In a study evaluating the validity of self-report comparing self-reported utilization with chart audit(30), there were no biases toward improved reporting over time.

Data Analysis. Baseline comparison of SDSMP intervention participants versus usual-care controls utilized t-tests. Variables demonstrating significant differences were included as covariates in multivariate analyses of six month outcomes.

Those who failed to complete the six-month questionnaire were then compared at baseline with those who had completed questionnaire utilizing t-tests.

At six months, analyses of covariance (ANCOVA) were used to compare treatment versus control groups. Demographic variables and the outcome variable at baseline were used as controlling covariates in ANCOVA models. Randomization was the factor variable and dependent variables were six month outcomes. Least-squared means (adjusted for covariates) were computed to determine if there were significant differences.

For all who had taken the SDSMP intervention (including controls who took the intervention after six months) and had not received reinforcement, 18-month scores were compared to baseline using paired t-tests.

SDSMP-plus-reinforcement participants were compared to non-reinforced SDSMP participants at 18 months utilizing ANCOVA models. Demographic and baseline values of the outcome variables were used as covariates and least-squared means were computed and tested for significant differences.

RESULTS

Participants. Although participants in the six month randomized study and the randomized telephone reinforcement study were recruited from the same pool of interested applicants and overlap, the two studies were separate, and some participants were recruited for one and not the other study. Figures 1 and 2 (available online at <http://care.diabetesjournals.org>) show the distribution of participants in the two studies.

Randomized six-month study. Forty-six SDSMP workshops were held between 2002 and 2005. Of 533 individuals who completed the consent form and a baseline questionnaire, 198 were randomized to the usual-care group and 335 to the SDSMP. SDSMP participants (excluding the earliest and the last groups) were further randomized to receive telephone reinforcement or no reinforcement. The non-reinforcement group included most of the intervention group for the randomized study (N=219), while the telephone reinforcement group was excluded from the randomized six-month study (N=116). At six months, 173 controls (87%) completed follow-up questionnaires, as did 179 (82%) intervention participants. Study participants had a mean age of 52.9, 62% were female, and the mean years of education was 7.5. There was a significant difference in the percentage female between the control group and the intervention group (67.2% versus 57.1%, $p=.034$, Table 1). The only outcome with significant baseline difference was activity limitation ($p=.036$). The usual-care control group had greater limitation ($p=.036$).

Longitudinal 18-month (non-reinforced) follow-up. Fifty-four controls and 152 intervention participants took part in the SDSMP at least 20 months before the end of the 4 year study period and did not receive telephone reinforcement. Of these 206 eligible SDSMP participants, 146 (71%) completed the eighteen month follow-up questionnaire.

Eighteen-month randomized telephone reinforcement study. Three-hundred and eighty-seven participants took part in the SDMSMP at least 20 months before the end of the 4 year study period. Of those, 184 were randomized to receive telephone reinforcement and 203 received no reinforcement. At 18 months, 149 (73.4%) non-reinforced SDSMP participants and 151 (82.1%) reinforced participants completed questionnaires. The telephone reinforcement study participants had a mean age of 52.1, 62% were female and averaged 7.5 years of education. There was a significant difference in the percentage of females at baseline, 68% for the reinforced versus 56% for non-reinforced ($p=.012$). None of the other demographic or outcomes variables differed at baseline (not shown).

Non-Completers. Randomized six-month study. Comparing study participants who completed six month questionnaires (N=352) to those who did not (N=65), the non-completers did not differ significantly on baseline demographics, although a higher proportion were unmarried (45% versus 37%, $p=.070$). They also had higher HbA1c, lower self-reported health, and more fatigue ($p=.034$, $.020$, and $.037$, respectively). There were also tendencies for non-completer's communication with physicians to be lower and emergency visits and days in hospital to be higher ($p=.063$, $.096$, and $.054$, respectively). When comparing baseline variables of intervention six-month non-completers with usual-care-control six-month non-completers, there were no significant differences except intervention non-completers were more educated (8.3 years versus 6.2 years, $p=.048$). The proportion of intervention non-completers compared to that of usual-care control non-completers was not statistically significant.

Longitudinal 18-month (non-reinforced) follow-up. Comparing those eligible but not completing 18-month questionnaires with those who did, two outcomes were significantly different. Non-completers had

more symptoms of hyper- and hypoglycemia ($p=.045$ and $.005$, respectively). There was also a tendency for the non-completers to be younger (mean age 49.9 versus 53.6, $p=.068$). Eighteen month randomized telephone reinforcement study. At baseline those in the telephone reinforcement study not completing 18 months were more likely to be younger and male ($p=.028$ and $.001$, respectively). They had more symptoms of hypoglycemia and were less likely to be testing for glucose ($p=.012$ and $.031$, respectively). The non-completers also tended toward doing more aerobic exercise, stretching and strengthening exercise and had more symptoms of hyperglycemia ($p=.066$, $.060$ and $.088$, respectively). Comparing non-completers randomized to telephone reinforcement with those randomized to no reinforcement, the only statistically significant difference was those randomized to telephone reinforcement had more symptoms of hyperglycemia ($p=.050$).

Outcomes. Randomized six-month study. Because of baseline differences between intervention and control groups, baseline activity limitation was included as a covariate in all ANCOVA models. Comparing the intervention group with the usual-care control group, Hemoglobin A1c (HbA1c), health distress, symptoms of hypoglycemia and hyperglycemia demonstrated statistically significant improvement favoring the intervention group. Intervention participants had a decrease in HbA1c of .41%, while the usual-care controls had a reduction of .05%. Of people in the treatment group entering the study with HbA1c of 7 or greater ($N=101$), 30% were below 7 at 6 months (compared to 22% for controls). The differences in the change scores for all health status variables were in the hypothesized direction. There were no significant differences between groups in health behaviors, BMI, insulin use or health care utilization. Self-efficacy was significantly improved for the intervention

group compared to usual-care controls (see Table 1, $p<.001$).

Longitudinal 18-month follow-up. Paired t -tests determined if there were improvements from baseline to 18 months for those who had participated in the intervention (Table 2). Five of seven health indicators demonstrated statistically significant improvement (hemoglobin A1c, health distress, self-reported health, symptoms of hypo and hyperglycemia). Communication with physician was significantly improved, while stretching and strengthening exercise was marginally improved ($p=.063$). Emergency visits (past six months) decreased significantly an mean .18 days, while there were .49 fewer physician visits in the past six months ($p=.066$). Self efficacy remained significantly improved.

Eighteen-month randomized telephone reinforcement study. The 184 SDSMP participants who were randomized to receive 15 monthly automated-telephone reinforcement calls completed a mean 10.7 calls, and listened to a mean 11.9 recorded vignettes. The reinforcement was suspended for 34 participants because of disconnected phones or at their request. Two participants never completed any calls. The remaining 148 averaged 12.5 completed calls ($SD=4.4$). Eighty-one reinforcement participants left a total of 211 messages. Over 90% of the messages conveyed appreciation for the continuing contact. The remaining calls commented on a problem or requested additional help.

Comparing those who received automated-telephone reinforcement to those who did not, there was only one significant difference. Those in the telephone reinforcement group were more likely to have monitored their glucose in the last week (Table 3). There was a tendency for fewer hospital days for those with reinforcement ($p=.096$).

The data were rerun with number of completed calls included as a covariate, with virtually identical results. The number of completed calls was not correlated with any of the 18-month outcome change scores except for greater number of visits to physicians ($r=.21$, $p=.011$).

DISCUSSION

Limitations. Because SDSMP participants could not be blinded, there is the possibility of an attention effect. However, since the telephone reinforcement appeared to have limited effect, and the improvements seen in the first six months were retained over 18 months, it seems unlikely that the results could be purely the result of attention.

Although the non-completion rate was moderately high, we observed few differences at baseline between those who completed or did not complete their six-month questionnaire. Non-completers appeared to have more health problems. Thus, it is possible that those who had negative results following the intervention were more likely to drop than those who continued to complete questionnaires. Because there were no differences in the baseline outcome variables between the six months intervention non-completers and usual-care control group non-completers, this likely was not an important factor affecting the six-month randomized study. More caution must be exercised in considering the 18-month outcomes, as there was no control group for comparison.

With a largely self-selected sample, we cannot claim that our sample of Hispanics with diabetes is representative of a larger population. A comparison of a few characteristics of our sample with Latino diabetics in Santa Clara County suggests that our participants were more likely to be obese, were more active, and were about as likely to have had a foot exam. (31)

Cost Effectiveness. The direct costs of the SDSMP are approximately \$250 per

participant. Gilmer has demonstrated that as HbA1c increases so does health care costs.(32) Wagner has suggested that lowering of HbA1c results in lower health care costs.(33) The present study suggested significant reductions in HbA1c and Emergency Department use over 18 months. While we did not attempt a cost-benefit analyses, past studies and present evidence suggest that the SDSMP may be a cost-effective intervention. This aspect of the intervention merits further study.

Six-Month Randomized Study. The results strongly support the hypotheses that the SDSMP resulted in improved HbA1c and health status indicators. However the hypothesis of increases in positive health behaviors was not supported. One possible reason for this unexpected finding is that the SDSMP encourages participants to choose behaviors that are 'right' for them--to self-tailor the intervention to their own needs. Thus different participants choose different behaviors, making it difficult to find statistically significant changes in individual behaviors.

Self-efficacy was strongly improved by participation in the SDSMP intervention, and is likely to have contributed to positive health outcomes.

Longitudinal 18-month follow-up. After 18 months, SDSMP participants continued to show improvements in health status and self-efficacy. They also demonstrated improvements in communication with their physicians and decreased emergency department visits. Although caution must be exercised in interpreting this data because of the unknown effect of non-completers, the results suggest that the intervention continued to have positive effects 18 months later.

Eighteen-Month Telephone Reinforcement Trial. Although participants expressed satisfaction with automated-telephone reinforcement, there appeared to be little additional benefit compared to the SDSMP without reinforcement. The SDSMP alone

appears to be sufficient to promote improvements in health status. Future studies might explore the effectiveness of face-to-face reinforcement.

Summary. The randomized trial suggests that a peer-led diabetes self-management intervention held in community settings can improve HbA1c and quality of life and that these effects can persist for 18 months. Contrary to expectations, automated-telephone

reinforcement did not improve the effectiveness of the SDSMP. It is possible that a more personalized and interactive reinforcement may have been more effective. Given the high needs of the Spanish-speaking population, the dearth of effective replicable programs, and the relatively low cost of the SDSMP, we suggest that this intervention deserves consideration for implementation and further study.

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TABLE 1. BASELINE MEANS AND SIX-MONTH CHANGES, RANDOMIZATION STUDY

VARIABLE	BASELINE			6-MONTH CHANGE SCORES		
	USUAL CARE (N=198)	SDSMP (N=219)	p	USUAL CARE (N=173)	SDSMP (N=179)	p
Demographic Variables						
Age (range 21 to 84)	52.8 (13.4)	52.9 (13.2)	.973	-	-	-
Percent female	67.2	57.1	.034	-	-	-
Years of education (range 0 to 20)	7.30 (4.54)	7.68 (4.49)	.394	-	-	-
Percent married	63.6	66.7	.518	-	-	-
Percent Born in Mexico	69.2	75.8	.131	-	-	-
Baseline Weight (kilograms)	77.9 (13.4)	80.0 (18.5)	.106			
Percent Using Insulin	12.1	8.7	.523			
Health Indicators						
Hemoglobin A1c ↓	7.38 (1.87)	7.44 (2.00)	.765	-0.050 (1.57)	-0.408 (1.42)	.040
Health Distress (0-5) ↓	2.31 (1.28)	2.50 (1.25)	.158	-0.089 (1.29)	-0.595 (1.30)	.009
Self-reported Global Health (0-5) ↓	3.66 (0.821)	3.73 (0.745)	.335	-0.023 (0.807)	-0.128 (1.30)	.713
Symptoms of hypoglycemia (0-12) ↓	2.24 (1.75)	2.40 (1.84)	.738	0.029 (1.46)	-0.453 (1.80)	.042
Symptoms of hyperglycemia (0-12) ↓	2.51 (2.06)	2.58 (2.08)	.714	0.029 (2.09)	-0.827 (2.11)	<.001
Activity Limitation (0-4) ↓	1.30 (1.18)	1.07 (0.978)	.036	-0.119 (1.12)	-0.149 (1.05)	.273
Fatigue (0-10) ↓	4.69 (3.14)	4.77 (3.05)	.810	-0.145 (3.48)	-0.254 (3.08)	.694
Health Behaviors						
Aerobic Exercise (min/week) ↑	110.8 (101)	102.0 (104)	.384	-3.47 (115)	3.60 (107)	.891
Stretching / Strength Exercise (min/week) ↑	36.6 (56.4)	35.6 (57.5)	.862	1.04 (72.7)	9.52 (8.96)	.105
Communication with Physician (0-5) ↑	1.88 (1.41)	1.89 (1.32)	.978	0.144 (1.34)	0.324 (1.45)	.139
Test Glucose (times/week) ↑	.783 (.413)	.807 (.395)	.537	.080 (0.365)	.050 (0.387)	.457
Self-Efficacy						
Self-Efficacy (1-10) ↑	6.29 (2.14)	6.51 (2.14)	.278	0.004 (2.37)	0.695 (2.36)	<.001
Health Care Utilization						
Physician Visits (past 6 months)	2.92 (2.51)	2.75 (2.41)	.462	-0.064 (2.64)	-0.028 (3.14)	.852
Emergency Visits (past 6 months)	0.389 (1.16)	0.339 (.783)	.589	-0.081 (0.943)	-0.107 (0.820)	.665
Days in Hospital (past 6 months)	0.429 (1.72)	0.500 (2.57)	.740	-0.087 (1.49)	0.354 (7.18)	.262

Notes: The range and direction are given with each variable, where applicable. An upward arrow indicates a higher value is desirable, a downward arrow that a lower value is desirable.

Standard Deviations are included in parentheses following each mean. The baseline p-values are from t-tests comparing the two groups. Change score p-values compare least-squares means at six months after controlling for baseline value of the outcome and demographic variables as covariates in ANCOVA models.

TABLE 2. 18-MONTH FOLLOW-UP, CHANGES AFTER INTERVENTION, NON-REINFORCED SPANISH DIABETES PROGRAM PARTICIPANTS

VARIABLE	Change (N=146) Mean (S.D.)	p
Health Indicators		
Hemoglobin A1c ↓	-0.319 (1.69)	.030
Health Distress (0-5) ↓	-0.561 (1.98)	<.001
Self-reported Global Health (0-5) ↓	-0.336 (0.942)	<.001
Symptoms of Hypoglycemia (0-12) ↓	-0.438 (1.71)	.002
Symptoms of Hyperglycemia (0-12) ↓	-0.473 (1.97)	.005
Activity Limitation (0-4) ↓	-0.046 (1.10)	.617
Fatigue (0-10) ↓	-0.448 (2.99)	.073
Health Behaviors		
Aerobic Exercise (min/week) ↑	15.4 (113)	.103
Stretch/Strength exercise(min/week) ↑	10.8 (69.6)	.063
Communication with Physician ↑	0.411 (1.45)	<.001
Test Glucose (times/week) ↑	0.021 (0.343)	.477
Self-Efficacy (1-10) ↑	0.818 (1.79)	<.001
Utilization		
Physician Visits (past 6 months)	-0.490 (3.18)	.066
Emergency Visits (past 6 months)	-0.181 (0.929)	.021
Days in Hospital (past 6 months)	0.451 (7.74)	.485

Notes: The range and direction are given with each variable, where applicable. An upward arrow indicates a higher value is desirable, a downward arrow that a lower value is desirable.

Standard Deviations are included in parentheses following each mean. P-values are from paired t-tests comparing baseline with 18-month scores.

TABLE 3. 18-MONTH CHANGES REINFORCED VS. UNREINFORCED INTERVENTION SDSMP PARTICIPANTS

VARIABLE	With Automated-Telephone Reinforcement (N=149) Mean (S.D.)	No Automated-Telephone Reinforcement (N=151) Mean (S.D.)	p
Health Indicators			
Hemoglobin A1c ↓	-0.014 (1.70)	-0.194 (1.79)	.298
Health Distress (0-5) ↓	-0.227 (1.54)	-0.551 (1.42)	.120
Self-reported Global Health (0-5) ↓	-0.277 (0.925)	-0.311 (0.967)	.680
Symptoms of Hypoglycemia (0-12) ↓	-0.651 (1.90)	-0.325 (1.59)	.389
Symptoms of Hyperglycemia (0-12) ↓	-0.309 (1.99)	-0.457 (1.93)	.700
Activity Limitation (0-4) ↓	0.034 (1.15)	-0.011 (1.10)	.582
Fatigue (0-10) ↓	-0.095 (3.52)	-0.413 (3.13)	.859
Health Behaviors			
Aerobic Exercise (min/week) ↑	23.8 (129)	23.8 (113)	.565
Stretch/Strength exercise(min/week) ↑	14.2 (70.7)	12.5 (69.9)	.597
Communication with Physician ↑	0.282 (1.43)	0.431 (1.44)	.778
Test Glucose (times/week) ↑	0.107 (0.332)	0.027 (0.347)	.001
Self-Efficacy (1-10) ↑	0.680 (2.13)	0.721 (1.88)	.570
Utilization			
Physician Visits (past 6 months)	-0.557 (3.43)	-0.453 (3.09)	.682
Emergency Visits (past 6 months)	0.013 (0.937)	-0.193 (0.910)	.236
Days in Hospital (past 6 months)	-0.134 (2.04)	0.060 (3.74)	.096

Notes: The range and direction are given with each variable, where applicable. An upward arrow indicates a higher value is desirable, a downward arrow that a lower value is desirable.

Probabilities compare least-squares means at eighteen months after controlling for baseline value of the outcome and demographic variables as covariates in ANCOVA models.