Readiness to Change and Clinical Success in a Diabetes Educational Program

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Background: **We wanted to determine whether a simple tool characterizing readiness to change among patients before participating in a diabetes educational intervention successfully screens for patients who will achieve satisfactory clinical improvement.**

Methods: **Fifty patients referred to a diabetes educational center with hemoglobin A_{1c} levels of more than 9.0% were asked four questions before participation in a diabetes educational program. Patients were categorized into precontemplation-contemplation, preparation, and action stages of readiness to change. Intensive diabetes education was offered to all participants. Hemoglobin A_{1c} levels were measured for 24 months after the educational program.**

Results: **Patients in preparation and actions stages achieved a significantly larger reduction in hemoglobin A_{1c} levels in a shorter time than patients in the combined precontemplation-contemplation stage. Average change in hemoglobin A_{1c} levels at 12 months was -1.06 ± 1.80 ($P = .17$) for the precontemplation-contemplation stage, -1.82 ± 1.84 ($P = .006$) for the preparation stage, and -2.56 ± 2.12 ($P = .0006$) for the action stage. Patients had significantly more hemoglobin A_{1c} measurements in the preparation stage (4.63 ± 2.42, $P = .036$) and the action stage (4.94 ± 2.38, $P = .013$) than patients in the precontemplation-contemplation stage (3.00 ± 1.22) during the 24-month study.**

Conclusions: **In this small population, stage of change as determined by a simple clinical tool was significantly associated with clinical improvement in hemoglobin A_{1c} levels at 3 months after an educational intervention. Significant differences in clinical improvement between groups persisted for at least 12 months. This tool could be used to tailor the most effective clinical diabetes interventions for patients and to address the needs of patients in a more targeted manner. (J Am Board Fam Pract 2002;15: 266–71.)**

The prevalence of diabetes mellitus in the United States increased by 33% between 1990 and 1998 and imposes an enlarging burden on the US health care dollar.[1] Large trials have shown that better control of risk factors, such as glycohemoglobin (A_{1c}), blood pressure, and lipids, substantially reduces the frequency of developing complications among persons with diabetes.[2–5] Throughout the country efforts to improve care delivery and reduce the frequency of risk factors have reported mixed results.[6] Although primary care offices are a focal point for improving the delivery of diabetes care, most medical decisions concerning diabetes are made by the patient outside the medical environment.[7] In the effective treatment of diabetes, the patient is the most important provider of medical care. Patient self-management has been shown to be effective in lowering risks of developing complications among diabetes patients.[8,9]

Not all patients, however, are similarly willing or ready to begin educational programs that promote self-management. Repeatedly educating a patient who is not ready to accept changes in lifestyle can become frustrating for both the patient and the physician.[10] Furthermore, relapse in behavior is sometimes seen as patient failure, or a patient compliance problem, and can result in the patient avoiding contact with a physician or avoiding treatment altogether.[11]

The transtheoretical, or stages-of-change, model has been used to describe the stages in a person's readiness to alter current behavior. The stages-of-change model characterizes increasing willingness to make substantial lifestyle modifications, ranging from precontemplation and contemplation to preparation, action, and maintenance stages, and is more fully described elsewhere.[12,13] This model has been effective in determining which patients are

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likely to succeed with a variety of important behavioral changes, such as smoking cessation, alcohol abuse, and weight loss.[14,15] Readiness to change behavior has previously been described as a potential educational and psychosocial barrier in diabetes care.[16] Evaluation of readiness to change, however, involved completion and interpretation of a patient questionnaire, and it remained unclear whether a patient's readiness to change at the initiation of a well-developed diabetes education program substantially affected the clinical outcomes achieved by the program.

By characterizing patients' readiness to change their diabetes self-management, it might be possible to assess referrals more appropriately or to design more effective health interventions for a patient.[17] This pilot study tested a simple tool that characterized readiness to change among patients at the initiation of a comprehensive diabetes educational intervention. The study examined the association between patients' stage of change at the beginning of the intervention with the success patients achieved in improving clinical outcome measures during the next 2 years.

Methods

A consecutive sample of 50 patients with a hemoglobin A_{1c} level of 9.0% or higher referred for diabetes education by primary care physicians was contacted by the diabetes educator. This group, which represented patients at high risk for whom substantial improvement would be possible, was chosen to increase power in the small sample. Referral sources were primary care offices that were part of an owned health care system. During the study patients were cared for both by the diabetes education center and by their referring physician. After the educational intervention, additional hemoglobin A_{1c} levels were measured by the primary physician as part of usual care. The study was originally part of a quality improvement evaluation. Human subjects' protection was assured through the hospital system institutional review board.

At each patient's initial visit, the diabetes educator asked which of the four statements in Table 1 the patient agreed with most, if any. Based on responses to the four questions, patients were categorized as belonging to the precontemplation, contemplation, preparation, action, or maintenance stage. These questions were based on similar questions used in evaluation of the process of smoking cessation.[18]

Table 1. Stages of Readiness to Change.

Stage	Statement of Willingness to Change
Precontemplation	(Negative response to all 4 statements)
Contemplation	I am intending to make changes in my diabetes management in the next 6 months
Preparation	I am intending to make changes in my diabetes management in the next month
Action	I have made changes in my diabetes management in the last 6 months
Maintenance	My diabetes has been in good control for more than 6 months

Regardless of their responses, patients were offered a personalized educational program directed at lowering hemoglobin A_{1c} levels. This program, recognized by the American Diabetes Association, had been found to be effective in producing improved clinical outcomes.[19] Barriers for each patient were determined, and educational support was designed to address individual needs. Patients were offered support in one of the following seven program tracks: (1) attending a comprehensive diabetes management program, (2) small-group education at the diabetes education center, (3) small-group education by a diabetes educator that would occur at their local primary care clinic, (4) individual education at the diabetes education center, (5) individual education located at their primary care clinic, (6) telephone- or fax-based education, and (7) specific diabetes help offered when the patient called the health care hotline at their convenience. The patients were also offered no further intervention.

Similar educational information was made available in each program track. Educational intervention was independent of stage-of-change evaluation, and group education classes included patients from all stages of change. The educational program was completed within 3 months. Participation in a specific program sometimes changed during the study either at the patient's request or when the patient was unable to attend a program. All patients were asked to return for hemoglobin A_{1c} measurements at the end of this initial period.

All blood samples for measurement were collected at the referral sources and were measured at

Table 2. Characteristics for Patients by Stage-of-Change Category and Type of Diabetes.

Readiness Stage	No.	Female	Average Age, Years No. (SD)	*P* Value*	Average Years Since Diagnosis No. (SD)	*P* Value*
Precontemplation-Contemplation						
Type 2 diabetes	9	7	61.5 (13.9)	—	10.0 (8.1)	—
Type 1 diabetes	4	0	37.0 (9.2)	—	18.8 (10.6)	—
Preparation						
Type 2 diabetes	16	6	55.0 (12.0)	.253	5.6 (3.6)	.086
Action						
Type 2 diabetes	16	7	64.9 (12.2)	.540	4.9 (3.6)	.038
Type 1 diabetes	1	0	52.0 (—)	—	24.0 (—)	—

**P* values for patients with type 2 diabetes compare averages with precontemplation-contemplation group.

one central health system laboratory. Hemoglobin A_{1c} values were reviewed by the diabetes education center 24 months after the intervention.

At the initial visit the most recently measured hemoglobin A_{1c} level was used as baseline. All patients had their hemoglobin A_{1c} levels measured again at the conclusion of the 3-month intervention. Subsequent hemoglobin A_{1c} levels were measured at intervals of 3 to 12 months and 12 to 24 months after the initial contact. If more than one hemoglobin A_{1c} measurement had been performed during an interval, the values measured closest to 12 and 24 months, respectively, were used to determine mean levels. The change in the hemoglobin A_{1c} level from baseline was determined for each patient at each interval, and the mean change was determined for each group. Mean values between groups were compared using Student *t* test. Paired *t* tests were used to determine significance of change in hemoglobin A_{1c} levels within groups. Linear regression was performed for change in hemoglobin A_{1c} levels using stage of change, length of diagnosis, age, and weight as independent variables. Analysis was performed using SAS software (Version 6.12, SAS Institute, Cary, NC).

Results

Four patients did not attend the initial visit at the education center despite repeated telephone calls. The reasons for not attending included access problems and patient initiation of other diabetes interventions. These patients did not meet the criteria for the precontemplation stage and were not included in further evaluation.

As would be expected for patients with high hemoglobin A_{1c} levels, not one patient was categorized as being in the maintenance stage. Eight patients were assigned to the precontemplation stage, and 5 to the contemplation stage. These two groups were combined for further analysis. Sixteen patients were assigned to the preparation stage, and 17 were assigned to the action stage. Five patients in the study had type 1 diabetes according to the medical record. Four of these patients were in the precontemplation-contemplation group, and 1 was in the action group.

Baseline values for length of diagnosis, age, and sex were determined for patients with type 1 and type 2 diabetes separately and are shown in Table 2 for each stage-of-change group. The significance of differences between groups was determined by comparing averages for patients with type 2 diabetes from each group with those of patients with type 2 diabetes in the precontemplation-contemplation group. Although the average age for patients with type 2 diabetes appeared similar between groups, patients with a shorter duration of diabetes tended to be in the preparation ($P = .086$) or action group ($P = .038$). Five patients (38%) from the precontemplation-contemplation and 1 patient from the action group (6%) chose not to participate in the educational intervention offered. The selection of any specific type of educational intervention was not significantly correlated with readiness-to-change category.

The average hemoglobin A_{1c} level at baseline for patients attending the diabetes education center was 10.45% ± 1.13%. The average hemoglobin A_{1c} level at baseline, 3, and 12 months for each group is shown in Figure 1. A significant drop in hemoglobin A_{1c} levels at 3 months ($P < .001$) was seen in the preparation and action groups. This

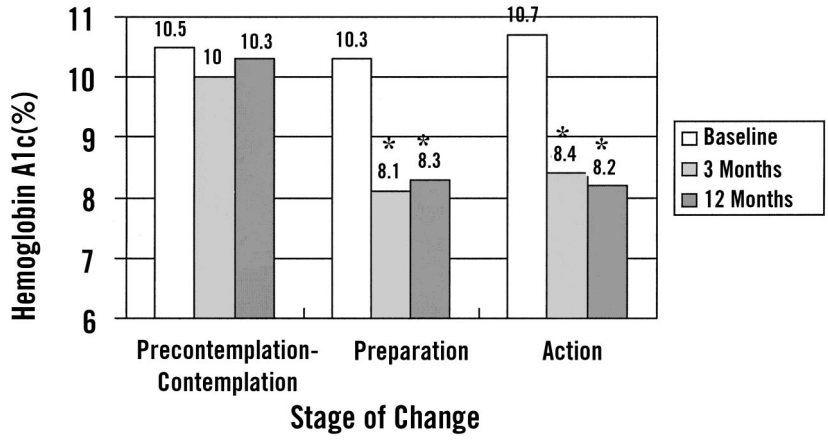

Figure 1. Mean hemoglobin A_{1c} levels at baseline, 3 and 12 months, by stage-of-change group. *$P < .01$.

change was still significant at 24 months. The change in hemoglobin A_{1c} levels in the precontemplation-contemplation group was not significant.

The intervention lasted only 3 months, after which the patients were referred to their primary provider for further care. The mean change in hemoglobin A_{1c} levels and the number of patients who had their hemoglobin A_{1c} measured at 3, 12, and 24 months are displayed in Table 3. The mean change in hemoglobin A_{1c} levels in Table 3 vary from the mean change in hemoglobin A_{1c} levels in Figure 1 because of patients being lost to follow-up, an effect that was particularly notable in the precontemplation-contemplation group. By 12 months only 54% of the patients in this group were still participating in the study, and the baseline hemoglobin A_{1c} levels of these patients were slightly higher than the baseline of the entire group.

Eight of the participants from the precontemplation-contemplation group (62%), and 5 (31%) and 8 (47%) from the preparation and action groups, respectively, did not have their hemoglobin A_{1c} measured during the 12- to 24-month interval after the intervention, which substantially limited power of the 24-month measurements. Because patients who did not have hemoglobin A_{1c} levels measured might be expected to have particularly high values, 24-month comparisons could be misleading. Although the average hemoglobin A_{1c} level for participants from the precontemplation-contemplation group between 12 and 24 months averaged 8.5%, this figure did not reach significance ($P = .07$) because fewer patients had their hemoglobin A_{1c} levels measured.

Linear regression for change in hemoglobin A_{1c} levels at 12 months as a dependent variable showed a significant contribution by stage of change at baseline ($\beta = 0.18$, $P < .05$). Weight, length of diagnosis, and age were not significant as independent variables for change in hemoglobin A_{1c} levels in this study.

The average number of hemoglobin A_{1c} measurements for each group during the 24 months was 3.00 (SD, 1.22), 4.63 (SD, 2.42), and 4.94 (SD, 2.38) in the precontemplation-contemplation, preparation, and action groups, respectively, indicating that patients in the preparation stage ($P = .036$) and action stage ($P = .013$) had more hemoglobin A_{1c}

Table 3. Mean 24-Month Decrease in Hemoglobin A_{1c} Level for Each Stage-of-Change Group.

Readiness Stage	No.	Change in Hemoglobin A_{1c} Level	SD	*P* Value*
Precontemplation-contemplation				
3 months	12	−.61	1.48	.17
12 months	7	−1.06	1.80	.17
24 months	5	−2.10	1.98	.07
Preparation				
3 months	14	−2.02	1.47	.0002
12 months	12	−1.82	1.85	.006
24 months	11	−2.72	1.47	.0001
Action				
3 months	14	−2.46	1.95	.0004
12 months	14	−2.56	2.12	.0006
24 months	9	−2.12	2.27	.023

*Significance of change from baseline.

measurements than those in the precontemplation-contemplation stage.

Discussion

This small pilot study suggests that a patient's readiness to change diabetes self-management as measured by four simple questions was significantly associated with the likelihood of a successful clinical outcome in this educational intervention. Patients who stated that they were ready to begin to change their diabetes-related behavior now (action stage) or within 1 month (preparation stage) reduced their baseline hemoglobin A_{1c} levels more quickly and to a greater degree than patients who were willing to change their diabetes management in 6 months (contemplation stage) or who did not want to change their diabetes management (precontemplation stage). Large clinical trials indicate that a 1% reduction in hemoglobin A_{1c} levels is associated with a 38% reduction in eye disease and a 22% reduction in kidney disease in 6.5 years.[2] Those in the preparation and action stages reduced their hemoglobin A_{1c} levels by an average of approximately 2.5%, which would be expected to result in substantial clinical benefit. In addition, patients in the action and preparation groups were likely to have their hemoglobin A_{1c} measured more often than patients in the precontemplation-contemplation group. This finding might reflect a more concerted effort to follow up with their health care provider and receive or request the recommended testing.

It should be noted that all the study patients had particularly high hemoglobin A_{1c} levels. Although substantial reductions were achieved in the study, none of the groups achieved a mean hemoglobin A_{1c} level of 8% or less at 1 year. Clearly, more therapeutic improvement needs to be achieved with many patients. In addition, during the study period none of the groups had the eight hemoglobin A_{1c} measurements recommended by the American Diabetes Association (ADA) for patients with high values.[2,20] The ADA clinical care recommendations suggest that poorly controlled patients should have their hemoglobin A_{1c} measured quarterly, more often if needed, to monitor therapy closely.

Although incomplete data for the 24-month study participants preclude clear comparisons, some patients from the precontemplation-contemplation group made substantial changes in hemoglobin A_{1c} levels. The patients from this group who remained under the care of their physician were noted to have hemoglobin A_{1c} levels that were similar to those of patients in the preparation or action group in the 12- to 24-month period. That change in hemoglobin A_{1c} levels at 24 months for the precontemplation-contemplation group did not achieve significance might have been a power problem. It is not possible to determine clearly whether substantial differences in hemoglobin A_{1c} levels persisted between groups at 24 months.

Patients' readiness-to-change scale was determined before starting a standard local intervention that provided intensive diabetes education. This educational intervention was more effective among patients willing or eager to change their current self-management. Many interventions in diabetes care rely on patient motivation, and patients are likely to respond in a similar fashion to the readiness-to-change scale used in this study. This simple tool could be used to target patients for educational programs more effectively and to design diabetes interventions more acceptable for both the patient and the health care provider.

This pilot study had several limitations. There were only a few patients in each group. The patients included in the study had high hemoglobin A_{1c} levels and might not be representative of the average patient. The intervention used in the study relied on the patient's help to select a program that would be acceptable to the patient and address individual needs. This type of intervention might have been more sensitive to a patient's readiness to change than other interventions. Other psychosocial or medical interventions could be designed that would not rely so heavily on a patient's readiness to change. Although intended to be purely observational, because of the design it was not possible to assure that the educators were blinded to patients' stage of change. Nevertheless, the educational program was pre-existing and did not appear to alter in any noticeable way when the staging questions were introduced.

Of course the readiness- to change-model emphasizes that stages of change alter with time, and the study did not reevaluate stages of change with time. It might be that patients experienced an alteration in readiness to change as a result of the intervention and before subsequent reductions in hemoglobin A_{1c} levels. The study did not recategorize patients after the initial intervention. Never-

theless, the study provides information about expected clinical outcomes at a specific time, that is, after referral for an educational intervention. Although this assessment appears to have significant association with outcomes at 12 months, association with outcomes for longer periods is unclear. It would appear reasonable to repeat categorization into readiness-to-change stages after 12 months.

Assessment of this simple tool in larger groups and with different interventions might be of value in learning about how education programs can improve clinical outcomes more consistently. Further study on interventions that promote progression through the stages of change is warranted. In particular, educational interventions might be able to increase effectiveness by tailoring messages to more directly appeal to patients in different stages.

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