Association of Self-Efficacy and Self-Care With Glycemic Control in Diabetes

Carla Moore Beckerle, DNP, APRN, ANP-BC, and Mary Ann Lavin, DSc, APRN, ANP-BC, FNI, FAAN

Abstract

Successful daily self-management of diabetes is essential to the achievement of positive health outcomes. Basic to successful self-management of any disease is a sense of self-efficacy, or the feeling of confidence in one’s self-management abilities. This study examined the association of these variables on the achievement of glycemic control, specifically A1C levels.

This study used a retrospective cohort design to evaluate the predictive relationship of self-efficacy and self-care behaviors on A1C level. After Institutional Research Board approval was obtained, 60 medical records were accessed of people ≥ 18 years of age with type 1 or type 2 diabetes who were seen consecutively in a primary care practice located in an urban setting.

Data analysis revealed no statistically significant relationships between global measures of self-efficacy and self-care and A1C levels. However, there were two questions from the Stanford Diabetes Self-Efficacy for Diabetes Scale found to be significantly related to A1C (P < 0.009). Those whose diabetes was well controlled were confident in selecting appropriate foods when hungry and in their ability to exercise for 15–30 minutes, four to five times per week. These findings, if replicated in future studies, may provide clinicians an opportunity to develop and test targeted self-management interventions yielding the highest probability of improved glycemic control.

The incidence of diabetes has escalated in the United States, with the estimated number of those diagnosed with the disease doubling in the past several years to 8.3% of the population.1 Successful daily management of diabetes and the use of self-management techniques require a positive expectation of outcomes and confidence in one’s ability to manage the disease. Factors that influence diabetes control include the association between self-efficacy and self-care behaviors.2 When diabetes control is achieved, micro- and macrovascular complications decline.3

According to the American Diabetes Association (ADA) Standards of Medical Care in Diabetes,4 achieving adequate glycemic control requires behavioral changes to increase activity levels, change eating patterns, comply with medication regimens, perform self-monitoring of blood glucose, and monitor carbohydrate intake. An explanation of how such behavioral changes require self-efficacy and self-care management is appropriate.

Bandura5 defined self-efficacy as “people’s beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives.” Self-efficacy beliefs determine how people feel, think, motivate themselves, and behave over time. A judgment regarding self-efficacy may determine how much effort a person expends when confronted by challenges. This means that people with an adequate sense of self-efficacy feel
confident in their ability to perform, whether that means administering their medications correctly, adjusting their diet as indicated, preventing hypoglycemia, or exercising appropriately. A strong sense of self-efficacy is necessary to master challenges inherent in these activities. The perception of being capable influences the thought patterns necessary to perform such tasks.

Bandura advocates evaluating self-efficacy beliefs in terms of judgments of capability (“I am capable of . . .”) or “I feel confident that I can . . .”). He further recommends that people’s judgment about their capability be measured across realms or domains of activity, with different degrees of task difficulty and under different situational circumstances. For people with type 1 or type 2 diabetes, a sense of confidence in their ability to performing daily self-care activities seems basic to successful diabetes self-care influence the choices people make, some people may have a high degree of both but may still choose unhealthy behaviors. Two examples would be a physician with diabetes who does not adhere to dietary recommendations or a registered nurse with diabetes who does not take steps to decrease portion sizes. Yet, these individuals would answer that they have confidence in their ability to implement these behaviors. Still, enhancing self-efficacy and self-care is thought to be a strategy for accelerating the implementation of new behaviors.

According to Bandura, “self-care behavior is the end result of cognitive processes that people employ when acquiring knowledge.” Knowledge acquisition, in turn, is the result of a teaching and learning process. The aim of self-care is to appropriately fulfill the daily regimen of tasks that individuals need to carry out to manage diabetes. Self-care behavioral skills in people with diabetes can be challenging for individuals because self-care poses many demands regarding such areas as dietary choices, exercise, glucose monitoring, and medication adherence.

Although self-efficacy and self-care influence the choices people make, some people may have a high degree of both but may still choose unhealthy behaviors. Two examples would be a physician with diabetes who does not adhere to dietary recommendations or a registered nurse with diabetes who does not take steps to decrease portion sizes. Yet, these individuals would answer that they have confidence in their ability to implement these behaviors. Still, enhancing self-efficacy and self-care is thought to be a strategy for accelerating the implementation of new behaviors.

This study evaluates self-efficacy and self-care and its predictive relationship to A1C levels. Its hypothesis is that, as self-care and self-efficacy increase, A1C levels decrease.

Table 1. Self-Efficacy for Diabetes Scale

<table>
<thead>
<tr>
<th>Question</th>
<th>Not at all 1 2 3 4 5 6 7 8 9 10</th>
<th>Confident</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How confident do you feel that you can eat your meals every 4 to 5 hours every day, including breakfast every day?</td>
<td>Not at all 1 2 3 4 5 6 7 8 9 10</td>
<td>Confident</td>
</tr>
<tr>
<td>2. How confident do you feel that you can follow your diet when you have to prepare or share food with other people who do not have diabetes?</td>
<td>Not at all 1 2 3 4 5 6 7 8 9 10</td>
<td>Confident</td>
</tr>
<tr>
<td>3. How confident do you feel that you can choose the appropriate foods to eat when you are hungry (for example, snacks)?</td>
<td>Not at all 1 2 3 4 5 6 7 8 9 10</td>
<td>Confident</td>
</tr>
<tr>
<td>4. How confident do you feel that you can exercise 15 to 30 minutes, 4 to 5 times a week?</td>
<td>Not at all 1 2 3 4 5 6 7 8 9 10</td>
<td>Confident</td>
</tr>
<tr>
<td>5. How confident do you feel that you can do something to prevent your blood sugar level from dropping when you exercise?</td>
<td>Not at all 1 2 3 4 5 6 7 8 9 10</td>
<td>Confident</td>
</tr>
<tr>
<td>6. How confident do you feel that you know what to do when your blood sugar level goes higher or lower than it should be?</td>
<td>Not at all 1 2 3 4 5 6 7 8 9 10</td>
<td>Confident</td>
</tr>
<tr>
<td>7. How confident do you feel that you can judge when the changes in your illness mean you should visit the doctor?</td>
<td>Not at all 1 2 3 4 5 6 7 8 9 10</td>
<td>Confident</td>
</tr>
<tr>
<td>8. How confident do you feel that you can control your diabetes so that it does not interfere with the things you want to do?</td>
<td>Not at all 1 2 3 4 5 6 7 8 9 10</td>
<td>Confident</td>
</tr>
</tbody>
</table>

*This scale is free to use without permission. Stanford Patient Education Research Center, 1000 Welch Road, Suite 204, Palo Alto, CA 94304. Funded by the National Institute of Nursing Research.*
The study site, Esse Health, comprised 31 private primary care offices in a large, Midwestern suburb. Esse Health serves patients with Medicare and commercial insurance, as well as those who self-pay for health care.

Esse Health encourages innovation to improve chronic disease care. A quality improvement committee oversees the design and implementation of numerous projects at these sites. At the time of this study, one of the innovations was the inclusion of the Stanford Self-Efficacy for Diabetes Scale (SES) (Table 1) and the Self-Care Inventory (SCI) (Table 2) in the assessment process. The Esse Health dietitians were responsible for documentation of the two surveys in the health care records of people with type 1 or type 2 diabetes.

This innovation prompted analyses of baseline self-efficacy and self-care management data and their relationship to glycemic control. The specific questions asked were:

1. What is the association between self-efficacy and self-care? Does the risk of poor self-care increase as self-efficacy decreases?
2. What is the association between self-efficacy and A1C? Does the risk of poor glycemic control increase as self-efficacy decreases?
3. What is the association between self-care and A1C? Does the risk of poor glycemic control increase as self-care decreases?
4. Given that the above associations are positive, what percentage of the variance in A1C values is accounted for by self-care or self-efficacy measures?

To answer these questions, archived data were retrieved for all cognitively unimpaired people, aged ≥ 18 years, with type 1 or type 2 diabetes seen between 10 February and 10 March 2012. The specific data reviewed included SES and SCI scores and all A1C results conducted within the 12-month period preceding the visit that occurred between 10 February and 10 March 2012. Charts missing the required data were excluded. For adequate power, it was determined that 60 records were needed for a sample size large enough to detect a 33% improvement in the proportion of people with well-controlled glycemia a level of α = 0.05. All data collected were de-identified and entered into SPSS Statistics for Windows, version 17 (SPSS Inc., Chicago, Ill.) for analysis.

The study focused on two independent variables and one dependent, or outcome, variable. The independent variables were the SES and SCI scores. The SCI is an eight-item questionnaire. Each item requires a response on a 10-point Likert scale, with 1 being “not at all confident” and 10 being “totally confident.” The SCI is a 14-item questionnaire with a 5-point Likert scale with 1 being “I do not do what is recommended” and 5 being “I always do what is recommended.” The dependent, or outcome, variable was glycemic control, defined as the ADA-recommended A1C value of < 7.0%. Lack of glycemic control refers to a value ≥ 7.0%. If A1C is within the target range, the recommended frequency of testing is every 6 months; if it is not, the recommended testing frequency is every 3 months. Patients’ mean A1C

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**Table 2. Self-Care Inventory**

Please rate each of the items according to how well you followed your prescribed regimen for diabetes care in the past month.

Scale: 1 = Never do it; 2 = Sometimes follow recommendations, mostly not; 3 = Follow recommendations about 50% of the time; 4 = Usually do this as recommended, occasional lapses; 5 = Always do this as recommended without fail; and NA = Cannot rate this item/not applicable

1. Glucose testing 1 2 3 4 5 NA
2. Glucose recording 1 2 3 4 5 NA
3. Administering correct insulin dose 1 2 3 4 5 NA
4. Administering insulin at right time 1 2 3 4 5 NA
5. Adjusting insulin intake based on blood glucose values 1 2 3 4 5 NA
6. Eating the proper foods; sticking to meal plan 1 2 3 4 5 NA
7. Eating meals on time 1 2 3 4 5 NA
8. Eating regular snacks 1 2 3 4 5 NA
9. Carrying quick-acting sugar to treat reactions 1 2 3 4 5 NA
10. Coming in for appointments 1 2 3 4 5 NA
11. Wearing a medic alert ID 1 2 3 4 5 NA
12. Exercising regularly 1 2 3 4 5 NA
13. Exercising strenuously 1 2 3 4 5 NA
was, therefore, usually based on a minimum of two values per year. If only one value was available in the medical record, this single value was used in lieu of a mean.

Data analysis addressed each of the study questions. Pearson $\chi^2$ and Fishers exact tests were used to determine the association between high and low self-care and self-efficacy scores and A1C levels $\geq 7.0\%$ and $< 7.0\%$ (uncontrolled and controlled glycemia, respectively). These results were also stratified to examine age and sex effects. The influence of ethnicity was not examined, because this information was not collected by Esse Health at the time of the project.

The distribution of the self-care and self-efficacy scores were plotted to examine how well self-care and self-efficacy scores predicted A1C values. If the distribution appeared normal, then the variables were to be evaluated as continuous variables. If the distributions did not appear normal, then the relationship was to be tested using nonparametric statistics (Spearman’s correlation coefficient).

**Study Results**

Initially, 60 medical records were evaluated, but only 57 contained completed data. Therefore, 57 medical records were reviewed and included. Table 3 presents the age and sex distribution of people comprising the retrospective cohort. There was relatively even distribution between the sexes. Age was distributed by adults (18–62 years), older adults (63–74 years), and very old adults (75–99 years). This distribution was established to generally reflect the working population (18–62 years) and the younger and older retired populations. It was thought that members of the older retired population may experience an escalating number of chronic illnesses and a decreased ability to self-manage their diabetes. If such differences existed, the investigators wanted to identify them. $\chi^2$ analyses were used to determine the associations between controlled versus uncontrolled A1C and sex (male vs. female) and each of the three age categories. No statistically significant findings were detected.

Figure 1 addresses the first question: What is the association between self-efficacy and self-care? The distribution of SES and SCI responses were examined. Note that self-efficacy and self-care vary together ($\chi^2 = 7.86$, degrees of freedom [df] 1, $P = 0.007$; Spearman’s correlation coefficient [$\rho$] = 0.537, $P < 0.000$ (two-tailed)).

The second question asked whether there was a difference in mean A1C values between patients with high and low self-efficacy and self-care scores. No significant differences were found. Self-efficacy and self-care scores varied together.

These findings evoked a closer examination of the SES and SCI items and why they may or may not be related to glycemic control. The question asked was: Why would self-care items such as how well a person obtains or records glucose values in the past month be poorly correlated with A1C? The answer may be that, regardless of how well glucose values are recorded, they will yield glycemic control if the prescribed regimen was less than optimal.

This study did not examine provider compliance with ADA guidelines. For example, it did not look at records to see whether metformin dosages were increased in response to high A1C levels. Similarly, the frequency with which a person obtains and records glucose values will not yield better A1C values if the person was nonadherent to a prescribed regimen. Unfortunately, a medication possession ratio was

**Table 3. Age and Sex Distribution of the Retrospective Study Cohort**

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Sex</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>18–62</td>
<td>Male (52%)</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Female (48%)</td>
<td>8</td>
</tr>
<tr>
<td>63–74</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>75–99</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>31</td>
</tr>
</tbody>
</table>

*At the time of this study, Esse Health did not collect data on race and ethnicity. Therefore, these parameters were not included.
not included in the records of study participants.\(^1\),\(^2\)

Thus, if A1C outcomes are to be used, then only self-care measures that are directly related to A1C (e.g., “I take my medication as prescribed”) must be used, with the response checked against a medication possession ratio for reliability.

A deeper analysis of the relationship between SES and A1C was also undertaken. Even if not all items were associated with greater glycemic control, perhaps specific items on the SES were directly related to glycemic control. Therefore, each item was evaluated independently.

The results indicated that two items may serve as proxy measures for self-efficacy in general among people with diabetes. The first (item 3) was: How confident are you that you can choose the appropriate foods to eat when you are hungry?

Although the association with A1C

Figure 2. Correlation of composite scores for items 3 and 4 in the SES and A1C.

Table 4. Clinical Decision-Making Based on Self-Efficacy Assessment, Diagnosis, and A1C Outcomes and Related Interventions

<table>
<thead>
<tr>
<th>Self-Efficacy Assessment (answers to SES items 3 and 4)</th>
<th>Self-Efficacy Diagnosis</th>
<th>A1C Outcomes and Related Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both responses positive</td>
<td>High self-efficacy</td>
<td>Continue to reinforce patient’s confidence in self-management. Initiate interventions to check medication possession ratio. If the patient is compliant, check the adequacy of the provider’s adherence to ADA recommendations for drug therapy and adjust as needed.</td>
</tr>
<tr>
<td>One response positive, the other negative</td>
<td>Moderate self-efficacy</td>
<td>Continue to reinforce patient’s confidence to self-manage well with the one variable. Initiate interventions to build self-confidence in the other variable.</td>
</tr>
<tr>
<td>Both responses negative</td>
<td>Low self-efficacy</td>
<td>Congratulate patient on the degree of glycemic control, while initiating interventions to build self-confidence in these two self-management areas. Continue to build confidence in the patient’s ability to self-manage, while also checking the patient’s medication possession ratio. If the patient is compliant, check the adequacy of the provider’s adherence to ADA recommendations for drug therapy and adjust as needed.</td>
</tr>
</tbody>
</table>
was not statistically significant, the responses approached significance ($P < 0.06$). The second item (item 4) was: How confident do you feel that you can exercise 15–30 minutes, four to five times per week? The association here with A1C was statistically significant ($P < 0.016$).

When the two items were computed together as a composite score, they yielded a probability of $< 0.009$ (Figure 2). Those who scored high on the composite score of items 3 and 4 were more likely to have an A1C of $< 7\%$. The slope of the line indicated that, as scores decrease, so too does glycemic control, manifested by higher A1C values. Finally, the blue area in Figure 2 indicates that there were some patients who scored well on the composite items (above the slope) but still had poorly controlled glycemia (A1C values well above 7%). These were people who felt confident in their ability to exercise and properly portion their food but who may not do so or who may have a subtherapeutic drug regimen.

Figure 2 also raises questions applicable to future research. For example, assuming appropriate medication possession ratios and a therapeutic, guideline-based drug regimen, could time and money be saved and effectiveness boosted by using these two items to gauge patients’ self-efficacy? Could interventions aimed at increasing patients’ confidence in incorporating exercise into their routine and selecting appropriate foods enhance glycemic control more effectively than current standard care?

There were some limitations involved in the implementation of this study. Although each item was read to patients at the time of patients’ interview with the dietitian, some patients may not have fully understood how to scale their responses. The ability to scale responses may require a conceptual clarity that some patients did not possess. In future studies, it is recommended that the intra-rater reliability of patient responses be evaluated and enrollment limited to the records of patients with acceptable reliability scores.

Another possible limitation involved the SCI. It is possible that people may have found it difficult to report to a dietitian who is part of the health care team that they did not do what the team recommended. This may have been especially true when patients saw that their responses were to be recorded in their health record.

**Summary**

This retrospective chart review suggests that increased confidence of patients with diabetes with regard to selecting appropriate foods when hungry (SES item 3) and working exercise into their daily routine (SES item 4) seems to be correlated with improved glycemic control. On the basis of these results, these two questions were inserted into the nutrition screening tool at Esse Health, and their relationship to glycemic control will continue to be evaluated. In addition, a clinical decision-making tool was developed (Table 4).

This tool is a simple assessment and diagnosis of self-efficacy and its relationship to glycemic control and related interventions. Future studies will report on the results obtained through the use of this tool. The evaluation of such an approach is an important area for future research.

Finally, when glycemic control is the outcome variable being evaluated for clinical or research purposes, it is highly recommended that medication possession ratios and the adequacy of patients’ therapeutic regimen be considered variables that should be controlled, if results are to be interpreted correctly. Clinically, medication possession ratios and the adequacy of patients’ therapeutic regimen should be evaluated at each clinic visit at which it is determined that glycemic control has not been achieved. This study suggests that a two-item self-efficacy assessment (Table 4) should also be performed at these same visits.

**References**


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Carla Moore Beckerle, DNP, APRN, ANP-BC, is vice president of clinical programs at Esse Health in St. Louis, Mo. Mary Ann Lavin, DSc, APRN, ANP-BC, FNI, FAAN, is an associate professor at the St. Louis University School of Nursing in Missouri.