# The Influence of Literacy on Patient-Reported Experiences of Diabetes Self-Management Support

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## Abstract

**Background—**Variability in disease-related outcomes may relate to how patients experience self-management support in clinical settings.

**Objectives—**To identify factors associated with experiences of self-management support during primary care encounters.

**Method—**A cross-sectional survey was conducted of 208 patients seen in a multidisciplinary diabetes program in an academic medicine clinic. Multiple regression analysis was used to test associations between patient-rated experiences of self-management support (Patient Assessment of Chronic Illness Care [PACIC]) and race, gender, insurance status, literacy, duration of diabetes, and intensity of care management.

**Results—**The PACIC ratings decreased with age ($r = -0.235$, $p = .001$), were higher for women than for men (3.95 vs. 3.65, $t = 2.612$, $p = .010$), and were greater for those with more education ($F = 3.927$, $p = .009$) and greater literacy skills ($t = 3.839$, $p < .001$). The ratings did not vary between racial ($t = -1.108$, $p = .269$) or insurance ($F = 1.045$, $p = .374$) groups and were unaffected by duration of diabetes ($r = 0.052$, $p = .466$) and the intensity of care management ($F = 1.028$, $p = .360$). In

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multivariate models, literacy was the only variable contributing significantly to variation in self-management support ratings.

**Discussion**—Even when considering the objective intensity of health services delivered, literacy was the sole variable contributing to differences in patient ratings of self-management support. Although conclusions are limited by the cross-sectional nature of this study, the results emphasize the need to consider literacy when developing and communicating treatment plans requiring self-management skills.

## Keywords

diabetes mellitus; self-care; literacy

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The microvascular and macrovascular complications associated with diabetes mellitus are reduced significantly through vigilant glycemic, lipid, and hypertension management (American Diabetes Association, 2009; Chin et al., 2000; United Kingdom Prospective Diabetes Study Group [UKPDS], 1998a, 1998b). Despite significant advances in the treatment of diabetes, however, few patients reach outcomes recommended in clinical guidelines: Only 50% of Americans with diabetes have a glycosylated hemoglobin (A1C) level of < 7%, only 66% have normal renal function, and approximately 33% have desired lipid profiles (Dowell et al., 2004; Nelson, Chapko, Reiber, & Boyko, 2005; Putzer et al., 2004; Resnick, Foster, Bardsley, & Ratner, 2006). Racial minority status, lower literacy skills, and lack of insurance are associated with poorer diabetes-related outcomes (Piette, Wagner, Potter, & Schillinger, 2004; Schillinger, Barton, Karter, Wang, & Adler, 2006; Schillinger, Bindman, Wang, Stewart, & Piette, 2004; Schillinger et al., 2002).

A possible explanation for the less-than-optimal outcomes associated with diabetes is that despite the increasing availability of effective medications, successfully managing diabetes requires that patients integrate numerous actions (e.g., medication management, glucose testing, regular appointments, diet, and exercise) into their daily lives. In fact, patients who report greater engagement in self-care experience better outcomes (Heisler, Piette, Spencer, Kieffer, & Vijan, 2005). However, patients often are not taught self-management skills, which include basic knowledge acquisition, skill in applying practical information, setting realistic goals, and problem solving.

Although efforts to expand diabetes self-management support through alternative means (e.g., telephone, Internet) are promising (Piette, 2002; Schillinger et al., 2008), the vast majority of diabetes care takes place in traditional primary care settings (Schappert & Rechtsteiner, 2008) where the quality of self-management support generally falls far short of that documented to improve outcomes (Peyrot, Rubin, Funnell, & Siminerio, 2009). In response, the popular Chronic Care Model (CCM) has been applied to improve the overall quality of diabetes care delivered in primary care settings. Care modeled after the CCM includes providing self-management support to patients through goal-setting, follow-up, and links to community resources, as well as providing support to care providers through delivery system redesign, decision support, and clinical information systems (Bodenheimer, Wagner, & Grumbach, 2002a, 2002b; Wagner, 2001a, 2001b; Wagner, Austin, et al., 2001; Wagner et al., 2005; Wagner, Glasgow, et al., 2001). Modeling primary care services after the CCM improves diabetes outcomes (Bray et al., 2005; Bray, Thompson, Wynn, Cummings, & Whetstone, 2005; Siminerio, Piatt, & Zgibor, 2005).

Assessments of how well clinical care is aligned with the CCM have relied largely on the Assessment of Chronic Illness Care (ACIC; Bonomi, Wagner, Glasgow, & VonKorff, 2002). The ACIC, completed by providers in practices, assesses key elements of the CCM, including (a) the organization of the health care delivery system (e.g., leadership, chronic illness

management as a priority); (b) community links (e.g., to insurance-based resources); (c) self-management support (assessment and documentation of patient self-management needs); (d) decision support (accessibility of evidence-based guidelines and specialists); (e) delivery system design (organization of appointments for follow-up, continuity of care); (f) clinical information systems (reminders and feedback to providers); and (g) integration of CCM components (linking patients' self-management goals to information systems and registries (MacColl Institute for Healthcare Innovation, 2000). Because the ACIC is completed at the clinic level, though, researchers have since developed the Patient Assessment of Chronic Illness Care (PACIC) to understand and incorporate patient perspectives, provide convergent information, address potential over-reporting bias on the part of clinicians, and create a means to assess the quality of chronic illness care on a larger scale (Glasgow, Wagner, et al., 2005; Glasgow, Whitesides, Nelson, & King, 2005). Informed by theories of patient-centeredness and behavior change, the activities specifically assessed using the PACIC include information sharing, open communication, engagement in setting goals, and receipt of follow-up support. In validation studies, higher PACIC scores were associated with receipt of routine diabetes-related laboratory tests and behavioral counseling and were unassociated with patient characteristics (Glasgow, Whitesides, et al., 2005; Schmittdiel et al., 2008).

Researchers have found that non-Caucasians and those with lower educational attainment score higher on the PACIC (Jackson, Weinberger, Hamilton, & Edelman, 2008), which corresponds with research findings documenting racial or ethnic, gender, and age-related differences in patient satisfaction ratings (Murad, Gjerde, Bobula, Ostrov, & Murad, 2009; Young, Meterko, & Desai, 2000). Because studies thus far have associated PACIC scores with patient-reported outcomes (e.g., self-care activities, receipt of routine blood work) rather than objective process measures (e.g., number and nature of visits), it is unclear whether these results reflect differences in health care quality or in perceptions among demographic groups. In addition, because studies have relied on mailed, self-administered surveys, it is also unclear whether literacy, an important factor related to diabetes self-care behaviors and clinical outcomes (Dewalt, Berkman, Sheridan, Lohr, & Pignone, 2004; Keller, Wright, & Pace, 2008), affects PACIC ratings. The purpose of this study was to examine whether demographic characteristics, insurance status, literacy, duration of diabetes, and intensity of care management were associated with PACIC ratings in a diabetes management program modeled after the CCM.

## Method

### Setting

Patients were recruited from a diabetes management program housed within an academic internal medicine practice. The program utilizes a patient registry, evidence-based treatment algorithms, and a multidisciplinary team that includes a clinical pharmacist, nurse practitioner, registered dietician (all certified diabetes educators offering one-on-one visits for individualized care, American Diabetes Association-approved diabetes self-management classes, and consultation to patients and primary care providers), and trained care assistants (who attend primary care visits and provide regular telephone follow-up; Malone, Shilliday, Ives, & Pignone, 2007; Rothman et al., 2006). Improving blood glucose levels, reducing cardiovascular risk, providing foot care, treating depression, and encouraging vaccination and ophthalmic care are mainstays of the program. In addition, the program is focused on improving patients' diabetes-related knowledge and self-management and helping to address common treatment barriers, such as transportation and medication costs. Clinical care is delivered individually and in groups. Past studies have shown that improvements among those enrolled in this program are greatest for the most vulnerable patients, particularly those with limited literacy skills (Rothman, DeWalt, et al, 2004).

### Sampling and Participants

A sample of 208 consecutive patients with diabetes seeking routine clinical care was recruited to complete surveys between January and March 2008. The sample size was calculated to yield power of 80% to detect contributions of 5% for any term in a general linear model with eight or fewer additional terms that did not contribute additional explanatory power.

Inclusion criteria were being 18 years or older and having the ability to speak English. Patients were excluded if, by clinician report, they were not responsible for their own diabetes care (e.g., residents of skilled nursing facilities) or had significant cognitive deficits. Because most patients seen in this practice have type 2 diabetes, only those with type 2 diabetes were recruited. The racial or ethnic composition of the study population was most conducive to exploring African American and Caucasian differences; therefore, those who did not identify themselves as African American or Caucasian were excluded.

### Measures

**Health literacy—**Patient literacy was assessed using the short version of the Test of Functional Health Literacy for Adults (S-TOFHLA; Baker, Williams, Parker, Gazmararian, & Nurss, 1999; Parker, Baker, Williams, & Nurss, 1995) The S-TOFHLA is a reading comprehension test commonly used in health care settings. It is highly correlated with tests used in general education, such as the revised Wide Range Achievement Test ($r = 0.74$; Davis, Kennen, Gazmararian, & Williams, 2004) and with scores on the Rapid Estimate of Adult Literacy in Medicine ($r = 0.84$; Davis et al., 1993). The S-TOFHLA is scored on a scale of 0 to 36; a score of 23 to 36 indicates adequate literacy, 17 to 22 indicates marginal literacy, and 0 to 16 indicates inadequate literacy (Baker et al., 1999; Parker et al., 1995).

**Self-management support—**Patients' perceptions of the quality of the self-management support they received were assessed using the PACIC. The PACIC is a 26-item, 5-point-response (ranging from almost never [0] to almost always [5]) patient questionnaire used to determine to what extent the care received aligns with the CCM (Glasgow, Wagner, et al., 2005; Glasgow, Whitesides, et al., 2005). It includes a summary score (mean of 20 items) and five subscales: Patient Activation (items 1–3; e.g., Asked for my ideas when we made a treatment plan), Delivery System Design/Decision Support (items 4–6; e.g., Given a written list of things I should do to improve my health), Goal Setting (items 7–11; e.g., Asked to talk about my goals in caring for my illness), Problem-Solving/Contextual Counseling (items 12–15; e.g., Helped make a treatment plan that I could do in my daily life), and Follow-Up/Coordination (items 16–20; e.g., Contacted after a visit to see how things were going). Scores are calculated as means of the items within each subscale. The summary score is the mean of items 1 to 20. Items 21 to 26 are used to associate the PACIC with the organizational-level acic (Bonomi et al., 2002), which was not addressed in this study.

Studies have demonstrated that the PACIC is internally consistent ($\alpha = 0.93$), demonstrates test-retest reliability ($r = 0.58$ over 3 months), and is correlated to patient activation and primary care measures ($r = 0.32$–$0.60$; Glasgow, Wagner, et al., 2005; Glasgow, Whitesides, et al., 2005).

**Intensity of care management—**The intensity of clinical management was measured through the number of (a) phone calls made by program staff, (b) visits attended by program staff, and (c) A1C tests during the year prior to study enrollment. Also considered was the program's clinician-constructed system, which stratifies patients into three risk categories (high, moderate, low) based on factors clinicians believe indicate a patient's need for more intensive treatment (e.g., poor glycemic control, high blood pressure, previous incidents of hypoglycemia, depression). Because these risk categories drive the program's stepped care

approach, in which those in the higher risk categories receive more intensive treatment (e.g., more frequent visits, lab tests, phone support, visits attended by additional clinic staff) and subsequently determine the level of program staff involvement, this variable was felt to provide the most comprehensive measure of care intensity (Table 1).

### Procedures

Per the protocol approved by the Public Health-Nursing Institutional Review Board of University of North Carolina at Chapel Hill, a trained research assistant approached patients during a routine clinic visit. After obtaining informed consent, the research assistant administered the S-TOFHLA literacy assessment. Patients scoring 23 or above, indicating adequate literacy, self-administered the surveys. Surveys were orally administered to patients scoring 22 or below, indicating marginal or inadequate literacy. Surveys took approximately 15 minutes to complete and usually were administered while patients waited for their care provider. Patients were compensated for their time with $2 clinic parking vouchers. Research staff then collected utilization and laboratory data from patients' medical records.

### Analysis

Correlations among the five PACIC subscales ranged from 0.50 to 0.75. A principal factor analysis of the subscales yielded one significant eigenvalue, confirming that there was considerable overlap among them. Because the subscales were not empirically distinct from each other, the PACIC summary score was chosen as the dependent variable for analysis. Values for the summary score ranged from 1.00 to 5.00, with a mean and standard deviation of 3.84 and 0.80, respectively, and mild to moderate skew and kurtosis. Product moment correlations and analysis of variance were used for bivariate analyses relating the PACIC summary score to patient characteristics, insurance coverage, and level of literacy. Analyses to explore the joint contributions of patient characteristics, insurance coverage, and level of literacy to the PACIC summary score were performed by regressing the PACIC summary score on a set of centered predictors from those domains. Because literacy and education were associated strongly, only literacy was retained as a predictor in multivariate analyses to prevent incorrect conclusions due to multicollinearity. Literacy was preferred over education because it was measured at the time of the study using a reliable instrument, whereas the interpretation of education effects suffers from differences in the quality of schools, differences in performance level for persons passing the same grade within a school, and varying periods of time from the end of formal education to enrollment in the study. The duration of diabetes exhibited noticeable positive skew and severe positive kurtosis, which was remediated considerably with a logarithmic transformation.

Clinically meaningful criteria have been established for using the S-TOFHLA to classify patients' health literacy as inadequate, marginal, or adequate; patients were grouped into those ordinal classes to make the interpretation of results more clinically relevant. The inadequate and marginal categories were merged because the effects of low health literacy may persist into the marginal category (Dewalt et al., 2004). Finally, for intensity of care management, the high- and moderate-risk categories were combined for contrast with the low-risk category because patients in the high- and moderate-risk categories are managed actively in the diabetes program, whereas those in the low-risk category only receive extra attention if the patient or physician requests it.

## Results

### Participants

Two hundred eight patients with type 2 diabetes agreed to participate. Four participants were eliminated from the analysis because they did not identify themselves as African American or

Caucasian, leaving a total sample of 204 patients. Preliminary analyses revealed that 195 participants (96%) completed all survey items. There were no demographic or literacy differences between those who completed all survey questions and those who did not. No data imputation was attempted.

The mean age of participants was 58 years (range = 23–85). Sixty-four percent were women, and 48% were African American. Twenty-four percent of the participants were uninsured, and 20% had Medicaid. Thirty-four percent did not finish high school, and 31% demonstrated less than adequate literacy. Participants communicated extensive experience with their diabetes, with an average length of time since diagnosis of 10 years (range = 1–50). Participants' mean A1C was 7.5% (range = 4.6%-14.1%), and mean body mass index was 37.0 kg/m$^2$ (range = 21.5–66.5); 51% were receiving insulin therapy.

According to the diabetes program's clinical algorithm (Table 1), 28% of participants were categorized as high risk, 35% were moderate risk, and 37% were low risk (high and moderate risk indicate delivery of high-intensity care management services). During the year prior to recruitment, participants had a mean of 3 primary care provider visits (range = 0–11) attended by program staff and received 3 follow-up phone calls (range = 0–19) and 3 A1C tests (range = 1–7).

### Bivariate Analyses

Bivariate analyses showed that PACIC ratings decreased with age ($r = -0.235$, $p = .001$), were higher for women than for men (3.95 vs. 3.65, $t = 2.612$, $p = .010$), and were greater for those with more education ($F = 3.927$, $p = .009$) and greater literacy skills ($t = 3.839$, $p < .001$). The ratings did not vary between racial ($t = -1.108$, $p = .269$) or insurance ($F = 1.045$, $p = .374$) groups and were not associated with duration of diabetes ($r = 0.052$, $p = .466$).

The PACIC ratings did not vary according to the intensity of disease management (i.e., among the high-, moderate-, and low-risk categories; $F = 1.028$, $p = .360$) and were not associated with the number of telephone contacts ($r = -0.89$, $p = .365$), number of primary care visits attended by program staff ($r = -0.009$, $p = .913$), and number of A1C tests completed ($r = 0.051$, $p = .512$) during the year prior to data collection. Because PACIC ratings could be related to patient factors (i.e., missed appointments), a ratio was created to reflect the involvement of clinic staff relative to the total number of patient visits during the previous year (i.e., the number of completed primary care physician visits divided by number of visits attended by program staff). Again, no relationship between this proportion and the PACIC score was found ($r = 0.037$, $p = .646$).

### Multivariate Analyses

Adequate literacy was the only predictor contributing to variability in self-management support ratings in multivariate models (0.392, $p = .003$; Table 2). Except for the delivery system design subscale, literacy-based differences persisted throughout the PACIC subscales (Table 3).

### Exploration of Literacy-Based Differences

Because surveys were administered verbally to those with inadequate (0–16) and marginal (17–22) literacy and self-administered by those with adequate (23–36) literacy, the association between the raw S-TOFHLA scores was examined as a continuous variable and between the PACIC total and subscale scores for all respondents. Again, except for delivery system design ($r = 0.115$, $p = .119$), the association between PACIC scores and literacy remained significant for the total score and subscales ($r = 0.253–0.292$, $p \leq .001$, suggesting that differences are due to literacy and not to differences in administration.

Because the intensity of treatment (i.e., the risk level) is determined by a number of subjective factors that may be related to literacy, differences in literacy among the high-, moderate-, and low-risk categories were explored. There were no differences in literacy levels between the three risk categories, either with literacy as a continuous ($F = 1.981$, $p = .141$) or as a categorical (inadequate or marginal vs. adequate) variable ($\chi^2 = 2.69$, $p = .261$). These findings suggest that the risk category and literacy were independent constructs and that the model accurately reflects the contribution of each to PACIC variability.

### Exploration of Gender and Literacy

Potential associations of gender and literacy were explored to understand their relative contributions in the multivariate model. Although women had higher literacy skills than men in the sample (mean TOFHLA = 27.56 for women, 21.01 for men, $p = .001$), diagnostics from the regression analysis did not indicate substantial collinearity between gender and literacy. These findings suggest that the results of the multivariate model are accurate: gender likely influenced PACIC ratings, but the effect was much smaller than that of literacy.

## Discussion

The relationships among PACIC scores, clinical support intensity, and patient factors known to influence diabetes outcomes were assessed. Literacy was related more strongly to perceived chronic illness care than other patient factors and actual care intensity. This study has the advantage of documented services reflecting clinicians' approach to intensive therapy (i.e., care management), and the approach was not related to the patient's perception of comprehensiveness of chronic illness care.

In a study assessing the use of the PACIC instrument in a population of diabetic patients, Glasgow, Whitesides, et al. (2005) concluded that PACIC scores were unrelated to patient characteristics but were related instead to the quality of diabetes care received (i.e., patient-reported blood tests and behavioral counseling). Others have found racial or ethnic and education-based variability in PACIC scores, with non-Caucasians and people with lower educational attainment scoring higher on the PACIC (Jackson et al., 2008). Both of these findings are contrary to the results of the current study. Even when considering several variables indicating the intensity of health services delivered to patients during the year prior to study enrollment, there was no association between the intensity of care and patients' ratings of their self-management support. Although there were bivariate differences between gender groups, literacy was related much more strongly to variability in PACIC scores in the multivariate model. This finding indicates that patient literacy may be one of the most important factors to consider when designing and implementing programs to improve chronic illness outcomes, especially for conditions requiring significant self-management on the part of patients.

Research suggests that low literacy is associated with a number of health-related outcomes, including less health-related knowledge, lower functional status, higher morbidity, and greater use of health resources (Dewalt et al., 2004; Keller et al., 2008). In a previous study, the particular disease management model used in this study showed greater improvement for those with limited literacy skills (Rothman, Malone, et al., 2004), but understanding the effectiveness of interventions targeting literacy is an area needing continuing research (Pignone, DeWalt, Sheridan, Berkman, & Lohr, 2005). The only subscale that did not vary by literacy level was delivery system, or practice design, which is assessed with three questions focusing on whether patients were given written instructions, whether they were satisfied that their care was well-organized, and whether they were shown the association between self-care and the effect on their illness. A possible explanation for the lack of difference may be that these questions are more process oriented than those on other scales, which include more questions about whether

patients were asked for input or whether their health care providers considered the context of their daily lives.

On average, women scored higher on the PACIC than men in this study. The contribution of gender to variability of PACIC ratings also approached significance in the multivariate model. This finding corresponds to the initial PACIC validation study of patients with one or more chronic illnesses (Glasgow, Wagner, et al., 2005), but is contrary to other studies focused on patients with diabetes, where women generally report lower satisfaction (Nicolucci et al., 2009; Unden et al., 2008). Although it is documented widely in the research literature that non-Caucasians are more likely to experience poorer diabetes care and health outcomes, disparities are not found in PACIC ratings among racial groups. A recent study of patients seeking care in the Veterans Administration system showed that non-Caucasians and those with lower educational attainment reported their care as more in line with the CCM (Jackson et al., 2008). These results beg the question of whether patient-perceived quality accurately reflects quality of care or whether it reflects differences in expectations and other patient traits or states, such as mental well-being and functional health status (Nicolucci et al., 2009).

Although the PACIC has been associated with markers of quality diabetes care (i.e., blood tests and behavioral counseling; Glasgow, Whitesides, et al., 2005) and reported self-care behaviors (Schmittdiel et al., 2008), a particular strength of this study is that, unlike previous studies, the measures of the nature and intensity of care management did not rely on patient self-report. If patients' experiences of support were reflective of the intensity of care being delivered, those receiving more intensive disease management services would be expected to have higher PACIC ratings. This was not the case for any of the measures included in this study. Two explanations follow from the results: The PACIC instrument may not reflect accurately the nature and quality of the chronic illness care being delivered in clinical settings. Such findings are not unique. Some researchers have found little association between technical quality of care and patient ratings (Rao, Clarke, Sanderson, & Hammersley, 2006), whereas others have found that improvement in the technical quality of care can be associated negatively with patient satisfaction (Weyer, Bobiak, & Stange, 2008). A second explanation may be that the lack of association between the number of care management services offered and patients' PACIC ratings may reflect that, despite being intensive for patients experiencing poor outcomes or psychosocial challenges, the clinical efforts in this setting may be unrelated to what patients understand as supporting their self-management.

No other study was found to consider how literacy influences PACIC ratings. Because surveys were administered orally to those with marginal and inadequate literacy and self-administered by those with adequate literacy, literacy-based differences in PACIC scores may reflect differences in administration. However, additional analyses exploring the relationship between literacy and self-management support ratings showed that the positive relationship between the two persists when the S-TOFHLA is used as a continuous variable and that differences exist between all three literacy levels. Another limitation is that variability in the patients' ability to interpret survey questions across literacy levels may explain differences in PACIC scores, although research assistants reported little difficulty (e.g., repeating questions, taking a long time to answer) with orally administering the survey to those with less than adequate literacy.

## Conclusions

Implications of this study include the need to consider literacy as an important factor when caring for patients with chronic illnesses, especially diverse and vulnerable populations. Literacy might affect patient assessments of health care quality. Finally, given the call to incorporate patient assessments into health care quality ratings, the results suggest that there is a continuing need to explore the association between patient ratings and objective measures

of health service delivery and the inherent value of each in determining health care quality. Future research should continue to explore relationships between the PACIC, patient traits and states (e.g., distress, activation, self-efficacy), and objective processes of care, and how each is related to health outcomes.

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**Table 1**

Program Treatment Criteria and Intensity of Care Management

|  | **High-Risk Category** | | **Moderate-Risk Category** | | **Low-Risk Category** | |
|---|---|---|---|---|---|---|
| Criteria | A1C > 8.5% *or*<br>BP > 160/90 *or*<br>no ASA or statin *or*<br>significant psychosocial<br>risk factors | | A1C = 7.5%–8.5% *and*<br>BP > 140–160/85–90 *and*<br>moderate psychosocial<br>risk factors | | A1C < 7.5% *and*<br>BP > 140/85 *and*<br>limited psychosocial risk<br>factors | |
| Care management plan | **1** | Bimonthly CDE visits (medical intervention) | **1** | Quarterly CDE visits (medical intervention) | **1** | CDE visits per request (medical intervention) |
|  | **2** | Intense medication management | **2** | Intense medication management | **2** | Passive medication management |
|  | **3** | Program Assistants at every PCP visit | **3** | Program Assistants at the majority of PCP visits | **3** | Program Assistants at PCP visits per request only |
|  | **4** | Three medical nutrition visits (RD) annually | **4** | Three medical nutrition visits (RD) annually | **4** | Three medical nutrition visits (RD) as needed |
|  | **5** | Annual nutrition class | **5** | Telephone follow-up as needed | **5** | Quarterly telephone follow-up |
|  | **6** | Monthly telephone follow-up | **6** | Toll-free telephone access and after-hours nurse support | **6** | Toll-free telephone access and after-hours nurse support |
|  | **7** | Toll-free telephone access and after-hours nurse support | **7** | Automated lab ordering and interpretation | **7** | Automated lab ordering and interpretation |
|  | **8** | Automated lab ordering and interpretation |  |  |  |  |

*Notes*. A1C = glycosylated hemoglobin; BP = blood pressure; ASA = aspirin; CDE = certified diabetes educator; PCP = primary care provider; RD = registered dietician

**Table 2**

Factors Associated With PACIC Total Score

| Variable | Coefficient | Standard Error | *p* Value |
|---|---|---|---|
| Intercept | 3.83 | 0.054 | < .001 |
| Low-risk category or least intensive clinical management | −0.72 | 0.116 | .5320 |
| Commercial insurance | 0.186 | 0.134 | .1673 |
| African American race | −0.041 | 0.115 | .7227 |
| Female gender | 0.226 | 0.118 | .0565 |
| Adequate health literacy | 0.392 | 0.131 | .0031 |
| Time with diabetes (log *e*) | 0.059 | 0.52 | .2620 |

*Notes*. PACIC = Patient Assessment of Chronic Illness Care

**Table3**

Differences in PACIC Total and Subscale Scores According to Literacy Groups

| PACIC Subscales | Mean Scale Score (SD) | | Difference |
| --- | --- | --- | --- |
| | Inadequate/Marginal (*n* = 61) | Adequate (n=134) | *t, p* |
| Activation | 3.716 (1.125) | 4.154 (0.886) | 2.676, .009 |
| Delivery system | 4.100 (0.732) | 4.291 (0.666) | 1.751, .082 |
| Goal setting | 3.323 (1.034) | 3.836 (0.848) | 3.652, < .001 |
| Problem solving | 3.682 (1.139) | 4.180 (0.850) | 3.056, .003 |
| Follow-up/coordination | 3.170 (1.113) | 3.628 (0.934) | 2.779, .007 |
| Total | 3.523 (0.892) | 3.977 (0.699) | 3.839, < .001 |

*Notes*. PACIC = Patient Assessment of Chronic Illness Care; SD = standard deviation.