Self-Efficacy and Hemoglobin A1C Among Adults With Serious Mental Illness and Type 2 Diabetes: The Roles of Cognitive Functioning and Psychiatric Symptom Severity

Thomas L. Wykes, MS, Aaron A. Lee, MS, Christine L. McKibbin, PhD, and Sean M. Laurent, PhD

ABSTRACT

Background: Self-efficacy is a core element of diabetes self-care and a primary target of diabetes interventions. Adults with serious mental illness (SMI) are twice as likely as adults among the general population to have Type 2 diabetes. This population faces substantial barriers (i.e., cognitive impairment, psychiatric symptoms) to optimal diabetes self-care, but the relationship of these barriers to both self-efficacy and glycemic control (hemoglobin A1C [A1C]) is not clearly understood.

Methods: Data collected from adult participants with SMI (i.e., schizophrenia, schizoaffective disorder, bipolar disorder) and Type 2 diabetes ($n = 92$) were used to examine the moderating effects of cognitive functioning and psychiatric symptoms (i.e., positive and negative symptoms) on the association between self-efficacy and A1C.

Results: The relationship between self-efficacy and A1C was moderated by cognitive functioning ($B = -4.03$, standard error = 1.54, $p = .011$). Greater self-efficacy was associated with better glycemic control when cognitive functioning was high, but worse control when functioning was low. The relationship between self-efficacy and A1C was moderated by negative symptom severity ($B = 6.88$, standard error = 3.34, $p = .043$). Higher self-efficacy was associated with poorer glycemic control only when negative symptom severity was high. Positive symptoms did not interact with self-efficacy to predict A1C.

Conclusions: These results suggest that adults with SMI and low cognitive function or high negative symptom severity may misperceive their ability to manage their diabetes. They may benefit from efforts, including care management and monitoring, cognitive remediation, and skill training, to identify and correct inaccurate diabetes self-efficacy.

Key words: glycemic control, serious mental illness, diabetes mellitus, diabetes self-efficacy.

INTRODUCTION

Adults with Type 2 diabetes are thought to provide approximately 95% of their own diabetes care in the form of self-care activities (1), which can include management of diet and physical activity, self-administration of daily oral hypoglycemic medication and/or insulin, and self-monitoring of blood glucose (2). The American Diabetes Association recommends that all people diagnosed as having diabetes or prediabetes receive structured diabetes education and support to help them manage these complex behaviors and maintain their health (2,3). The National Standards for Diabetes Self-Management Education dictate that interventions for diabetes self-management education incorporate psychosocial constructs such as diabetes self-efficacy (2,4), or confidence in one's ability to successfully manage and cope with the demands of caring for diabetes (5). Self-efficacy has long been recognized as an important construct in diabetes self-management (6). Improving self-efficacy has been identified as a major goal in diabetes self-management education due to its positive influence on outcomes such as self-care behaviors (7–10) and long-term glycemic control (11).

Much of the research addressing the association between diabetes self-efficacy and related outcomes has focused on the general population, with far fewer studies designed to

➢ Related editorial on pages 261–262.

A1C = hemoglobin A1C, **DES** = Diabetes Empowerment Scale, **DRS** = Dementia Rating Scale, **SMI** = serious mental illness

SDC Supplemental Content

From the Department of Psychology (Wykes, Lee, McKibbin), University of Wyoming, Laramie, Wyoming; and Department of Psychology (Laurent), University of Oregon, Eugene, Oregon.

Address correspondence and reprint requests to Christine L. McKibbin, PhD, Department of Psychology, University of Wyoming, Dept. 3415, 1000 E. University Ave, Laramie, WY 82071. E-mail: cmckibbi@uwyo.edu

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include adults with serious mental illness (SMI). Adults with SMI (i.e., schizophrenia, schizoaffective disorder, or bipolar disorder) are an important population to address because people with these conditions are twice as likely as their nonpsychiatric counterparts to have Type 2 diabetes (12,13). Antipsychotic medications used to treat SMI are thought to contribute to increased rates of diabetes mellitus among members of this population and are associated with a range of adverse metabolic effects such as weight gain and blood glucose dysregulation (14). These adverse effects, in addition to psychiatric factors such as cognitive impairments and motivational deficits, present unique challenges to adults with SMI in their efforts to manage diabetes (15). Moreover, studies have also shown that adults with SMI and diabetes may receive a lower quality of diabetes-related health services (16) and lower rates of diabetes education compared with adults with diabetes alone (16,17).

The consequences of poorly managed diabetes are substantial for adults with SMI. Recent work has shown that adults with SMI experience higher rates of diabetes-related macrovascular and microvascular complications (18), as well as higher rates of hospitalization for acute complications (19), than do adults with diabetes alone. There is also evidence of lower physical quality of life, lower mental quality of life, and lower satisfaction with general health among adults with SMI and diabetes, compared with adults with diabetes alone (20). These results suggest that adults with SMI may be less successful than members of the general population in managing diabetes. However, it should be noted that many other factors may contribute to poor diabetes-related outcomes, including increased risk for cardiovascular disease and metabolic problems compared with the general population (21,22) and adverse metabolic effects of antipsychotic medications (14).

Boosting diabetes self-efficacy has been suggested as an important strategy for overcoming barriers to proper diabetes health care among adults with diabetes and SMI (23). One psychosocial diabetes intervention study conducted among a sample of adults with SMI and Type 2 diabetes that specifically targeted improvements in self-efficacy found that higher levels of psychiatric symptom severity (e.g., positive and negative symptoms) were associated with diminished improvements in self-efficacy over the course of the program (24). Psychiatric symptoms may likewise affect the relationship between self-efficacy and other outcomes. Although few, if any, studies have addressed this possibility, existing research suggests relationships between self-efficacy, psychiatric symptoms, and functional outcomes in other contexts. An evaluation of self-efficacy and psychosocial functioning (e.g., daily living skills) conducted among adults with SMI indicated that negative symptom severity mediated the relationship between self-efficacy and psychosocial functioning (25). Indeed, psychiatric impairments have been described as the central barrier to effective diabetes management in qualitative research conducted among adults with SMI and Type 2 diabetes (26).

In addition to psychiatric symptoms, adults with SMI and diabetes may face impairment due to cognitive deficits associated with both SMI and diabetes (27–29). Moreover, adults with both SMI and diabetes seem to have greater cognitive impairment than adults with either condition alone (30), suggesting a potential compounding effect of comorbidity among members of this population. Studies have shown relationships between cognitive impairment and psychiatric medication management ability among adults with SMI (31), and between cognitive impairment and performance of specific diabetes self-care abilities among adults with diabetes (32). Unfortunately, few, if any, studies have characterized the relationships between cognitive functioning, self-efficacy, and diabetes-related outcomes among adults with both SMI and diabetes.

In light of the existing literature, psychiatric symptoms and cognitive impairments may be associated with diabetes self-efficacy or may affect relationships between diabetes self-efficacy and indicators of successful diabetes management among adults with SMI and diabetes. Few, if any, studies have directly addressed this question, although greater understanding of the relationships between these factors could lead to significant improvements in diabetes care for adults with SMI. For example, such knowledge could be instrumental in the design of diabetes management intervention programs tailored for adults with SMI, or could improve individual providers' ability to identify patients most at risk for having poor diabetes outcomes or discrepancies between their self-efficacy and actual success in managing diabetes. Thus, the objective of the present study was to investigate the impact of cognitive and psychiatric factors on the relation between diabetes self-efficacy and glycemic control among adults with SMI and Type 2 diabetes. We hypothesized that diabetes self-efficacy would be associated with hemoglobin A1C (A1C). We also hypothesized that positive symptoms, negative symptoms, and cognitive functioning would each moderate the putative relationship between diabetes self-efficacy and A1C.

METHODS

Study Sample

This study used baseline data from a healthy life-style intervention for adults with SMI and Type 2 diabetes or prediabetes, collected during successive program waves. A total of 104 participants were included in the present analysis if they were older than 18 years, diagnosed as having an SMI (i.e., schizophrenia, schizoaffective disorder, or bipolar disorder) and Type 2 diabetes (i.e., per chart review), and able to provide informed consent. Data regarding participant's current psychiatric medications were

extracted from medical records. Participants were excluded in the recruitment phase if they had a diagnosis of dementia. The final sample consisted of baseline data from 92 participants recruited from a variety of settings, including board-and-care facilities, community clubhouses, and community mental health centers. All recruitment and study procedures were approved by the University of Wyoming Institutional Review Board.

Assessments

Sociodemographic Variables and Patient Factors

The sociodemographic measures included items that assessed participants' age, years of education, sex, race/ethnicity, living situation, age of first psychiatric diagnosis, and history of diabetes education. Participants' psychiatric diagnoses and were abstracted from medical and psychiatric charts.

Diabetes Self-Efficacy

The Diabetes Empowerment Scale (DES) was used to measure diabetes self-efficacy (5). The DES is a 28-item self-report questionnaire regarding attitudes toward having and caring for diabetes. Reponses are based on a 5-point Likert scale, consisting of degree of agreement (1 = strongly disagree, 5 = strongly agree) with diabetes-related statements, such as, "In general, I believe that I can reach my diabetes goals once I make up my mind." The present study used the average score, and higher scores reflect higher diabetes self-efficacy. The DES has demonstrated excellent internal consistency reliability (α = .96) and convergent validity with other measures of diabetes attitudes (5). The short form of this measure has been used in a prior diabetes intervention study tailored for individuals with schizophrenia (33). To facilitate comprehension of the questionnaire, all questions and response scales were read aloud to participants. All response scales were visually depicted to participants in a large format.

Psychiatric Symptom Severity

Psychiatric symptom severity was measured using the 30-item Positive and Negative Syndrome Scale (PANSS) (34). The PANSS is a semi-structured interview that is administered by a trained rater and scored on the basis of verbal responses, behavioral observations, and informant data. This instrument comprises three subscales reflecting severity of positive, negative, and general psychiatric symptoms, scored according to a 7-point Likert scale (1 = absent, 7 = extreme). For example, positive symptoms include hallucinations, delusions, and conceptual disorganization; negative symptoms include restricted affective expression, motivational deficits, and stereotyped thinking; and general symptoms include anxiety, depression, and somatic concern. The positive and negative subscales were used in this analysis. Higher scores reflect greater symptom severity on each subscale. Studies have indicated that the PANSS positive and negative subscales have strong internal consistency reliability (α = .73 and α = .83, respectively) and convergent validity with other measures of positive and negative symptom severity (35).

Cognitive Functioning

Cognitive functioning was measured using Mattis' Dementia Rating Scale (DRS) (36). This 36-item measure provides a brief assessment of cognitive functioning across five domains, including attention, initiation/perseveration, conceptualization, memory, and construction. Each scale is scored as a sum of scores on a number of smaller tasks. The total score (obtained by adding scores across all five scales) was used in this analysis. Higher scores reflect better cognitive functioning. Studies have indicated that the DRS has strong internal consistency reliability (e.g., total score α = .84) and convergent validity with the Wechsler Adult Intelligence Scale–Revised, Wechsler Memory Scale, and Mini-Mental Status Examination among patients with and without cognitive impairment (36,37). The DRS has been widely used in studies of adults with SMI. For example, it has been used to demonstrate relationships between cognitive functioning and social skills (38) and between cognitive functioning and medication management ability (31).

Hemoglobin A1C

A1C is an index of an individual's overall glycemic control during the preceding 6- to 10-week period. Fasting blood samples of 3 ml were collected from each participant at the baseline time point. Blood samples were submitted to high-performance liquid chromatography, Bio-Rad method (39). A1C scores in excess of 7.0 reflect increasing likelihood of developing long-term diabetic complications (40).

Statistical Analyses

Descriptive statistics were used to characterize the sample. All variables were evaluated for normality and transformed as appropriate. Multicollinearity was assessed by examining tolerance diagnostics among predictor variables. Existing research has shown a relationship of diabetes education with both diabetes self-efficacy (41) and A1C (42). Moreover, some antipsychotic medications (i.e., clozapine and olanzapine) carry increased risk of glycemic dysregulation and metabolic complications (14). Consequently, both prior diabetes education (yes versus no) and antipsychotic medication (clozapine and olanzapine versus other medications) were included as covariates in all multivariate analyses. Age, sex, and race (non-Latino white versus other) were also included as covariates to control for demographic characteristics of the sample. Covariates, moderator variables (DRS scores, PANSS positive, PANSS negative), and the focal predictor variable (i.e., DES scores) were all mean centered (43), and multiplicative interaction terms were created (i.e., the product of DES and either DRS, PANSS positive, or PANSS negative) prior to conducting the regression analyses.

A series of three separate two-step hierarchical linear regression analyses were used to examine the main effect of DES on A1C, as well as the effect of the interaction of DES with each of three moderator variables (i.e., DRS, PANSS negative, and PANSS positive) on A1C. All covariates (i.e., prior diabetes education, antipsychotic medication type, age, sex, and race), DES, and one moderator variable were entered in the first step of each regression analysis. The interaction term for DES and each respective moderator variable was added in the second step of each regression analysis. Significant interaction terms were examined further using region of significance testing to determine the boundary values of the moderator variable above and below which DES scores were significantly associated with A1C (44). Three separate regression analyses, each of which included one of the three respective moderator variables, were used in order to avoid issues resulting from multicollinearity among the three moderator variables. All descriptive statistics, bivariate correlations, and regression analyses were performed using SPSS version 21.0 (45). α Value was set to $p < .05$, and all results were two tailed.

RESULTS

Most of the sample was non-Latino white, was female, had a diagnosis of schizophrenia, and had received some form of prior diabetes education. The mean age of participants was approximately 52 years, and the average educational attainment was approximately 12 years. The average age of psychiatric diagnosis (i.e., schizophrenia, schizoaffective disorder, bipolar disorder) was 29.4 years. A minority of participants (n = 6; 6.5%) reported receiving a psychiatric diagnosis after age 45 years (i.e., late-onset disease course)(46). The small number of participants with a late-onset psychiatric disorder precluded group comparisons. Most of the sample resided in a supported living environment (e.g., board and care facility) at the time of data

collection. All other participants lived independently in apartments or houses in the community, and there were no group differences in either DES score or A1C based on living situation. Most of the sample was prescribed an antipsychotic medication. Approximately 24% of the sample was prescribed an atypical antipsychotic medication with increased risk of metabolic complications (i.e., clozapine or olanzapine) (14). See Table 1.

Mean PANSS negative (mean [M; standard deviation {SD}] = 14.46 [5.76]) and PANSS positive (M [SD] = 14.37 [5.40]) scores were somewhat lower than those reported by Kay et al. (34), suggesting a relatively low level of psychiatric symptom severity. The internal consistency reliability of the PANSS positive (α = .76) and PANSS negative (α = .79) scales were adequate. Using published normative data (47), it was determined that participants' average DRS total score (M [SD] = 128.11 [14.32]) fell between the 6th and 10th percentile for adults 69 years or younger within the general population (i.e., a nonpsychiatric sample), suggesting a relatively low level of cognitive functioning among the sample compared with adults without SMI. The average DRS total score in the current study was similar to previously reported average DRS total scores for community-dwelling (48) and hospitalized (49) adults with SMI. Participants' average (SD) DES score was 3.74 (0.43), similar to nonpsychiatric samples in the existing literature (50). The internal consistency reliability of the DES was very good (α = .89). A1C values in the sample ranged from 4.90 to 16.40, with an average (SD) of 7.01 (2.18). Thus, the mean of A1C in the sample was at the maximum threshold (<7.0) recommended by the American Diabetes Association for acceptable glycemic control (3). See Table 1.

TABLE 1. Sociodemographic and Psychiatric Characteristics

Variables	*n* (%) or M (SD)
Sociodemographic variables	
Age, M (SD)	52.63 (2.19)
Sex (female), *n* (%)	48 (52.2)
Race (non-Latino white), *n* (%)	63 (68.4)
Prior diabetes education, *n* (%)	54 (58.6)
Supported living environment, *n* (%)	49 (53.2)
Years of education	12.52 (2.19)
Psychiatric variables, *n* (%)	
Schizophrenia diagnosis	56 (61.0)
Late onset (>45 y)	6 (6.5)
Any antipsychotic medication	75 (81.5)
Clozapine or olanzapine	22 (23.9)
Model variables, M (SD)	
A1C	7.01 (2.18)
DES	3.74 (0.43)
DRS	128.11 (14.32)
PANSS positive	14.46 (5.76)
PANSS negative	14.37 (5.40)

M = mean; SD = standard deviation; A1C = hemoglobin A1C; DES = Diabetes Empowerment Scale; DRS = Mattis' Dementia Rating Scale; PANSS = Positive and Negative Syndrome Scale.

n = 92.

There were no significant correlations between A1C and DES (r = 0.02, p = .823), DRS (r = 0.03, p = .759), PANSS negative (r = 0.01, p = .941), or PANSS positive (r = −0.12, p = .272). Similarly, DES, the moderator, was not significantly correlated with DRS (r = 0.04, p = .713), PANSS negative (r = −0.04, p = .697), or PANSS positive (r = −0.05, p = .614). DRS was significantly correlated with PANSS negative (r = −0.46, p < .001), but not with PANSS positive (r = −0.14, p = .184). Finally, there was a significant association between PANSS negative and PANSS positive scores (r = 0.65, p < .001). See Table S1, Supplemental Digital Content 1, http://links.lww.com/PSYMED/A270.

The first step of the first hierarchical linear regression analysis showed no significant association of DES (B = 0.16, standard error [SE] = 0.61, p = .800) or DRS (B = 0.26, SE = 0.67, p = .700) with A1C (R^2 = 0.03, p = .941). None of the covariates entered in the first step were significantly associated with A1C. However, the interaction of DES and DRS, added in the second step, was significantly associated with A1C (B = −4.03, SE = 1.54, p = .011, ΔR^2 = 0.08). Region of significance testing showed a significant relationship of DES with A1C at or beyond 1.02 SD below and 1.33 SD above the DRS mean score. Examination of the simple slopes of DES with A1C indicated that greater self-efficacy was associated with better glycemic control (i.e., lower A1C) when cognitive functioning was high (i.e., 1.33 SD above the mean DRS score), but that greater self-efficacy was associated with worse glycemic control when cognitive functioning was low (i.e., 1.02 SD below the mean DRS score; Fig. 1).

The first step of the second hierarchical linear regression analysis showed no significant relationship of DES (B = 0.15, SE = 0.61, p = .800) or PANSS negative (B = −0.50, SE = 1.55, p = .747) with A1C (R^2 < 0.01, p = .923). Similarly, none of the covariates entered in the first step were significantly associated with A1C. As in the first analysis, the interaction of DES scores and PANSS negative scores added in the second step was significant (B = 6.88, SE = 3.34, p = .043, ΔR^2 = 0.05). Region of significance testing revealed a significant relationship of DES with A1C at or beyond 2.29 SD above the PANSS negative mean score. The lower bound value of PANSS negative scores at which DES would be significantly associated with A1C was outside the range of the sample data. Examination of the simple slope of DES with A1C showed that greater self-efficacy was associated with

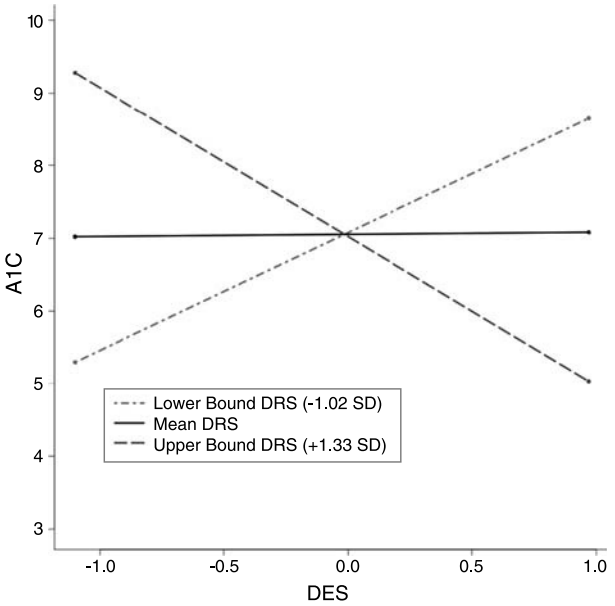

FIGURE 1. Descriptive plot showing the interaction of diabetes self-efficacy (DES) and cognitive functioning (DRS) on A1C. Lines depict the linear relationship of diabetes self-efficacy to A1C, plotted at the mean and upper/lower ranges of significance on DRS (separate lines). DES = Diabetes Empowerment Scale; DRS = Dementia Rating Scale; A1C = hemoglobin A1C; SD = standard deviation.

poorer glycemic control (i.e., high levels of A1C) when negative symptoms were high (i.e., 2.29 SD above the mean PANSS negative score; Fig. 2).

The first step of the third analysis showed no significant association between either DES (B = 0.13, SE = 0.55, p = .81) or PANSS positive scores (B = −1.53, SE = 1.47, p = .302) with A1C (R^2 = 0.01, p = .560). As with prior models, none of the covariates were significantly associated with A1C. The interaction between PANSS positive and DES with and A1C was also not significant (B = 0.20, SE = 4.46, p = .996, $\Delta R^2 < 0.01$), suggesting that positive symptom severity does not moderate the relationship between self-efficacy and A1C.

DISCUSSION

The current study is one of a very small number to examine diabetes self-efficacy among people with SMI. The lack of an observed association between diabetes self-efficacy and A1C was somewhat unexpected given previous evidence demonstrating an association between these variables (11). However, the interactive effect of cognitive function and diabetes self-efficacy on A1C is noteworthy. This result suggests that high self-efficacy may lead to better A1C when cognitive functioning is high, but worse A1C when cognitive functioning is low. Likewise, higher self-efficacy may lead to better A1C when negative symptoms are less severe, but worse A1C when negative symptoms are more severe. The ability of patients with SMI to accurately judge their diabetes self-management abilities, and their success in achieving glycemic control, may be compromised by cognitive deficits or interference from negative symptoms. These factors may lead to overconfidence or unrealistically high diabetes self-efficacy and, consequently, poor glycemic control. Prior research indicates adults with SMI may have particularly low knowledge regarding diabetes and related care requirements (17). Indeed, psychiatric factors may play a role in what adults with SMI know about diabetes. For example, Dickerson and colleagues (51) found a relationship between lower cognitive functioning and lower diabetes knowledge.

There is similar evidence from the SMI medication adherence literature. In a major survey of SMI treatment experts, Velligan and colleagues (52) identified limited patient insight regarding illness severity as an important source of problems with antipsychotic medication adherence. Accordingly, patients who do not perceive themselves as having a severe condition may be less likely to adhere to rigorous self-management regimens. The same may be true for adults with SMI and diabetes. Members of this population may have low awareness of the severity of their condition and correspondingly inflated evaluations of their own success in managing diabetes. The discordance between perceived diabetes severity and actual diabetes

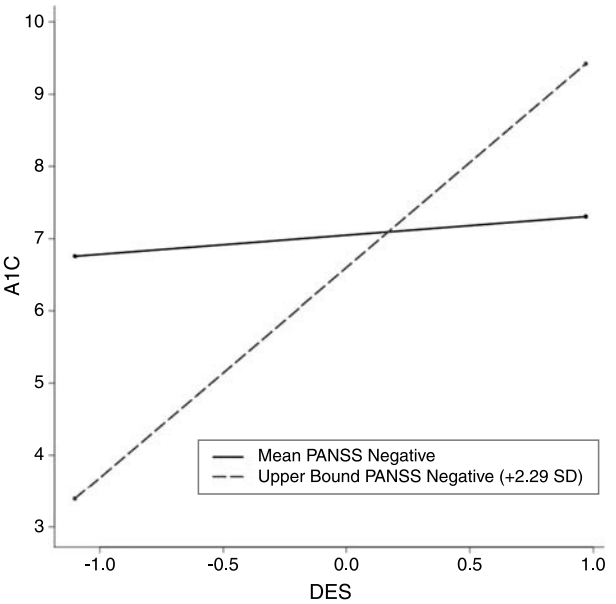

FIGURE 2. Descriptive plot showing the interaction of diabetes self-efficacy (DES) and psychiatric negative symptom severity (PANSS) on A1C. Lines depict the linear relationship of diabetes self-efficacy to A1C, plotted at the mean and upper range of significance of negative symptom severity (separate lines). DES = Diabetes Empowerment Scale; PANSS = Positive and Negative Syndrome Scale; A1C = hemoglobin A1C; SD = standard deviation.

severity among adults with diabetes is well known (53). Although this topic has not been explored among adults with SMI and Type 2 diabetes, the present study suggests that it may be an important direction for future research.

Despite the aforementioned difficulties faced by adults with SMI and Type 2 diabetes, it is important to note that evidence regarding their diabetes self-care behavior is mixed. There are some indications that adults with SMI and diabetes may have higher rates of adherence to antidiabetic medication (54), yet there are other indications that there may be no difference in adherence to diabetes self-care behavior. Interestingly, additional evidence indicates that adults with SMI and diabetes may have more favorable metabolic outcomes (e.g., A1C) than adults with diabetes alone (17). Kreyenbuhl et al. (54) hypothesized that greater antidiabetic medication adherence among this population may be due to existing antipsychotic medication–taking habits. Dixon et al. (17) also predicted that better outcomes among this population may be due to increased contact with health care providers through psychiatric services. It may be incorrect to assume that because of their psychiatric condition, adults with SMI have poorer functioning compared with adults without SMI in every self-care area. Rather, a number of factors—potentially including cognitive functioning and negative symptom severity—may have dynamic effects on diabetes-related behaviors and outcomes that cause significant heterogeneity in clinical presentation among members of this population.

Four limitations of the current study should be noted. First, the data used in this analysis were obtained from participants who elected to participate in a healthy life-style intervention. They may therefore have been predisposed to engagement with diabetes care services. Second, the extent to which participants were responsible for managing their own self-care was unknown. Although adults with diabetes are thought to provide approximately 95% of their own self-care (1), some participants (particularly those in supported living settings) may have received additional assistance with managing their self-care activities. Third, the study did not include measurements of other important psychosocial constructs, such as the extent of diabetes knowledge, perceived diabetes severity, or insight into the impacts of psychiatric symptoms on performance of diabetes self-management behaviors. These are factors that should be examined in future research. Finally, no studies of which we are aware have examined the validity of the DES among patients with low cognitive functioning.

In summary, adults with SMI and Type 2 diabetes comprise a population with substantial complexity in the dynamics of their comorbid disease management, with some apparent strengths and weaknesses in self-care practices. Future studies should focus on characterizing both actual and perceived success in performing self-care practices, including overconfidence in self-management abilities. The role of psychiatric factors in these areas should be explored as well. Investigators may also wish to explore possible strengths among adults with SMI and Type 2 diabetes.

Clinical Implications

The results of the present study suggest two important implications for treatment providers. First, providers and patients would likely benefit from the use of objective assessments of patient cognitive abilities and measures of negative psychiatric symptom severity. For example, brief measures of cognitive functioning, such as the DRS (used in the current study) or Mini-Mental Status Examination, are readily available and easily administered. Low cognitive functioning scores would suggest the potential for patient inaccuracy in assessing their diabetes self-care abilities (i.e., unrealistically high self-efficacy). Assessment of negative psychiatric symptom severity may be more challenging for providers without specialized training, but would serve the same purpose of identifying patients whose reports of high self-efficacy for diabetes self-management may be unfounded.

Second, patients with SMI and low cognitive functioning or severe negative symptoms may require greater monitoring and attention by providers. Such professionals could periodically explore what, specifically, their patients are doing to manage their diabetes, especially in cases where clients with lower cognitive functioning or more severe negative psychiatric symptoms report that they are highly confident in their self-management abilities. Recent work has shown the potential of electronic monitoring systems combined with care management for improving psychiatric medication adherence among adults with schizophrenia (55). The use of electronic monitoring devices could be a promising approach to improving diabetes-related outcomes among adults with SMI and diabetes affected by functional impairment. Objective data from such devices, regarding self-care areas such as medication self-administration and self-monitoring of blood glucose, could facilitate the provision of corrective feedback in cases where patients misperceive their diabetes self-management abilities. Such information could be used to align diabetes self-efficacy with actual practices, including raising patient awareness of areas where they are overestimating their self-care success. Although few, if any, studies have directly addressed the notion of using self-care monitoring to intervene in potentially inaccurate diabetes self-efficacy, studies among adults with SMI have shown that brief psychotherapy interventions to improve psychiatric-illness–related insight and self-awareness have been effective in improving compliance with treatment (56). In addition, there is support for the effectiveness of combined cognitive remediation strategies and functional adaptation skills training (e.g., reading and understanding prescriptions) for yielding improvements in real-world

functional domains including household activities and work skills (57). Such strategies may be effective if applied to improving diabetes self-efficacy and related diabetes self-care skills. It may also be helpful to identify patients whose self-appraisals are indeed accurate, so that treatment intensity can be adjusted accordingly. Sequential, multiple assignment, randomized trials can be used to evaluate adaptive interventions that tailor treatment intensity to patient's needs based on decision rules (58). A multiple assignment, randomized trial approach could examine cognitive function and negative symptom severity as decision-making variables in the context of adaptive interventions targeting diabetes management in this population. For example, such studies could be used to suggest a threshold for cognitive functioning below which patients could benefit from efforts to identify and correct inaccurate appraisals of diabetes management.

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