Correlates of Physical Activity in a Sample of Older Adults With Type 2 Diabetes

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OBJECTIVE — Physical activity is integral to the management of type 2 diabetes. Unfortunately, the majority of adults with type 2 diabetes do not regularly engage in physical activity. The purpose of this study was to assess physical activity behavior and its correlates (i.e., physical activity knowledge, barriers, and performance and outcome expectations) in older adults with type 2 diabetes.

RESEARCH DESIGN AND METHODS — A subgroup of 260 adults with type 2 diabetes was identified from a larger stratified random sample of adults aged ≥55 years. Participants completed an interviewer-administered survey designed from focus group findings and social learning theory.

RESULTS — The majority of the respondents (54.6%) reported 0 min of weekly physical activity. This was especially true of older female respondents. Performance expectation scores were lower among respondents who were in the oldest age-group, namely, white women. Physical activity knowledge varied by age-group, and barriers to physical activity were prevalent in all groups. The following are significant correlates of reported weekly physical activity: younger age, more education, fewer motivational barriers, and greater perceived health and performance expectations.

CONCLUSIONS — Given the importance of physical activity to diabetes management, the low prevalence of physical activity found in this and other studies should raise concerns among clinicians. Future research to identify predictors of physical activity is needed to guide clinicians in the promotion of physical activity.

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The benefits of regular physical activity for the prevention and management of type 2 diabetes are becoming well known. It has been shown that physical activity improves glycemic control through increased insulin sensitivity and glucose tolerance (1,2). Even physical activity of moderate intensity can improve insulin sensitivity, leading to potential reductions in the dosage of hypoglycemic agents as well as additional benefits for cardiovascular health, functional status, and longevity (3–9). Importantly, increased insulin sensitivity occurs within weeks of the adoption of a program of regular physical activity (8,10,11).

Unfortunately, it is estimated that 60–80% of the adult population in the U.S. do not meet the recommended levels of physical activity (12). Data from a nationally representative survey study have shown that adults with diabetes are even less likely to engage in regular physical activity rather than adults in general (13). National data have also shown significant variability in physical activity across sociodemographic groups (12). Previous studies have suggested that sociodemographic and health characteristics, such as low socioeconomic status, older age, race, and the presence of a chronic disease, tend to be associated with lower levels of physical activity (13,14). In addition, personal and environmental barriers have been consistently associated with physical activity participation (15,16). Knowledge related to physical activity may also be associated with physical activity (16,17). To effectively promote the adoption and maintenance of physical activity for diabetes management, information will be needed on the sociodemographic, health, cognitive, and environmental variables that influence physical activity behaviors among persons with diabetes.

While barriers and knowledge are important, performance expectations (i.e., performance confidence) have shown the greatest promise for explaining the adoption of physical activity among adult populations (17,18). In fact, Sallis et al. (17) found performance expectations to be the strongest correlate of physical activity among adults. According to Bandura's Social Learning Theory (19), behavioral changes are mediated by expectations in the following two areas: *1*) individual performance and *2*) outcomes from the behavior (19). These are referred to here as performance expectations and outcome expectations, respectively. Performance expectations have been defined as judgement of one's capability to accomplish a certain level of performance (19). Outcome expectations represent judgement of the likely consequences a behavior will produce (19). The mediating role of these two components of the social learning theory is shown in Fig. 1. Sociodemographic characteristics and health status are also shown in Fig. 1 and may influence physical activity indirectly through knowledge and barriers, as well

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Abbreviations: PASE, Physical Activity Scale for the Elderly; RMRS, Regenstrief Medical Records System; RPHAS, Regenstrief Physical Activity and Health Survey; WMH, Wishard Memorial Hospital.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

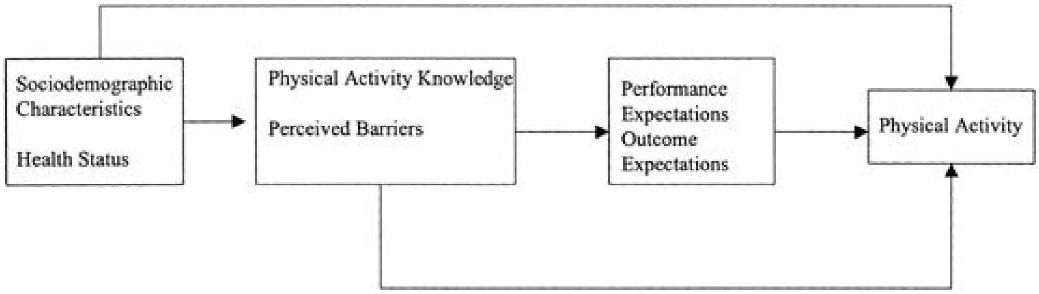

Figure 1—*Potential correlates of reported level of weekly physical activity.*

as expectations. It is important to note that although health status is, in part, an outcome of physical activity, at any point in time, health can also hinder or facilitate physical activity.

Studies that examine the relationships between social learning variables and physical activity participation among adults with type 2 diabetes are needed. Therefore, the following are the objectives of this study: *1*) to explore the relationship between selected social learning theory variables and self-reported physical activity by age, sex, and ethnicity in a sample of 260 low-income older adults with type 2 diabetes; *2*) to estimate a hierarchical multivariable model of correlates of physical activity as shown in Fig. 1; and *3*) to consider the implications of the results for the promotion of physical activity among older adults with type 2 diabetes.

RESEARCH DESIGN AND METHODS

Sample

Data for this report are based on a subgroup of individuals with type 2 diabetes who were part of a larger study of health and physical activity.

A total of 771 adults aged 55 years and older participated in the Regenstrief Physical Activity and Health Survey (RPHAS). The purpose of this study was to develop measures of physical activity and its correlates (i.e., knowledge, barriers, expectations) and to use the measures to describe and model physical activity in a stratified random sample of older, low-income primary care adults. The sample list was obtained from the Regenstrief Medical Records System (RMRS) (20). The RMRS stores longitudinal data from all Wishard Memorial Hospital (WMH) outpatient, emergency room, and inpatient venues, including health services utilization, medication histories, clinical outcomes, results of all tests and procedures, and diagnoses. Community-dwelling adults who had at least one scheduled visit to the WMH outpatient general medicine practice in the 12 months preceding the list generation, who had a valid address or phone number, and who were 55 years of age or older were eligible to participate. There were ~5,000 eligible subjects. The sample list was stratified by age (55–69 and ≥70 years), sex, and ethnicity (African-American and white). A total of 140 patients were randomly selected from each strata, except the older white male strata. There were only 108 white men in the ≥70 age-group; all of these men were selected. Of the 1,088 adults who met the eligibility criteria, 771 (71%) participated in either an interview that was face-to-face or by telephone. Of these interviews, 29% were in person and the remaining interviews were over the telephone. Bivariate analyses comparing those people interviewed (n = 771) with those not interviewed (n = 317) on sociodemographic and chronic disease indicators found the men to be less likely to participate. No significant differences were found between those individuals who were interviewed in person versus those interviewed by telephone. The interview generally lasted 20 min. From the total sample of 771 adults, those respondents with a medical diagnosis of type 2 diabetes (n = 260; 34%) were selected for these analyses.

Measures

The survey measures were created from focus group findings, Bandura's Social Learning Theory, and literature (19). The purpose of the focus groups was to learn more about the psychological, physiological, and environmental barriers to physical activity participation among older low-income adults. The focus group participants were drawn from the RMRS and were not participants in the survey study. Detailed information regarding the focus group sessions are reported elsewhere (21). Consistent with social learning theory, the survey addresses performance and outcome expectations (19), but also incorporates additional variables identified in literature as being associated with physical activity. Existing physical activity knowledge, barriers, and expectation scales were reviewed with the results of the focus groups in mind. Available measures generally had been developed on much healthier, better-educated, or younger respondents and were not appropriate for our study population. Subsequently, measures specific to our population were developed and pilot-tested using respondents excluded from the final survey.

The survey consisted of three main parts: *1*) sociodemographic and health status characteristics; *2*) performance and outcome expectations, knowledge, and barriers related to physical activity; and *3*) physical activity behavior. Sociodemographic characteristics that were measured included age, years of education, monthly household income, ethnicity, and sex. Several measures of health status were included in the survey. Perceived health was measured using a single question such as "over the past 4 weeks, would you say your health has been…?" Response choices were rated as excellent, very good, good, fair, and poor. The prevalence of chronic disease in addition to type 2 diabetes was determined by reviewing medical records for the medical diagnoses of any of the following disorders: angina, arthritis, cerebrovascular disease, coronary artery disease, and hypertension. BMI and pharmacological treatment for diabetes were also determined from medical records. Glycemic control was measured using glycosylated hemoglobin levels reported within the 12 months preceding the interview. Because of the prevalence of missing data (i.e., no test results recorded), glycosylated hemoglobin levels were categorized into the following four groups: *1*) those with a normal glycosylated hemoglobin level (4.0–8.0%); *2*) glycosylated hemoglobin level of 8.0–12.0%; *3*) glycosylated hemoglobin of >12%; and *4*) no reported glycosylated hemoglobin level within 12 months of the interview. Because so few of the respondents had glycemic levels in the normal range (14.6%), those with a glycosylated hemoglobin level of 8–12% (27%) formed the reference category.

Three items were used to determine performance expectations (i.e., performance confidence), and three items were used to determine outcome expectations (i.e., outcome confidence). These items were each framed in the same way, but the referenced activity varied in type and/or frequency. Response categories were "not at all sure," "a little sure," "somewhat sure," and "very sure" and were scored 0, 1, 2, and 3, respectively. Thus, the range for the performance and outcome expectation scores was 0 (not at all sure) to 9 (very sure). An example of a performance expectation item was "how sure are you that you could do 10 min of brisk walking about every day of the week?" The other two items referred to the performance of chair exercises and brisk walking for 30 min three times per week. Cronbach's α was used to calculate internal consistency reliability and α was 0.71. The outcome expectation items followed immediately after each performance expectation question and asked respondents how sure were they that the previously described activity and frequency (i.e., 10 min of brisk walking every day) would improve their health. Internal consistency reliability, as determined by Cronbach's α was 0.81. The activities and frequencies were chosen in an attempt to represent a range of physical activity difficulty and frequency relevant to this population as determined by the focus group sessions.

Physical activity knowledge was measured using five statements about physical activity and health. The statements were as follows: *1*) as people get older they should exercise less; 2) if you can talk while exercising, you aren't exercising hard enough; *3*) regular exercise can make you feel less tired; *4*) people with high blood pressure should not exercise; and *5*) a slow walk is as good as a brisk walk. Response categories were "agree," "disagree," and "not sure." We considered each statement except the third to be false; but for ease of presentation, responses were presented as the proportion agreeing with each statement.

Focus group sessions identified 18 perceived barriers to physical activity participation, and these barriers were subsequently incorporated into the survey. Participants were asked "do any of the following reasons keep you from walking or exercising more than you currently do?" For ease of presentation, the perceived barriers were grouped. Exploratory factor analysis revealed three factors that explained 50% of the variance in the 18 identified barriers. These factors were labeled symptom barriers, environmental barriers, and motivational barriers. Minimum factor loadings within the three factors were all >0.55. Symptom barriers were pain, swelling, fear of chest pain, no energy, and fear of shortness of breath. The environmental barriers were concern about crime, lack of or uneven sidewalks, poor weather, and getting out and having no place to sit down. Finally, the motivational barriers were not enough will power, lack of interest, and not enough time.

Initially, physical activity was to be measured by the Physical Activity Scale for the Elderly (PASE) (22). Pilot-testing, however, showed that most of the respondents were reporting <1 h of daily activity, which is the floor of the PASE (22). Therefore, an instrument specific for the population studied was developed. To measure the amount of time spent walking on a weekly basis, participants were asked whether they ever walked as far as one block, and if so, how often they took such walks during a normal week and how many minutes such a walk would last. Participants were also asked whether they took part in physical activities other than walking, how often and for how many minutes. All activity reported was combined to arrive at a single measure of total minutes of physical activity per week. This measure of minutes of physical activity had a 2-week test-retest reliability of 0.59 (21). Because minutes of physical activity were highly skewed, minutes of reported physical activity per week were categorized as follows: 0 for those who reported no minutes of weekly physical activity; 1 for those reporting up to 60 min of weekly physical activity; and 2 for those reporting >60 min of weekly physical activity. The reference group was individuals reporting no minutes of weekly physical activity.

Analyses

All analyses were completed using the SPSS for Windows (23) and SAS (24). Descriptive statistics on sociodemographics, health status, reported physical activity, performance and outcome expectations, physical activity knowledge, and barriers are presented for all respondents. Age-, sex-, and ethnicity-specific differences on these variables were explored using independent *t* tests and χ^2 analyses. To determine associations with physical activity, a three-step multivariable hierarchical, cumulative logistic regression analysis was performed. Because the dependent variable (physical activity) was discrete, taking on three possible ordinal responses, a cumulative logistic model was used (25). This is analogous to the well-known logistic regression model, in that the number gives the odds of being physically active. In the cumulative logistic model presented here, the odds ratio is obtained from essentially two comparisons; category 0 vs. 1 and 2 and categories 0 and 1 vs. 2. As a result, it is the cumulative odds ratio that is obtained in these models. A hierarchical approach was used to test the model proposed in Fig. 1 and to identify any interactions between the variables. In step 1, sociodemographic and selected health status variables were entered. In step 2, physical activity knowledge and barriers were entered. In the final step, performance and outcome expectation variables were entered. The sample size for these analyses was 260. Tests for multicollinearity were negative. A probability level <0.05 was considered statistically significant.

RESULTS

Sample characteristics

Of the 260 respondents with type 2 diabetes, the mean age was 67 years. The majority of the respondents were African-American (59.2%), female (63.2%), with <12 years of education (66.2%), and a monthly income of less than $1,000 (78.5%). As shown in Table 1, most respondents rated their health as fair or poor and had been diagnosed with hypertension, and BMI averaged 32 kg/m^2. Of the respondents, 42% were on insulin or a combination of insulin and oral hypoglycemic agents to control their diabetes, 34.2% took some type of oral hypoglycemic agent, and 24.3% were diet controlled. Age, sex, and ethnic differences are shown in Table 1. Few of the differences were statistically significant.

Close to half of the respondents (46.5%) did not have a reported glycosylated hemoglobin level within the 12

Table 1—*Chronic disease and health characteristics of RPAHS respondents with type 2 diabetes*

	Total	Age (years)		Sex		Ethnicity	
		50–69	≥70	Women	Men	African-American	White
n	260	159	101	165	95	154	106
BMI (mean)	31.8	30.3	32.7*	32.9†	29.8	31.1	32.8
Insulin/insulin and oral hypoglycemics (%)	41.5	42.1	40.6	41.7	41.1	46.1	34.9
Oral hypoglycemics (%)	34.2	34.0	34.7	33.7	35.8	37.7	29.2
Diet only (%)	24.3	23.9	24.7	24.6	23.1	16.2	35.9†
Reporting fair or poor health (%)	60.4	59.1	62.4	65.1	52.6	57.8	64.1
Angina (%)	10	10.7	8.9	13.5	4.2	9.7	10.4
Arthritis (%)	31.5	22.6	45.5†	40.5*	15.8	35.1	26.4
Stroke (%)	13.8	10.7	18.8	13.5	14.7	10.4	18.9
Coronary artery disease (%)	16.2	16.4	15.8	13.5	18.9*	13.0	20.8
Hypertension (%)	80.4	78.6	83.2	85.3*	73.7	85.7*	72.6

Data are from statistical tests for within-group differences (e.g., men vs. women). *$P < 0.05$; †$P < 0.01$.

months preceding the interview, and 14% had a normal glycosylated hemoglobin level (4.0–8.0%). Twenty-seven percent had a glycosylated hemoglobin level of 8.0–12.0%, while 12% had a glycosylated hemoglobin of >12%. Glycemic control did not differ by age, sex, or ethnicity.

Expectations, knowledge, and barriers

Table 2 presents information on performance expectations, outcome expectations, physical activity knowledge, and barriers. The average performance expectation score was 3.6, indicating that respondents were "not at all" confident in their ability to perform the activities at the durations described. Outcome expectation scores revealed that respondents were "a little" confident that the activities at the durations described in the items would improve their health. As can be seen in Table 2, age, sex, and ethnic differences in performance expectations were evident.

The percent agreeing with physical activity statements varied considerably across the statements. There was also some variance by age, with more persons of the older group agreeing with the statements "as people get older they should exercise less" and "persons with high blood pressure should not exercise." Barriers to physical activity appeared to be prevalent. White respondents reported significantly more symptom barriers. There was no indication of age, sex, or ethnic differences in the reporting of environmental or motivational barriers.

Physical activity

Although not shown, 55% of the sample reported 0 min of weekly physical activity, while 22% reported engaging in 1–60 min of physical activity per week and 23% reported >60 min of weekly physical activity. Respondents aged 55–69 years reported significantly more minutes of weekly physical activity when compared with respondents aged ≥70. Female respondents reported fewer minutes of weekly physical activity than male respondents did, although this difference did not reach statistical significance. There were no significant differences in total minutes of reported weekly physical activity by ethnicity.

Logistic regression analysis

In Table 3, we show the results of a three-step multivariable hierarchical, cumulative logistic regression analysis. Step 1 estimated the association between selected sociodemographic and health status variables and physical activity. Individuals who were older, had ≤12 years of education, and perceived their health as fair or poor were less likely to be physically active.

In step 2, we incorporated physical activity knowledge and symptom, motivational, and environmental barriers. Respondents who reported fewer motivational barriers were more likely to report higher levels of physical activity. Additionally, individuals who disagreed with the statement, "as people get older, they should exercise less" were more likely to be physically active. Educational level and perceived health status associations were reduced slightly from step 1 to step 2 of the analyses. This suggests that a portion of the total association of education and perceived health with physical activity is indirect through knowledge and barriers.

In the final step, performance and outcome expectations were incorporated. Persons with higher levels of performance expectations were more likely to report participating in physical activity. Outcome expectations were not significantly associated with physical activity. The addition of performance and outcome expectations to the model did not reduce the association between age, educational level, and motivational barriers and physical activity. The association between perceived health and physical activity, however, was reduced. In other words, perceived health is associated with physical activity, in part, through an indirect association via expectations. The knowledge statement relating to age and physical activity was not significantly associated with physical activity in step 3. This implies that agreement with the statement is a marker for lower performance or outcome expectations, which are associated with a lower probability of physical activity. In sum, respondents who reported more minutes of weekly physical activity were younger; had a high school education; perceived their health as good, very good, or excellent; and reported fewer motivational barriers and higher performance expectations.

CONCLUSIONS — The data from these analyses are consistent with findings from Ford and Herman (13) that most adults with type 2 diabetes do not regularly engage in physical activity. The majority of the respondents (54.6%) reported 0 min of weekly physical activity. This was especially true of respondents in the oldest age-group (64.4%). Female respondents were more likely to report 0 min of weekly physical

Table 2—*Performance and outcome expectations, physical activity knowledge, and barriers among RPAHS respondents with type 2 diabetes*

	Total	Age (years)		Sex		Ethnicity	
		55–69	≥70	Women	Men	African-American	White
n	260	159	101	165	95	154	106
Expectations							
Performance (0–9)	3.63	3.96*	3.13	3.31	4.27*	4.04*	3.05
Outcome (0–9)	5.74	6.16	5.08	6.03	5.33	5.96	5.42
Physical activity knowledge (% agree)							
Older people should exercise less	74.2	79.2*	66.3	73.0	76.8	74.7	73.6
If can talk, not hard enough exercise	41.9	44.0	38.6	41.1	44.2	40.3	44.3
If have high blood pressure, should not exercise	66.5	76.1†	51.5	66.3	67.4	64.9	68.9
Slow walk is as good as a brisk walk	24.2	25.2	22.8	25.2	23.2	25.3	22.6
Exercise can make you less tired	57.3	59.7	53.5	60.1	52.6	55.2	60.4
Barriers							
Symptom (%)	67.3	69.2	64.4	71.2	60	59.7	78.3*
Environment (%)	82.7	83.6	81.2	85.3	77.9	82.5	83
Motivation (%)	50.8	54.1	45.5	52.1	49.5	51.3	50

Data are from statistical tests for within-group differences (e.g., men vs. women). *$P < 0.05$; †$P < 0.01$.

activity than male respondents (58.3 vs. 47.4%). Performance expectation scores were lower among respondents who were in the oldest age-group, female, and white. Physical activity knowledge varied some by age-group, with more respondents from the older group agreeing with statements, such as "as people get older they should exercise less" and "persons with high blood pressure should not exercise." In all groups, a majority reported barriers.

This study represents an effort to develop knowledge about the correlates of physical activity in older adults with type 2 diabetes. Within the limits of this study and sample, the multivariable model presented in Fig. 1 was only partially supported. Four of the six components shown in Fig. 1 were significantly associated with physical activity. Hierarchical logistic regression analysis for the total minutes of reported weekly physical activity revealed that certain sociodemographic (i.e., age, educational level), health status (i.e., perceived health status), and psychological variables (i.e., motivational barriers, performance expectations) directly affected the odds of being physically active. No significant associations were found between sex, ethnicity, monthly household income, glycemic control, a medical diagnosis of arthritis, BMI, physical activity knowledge, perceived symptom and environmental barriers, and outcome expectations and physical activity. It should be restated that these results are based on a sample of low-income, older adults with type 2 diabetes.

Analyses revealed that performance expectations were most strongly associated with physical activity, and this finding is consistent with previous studies (17,18). Bandura (19) theorized that performance expectations predict whether an individual will choose to engage in a behavior, how much effort the individual will expend on the behavior, and how persistent the individual will be in spite of barriers or obstacles. On the basis of the finding in this study that low socioeconomic status adults have limited performance expectations for basic exercises (i.e., chair exercises), it is quite unlikely that this most vulnerable group will initiate a program of physical activity without a significant investment of resources and support.

Among the perceived barriers, motivational barriers emerged as a significant correlate, suggesting that many respondents lacked sufficient motivation to be physically active. Outcome expectations, on the other hand, were not found to be associated with physical activity. This is consistent with Sallis et al. (26) who reported no association between outcome expectations and vigorous physical activity.

The lack of a direct association between physical activity knowledge and reported minutes of weekly physical activity is consistent with theoretical frameworks and prior studies that have shown physical activity knowledge to be poorly correlated with behavior (16). While this may suggest that educational programs may be ineffective in promoting physical activity, it could also be that our assessment of knowledge was deficient. It should be noted that our statements measured both knowledge and attitudes about physical activity. Regardless, the high percentage of respondents who agreed with the statements "as people get older they should exercise less" and "people with high blood pressure should not exercise" suggests that knowledge deficits regarding the specific benefits of physical activity may need to be addressed.

There were few indirect associations evident from the hierarchical models. Agreeing with the statement "as people get older they should exercise less" was indirectly associated via expectations with the odds of being physically active, while education and perceived health had indirect associations via knowledge and barriers.

Several limitations are inherent in this study. First, the physical activity data contained in the RPHAS survey are based on self-reported information. With self-report measures, the possibility of deliberate or unconscious misinformation exists (27). Also, because physical activity behavior and its correlates have rarely been investigated in similar populations, there was a need to develop tools to measure these constructs. Clark (21) has presented the characteristics of the measures in detail, but future work to further address the validity of the measures is needed. Second, because of the cross-sectional design of the study, we are only able to identify associations between variables. Consequently, we have relied on theory and literature to

Table 3—*Hierarchical cumulative logistic regression of variables regressed on total minutes of reported weekly physical activity among RPHAS respondents with type 2 diabetes*

Variables	Model 1	Model 2	Model 3
Sociodemographic variables			
Age (years)	0.96 (0.93–0.99)*	0.96 (0.92–0.99)*	0.96 (0.93–1.0)*
Women	0.59 (0.34–1.02)	0.60 (0.34–1.06)	0.65 (0.36–1.19)
White	1.26 (0.75–2.11)	1.29 (0.75–2.22)	1.52 (0.87–2.65)
No high school education	0.47 (0.27–0.80)†	0.50 (0.28–0.88)*	0.48 (0.27–0.86)*
Income less than $1,000/month	1.23 (0.66–2.28)	1.15 (0.60–2.19)	1.31 (0.68–2.54)
Health status variables			
Reporting fair or poor physical health (%)	0.38 (0.23–0.65)†	0.43 (0.24–0.76)†	0.49 (0.27–0.88)*
Glycated hemoglobin within normal range (4–8 vs. 8–12%)	0.52 (0.23–1.20)	0.54 (0.23–1.30)	0.49 (0.20–1.20)
Glycated hemoglobin >12% (vs. 8–12%)	1.48 (0.64–3.41)	1.34 (0.57–3.14)	1.11 (0.46–2.67)
No glycated hemoglobin reported (vs. 8–12%)	0.75 (0.41–1.36)	0.66 (0.35–1.23)	0.63 (0.34–1.19)
Arthritis	1.56 (0.85–2.84)	1.57 (0.85–2.92)	1.58 (0.84–2.98)
BMI	1.02 (0.98–1.06)	1.02 (0.98–1.07)	1.02 (0.98–1.07)
Statements on physical activity knowledge			
Older people should exercise less (agree)	—	2.24 (1.12–4.50)*	1.87 (0.91–3.82)
If can talk, not hard enough exercise (agree)	—	1.13 (0.66–1.93)	1.20 (0.70–2.06)
If have high blood pressure, should not exercise (agree)	—	0.95 (0.51–1.78)	0.86 (0.46–1.62)
Brisk walk is as good as a slow walk (agree)	—	0.95 (0.52–1.74)	0.92 (0.50–1.71)
Exercise can make you less tired (agree)	—	0.81 (0.47–1.42)	0.78 (0.45–1.38)
Barriers			
Symptoms	—	0.68 (0.36–1.28)	0.99 (0.51–1.95)
Motivation	—	0.52 (0.29–0.93)*	0.53 (0.29–0.95)*
Environment	—	1.92 (0.92–4.01)	1.69 (0.79–3.59)
Expectations			
Performance expectations	—	—	1.25 (1.09–1.44)†
Outcome expectations	—	—	1.02 (0.91–1.14)

Data are odds ratio (95% CI). $^*P < 0.05$; $^\dagger P < 0.01$.

direct our conclusions. Third, because data were collected from a sample of low-income older adults from one urban primary care setting, the results are not reflective of older adults with type 2 diabetes in general. Finally, the ability of the survey to capture physical activity patterns in this underactive older sample can be questioned. The survey did not address physical activities such as gardening, housework, or baby-sitting, which have been used as examples of moderate physical activity in recent literature. Focus groups indicated that these activities were relatively limited in this population, and there is debate surrounding the ability of such activities to improve health status or diabetes management (28).

Implications for practice and future work

Despite the limitations, this study is one of the first to present an assessment of potential correlates of physical activity in a sample of older, low-income adults with type 2 diabetes. Because older adults, individuals with chronic disease, and African-Americans have rarely been included in physical activity research, this study addresses important gaps in literature. Given the importance of physical activity to the management of diabetes, these results have important implications to health care providers regarding the design of interventions to increase physical activity in similar populations.

The findings demonstrate that sociodemographic variables have an important influence on the odds of being physically active. However, the findings also suggest that modifiable variables appear to influence physical activity as well. Effective methods for promoting increases in performance expectations and decreases in perceived barriers to physical activity need to be developed and should have a high priority for physical activity promotion research. Bandura (19) discussed four ways in which performance expectations are learned or enhanced: personal mastery, vicarious experiences, verbal persuasion, and one's emotional or physiological state. Although personal mastery is thought to have the most powerful effect on expectation levels, the low reported performance expectation scores in this study suggest that the respondents may be reluctant to initiate a physical activity program, which is a necessary step to experiencing personal mastery. Therefore, interventions aimed at increasing performance expectations through verbal persuasion or vicarious experiences may be beneficial. The use of physically active older adults of similar sex, ethnicity, and medical background might be very powerful in encouraging older adults to become more active. Because symptom barriers were prevalent among these respondents and perceived health status was poor, the interpretation of bodily sensations accompanying physical activity may enhance or erode the individual's probability of subsequent physical activity. Therefore, focusing on basic stretches and exercises and setting realistic personal goals may be important to the successful adherence to a program of physical activity and a sense of personal mastery.

The large percentage of respondents who reported a lack of willpower or lack of interest in physical activity as preventing them from walking or exercising more than they do signals that attention may need to be directed toward cognitive reformulations of the reasons to be physically active. In addition to physical health promotion, interventionists may also need to focus on the social and personal aspects of physical activity, such as increasing one's social network, enhancing body image, controlling stress, and improving mood, energy, and sleep quality. Additionally, although many respondents reported lack of time as an important barrier to physical activity, focusing on time management strategies may not be sufficient to change behavior. Symptom and environmental barriers were not significantly associated with the odds of being physically active, but the prevalence in which they were reported suggests that it would be wise to address these in the design of interventions.

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