Published in final edited form as:

J Rural Health. 2007 ; 23(4): 332–338. doi:10.1111/j.1748-0361.2007.00111.x.

Ethnic and Sex Differences in Ownership of Preventive Health Equipment Among Rural Older Adults With Diabetes

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Abstract

Context—Diabetes self-management is important for achieving successful health outcomes. Different levels of self-management have been reported among various populations, though little is known about ownership of equipment that can enhance accomplishment of these tasks.

Purpose—This study examined diabetes self-management equipment ownership among rural older adults.

Methods—Participants included African American, American Indian, and white men and women 65 years of age and older. Data included equipment ownership overall and by ethnicity and sex across diabetes self-management domains (glucose monitoring, foot care, medication adherence, exercise, and diet). Associations between equipment ownership and demographic and health characteristics were assessed using logistic regression.

Findings—Equipment ownership ranged from 85.0% for blood glucose meters to less than 11% for special socks, modified dishes, and various forms of home exercise equipment. Equipment ownership was associated with ethnicity, living arrangements, mobility, poverty status, and formal education.

Conclusions—Rural older adults with diabetes are at risk because they lack equipment to perform some self-management tasks. Providers should be sensitive to and assist patients in overcoming this barrier.

The major complications associated with diabetes (cardiovascular disease, nephropathy, lower extremity amputation, and blindness) can be reduced or delayed through diabetes self-management, which includes dietary modification, exercise, medical management, foot care, and self-monitoring of blood glucose.¹ Special equipment assists with accomplishing the tasks associated with successful adherence. For example, glucose self-measurement is entirely dependent on equipment for regular monitoring. Other self-care domains, such as foot care and medication adherence, are more easily performed if equipment is available, such as hand-held mirrors and pill boxes. Exercise equipment, which can be used in the place of exercise behaviors that do not require equipment, such as walking, also provides alternatives for performance of self-management.

Diabetes self-management among older adults in rural communities, particularly those who are members of racial minority groups, may be a challenge due to high levels of poverty, limited

availability of diabetes self-management education, environmental barriers, and lack of access to diabetes self-management equipment.^{2–5} Despite a wealth of information on the level of performance of diabetes self-management practices across various populations, very little information documents ownership of self-management equipment among adults with diabetes. These data are useful to understanding barriers to self-management and may identify vulnerable populations.

This study examines the ownership of diabetes self-management equipment across self-management domains among older rural adults, and the demographic and health characteristics associated with equipment ownership. We hypothesize that ownership of equipment will be less among men, among racial minorities, among those with fewer economic resources, and those in poorer health, including people with limited mobility.

Research Design and Methods

Data come from the ELDER (Evaluating Long-term Diabetes Self-management among Elder Rural Adults) Study, a population-based cross-sectional survey that comprehensively assessed the self-management strategies of rural adults aged ≥ 65 years with diagnosed diabetes.^{6–9} Participants were selected from two rural counties in central North Carolina with large minority populations. Both study counties were classified as rural using the structural operationalization of Butler and Beale,¹⁰ 1 county as rural-non-metropolitan with a Beale code of 6, and the other rural-non-metropolitan with a Beale code of 4.¹¹ The study was approved by the Institutional Review Board of Wake Forest University Health Sciences.

Sample

The ELDER Study recruited a stratified random sample of community-dwelling older adults with diabetes. The sampling frame was Medicare claims records. Random samples of male and female African Americans, American Indians, and whites were selected. Inclusion criteria were residence in the study counties, at least two outpatient claims for diabetes (ICD-9 250) in 1998–2000, age >65 , English speaking, and physically and mentally able to participate. An interviewer contacted each participant to confirm diabetes status and ethnicity, and assess eligibility and willingness to participate in the study. Participant in-home interviews lasting approximately 1.5 hours were conducted from May through October 2002. The overall response rate for eligible participants was 89% (701/787). Three were excluded from this analysis because they did not fit the 3 ethnic categories.

Measures

Face-to-face interviews were conducted by local, trained interviewers. The survey instrument included well-established standardized scales as well as items developed and pilot-tested by the investigators. Categorical variables included: ethnicity (African American, American Indian, white), sex, marital status (married vs not married), living arrangements (living alone, living with others and married, living with others and unmarried), poverty status (receiving Medicaid, not receiving Medicaid and household income below \$25,000/year, or not receiving Medicaid and household income equal to or greater than \$25,000/year), highest level of formal education (less than high school, high school, at least some college), participation in a diabetes education class, current use of diabetes medications (no medication, oral agents only, insulin with or without oral agents). Continuous variables included: age, mobility limitations, duration of diabetes, number of chronic conditions, and total number of prescription medications. Mobility was assessed using the mobility scale of the Medical Outcomes Study (MOS) Physical Functioning Measure, which has values of 2 through 10, with higher scores indicating greater mobility.¹² It is based on two questions: whether the participant needs help when traveling about the community and whether the participant is in bed most of the time.

The outcome measure was ownership of equipment utilized for 5 domains of diabetes self-management: glucose monitoring (blood glucose meter, blood sugar log or diary), foot care (special shoes or inserts; special socks; hand-held mirror; emery board, pumice stone or file), medication use (magnifier for insulin users, other insulin use aids, pill box for oral agent users), exercise (various types of home exercise equipment), and diet (various types of cooking aids). Since special shoes or inserts and special socks are indicated for high-risk patients, we limited analysis for these outcome measures to those who indicated that they had been diagnosed with neuropathy or had had an amputation (excluding double amputees).

Statistical Analysis

All variables were summarized overall, and ownership variables listed above were summarized and tested by chi-square (or Fisher's exact test when necessary) by ethnicity and by sex. Multiple logistic regression models were used to evaluate potential predictors of ownership of the following four self-management equipment items: blood glucose meter, hand-held mirror, pill box, and home exercise equipment. These items were selected because of their importance in self-management and because they were owned by more than a small proportion of the sample. Potential predictors included: ethnicity, sex, living arrangements, diabetes duration, and number of chronic conditions, mobility limitations, diabetes education class, number of prescription medications, poverty status, and formal education. Logistic regression results were presented as odds ratios and 95% confidence intervals.

For each outcome, a significance test was performed for an ethnicity-x-sex interaction, controlling for all potential predictors. Since the ethnicity-x-sex term was nonsignificant for all outcomes, the interaction term was dropped from the model and significance tests were performed for main effects of ethnicity and sex. For all potential predictors with more than 2 groups, all possible pairwise comparisons were tested. *P* values from these results were evaluated using Bonferroni's method ($\alpha = 0.05$ divided by the number of tests performed). Data were analyzed using SAS Statistical Software (version 8.2, SAS Institute, Inc., Cary, NC).

Results

The study sample was nearly equally divided among men and women, and more than half were either African American (31.5%) or American Indian (25.9%). The average age was 74.1 years, and nearly half (48.7%) lived with 1 other person. More than three quarters were either receiving Medicaid (35.3%) or not receiving Medicaid but had an annual household income below \$25,000 (45.5%), and about the same percentage had a high school education or less (85.5%). A small proportion (16.4%) had ever attended a diabetes education class. Almost 90% were either on insulin or oral agents. The average duration of diagnosed diabetes was 12.4 years. Participants had on average nearly 5 chronic health conditions and 6.5 prescription medications.

Table 1 shows the distribution, overall and by ethnicity and sex, of diabetes self-management equipment ownership for the 5 domains investigated. Overall, ownership was highest for blood glucose meters (85%); special oven mitts (73.8%); hand-held mirrors (67.3%); emery board, pumice stone, or file (61.3%); and juicer or blender (60.4%). About one third (33.5%) had at least 1 type of home exercise equipment. By contrast, ownership was low for special socks (10.5%), magnifiers (5.8%) and other aids (8.4%) for insulin administration, various forms of home exercise equipment (eg, hand weights, 7.6%), and lighter, less breakable dishes (7.6%). Significant ethnic differences were observed for: blood sugar log or diary ($P = .016$), special shoes (.0002), hand-held mirror and emery board (all $P < .0001$), pill box ($P = .026$), any home exercise equipment ($P = .0003$), hand weights ($P < .0001$), treadmill ($P = .043$), swimming pool ($P = .032$), outdoor or stationary bike ($P = .046$). All of the diet-related equipment variables

were significant, with the exception of lighter, less breakable dishes ($P = .58$). In most cases, equipment ownership was greatest for whites, with the exception of special socks or inserts.

For sex, the following variables were significant: women were more likely than men to own a hand-held mirror ($P = .0002$), emery board ($P = .0003$), and pill box ($P = .0014$), while men were more likely than women to own any home exercise equipment ($P = .0064$), outdoor or stationary bike ($P = .0010$), and special cookbook ($P = .047$).

For the multivariate analyses of blood glucose meter ownership, significant associations were observed for longer diabetes duration, participation in a diabetes education class, and higher number of prescription medications (Table 2). People with a high school education were less likely to own a blood glucose meter than people with less than a high school education (OR = 0.4, 95% CI 0.2–0.8). Those with some college education were more likely to own a blood glucose meter, compared to those with a high school education (OR = 2.5, 95% CI 1.0–6.0), although this relationship did not reach the adjusted level of statistical significance (0.05/3 = 0.017).

Significant associations were observed in ownership of hand-held mirrors for ethnicity and sex only. African Americans ($P = .0014$) and American Indians ($P = .0003$) were about half as likely to own this equipment as whites, while rates among these two minority groups were similar. Women were twice as likely to own a hand-held mirror as men ($P = .0007$).

Significant associations were observed for sex and number of prescription medications for pill box ownership. Women were 80% more likely to own a pill box than men ($P = .011$), and there was a 10% increased odds of owning a pill box for every one unit increase in the number of prescription medications ($P = .012$).

For home exercise equipment, while the overall effect of ethnicity was not significant, American Indians were 80% more likely to own home exercise equipment than African Americans. Living with others and being married was associated with a 2.1 times greater likelihood of exercise equipment ownership than living alone. Higher levels of mobility were associated with increased odds of ownership (OR = 1.02, 95% CI 1.01–1.03). Higher levels of income were associated with increased odds of ownership. Those in the highest income category (not receiving Medicaid and annual income of \$25,000 or more) were 2.4 times more likely to own home exercise equipment than those in the lowest income category (receiving Medicaid).

Discussion

A critical ingredient of successful outcomes for patients with diabetes is the regular performance of self-management practices across several domains, including diet, foot care, exercise, medication management, and monitoring of glycemia. These elements of self-management can only be performed (in the case of glycemia) or can be performed more efficiently (in the case of diet, foot care, exercise, and medication management) when equipment is available to the patient, either by owning the equipment or having it readily available through other sources.

Numerous studies have documented the performance of various elements of diabetes self-management across the United States and in specific population subgroups.^{13–16} For example, the 2003 Behavioral Risk Factor Surveillance System indicates that 58.3% of US adults with diabetes reported monitoring their blood glucose daily and 67.4% checked their feet daily.¹⁷ We have documented that 40% of participants in the ELDER study monitored their blood glucose daily⁷ and 64.7% checked their feet daily.⁸ Despite the availability of data on the level of performance of diabetes self-management across various populations, to our knowledge,

there are no data on the personal ownership of diabetes self-management equipment. Such information is needed to determine the degree to which this particular barrier—lack of equipment ownership—influences successful performance of self-management and ultimately results in successful outcomes. This is especially important for those in rural communities who face numerous barriers in diabetes self-management.

We found that ownership of some types of equipment, such as blood glucose meters and hand-held mirrors, was relatively high, while ownership of other types of equipment, such as pill boxes and home exercise equipment was relatively low. It is not surprising that ownership of some forms of more expensive types of home exercise equipment, such as treadmills and swimming pools, is low in this rural population, given the high rates of poverty. It is also not surprising that ownership of home glucose monitors is high, given that Medicare covers the cost of these instruments.

Conversely, even less expensive types of equipment, such as hand weights and thera-bands, were not owned by large segments of the population. This might reflect the desire for this population to use other more traditional forms of activities for exercise, such as walking and working around the home. We have previously documented relatively low rates of physical activity in the ELDER population,⁹ a finding consistent with other studies in rural communities.^{5,18–20} Among regular exercisers, the most popular form of exercise was walking and working around the home. These communities have limited access to exercise facilities, but also limited availability to sidewalks and shoulders on streets, which are important determinants of exercising in rural communities.⁵ Another possibility is the lack of availability of local health education efforts to promote these forms of exercise, also an important correlate of physical activity in rural communities.⁵

We hypothesized that certain factors would be associated with equipment ownership, including racial majority status, being female, higher levels of income and education, and better overall health and mobility. Of the 4 factors examined in multivariate analyses, a significant racial difference was observed for hand-held mirrors, where both African Americans and American Indians were less likely than whites to own this piece of equipment. This is discouraging, considering the ethnic disparities observed in diabetes-related lower extremity amputation.^{21,22} However, American Indians fared better than African Americans in ownership of home exercise equipment. Further investigation of this finding is needed to understand this relationship more fully.

Sex differences were observed for ownership of 2 of the 4 equipment categories that we investigated: women were more likely than men to own a hand-held mirror and pill box. Sex differences have been observed for performance of other types of preventive health behaviors,^{23–25} and, as we hypothesized, women were more likely to report owning these pieces of equipment. However, marital status also played a role in this relationship. For example, while there were no sex differences in ownership of home exercise equipment, people who were married were more likely to report owning this piece of equipment than those living alone. This finding indicates that spouses of diabetes patients may be playing a critical role in supporting diabetes self-management.

Income and education played some role in equipment ownership. Higher levels of income were associated with home exercise equipment ownership. The association of income with home exercise equipment was expected, given the expense associated with these pieces of equipment and the availability of less expensive alternatives for exercise. Given this finding the high rates of poverty in rural communities, promotion of low cost exercise equipment (eg, thera-bands) is suggested.

The relationship between education and blood glucose meter ownership is less clear. Overall, the relationship between educational status and blood glucose meter ownership was statistically significant. However, a contrasting association was observed. Those with less than a high school degree were more likely to own a blood glucose meter compared to those with a high school degree. Conversely, those with some college education were no different than those with a high school degree. Only minimal differences were observed at the 2 extremes of education attainment (some college vs less than high school). It is possible that those with less than a high school education, and those with some college education, had available to them health care resources that provided some coverage for blood glucose meters based on income. Further examination of this association is warranted.

A higher level of mobility was significantly associated with ownership of home exercise equipment. This is not surprising, considering that many types of equipment, such as exercise bikes and treadmills, require a high level of mobility to operate. However, we did include other forms of exercise equipment, such as hand weights and thera-bands, which do not require high levels of mobility to use. That these types of equipment were infrequently used may indicate that they are not readily available in this population, that there is a preference among those who are less mobile to do exercise that does not require equipment, or that those who are less mobile are less likely to perform any type of exercise.

Other factors considered for this analysis had limited association with equipment ownership. For example, participation in a diabetes education class and duration of diabetes were only associated with blood glucose meter ownership. The association with diabetes duration is understood, given that there is a greater degree of emphasis on glucose self-monitoring as the condition progresses. It is possible that the diabetes education programs in these rural communities may be assisting their patients in overcoming the barriers in obtaining blood glucose meters. It is also possible that the education received by these patients may be effective in stressing the importance of self-monitoring of blood glucose.

This study has some limitations that must be considered. First, this analysis only examined ownership and not utilization of these types of equipment. We have previously reported rates of blood glucose monitoring, foot care and physical activity in this population,⁷⁻⁹ but this study gives a picture of the ownership of this equipment, recognizing that this may be a barrier that could affect optimal self-management. Furthermore, use of these products might be hindered by other factors not addressed in this analysis. For example, despite high rates of ownership of blood glucose meters, use of this equipment might be limited due to the expense associated with purchasing test strips. Second, these data do not elucidate the specific reasons for not owning these types of equipment. We have considered some characteristics that were available to us that may influence equipment ownership, such as income, chronic conditions and mobility; however, there may be other factors not considered in this analysis. For example, while their access and availability in these rural communities is low, some may prefer to exercise in a public facility such as a gym or senior center. Furthermore, we were unable to determine what outside influences might have affected equipment ownership. We did not have access to information pertaining to whether a health care provider had encouraged or prescribed this equipment. We did observe that blood glucose meter ownership was associated with participation in a diabetes education class, although it is unclear to what extent the equipment included in this analysis was part of the education received through these programs.

Despite these limitations, this study has a number of strengths. These data are drawn from a large sample, with good measures of demographic and health characteristics to describe the factors associated with self-management equipment ownership. The study had a high response rate, and the data were drawn from a cross-section of ethnically diverse, community-dwelling

older adults, a population at risk for diabetes complications. Finally, this is, to our knowledge, the first systematic reporting of ownership of diabetes self-management equipment.

In summary, our data indicate that one potential barrier to diabetes self-management among older adults in rural communities is the lack of equipment that are critical for the performance of these behaviors. Further investigation is needed to understand more fully the reasons for lack of equipment ownership, and the various resources that are available to older rural adults for diabetes self-management.

Conclusion

Patients with diabetes in rural communities face numerous challenges in performing self-management practices. Lack of ownership of some equipment may be one of many potential barriers that may impede successful performance of these behaviors. While some types of equipment are expensive and require training for use, others, such as pillboxes and thera-bands, are relatively inexpensive and may provide benefit for individuals to be adherent in medication usage and physical activity. Diabetes educators in rural communities must make themselves aware of whether their patients own or otherwise have access to self-management equipment, what factors are associated with lack of ownership, and what strategies need to be employed to assist patients in obtaining these pieces of equipment or access to them.

Acknowledgements

Funding for this study was provided by a grant from the National Institute on Aging and the National Center on Minority Health and Health Disparities (AG17587).

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Table 1
Equipment Ownership for Domains of Diabetes Self-Management, Overall and by Ethnicity and Sex (count [%])

Domain/Equipment	White (n = 297)	African American (n = 220)	American Indian (n = 181)	Ethnicity P Value	Women (n = 343)	Men (n = 355)	Sex P Value	Total (n = 698)
Glucose monitoring								
Blood Glucose meter	252 (84.9)	179 (81.4)	162 (89.5)	.076	294 (85.7)	299 (84.2)	.58	593 (85.0)
Blood Sugar log or diary	148 (49.8)	107 (48.6)	67 (37.0)	.016	169 (49.3)	153 (43.1)	.10	322 (46.1)
Foot care								
Special Shoes or inserts** (n = 172)	30 (38.5)	31 (68.9)	30 (71.4)	.0002	52 (59.8)	39 (50.0)	.21	91 (52.9)
Special socks** (n = 172)	7 (9.0)	7 (15.5)	4 (9.5)	.50	9 (10.3)	9 (11.5)	.81	18 (10.5)
Hand-held mirror (n = 690)	232 (78.9)	133 (61.3)	99 (55.3)	<.0001	252 (73.9)	212 (60.7)	.0002	464 (67.3)
Emery board, pumice stone, file (n = 690)	220 (74.8)	105 (48.4)	98 (54.8)	<.0001	232 (68.0)	191 (54.7)	.0003	423 (61.3)
Medications								
Magnifier (insulin users only) (n = 190)	4 (6.3)	5 (6.8)	2 (3.9)	.86*	8 (8.7)	3 (3.1)	.097	11 (5.8)
Other (insulin users only) (n = 190)	5 (7.8)	5 (6.8)	6 (11.5)	.62	6 (6.5)	10 (10.2)	.36	16 (8.4)
Pill box (oral med users only) (n = 486)	98 (45.6)	49 (32.9)	57 (46.7)	.026	119 (49.2)	85 (34.8)	.0014	204 (42.0)
Exercise								
Home exercise equipment	122 (41.1)	53 (24.1)	59 (32.6)	.0003	98 (28.6)	136 (38.3)	.0064	234 (33.5)
Hand weights	38 (12.8)	10 (4.6)	5 (2.8)	<.0001	20 (5.8)	33 (9.3)	.084	53 (7.6)
Exercise video	13 (4.4)	5 (2.3)	6 (3.3)	.43	12 (3.5)	12 (3.4)	.93	24 (3.4)
Thera-bands	16 (5.4)	5 (2.3)	7 (3.9)	.20	11 (3.2)	17 (4.8)	.29	28 (4.0)
Treadmill	49 (16.5)	20 (9.1)	22 (12.2)	.043	39 (11.4)	52 (14.7)	.20	91 (13.0)
Swimming pool	7 (2.4)	0 (0.0)	1 (0.6)	.032*	3 (0.9)	5 (1.4)	.73*	8 (1.2)
Outdoor or stationary bike	80 (26.9)	40 (18.2)	37 (20.4)	.046	59 (17.2)	98 (27.6)	.0010	157 (22.5)
Other home exercise	4 (1.4)	3 (1.4)	8 (4.4)	.081*	4 (1.2)	11 (3.1)	.078	15 (2.2)
Diet								
Large print measuring cups	155 (52.2)	95 (43.2)	72 (39.8)	.018	156 (45.5)	166 (46.8)	.73	322 (46.1)
Special utensils	101 (34.0)	87 (39.6)	75 (41.4)	.021	124 (36.2)	139 (39.2)	.41	263 (37.7)
Special oven mitts	231 (77.8)	160 (72.7)	124 (68.5)	.075	257 (74.9)	258 (72.7)	.50	515 (73.8)
Vegetable steamer	152 (51.2)	67 (30.5)	42 (23.2)	<.0001	122 (35.6)	139 (39.2)	.33	261 (37.4)
Meat grilling machine (n = 694)	167 (56.2)	59 (27.3)	74 (40.9)	<.0001	137 (40.2)	163 (46.2)	.11	300 (43.2)
Juicer or blender (n = 697)	208 (70.0)	114 (52.1)	99 (54.7)	<.0001	199 (58.2)	222 (62.5)	.24	421 (60.4)
Food scale (n = 697)	74 (24.9)	30 (13.7)	12 (6.6)	<.0001	54 (15.7)	62 (17.5)	.53	116 (16.6)
Lighter less breakable dishes (n = 697)	20 (6.7)	20 (9.1)	13 (7.2)	.58	25 (7.3)	28 (7.9)	.76	53 (7.6)
Special cookbooks (n = 697)	78 (26.3)	37 (16.9)	22 (12.2)	.0004	57 (16.6)	80 (22.6)	.047	137 (19.7)

* Fisher's exact test used due to low expected cell counts.

** Analysis limited to study participants diagnosed with neuropathy, or had had an amputation (excluding double amputees).

Table 2

Multivariate Associations[‡] Between Ownership of Diabetes Self-Management Equipment Across Various Domains and Demographic and Health Characteristics

Variables	Blood Glucose Meter (N = 662) OR (95% CI)	Hand-Held Mirror (N = 655) OR (95% CI)	Pillbox (N = 461) OR (95% CI)	Home Exercise Equipment (N = 662) OR (95% CI)
Ethnicity		***		*
African American vs white	1.1 (0.6, 2.0)	0.5 (0.3, 0.8)	0.6 (0.37, 1.02)	0.7 (0.42, 1.02)
American Indian vs white	2.0 (1.04, 3.88)	0.4 (0.3, 0.7)	1.1 (0.6, 1.8)	1.2 (0.8, 1.9)
American Indian vs African American	1.8 (0.9, 3.4)	0.9 (0.6, 1.3)	1.8 (1.03, 3.00)	1.8 (1.1, 3.0)
Sex – Female vs male	1.5 (0.8, 2.5)	2.0 (1.3, 3.0) [†]	1.8 (1.1, 2.9) [†]	1.2 (0.8, 1.8) **
Living arrangements				
Living w/others and unmarried vs living alone	1.2 (0.6, 2.3)	0.8 (0.5, 1.2)	1.1 (0.6, 2.0)	1.3 (0.7, 2.2)
Living w/others and married vs living alone	1.9 (1.1, 3.5)	0.9 (0.6, 1.4)	1.2 (0.7, 2.0)	2.1 (1.3, 3.3)
Living w/others: married vs unmarried	1.6 (0.8, 3.3)	1.2 (0.7, 2.0)	1.1 (0.6, 2.0)	1.6 (0.96, 2.78)
Diabetes duration (log years)	1.6 (1.4, 2.0) [†]	1.0 (0.8, 1.1)	1.0 (0.9, 1.3)	0.9 (0.8, 1.1)
Number of chronic conditions	1.0 (0.9, 1.1)	1.0 (0.9, 1.1)	1.0 (0.9, 1.1)	1.1 (0.97, 1.18)
Mobility (limitations)	1.0 (0.99, 1.02)	1.0 (0.99, 1.01)	1.0 (0.98, 1.01)	1.0 (1.01, 1.03) [†]
Diabetes education class	5.6 (1.9, 16.3) [†]	1.5 (0.9, 2.4)	1.2 (0.7, 2.0)	1.0 (0.6, 1.6)
Number of prescription medications	1.2 (1.1, 1.3) [†]	1.0 (0.92, 1.01)	1.1 (1.02, 1.15) [†]	1.0 (0.93, 1.04) *
Poverty status				
Not receiving Medicaid and annual household income < \$25,000 vs on Medicaid	1.5 (0.8, 2.6)	1.1 (0.7, 1.6)	1.0 (0.6, 1.7)	1.6 (1.01, 2.49)
Not receiving Medicaid and annual household income ≥ \$25,000 vs receiving Medicaid	1.8 (0.8, 4.5)	1.8 (0.96, 3.48)	1.2 (0.6, 2.4)	2.4 (1.3, 4.5)
Not receiving Medicaid and annual household income ≥ \$25,000 vs not receiving Medicaid and annual household income < \$25,000	1.3 (0.6, 2.7)	1.7 (0.96, 2.95)	1.1 (0.6, 2.0)	1.5 (0.95, 2.50)
Formal education	*			
High school vs less than high school	0.4 (0.2, 0.8)	1.4 (0.9, 2.3)	1.3 (0.8, 2.2)	1.3 (0.8, 2.1)
At least some college vs less than high school	1.1 (0.5, 2.6)	1.3 (0.7, 2.4)	1.0 (0.5, 1.9)	1.9 (1.1, 3.3)
At least some college vs high school	2.5 (1.03, 6.01)	0.9 (0.5, 1.9)	0.8 (0.4, 1.5)	1.5 (0.8, 2.6)

[‡] Separate logistic regression models were performed for each of the 5 self-management characteristics and all of the variables in the rows as predictor variables, with the latter category being the referent group. The results shown are for models without the ethnicity-x-sex interaction since this term was not significant for any of the outcomes (blood glucose meters, $P = .48$; hand-held mirror, $P = .88$; pill box, $P = .17$; home exercise equipment, $P = .15$).

For overall tests of categorical covariates with >2 levels: *** = P value $\leq .001$, ** = $0.001 < P$ value ≤ 0.01 , * = $0.01 < P$ value ≤ 0.05 .

[†] $P < .05$ for continuous or dichotomous variables.