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A New Method for Identifying Characteristics of Needing Help to Take Medications in an Older Representative Community-Resident Population: The Duke Medication Assist Scale

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Abstract

OBJECTIVES—To determine the sociodemographic characteristics, health conditions, cognitive and functional status associated with baseline prevalence and new need for help taking medication three years later, and to construct a brief scale indicative of need for help taking medications.

DESIGN—Retrospective cross-sectional and 3-year longitudinal study

SETTING—Five-county area in north-central Piedmont, North Carolina

PARTICIPANTS—Representative community-resident sample of African Americans and Whites age 65 and older (N=4,136)

MEASUREMENTS—Information was obtained in person in the home, using structured questionnaires. Health conditions included sensory impairment and self-report of physician-diagnosed conditions. Cognitive status was assessed by the 10-item Short Portable Mental Status Questionnaire. Functional status was assessed by the 3-item Rosow-Breslau, 5-item Katz basic activities of daily living (ADL), and a modified 6-item OARS instrumental (I) ADL scale.

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RESULTS—Characteristics associated with need for help taking medications were age (≥ 80 years), being male, living with others, four or more chronic conditions and impaired cognitive or functional status (c-statistic 0.94, 77.1% sensitivity, 87.9% specificity). Predictors of new need for help with medications 3 years later included older age (age 75 and over at baseline), being male, and impaired cognitive and functional status (c-statistic 0.75)

CONCLUSION—This brief scale should help to identify persons currently needing help with medications and be useful in assisting clinicians with patient medication management.

Keywords

Medication taking behavior; older people; medication adherence; Medication Assist Scale

INTRODUCTION

As age increases a larger proportion of older people develop medication-taking problems.¹ Few studies, however, have tried to identify the characteristics of those who have, or who may develop need for help taking medications,^{2–5} or the prevalence and incidence of this problem. Such information is critical, since optimal management of chronic medical conditions relies heavily on appropriate prescribing and appropriate use of medications, and on awareness of the extent of the problem. Poor adherence can result in worsening of disease, increased health care costs, and death.⁴

Medication self-management (ability to handle taking medication without assistance), is a complex process requiring both cognitive and physical abilities.⁶ The median number of medications used by persons over 65 has doubled from 2 to 4 over the last 20 years, with individuals on multiple medications having worse health status.⁷ Those who cannot or do not take their medications properly have poorer health outcomes, and higher all-cause mortality.^{8–10} Patients 65 and older experience a two-fold higher risk of drug-related complications.¹¹ In a large retrospective cohort of Medicare enrollees in an ambulatory setting, 27.6% of all drug-related adverse events were considered preventable, with 21.1% of these events due to patient error such as taking the wrong dose or wrong medication.¹²

Given information already available, we expect that the personal characteristics associated with needing help taking medications will be associated with factors attendant on age,^{13–14} including decline in cognitive functioning,¹⁵ the number of medical conditions present, the number of medications prescribed,^{16–17} and self-reported instrumental and basic activities of daily living.^{18–20} Insofar as education and income are associated with health status,^{21–22} it is possible that these characteristics may also help to explain need for help with medications. We have examined data from a representative, older, community-resident sample of African Americans and Whites. Our aims were 1) to determine the sociodemographic characteristics, and general health, cognitive and functional status associated with the baseline prevalence, and new occurrence three years later, of the need for help taking medication, and 2) based on the information obtained, to construct a brief scale indicative of need for help taking medications.

METHODS

Sample

Our data come from the first two in-person waves (1986, 1989) of the 10-year (1986–1996) longitudinal Duke Established Populations for Epidemiologic Studies of the Elderly (Duke EPESE), based on a probability sample of persons aged 65 years or older living in households in a five-county Piedmont area of North Carolina.²³ African Americans were oversampled to increase statistical precision for this group. Of the 4,162 persons successfully interviewed (80% of those contacted), 54% (2,261) were African-American, 45% (1,875) White, and 26 of other race/ethnicity; 35% were male. Roughly half came from the single urban and half from the four rural counties. For all participants, survival status was determined by search of National Death Index records.²⁴

Sample members of “other” race (N = 26), and those for whom information on ability to take their own medications was missing (N = 30), were excluded, resulting in an analysis sample of 4,106 older African Americans and Whites. This study was approved by the Institutional Review Board of Duke University Medical Center. Written consent was obtained from sample members or their legal representatives.

Information obtained

Information was obtained in person in the home, using structured questionnaires. When the sample member was unable to respond (or unwilling and designated another person), information was obtained from a proxy respondent (3.9%, n=158), an adult who had close contact with the sample member, and knew that person well (spouse, kin, close friend). Proxies provided only objective information.

Dependent variable—The following question indicated need for help taking medications: “Are you (is he/she) able to take your (his/her) medicine without help (in the right doses at the right time)?” (need help coded 1, no help needed coded 0).

Covariates

Sociodemographic characteristics included age (categorized as 65–69/70–74/75–79/ 80 years), sex (reference: female), race (reference: White), education (8 years/some high school/ completed high school), annual income from all sources (<\$5000/\$5,000–<\$10,000/\$10,000), and whether living alone.

Health conditions included sensory impairment (poor vision, poor hearing), and self-report of physician-diagnosed stroke, diabetes, hypertension, heart attack, and cancer (skin cancer excluded). Physician-diagnosed conditions were summed, and categorized as 0–1/2–3/4–5 conditions. Number of prescription and over-the-counter medications being taken was determined by review of containers, and categorized as 0–2 vs 3 for over-the-counter drugs, and 0–5 vs 6 for prescription drugs, based on review of the distribution present.

Cognitive status was assessed by the 10-item Short Portable Mental Status Questionnaire,²⁵ with 0–3 errors considered cognitively intact vs 4 errors indicating cognitive difficulty.

Functional status was assessed by the 3-item Rosow-Breslau,²⁶ 5-item Katz basic activities of daily living (ADL),²⁷ and the 7-item older Americans Resources and Services (OARS) instrumental (I) ADL scale,²⁸ from which the question on need for help with medications was excluded (i.e., resulting in a modified 6-item IADL scale). Information on the validity and reliability of these measures had been determined previously.²⁸ On each scale, each item was scored dichotomously (able to do unaided [coded 0] vs need help or unable to do [coded 1]). The items in each scale were summed, and dichotomized to indicate whether there were any problems (coded 1), or none (coded 0). (The specific items in the IADL and ADL scales are given in the on-line Appendix.)

Statistical analysis

To maintain the sample, missing data for education (1.6%), income (18.9%), Rosow-Breslau (4.3%), and IADL (2.3%) were imputed using stochastic regression imputation.²⁹ A logical imputation approach was used for the SPMSQ (1.2% missing), e.g., if the missing item was easier than an item that had been answered correctly, the missing item was coded as correct. Information on vision was excluded because of substantial missing data.

Descriptive statistics (mean, standard deviation, N, %, chi square) were used to characterize the sample and to examine differences between those needing help vs those not needing help to take medications. A two-phase analysis strategy was employed in an effort to reduce the number of comparisons when developing multivariable logistic regression models. The candidate predictor variables were grouped into chunks (sociodemographic; health conditions and medications; sensory loss, cognitive and functional status), with each chunk entered into a separate multivariable logistic regression. If the chunk as a whole was significantly associated with the dependent variable, we retained the significant individual predictor variables present. By prior decision, age, sex, race, and education were retained regardless of significance status. The Rosow-Breslau was retained to maintain information on the entire range of functional status. The independent variables entered into the final baseline model are displayed in Table 2. Multicollinearity of the candidate variables was assessed and found not to present a problem. Pairwise correlations among Katz ADL, 6-item IADL, and Rosow-Breslau ranged from 0.33–0.47, which do not approach levels such as 0.70 which threaten model validity. A sensitivity analysis, in which those not currently taking medications were excluded, showed inconsequential differences with the results shown in this manuscript.

Following analysis of baseline data, we checked whether the significant baseline variables also predicted need for help three years later in survivors that needed no help with medications at baseline

Although adjustment for sampling design is not considered necessary when, as here, sampling characteristics are included in analysis,³⁰ we nevertheless checked to determine whether design effects should be taken into account. The resulting design effect (1.44) is considered low, indicating that sampling design has little effect on the generalizability of the results. We nevertheless used person weights to more accurately indicate the prevalence of self-reported need for help taking medications at baseline, and three years later.

Using receiver operating characteristics (ROC) analyses, we determined which set of variables significantly associated with both baseline (prevalent) and new need for help taking medications three years later best constituted a rapid scale to identify such need. All analyses were carried out using SAS version 9.3 (Cary, NC). The threshold of $p=.05$ determined statistical significance.

RESULTS

Baseline Cross-sectional Results

Two thirds of the sample were female, 55% were African American, nearly 40% were age 75 or older; education was limited (fewer than half had gone beyond grade school), and income was low (Table 1, also on-line Table 1, with row-wise description).

At baseline, 7.1% ($n=291$; weighted: 7.14%) of the sample needed help taking medications. While 9% were taking no medication, they reported a higher rate of having trouble taking medications (8.7%) than did the group taking any medications (6.9%). Those needing help taking their medications were, on average, 5.6 years older, more likely to be male, African American, averaged 1.7 fewer years of education, lower income, and were less likely to live alone. They reported poorer hearing, more health conditions, a larger number of prescription medications but fewer over-the-counter drugs. Their cognitive status was poorer, as was their functional status.

After including pre-determined demographic characteristics and the Rosow-Breslau, and excluding non-significant variables (see Statistical Analysis section), we further excluded income from the multivariable analysis since the association with income in controlled analyses was inconsistent. Further analysis was unable to explain this finding, which did not occur when only demographic characteristics were included in the model.

Information in Table 2 indicates that persons age 80 and over had a 56% greater odds of needing help with medications than those aged 65–69; men were nearly twice as likely as women to need help; those who lived with others, who reported four or more chronic conditions, or had mobility problems had more than twice the odds of needing help. The odds of needing help was four to 16 times greater among those with impaired cognitive functioning or impaired instrumental or basic ADL. Race, level of education, and high number of prescription drugs were not associated with needing help with medications. The c-statistic for this analysis was 0.941, indicating high discriminative ability for this model.

Predicting new need for help with medications three years later

At baseline 3,815 participants needed no help in taking their medications; 3,090 were available for the full model analysis three years later, of whom 349 (11.3%; weighted: 11.0%) now needed help. Drop-out was due to death (12.8%, $n=489$), refusal (4.0%, $n=151$), loss to follow-up (1.4%, $n=44$), and incomplete information (1.3%, $n=41$). We re-ran the final full baseline model to determine whether the variables associated with needing help taking medications at baseline also predicted new need for such help three years later. In the fully adjusted model, predictors of new 3-year need for help with medications included older age (age 75 and over at baseline), being male, White race, and impaired cognitive and

functional status. With the exception of the oldest age, the predicted odds of needing help were lower than the cross-sectional odds. Living alone and having multiple chronic conditions were no longer predictive of needing help, but being African American was newly protective. Education and number of prescription medications remained non-significant. The c-statistic (0.5 indicates no discriminative ability, 1.0 indicates perfect discriminative ability), for new 3-year need for help with medications was 0.752. Thus, a core set of characteristics was both associated with, and predicted new 3-year need for help taking medications; some variables were consistently not associated, while others were less stable in this regard.

To construct a brief scale indicative of need for help with medications we then selected those variables that were consistently associated with needing help: age (dichotomized for further analysis as 65–74 vs 75), sex, SPMSQ, modified OARS IADL, and Katz ADL. We omitted the Rosow-Breslau from further consideration since approximately half of those needing no help with their medications were impaired on this measure. Keeping age, sex, and SPMSQ as a core set, we determined whether the addition of ADL, IADL, or both measures yielded the best sensitivity and specificity for determining current need for help, using ROC analysis. The best combination included age (75), sex (male), SPMSQ (4 errors), 1 IADL, and 1 ADL problem. With a potential scoring range of 0–5, a score of 3 had sensitivity 77.1%, specificity 87.9%, positive predictive value (PPV) 32.1%, negative predictive value (NPV) 98.1% ($c=.905$) (Figure 1). Details are given in the on-line Appendix.

Predicting new 3-year need for help with medication, the same combination of variables, with the same cut-points, had sensitivity 32.0%, specificity 92.8%, PPV 36.2%, NPV 91.5% ($c=.716$). However, sensitivity and specificity are improved with a cut-point of 2 (sensitivity 56.9%, specificity 76.9%; PPV 23.9%, NPV 93.3%) ($c=.704$).

DISCUSSION

There is a paucity of information on factors associated with or predictive of need for help taking medications among older community residents. We found that, in 1986/87, 7.1% reported needing such help. This prevalence rate agrees with other studies of persons age 65 and over which have used a comparable assessment: 7% in Durham county; 6% in both a statewide survey in Virginia, and in Cleveland, Ohio,³¹ and 7.6% in the Canadian Study of Health and Aging (data recalculated to adjust for differential oversampling by age).³² Our prevalence rate of 17.6% for persons age 80 and over agrees with the 17.9% reported by the Newcastle 85+ study,³³ however, the Health and Retirement Survey found a prevalence rate of 6.2% in 1995, declining to 5.8% in 2004 in a representative US sample age 75 and over.³⁴ When need for help with medications was examined in terms of time till death, 14% of a nationally representative sample age 50 and over required help two years prior to death, with 32% needing help in the last month of life.¹ Among persons who survived for three years, who had not needed help initially, 11.3% (weighted: 11.0%) now reported needing help. We have been unable to find published comparison information. Given an increase in the number and proportion of older persons, a doubling in use of medications,⁷ and a marked increase in need for help within two years of death,¹ a problem is present.

Our population included all subjects including those who were not taking an over-the-counter or prescription medication at the time of the baseline assessment. Their reported problems taking medications likely reflects a previous episode, or the need to handle as needed medications. Adjusted analysis indicated greater need for help taking medications among men, persons age 80 and over, those living with others, those with multiple chronic conditions, and impaired cognitive and functional status. Level of education, race, and a higher number of medications were not associated with need for help taking medications. Variables associated with prevalent need overlapped with those predicting new need for help three years later: again men, older persons, and poor cognitive and functional status predicted need for help. And again, number of medications was irrelevant. However, while race became significant (lower odds of needing help among African Americans, possibly because of differences in survival at older ages), living alone and number of chronic conditions lost significance. Aside from cognitive status,³⁵ there is no consensus concerning characteristics associated with medication management ability.

The characteristics we examined to determine need for help taking medications fell into three categories: characteristics associated with both current and new need for help in three years' time; characteristics associated with neither; and characteristics where the association was inconsistent.

Characteristics associated with both current and new need for help in three years' time, included increased age, male gender, and impaired cognitive and functional status. We found that higher age was consistently associated with need for help with medications. This is to be expected given that number of medications (and with it drug complexity), increase with patient age,^{17,36} and that age has been found to be an important predictor of medication self-management.³⁷

There is no consistency across publications as to whether it is men or women who need help taking their medications.^{38,39} Our finding that older men are more likely to report needing help may reflect our study's geographical area, and its' cultural norms for the generation of seniors we studied. In agreement with the literature, we found that cognitive function was a consistent predictor of medication-taking ability.^{15,37,40} Executive function, in particular, has been identified as a significant determinant.⁴¹ Those with mild cognitive impairment, who were otherwise functioning independently, have been shown to have trouble taking their medications.⁴²

Ability to take one's own medications is a recognized instrumental ADL, so the association between need for help taking medication and functional status is to be expected.⁴³ In addition, a narrative review of the association between medications and functional decline⁴⁴ found decline in functioning associated with polypharmacy and with some medications.

Characteristics associated with neither current nor new 3-year need for help included education and taking 6 prescription medications. This may be due to the association of education and number of prescription medications with age, so that in multivariable analysis age accounts for both characteristics. Medications are more likely to be modified or added gradually and incrementally, so that only a small additional piece of information must be

incorporated each time, and that information is practiced multiple times. Under such circumstances level of education may become less important. Based on these observations, seniors who have preserved IADL/ADL function and memory may still retain the ability to take medications independently.

Inconsistent characteristics included living with others and reporting four or more chronic conditions (associated with current need for help), and being African American (predicted reduced new 3-year need). The finding that a larger proportion of patients who lived with someone had a current need for help, but not new 3-year need for help, may be related to the fact that persons who live with someone already had an existing need to manage medications. We have no good explanation for the protective finding for African Americans. It may be a peculiarity of current data, and needs to be explored in other datasets. The finding on reduced need for help by African Americans over time may reflect a cross-over effect regarding both survival and functional status.⁴⁵

Our findings have practical application. Omitting the Rosow-Breslau, but otherwise accepting all five variables associated with both prevalent and new 3-year need for help taking medications, the brief scale we constructed (age ≥ 75 , being male, ≥ 4 errors on the SPMSQ, ≥ 1 IADL problem, ≥ 1 basic ADL problem) identified persons currently needing help with 77.1% sensitivity and 87.9% specificity. While this measure did not perform as well in predicting need for help in three years' time, it facilitates identification of those currently needing help. Demographic characteristics are already part of the medical record, and the Medicare Annual Wellness Visit recommends obtaining information on cognitive and functional state. If already collected in the clinic, this measure should not require additional data gathering for the tool to be used.

This study has both strengths and weaknesses. In analysis we have included the main, readily measurable characteristics considered to be associated with medication-taking problems. We were, however, unable to include either visual problems (causing difficulties reading medication directions) because of a substantial amount of missing data, or a measure of depression.⁴⁶ The latter was not obtained when a proxy was needed, and a large proportion of persons needing help with their medications used a proxy. Self-report bias may be an additional limitation, however, such reports have been found to be valid and reliable.²⁸ Further, we were limited by the information collected in our dataset, and were not able to adjust for possible bias associated with higher income resulting in greater access to prescribed medications (and so greater opportunity for problems with medications). The initial data were obtained nearly three decades ago, however medication-taking problems still remain. While there are indications that need for help with medications has been declining,³⁴ the problem may become more severe since the number of persons 65 years of age and older with multiple chronic conditions and taking multiple medications has been increasing.^{7,17} Our data come from the southern region of the U.S., and may not be representative of the U.S. in general.

Our strengths include use of a representative, older, community-based sample of African Americans and Whites. Our multivariable analyses indicate the more general experience of older persons, and are not restricted to experience with a particular medication, or a

particular disease.⁴⁷ Our findings are easy to use, and do not depend on gathering information other than that mandated (age, cognitive status, and functional status) during the Medicare Annual Wellness Visit. Patients needing help may be identified by physicians, nurses and/or pharmacists, and appropriate intervention put in place.

Conclusion

In our cohort of seniors age 65 and over, 7% needed help when seen initially. Among those surviving for three years, 11% developed a need for help. Our final model showed that a limited set of mandated information (age, sex, cognitive impairment, and any impaired instrumental or basic ADL) could identify need for help taking medications with 77.1% sensitivity and 87.9% specificity. How help is to be provided remains an issue, but identifying the need and the magnitude of that need is a first step in that direction.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.

ROC curve for Duke Medication Assist Scale.

Base model = Age (65–74 vs 75; 75=1), sex (male=1), SPMSQ score (0–3 vs 4 errors; 4 errors=1)

IADL = modified 6-item OARS instrumental ADL scale, any problem reported = 1

ADL = Katz basic ADL scale, any problem reported = 1.

The Figure depicts the sensitivity and specificity curves for each of the 4 models evaluated

Table 1

Baseline characteristics of the sample

	Total sample N = 4106 N (column-wise %) or Mean ($\pm$ SD)	Need no help taking medication N= 3815 N (column-wise %) or Mean ($\pm$ SD)	Need help taking medication N=291 N (column-wise %) or Mean ($\pm$ SD)	P-value
Sociodemographic characteristics				
Age (years)				
Mean ($\pm$ SD)	73.54 (6.73)	73.1 (6.4)	78.7 (8.7)	<.001
65–69 years	1402 (34.0)	1349 (35.4)	53 (18.2)	
70–74 years	1110 (27.0)	1063 (27.9)	47 (16.2)	
75–79 years	782 (19.1)	734 (19.2)	48 (16.5)	
80 years	812 (19.9)	669 (17.5)	143 (49.1)	
Gender				
Female	2676 (65.2)	2502 (65.6)	174 (59.8)	.046
Male	1430 (34.8)	1313 (34.4)	117 (40.2)	
Race/ethnicity				
African	2244 (54.7)	2057 (53.9)	187 (64.3)	.001
American White	1862 (45.4)	1758 (46.1)	104 (35.7)	
Education (years)				
Mean ($\pm$ SD)	8.49 (4.08)	8.6 (4.06)	6.9 (4.04)	<.001
0–8 years	2178 (53.0)	1981 (51.9)	197 (67.7)	
Some high school	1005 (24.5)	949 (24.9)	56 (19.2)	
High school	923 (22.5)	885 (23.2)	38 (13.1)	
Annual Income				
Mean ($\pm$ SD)	10238 (9934)	10422 (10022)	7832 (8361)	<.001
<\$5,000	1685 (41.0)	1516 (39.7)	169 (58.1)	<.001
\$5000–<\$10,000	1176 (28.6)	1110 (29.1)	66 (22.7)	
\$10,000	1245 (30.3)	1189 (31.2)	56 (19.2)	
Living arrangement				
Total number. in household mean ($\pm$ SD)	2.03 (1.26)	1.98 (1.21)	2.73 (1.60)	<.001
Lives alone	1561 (38.0)	1512 (39.6)	49 (16.8)	<.001
Lives with others	2545 (62.0)	2303 (60.4)	242 (83.2)	
Proxy				
No proxy	3948 (96.1)	3773 (98.9)	175(60.1)	
Proxy used	158 (3.9)	42 (1.1)	116 (39.9)	<.001
Physical Health Status				
Sensory problems				
Poor vision ^a	345(8.9)	287 (7.7)	58 (34.1)	<.001
Poor hearing	556 (13.6)	472 (12.4)	84 (29.7)	<.001

	Total sample N = 4106 N (column-wise %) or Mean (±SD)	Need no help taking medication N= 3815 N (column-wise %) or Mean (±SD)	Need help taking medication N=291 N (column-wise %) or Mean (±SD)	P-value
Number of Chronic Conditions				
Mean (±SD)	1.11 (0.95)	1.08 (0.93)	1.53 (1.18)	<.001
0–1 condition	2903 (70.7)	2757 (72.3)	146 (50.2)	<.001
2–3 conditions	1141 (27.8)	1013 (26.6)	128 (44.0)	
>3 conditions	62 (1.5)	45 (1.2)	17 (6.8)	
Number of Prescription Medications^b				
Mean (±SD)	2.37 (2.27)	2.29 (2.2)	3.29 (2.9)	<.001
0–5 Rx meds	3744 (91.2)	3511 (92.0)	233 (80.1)	<.001
6 Rx meds	362 (8.8)	304 (8.0)	58 (19.9)	
Number of Over-the-Counter Medications^b				
Mean (±SD)	1.13 (1.16)	1.14 (1.17)	1.00 (1.12)	0.376
0–2 OTC med.	3660 (89.1)	3400 (89.1)	260 (89.4)	
3 OTC meds.	446 (10.9)	415 (10.9)	31 (10.7)	0.905
Cognitive status				
SPMSQ mean (±SD)	1.94 (2.00)	1.67 (1.65)	5.44 (3.47)	<.001
SPMSQ 0–3 errors	3476 (84.7)	3377 (88.5)	99 (34.0)	
SPMSQ 4 errors	630 (15.3)	438 (11.5)	192 (66.0)	<.001
Functional Status				
Rosow Breslau^c mean (±SD)	0.96 (1.15)	0.85 (1.08)	2.43 (0.90)	
0 problems	2024 (49.5)	2008 (52.8)	16 (5.6)	<.001
1 problem	2068 (50.5)	1796 (47.2)	272 (94.4)	
6 item IADL mean (±SD)	0.87 (1.62)	0.58 (1.18)	4.65 (1.82)	<.001
0 problems	2746 (66.9)	2736 (71.7)	10 (3.4)	<.001
1 problem	1360 (33.1)	1079 (28.3)	281 (96.6)	
Basic (Katz) ADL^d mean (±SD)	0.27 (0.87)	0.15 (0.59)	1.84 (1.88)	<.001
0 problems	3556 (87.7)	3452 (91.5)	104 (37.1)	<.001
1 problem	498 (12.3)	322 (8.5)	176 (62.9)	

^aDropped because of too much missing data. Data missing on 207 participants (121 who need help, 86 who do not)

^b9% of the sample used neither prescription nor over-the-counter medications

^cData missing on 68 participants (8 who need help, 60 who do not)

^dData missing on 52 participants (11 who need help, 41 who do not)

Table 2

Characteristics of Need for Help Taking Medications at Baseline, and of new Need for Help Three Years Later among Survivors who Needed No Help at Baseline

	Need for help to take medications at baseline OR (95% CI) P-value	Does baseline information predict new need for help three years later? OR (95% CI) P-value
Demographics		
Age		
65–69 years	Reference	Reference
70–74 years	0.88 (0.54–1.43) 0.596	1.29 (0.91–1.82) 0.148
75–79 years	0.96 (0.58–1.60) 0.880	1.68 (1.17–2.41) 0.005
80 years	1.56 (1.01–2.41) 0.048	3.09 (2.18–4.37) <.001
Sex		
Female	Reference	Reference
Male	1.88 (1.35–2.62) <.001	1.41 (1.07–1.85) 0.014
Race		
White	Reference	Reference
African American	0.97 (0.69–1.37) 0.856	0.71 (0.55–0.92) 0.010
Education		
0–8 years	Reference	Reference
9–11 years	1.48 (0.96–2.27) 0.073	0.95 (0.68–1.31) 0.731
12 years	1.25 (0.77–2.02) 0.362	1.13 (0.81–1.56) 0.468
Lives alone	0.39 (0.27–0.56) <.001	1.10 (0.86–1.42) 0.444
Physical Health		
Prescription drugs		
0–5 drugs	Reference	Reference
6 drugs	1.14 (0.74–1.77) 0.546	1.07 (0.71–1.62) 0.748
Chronic conditions		
0–1 condition	Reference	Reference
2–3 conditions	1.27 (0.91–1.77) 0.160	1.08 (0.82–1.42) 0.605
4–5 conditions	2.94 (1.28–6.75) 0.011	1.16 (0.41–3.31) 0.779
Cognitive status		
SPMSQ ^a		
0–3 errors	Reference	Reference
4 errors	4.88 (3.51–6.79) <.001	2.94 (2.15–4.03) <.001
Functional status		
Rosow-Breslau ^b		
0 problems	Reference	Reference
1 problem	2.50 (1.38–4.51) 0.002	1.47 (1.10–1.96) 0.009
Instrumental ADL ^c		

	Need for help to take medications at baseline OR (95% CI) P-value	Does baseline information predict new need for help three years later? OR (95% CI) P-value
0 problems	Reference	Reference
1 problem	16.61(8.38–32.95) <.001	2.13 (1.61–2.82) <.001
Katz ADL ^d		
0 problems	Reference	Reference
1 problem	3.84 (2.76–5.36) <.001	1.93 (1.34–2.76) <.001
C statistic	0.940	0.752

^aSPMSQ = 10-item Short Portable Mental Status Questionnaire

^bRosow-Breslau = Abbreviated 3-item health scale for the aged

^cIADL = modified 6-item Older Americans Resources and Services instrumental activities of daily living scale (item on needing help to take own medication excluded)

^dKatz = 5-item basic activities of daily living scale