



Racial Disparities in the Quality of Medication Use in Older Adults: Baseline Findings from a Longitudinal Study

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BACKGROUND: Medication-related problems are prevalent in older adults and adversely affect the quality of care. It has been suggested that racial differences exist in medication use. Most efforts to evaluate the quality of medication use target specific drugs or disease states, or a set of pre-defined quality indicators, rather than the patient.

OBJECTIVE: We conducted a prospective cohort study to determine the prevalence and types of medication-related problems in older adults, examining the impact of race on quality medication use.

METHODS: In-home interviews and medical record reviews of 200 (100 white, 100 black) older adults were conducted three times over 1 year. The quality of medication use was measured using a clinical pharmacist's assessment of quality and the Assessing Care of Vulnerable Elders quality indicators. We used logistic and negative binomial regression models to analyze the two primary endpoints of prevalence and number of medication-related problems.

RESULTS: Mean age was 78.3 (whites) and 75.5 (blacks), with the majority being female. Although whites used more medications than blacks (11.6 versus 9.7; $p < 0.01$), blacks had more medication-related problems per person than whites (6.2 versus 4.9; $p < 0.01$). All patients had at least one medication-related problem; undertreatment, suboptimal drug, suboptimal dosing, and nonadherence were most prevalent. Blacks had significantly higher rates of nonadherence than whites (68% versus 42%; $p < 0.01$).

CONCLUSION: Medication-related problems are prevalent in community-residing older adults. Blacks had more medication-related problems than whites, including higher rates of nonadherence. These findings require further study to better understand racial disparities in quality medication use.

KEY WORDS: quality; medications; race; disparities; elderly.

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BACKGROUND

Older adults are more likely to have multiple co-existing chronic diseases, visit more than one prescriber, and use multiple medications, placing them at an increased risk of developing medication-related problems. This, in turn, may compromise their health status, functional status, and quality of life.¹⁻³ Moreover, the costs associated with drug-related morbidity and mortality are staggering, estimated in one study to be \$177 billion annually, with nearly half (\$80 billion) in ambulatory care.⁴⁻⁷ The effect of race on the quality of medication use is unknown, although it has been suggested that racial differences exist in medication use.⁸ For example, older black adults have been found to have lower total drug spending, use fewer prescription medications, and have higher rates of nonadherence than whites.^{9,10}

Traditional efforts to measure the quality of medication use often focus on select medication-related problems or pre-defined quality indicators; however, such an approach fails to consider the multiple, co-existing problems within individuals.^{11,12} A more comprehensive, individualized approach to evaluating and managing medications may be more effective in improving the overall quality of medication use. Such an approach is especially needed for older adults who have complex medication regimens and are at increased risk for experiencing medication-related problems.

Adapted from the Institute of Medicine's definition of quality of care, the quality of medication use can be defined as "the degree to which medication use for individuals and populations increases the likelihood of desired health outcomes and is consistent with current professional knowledge."^{13,14} We present baseline data from a longitudinal study of community-dwelling older adults, illustrating racial differences in the quality of medication use overall and by type of problem.

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METHODS

Overview

The detailed methods for the longitudinal study are described elsewhere.¹⁵ Patients were recruited from the Department on Aging Eldercare Program and two senior housing complexes located in Orange County, North Carolina. Subjects met the following inclusion criteria: (1) age ≥60 years, (2) residing independently in the community setting, (3) taking ≥3 regularly scheduled prescription and/or non-prescription medications, (4) able to read and speak English, and (5) willing to participate, as indicated by providing informed consent and HIPAA-compliant authorization for release of medical information. Patients were excluded if they had ≥3 errors on a cognitive screening instrument¹⁶ or had received clinical pharmacy services within the past 6 months. Eligible individuals (100 white and 100 black) were interviewed in their homes at baseline, 6 months, and 12 months. The study was conducted from April 2005 through August 2007. The Bio-medical Institutional Review Board of the University of North Carolina at Chapel Hill approved this study.

The study employed two part-time pharmacists with Doctor of Pharmacy degrees. One completed residency training in geriatrics, is a board-certified pharmacotherapy specialist, and has practiced as a clinical pharmacist in an outpatient, interdisciplinary geriatric practice setting for 5 years; the other is an independent consultant pharmacist providing medication management services to older adults in the community.

Participant Recruitment

Using the Eldercare Program contact list, a screening call was conducted with each older adult to describe the study and invite them to participate in a baseline visit for verification of eligibility and enrollment. Interested individuals from the two senior housing complexes responded by telephone to posted flyers. The pharmacists conducted screening telephone calls, and, for individuals interested in participating, arranged a home visit to discuss the study, verify eligibility, obtain informed consent and HIPAA-compliant authorization for release of medical information, and enroll eligible individuals into the study. Of 435 older adults screened via telephone, 235 individuals were excluded because they were not eligible (105), could not be reached by phone (72), refused to participate (44), or had died (14). Thus, 200 patients were enrolled into the study and interviewed by a pharmacist.

Data Collection and Measures

All measures used in this study have been described in detail elsewhere.¹⁵ They include demographics; the short test of functional health literacy in adults (S-TOFHLA), which categorizes patient’s ability to read and understand health-related material as inadequate (0–16), marginal (17–22), or adequate (23–36) health literacy;¹⁷ and an eight-item self-reported instrumental activities of daily living (IADL) scale that ranged from 0 (poorest) to 16 (best) functional status.¹⁸ Each item was scored as 0 (completely dependent on others), 1 (some assistance required), or 2 (independence), with items summed (maximum=16) to compute an IADL total score.

The quality of medication use was measured in two ways. First, the pharmacist used a three-step implicit process: (1) a

comprehensive medication review with the older adult, (2) a medical record review, and (3) formulation of an assessment of quality medication use. During the comprehensive medication review, the pharmacist recorded detailed information on medical conditions, medications, and medication-taking behaviors.¹⁵ Following the home visit, the pharmacist conducted a medical record review to abstract information on medications, medical conditions, laboratory values, physician assessment of the individual’s medical conditions, hospitalizations, and any other information pertinent to assessing the individual’s quality of medication use. For the final step, using data from the comprehensive medication review and medical record review, the pharmacist formulated an assessment of quality medication use by integrating best research evidence (e.g., published literature, established indicators of quality care, clinical practice guidelines) with clinical expertise and patient values. This assessment was guided by a list of potential medication-related problems (Table 1) that was

Table 1. Framework for Assessing Medication-Related Problems as a Measure of the Quality of Medication Use in Community-residing Older Adults

Potential medication-related problem	Definition
Suboptimal drug	The individual is receiving a drug that has no indication, is not effective, or is potentially not safe (i.e., risk of using drug outweighs benefit)
Suboptimal dose, duration, frequency, or administration	The individual is taking an appropriate medication, but the dose, duration, frequency, or administration is not optimal to achieve the desired response, or has the potential for harm
Adverse drug events	The individual is experiencing adverse consequences attributed to a drug or the inappropriate use of a drug
Nonadherence	The individual has not filled a prescription, is not taking a drug, or is not using a drug as prescribed, whether intentional or unintentional
Less costly drug available	The individual is prescribed a medication for which a less costly, equally effective and safe drug is available, and preferred by the patient, but the patient is receiving a more expensive product; or the patient could benefit from prescription assistance, but is not receiving the benefit and desires to
Undertreatment	The individual has a medical condition or risk factors for a disease that would benefit from drug therapy (clear indication) and the patient has no contraindications to the drug, but the drug was not prescribed
Suboptimal medication monitoring	The individual is receiving a drug and monitoring is recommended (according to established practice guidelines or quality indicators) to assess response to therapy or prevent harm, but has not been done

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developed by study investigators following an extensive literature review. The categories in Table 1 were adapted from a previously published model to incorporate current professional knowledge and clinical experience.¹⁹⁻²¹

Second, to complement the implicit assessment, the pharmacist completed an explicit assessment during the medical record review using the Assessing Care of Vulnerable Elders (ACOVE-2) quality indicators.¹² ACOVE-2 consists of 39 quality indicators of medication use categorized into four domains: (1) prescribing indicated medications, (2) avoiding inappropriate medications, (3) education, continuity, and documentation, and (4) medication monitoring. The ACOVE-2 indicators have excellent face validity due to the expert consensus process used in their development.

Adherence was assessed in two ways: (1) pharmacist assessment of adherence and (2) a validated patient self-report measure.²² The pharmacist's assessment was determined during the medication review for each chronic, maintenance medication a person was taking and based on both patient self-report and inspection of pill bottles. For each chronic medication, the pharmacist recorded "adherent" or "non-adherent." Any assessment of nonadherence was then documented as a medication-related problem in the category of nonadherence. Patient self-report was based on a validated four-item measure of medication-taking behavior over the past 4 weeks.²²

Statistical Analysis

The sample size estimation for our study was based on confidence interval (CI) widths and detecting meaningful differences between whites and blacks in the proportion of individuals with ≥ 1 medication-related problem at baseline. A sample size of 100 per group met the conservative "sufficiently large" criterion formula.²³

Descriptive statistics are presented, and comparisons were made by race (we oversampled blacks to specifically address racial differences) using two sample t-tests (continuous data) or chi-square tests of association (categorical data). The two primary outcomes were: (1) overall prevalence of medication-related problems in the population (proportion of subjects with any of the medication-related problems) and (2) average number of medication-related problems per person. Secondary outcomes were the prevalence and average number of problems broken down by the seven individual medication-related problems. The assessment of quality medication use using the ACOVE-2 quality indicators was included, but was not the primary outcome of this study; findings based on the ACOVE-2 quality indicators are beyond the scope of this paper, but will be the focus of subsequent work.

Logistic regression models were used to model the prevalence of each of the individual medication-related problems. Negative binomial models were used for the outcome of total number of medication-related problems (and each individual medication-related problem) since a Poisson regression did not provide a good fit to the data (large overdispersion). The primary "exposure" of interest was race. Due to pharmacist variability, models were adjusted for pharmacist and the following covariates identified *a priori* based on published literature suggesting that these variables may have an impact on one or more medication-related problems: number of medications currently being taken by the individual, S-TOFHLA, age, and gender. For the primary

outcomes of interest, statistical significance was achieved at a level of $p \leq 0.05$. No formal corrections for multiple testing were conducted for the secondary outcomes of interest; however, we were conservative. Tests were considered statistically significant at a level of 0.01, whereas tests with $0.01 < p\text{-value} \leq 0.05$ were considered suggestive of a relationship, but were not given as much weight. All analyses were conducted using SAS version 9.1 (SAS, Cary, NC).

RESULTS

Baseline demographic characteristics for the 200 subjects are presented in Table 2. Whites were significantly older, had more education, and were more likely to live alone. Whites used more medications (11.6 versus 9.7, $p < 0.01$), had a greater number of chronic conditions (8.4 versus 7.4, $p = 0.01$), and used more physicians (3.6 versus 2.8, $p < 0.01$) compared to blacks (Table 3). In addition, more whites maintained a written list of their medications than blacks (30% versus 16%, $p = 0.02$), whereas a higher percentage of blacks could not purchase their medications because of cost (28% versus 12%, $p < 0.01$). Whites were more likely than blacks to have adequate health literacy (58% vs. 29%, $p < 0.01$).

Quality of Medication Use

The overall prevalence of problems was 100%, that is, each participant had at least one medication-related problem documented at baseline. The most common problems cited for whites and blacks (Fig. 1) were undertreatment (83% versus 87%), suboptimal drug use (59% versus 66%), suboptimal dosing (48% versus 56%), and nonadherence (42% versus 68%). A significant difference in the prevalence of medication-related problems between whites and blacks was noted for nonadherence ($p < 0.01$), with a smaller difference noted for suboptimal medication monitoring (15% whites, 29% blacks; $p = 0.05$). These findings were unaltered by adjustment for *a priori* potential confounders.

Although blacks were prescribed significantly fewer medications than whites, they had significantly more problems than whites (6.2 versus 4.9, $p < 0.01$) (Table 4). A large part, but not all, of this difference can be attributed to the difference in nonadherence (0.90 whites, 1.9 blacks; $p < 0.01$). These differences

Table 2. Demographic and Baseline Characteristics of Community-Residing Older Adults (n=200)

	White (n=100)	Black (n=100)	P-value
Age, mean (SD), years	78.3 (8.2)	75.5 (8.5)	0.02
Female, %	72	81	0.13
Education, highest level completed, %			<0.001
Elementary	8	24	
Some high school	6	19	
High school graduate	21	35	
Some college or technical school	24	12	
College graduate	18	6	
Postgraduate	23	4	
Living alone, %	64	49	0.03

Table 3. Medication and Health-Related Characteristics of Community-Residing Older Adults (n=200)

	White (n=100)	Black (n=100)	P-value
Medications, ^a mean (SD); range	11.6 (5.0); 3–26	9.7 (4); 4–21	0.003
Chronic conditions, ^b mean (SD); range	8.4 (3.1); 2–19	7.4 (2.8); 2–18	0.01
Physicians, mean (SD); range	3.6 (1.8); 1–9	2.8 (1.5); 0–8	<0.001
Pharmacies, mean (SD); range	1.3 (0.6); 1–3	1.3 (0.5); 1–3	0.42
Has help with medications, %	16	16	1.00
Uses medication aid ^c , %	70	57	0.06
Pill box, %	47	50	0.67
Written list of medications, %	30	16	0.02
Other, %	16	6	0.02
Shows written list to physician, %	18	11	0.16
Has some form of prescription drug coverage, %	91	94	0.42
Could not purchase meds due to cost, %	12	28	0.005
Short-test of functional health literacy in adults (S-TOFHLA); ^d mean (SD); range	24.2 (10.6); 0–36	14.8 (11.9); 0–35	<0.001
Adequate	58	29	
Marginal	12	13	
Inadequate	30	58	
Lawton Instrumental Activities of Daily Living Scale (IADLs); ^e mean (SD); range	13.7 (3.0); 1–16	13.5 (3.0); 4–16	0.69

^aIncludes all medications (i.e., prescription, over-the-counter, and complementary and alternative medications)

^bDefined as any chronic condition documented in the medical record

^cDoes not add up to 100%, since patients may have been using more than one medication aid

^dScores range from 0 to 36 and are categorized as inadequate (0–16), marginal (17–22), or adequate (23–36) health literacy

^eScores range from 0 (low function, dependent) to 16 (high function, independent)

NS = not significant (p>0.05)

remained even after adjustment for our *a priori* confounders. When removing nonadherence from the model, the mean number of medication-related problems remained significantly greater for blacks than whites (4.34 versus 3.97; adjusted p=0.037). There was also a trend towards blacks having significantly more problems related to monitoring (0.34 vs. 0.18, p=0.05 and p=0.06, covariate adjusted).

DISCUSSION

Efforts to measure and improve the quality of medication use in older adults have traditionally focused on specific problems, pre-defined quality indicators, or individual diseases (even when patients have multiple chronic conditions).^{11,12,24–27} While important, each approach fails to consider the patient

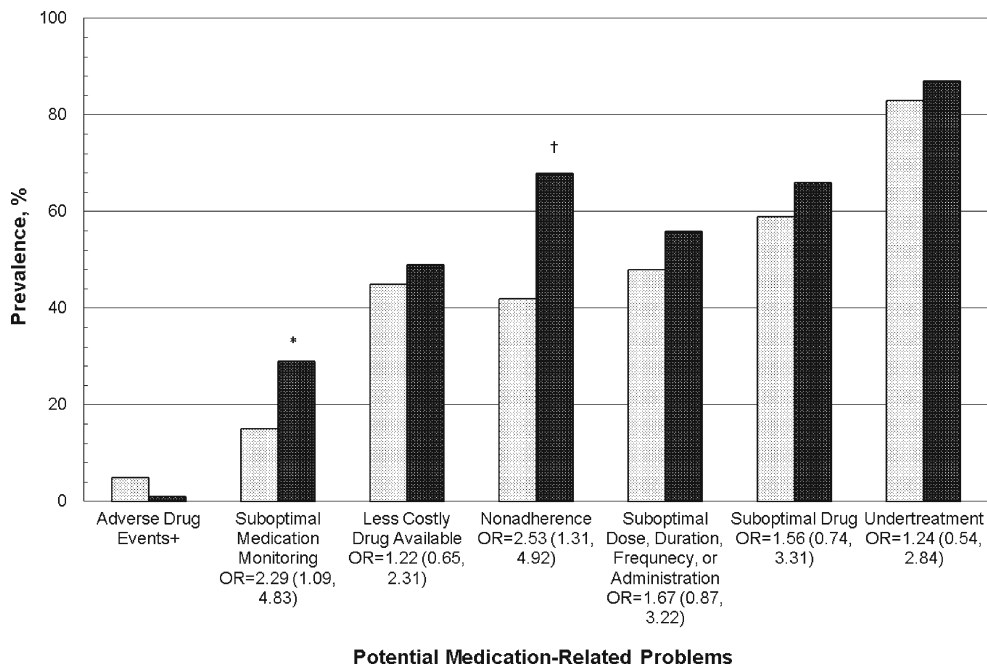


Figure 1. Prevalence of medication-related problems in community-residing older adults (n=199), with prevalence defined as the number of older adults with any of the drug therapy problems/number of older adults in the sample (unadjusted). Odds ratios (OR) and 95% confidence intervals for race are included for the covariate adjusted models with White race being the reference category. *p<0.05, †p<0.01, †too few events to calculate OR, White race (n=99, white bar), Black race (n=100, shaded bar).

Table 4. Medication-Related Problems in Community-residing Older Adults (n=199)

	White, (n=99) ^a	Black, (n=100)	P-value	Covariate-adjusted ^e p-value
Overall, raw number	470	623		
Overall, mean (SE)	4.87 (0.26)	6.19 (0.30)	0.001	<0.001
Adverse drug events ^{b,c} , mean (SE)	0.05 (0.02)	0.01 (0.01)	–	–
Drug cost, mean (SE)	0.59 (0.08)	0.68 (0.08)	0.44	0.19 ^c
Suboptimal medication monitoring, mean (SE)	0.18 (0.04)	0.33 (0.06)	0.05	0.06
Nonadherence, mean (SE)	0.89 (0.13)	1.84 (0.24)	<0.001	0.002
Suboptimal dose, duration, frequency, or administration, mean (SE)	0.73 (0.09)	0.71 (0.08)	0.87	0.51
Suboptimal drug, mean (SE)	1.15 (0.14)	1.21 (0.14)	0.76	0.12
Undertreatment ^c , mean (SE)	1.22 (0.11)	1.33 (0.12)	0.48 ^d	0.92 ^d

All means and p-values are adjusted for a fixed pharmacist effect unless otherwise noted

^aMedication-related problems were not assessed for one individual because medical records were not available for review

^bUnable to calculate p-value due to scarce number of events experienced

^cRaw means presented

^dNo pharmacist effect included; model would not converge

^eAdjusted for total number of medications, health literacy, gender, and age

and the multiple, co-existing medication-related problems that may be present. We conducted a longitudinal cohort study to examine the breadth and scope of medication-related problems among community-dwelling older adults and designed the study to examine racial differences in these problems.

Results from the baseline data highlight the prevalence of medication-related problems in community-dwelling older adults. All individuals in our study had at least one clinically important medication-related problem. Moreover, we found significant differences between whites and blacks with respect to total number of medications, ability to afford and purchase medications, and ability to understand and interpret health information. Perhaps most surprisingly, despite blacks having fewer medications (9.7 vs. 11.6, $p < 0.01$), they had more medication-related problems (6.2 versus 4.9, $p < 0.01$). The most common problems for both races were undertreatment, suboptimal drug use, suboptimal dosing, and nonadherence. However, the magnitude of non-adherence was far greater among blacks than whites (1.84 vs. 0.89). Prior work suggests that racial differences exist in medication use and access to care; it is well documented that older black adults have lower total drug spending, use fewer prescription medications, and have higher rates of nonadherence than whites.^{9,10} However, it is unclear what impact race may have on an individual's quality of medication use. Future studies will need to more closely examine factors contributing to racial disparities in medication nonadherence as well as racial disparities in the overall quality of medication use.

Although several studies have been conducted outside the US, only a handful of studies in community-residing older adults in the US have examined the prevalence of multiple, co-existing medication-related problems in individuals. In a study of 183 elderly residents residing independently in federally subsidized apartment buildings, 75% had one or more potential medication problems. The most common problems were discrepancies between labeled dosage and dosage actually taken (37%), potential drug interactions (27%), and underuse of needed medication (24%).²⁸ In a study of potential medication-related problems in dually eligible older adults in a Medicaid waiver management program, 49% were found to have at least one potential medication-related problem, with the most prevalent problem being therapeutic duplication, which occurred in 24% of individuals.²⁹ A large pharmaceu-

tical care registry between of patients cared for by pharmacists working in ambulatory care clinics and community pharmacy settings found that 30% of older adults had at least one drug therapy problem, with the most common problems being additional drug therapy needed (30%), too low dosage (23%), and nonadherence (18%).³⁰ A study of 159 older adults in the community pharmacy setting documented 3.9 medication-related problems per patient, with the most common problem being undertreatment. This study found that medication-related problems increase as patients take more medications and experience more medical problems.³¹

Several factors may account for the higher number of medication-related problems per older adult documented in our study compared to previous studies.^{30,31} First, previous studies used a variety of implicit frameworks for assessing medication-related problems, with some more comprehensively defined and operationalized than others. Second, most previous studies in the community or community pharmacy setting relied on patient interviews and prescription records in formulating their assessments of medication-related problems. In our study, pharmacists conducted thorough medication reviews with each older adult and had access to patients' medical records. Thus, we had more complete information when making an assessment of quality of medication use.

Our study has several limitations. First, patients were recruited from older adults already receiving support from the Department on Aging to maximize their independence. Indeed, our sample was highly functional and independent. Moreover, we excluded individuals with cognitive impairment. Given these factors, the prevalence of medication problems may be even higher among other community-dwelling elders. Second, pharmacists and physicians were not blinded to the race of the patient. However, it would be impossible for either the pharmacist or physician directly responsible for the person's care to be blinded to their patient's race. In addition to those directly involved in the patient's care, future studies could consider utilizing a pharmacist and physician team blinded to race as a final step in the adjudication process. Third, we used an implicit approach to assessing the quality of medication use. This approach allows one to integrate all available information when assessing quality; however, it is less reproducible. Notably, relying solely on explicit measures of quality is not patient-centered and overlooks potentially

important and significant medication-related problems that often co-exist in older adults. It will be important in future studies to determine the reliability and validity of our measure of quality medication use as well as physician agreement with the pharmacist's assessment of medication-related problems and their acceptance of recommendations to optimize medication therapy. A fourth, and related, point is that, despite training on our medication-related-problem framework, there were differences in the number of problems identified per pharmacist (i.e., on average, one pharmacist documented 1.6 more medication-related problems per patient than the other). Although we adjusted for this difference in our analyses, future studies should seek to enhance the reliability and validity of our measure. Finally, our assessments required travel to patients' homes (medication reviews) and physician offices (medical record reviews). This approach requires significant resources.

CONCLUSION

Medication-related problems are prevalent in community-residing older adults and appear to be more prevalent in blacks than whites. Older adults have multiple, co-existing medication-related problems present at a single point in time, with undertreatment, nonadherence, use of a suboptimal drug, and suboptimal dosing being the most prevalent problems in both whites and blacks. Blacks have significantly higher rates of nonadherence than whites. Strategies to more reliably measure the quality of medication use in older adults are needed, and efforts to improve the quality of medication use in older adults must account for potential differences in both the number and types of problems affecting whites and blacks.

These baseline data come from a larger longitudinal study that examines the quality of medication use in white and black older adults over time. Examining the baseline data is an initial and necessary exploratory step toward better defining the elements of quality medication use at the level of the patient. Notably, we have designed our measures to provide the basis for intervening with elderly patients to improve the quality of medication use. It is our hope that such efforts will eventually lead to improvements in the quality of medication use and health outcomes for the older adult population.

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