Concerns and Beliefs About Medicines and Inappropriate Medications: An Internet-Based Survey on Risk Factors for Self-Reported Adverse Drug Events Among Older Adults

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ABSTRACT

Background: Adverse drug events (ADEs), which can be especially problematic in older adults, often can be prevented by detecting potential risk factors. Sociopsychological factors such as concerns and beliefs about medicines (patients' anxieties about the harmful effects of prescribed medications) may also be risk factors related to self-reported ADEs, even when considering clinical variables such as receiving an inappropriate medication.

Objectives: This study was designed to quantify the use of inappropriate medications among older adult outpatients and to determine whether an association exists between the use of inappropriate medications, concerns and beliefs about medicines, and self-reported ADEs.

Methods: This cross-sectional, Internet-based survey of Medicare beneficiaries was conducted in 2007. Harris Interactive®, a New York-based marketing research firm, invited participants from their online panel who were ≥65 years of age, residents of the United States, and enrolled in the Medicare health plan to participate in the survey. The updated Beers criteria and a modified version of the Assessing Care of Vulnerable Elders quality indicators were used to determine the appropriateness of medications. Respondents' concerns about their medicines were assessed using items from a validated scale such as "Having to take medicines worries me" and "I sometimes worry about the long-term effects of my medicines." To establish self-reported ADEs, respondents were asked, "Did you see a doctor about any side effects, unwanted reactions, or other problems from medicines you were taking in the past year?"

Results: Of the 1024 panelists who responded to the survey, 874 provided all of the information required for analysis. The respondents who were included in the analyses ranged in age from 65 to 94 years; 56.6% were female, 94.4% were white, and 20.3% self-reported an ADE. The frequency of patients receiving either an inappropriate medication or a medication that failed a quality indicator was 45.8%. Stronger concerns and beliefs about medicines (odds ratio [OR] = 1.57; 95% CI, 1.02–2.39; $P = 0.04$) and having more symptoms (OR = 2.26; 95% CI, 1.22–4.22; $P = 0.01$) were significantly related to self-reporting of ADEs, whereas receiving an inappropriate medication (OR = 1.03; 95% CI, 0.65–1.64) and the number of medications received (OR = 1.28; 95% CI, 0.52–3.13) were not.

Conclusions: Stronger concerns and beliefs about medicines and having more symptoms were significantly related to self-reporting of ADEs. Receiving an inappropriate medication and the number of medicines received were not significantly related. (*Am J Geriatr Pharmacother.* 2010;8:245–257) © 2010 Excerpta Medica Inc.

Key words: inappropriate medications, concerns and beliefs about medicines, adverse drug events, older adults.

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INTRODUCTION

Drug-related problems can have considerable health, safety, and economic consequences for older adults (≥65 years of age) and have been implicated in 30% of hospital admissions among this age group.[1] Adverse drug events (ADEs), defined by the Institute of Medicine as an injury resulting from medical interventions related to a drug, have unwanted health outcomes and may be related to preventable problems in older adults (eg, depression, constipation, falls, confusion, hip fractures).[1–4] Hanlon et al[4] found that 35% of ambulatory older adults who were receiving ≥5 medications experienced ADEs, and 29% required health care services such as physician visits, emergency department visits, or hospitalization for their ADEs.

Medication-related problems cause ~106,000 deaths annually.[5] The cost of these problems has been estimated to be $76.6 billion for ambulatory care, $20 billion for hospitals, and $4 billion for nursing home facilities (1997 US $).[6,7] Although the impact of ADEs is huge, it has been estimated that 15% to 56% of these events are preventable.[2,6,8] One potential strategy is to identify prospectively those patients who are at high risk for ADEs (eg, older adults, those taking multiple medications) and to target interventions for this group.[9]

Despite the identification of risk factors for ADEs, few studies have examined the relationship between these factors and self-reported ADEs.[10–13] Self-reports of ADEs in older patients have high detection rates (eg, 44% in a study by Hanlon et al[14]) and are often more accurate than other means of detecting ADEs such as chart reviews and medical records.[14,15] Patient self-reports can identify ADEs not obtained by other methods.[8,16] In one study,[17] self-reports resulted in a 5-fold greater frequency of ADE detection than did clinician reports and computerized searching of electronic notes. Self-reporting of ADEs is therefore important, especially in outpatient settings (eg, community-dwelling older adults), because this measure represents the patients' views of their symptomatology.

The use of inappropriately prescribed medications (ie, those that have more potential risks than benefits) has been identified as a risk factor for ADEs in 2 studies.[18,19] The use of inappropriate medications based on the Beers criteria, a consensus-based list of medications to be avoided by older adults, has ranged from 11.6% to 45.0%.[18,20–25] The list includes 48 medications or medication classes considered to be inappropriate, independent of diagnoses or conditions, as well as ≥60 medications or medication classes considered to be inappropriate in 20 specific conditions.[5] Using the Assessing Care of Vulnerable Elders (ACOVE) criteria, only one study reported that >50% of the patients had received ≥1 inappropriate rating for underuse.[26] Most studies of ADEs have focused on identifying patient risk factors such as the number and types of medications used, the number of comorbidities, and other sociodemographic factors (eg, age, sex), probably because these factors are available in payer databases.[9,10,27–29] Few studies have examined the role of sociopsychological variables as risk factors for ADEs.[11,12]

Concerns and beliefs about medicines, defined by Horne[30] as patients' anxieties about the harmful effects of their medicines, are sociopsychological concepts that may help in understanding why people perform certain health behaviors. Concerns and beliefs about medicines have been found to be important in patient self-reporting of ADEs.[11,12] These concerns and beliefs reflect patients' experiences with medicines and are related to medication adherence and symptom reporting.[30,31]

The Beliefs about Medicines Questionnaire (BMQ)–Specific scale,[32] which assesses both emotional and cognitive concerns and beliefs about medicines, consists of items such as "I sometimes worry about the long-term effects of my medicines," "Having to take my medicines worries me," "I sometimes worry about becoming too dependent on my medicines," "My medicines disrupt my life," and "My medicines are a mystery to me." A positive significant relationship was found between concerns and beliefs about medicines and self-reported ADEs among Medicare enrollees, rather than the number of medicines used.[11,12] This finding was consistent with the results of a cross-sectional study[11] and a longitudinal study.[12] The results of these 2 studies suggest the importance of this sociopsychological variable for future studies of ADEs.

The objectives of this study were to quantify the use of inappropriate medications among older adult outpatients and to determine whether an association exists between the use of inappropriate medications, concerns and beliefs about medicines, and self-reported ADEs. It was hypothesized that (1) the percentages of older adults in outpatient settings who used inappropriate medications (based on the Beers list and ACOVE quality indicators) would be high (~12%–49%), as in previous studies[1,18]; (2) no independent association would be found between the use of inappropriate medications and self-reported ADEs; and (3) concerns and beliefs about medicines would be a significant risk factor for predicting self-reported ADEs. Concerns and beliefs about medicines may be the primary risk factor for self-reported ADEs despite the use of inappropriate medications; the ways in which symptoms are

attributed to medications and labeled as ADEs may be based on an individual's tolerance of the ADEs. In addition, patients' concerns and beliefs about medicines may drive their interpretation of the ADEs. The use of inappropriate medications does not reflect patients' perceptions of their symptoms. Patients may not know whether they are receiving an inappropriate medication; therefore, their interpretation of the symptoms they are experiencing would not be related to the inappropriateness of the medication, but rather their beliefs about the medicine and how it affects their health.

PATIENTS AND METHODS

Study Design

This was a secondary analysis using the data and pool from a cross-sectional survey. The primary focus of the survey was to examine medication use among Medicare enrollees, including factors associated with access to medicines and safety of medicines. The survey had 1024 older adults; of those 874 were included in this secondary analysis (only 178 of whom reported ADEs). Previously obtained survey data were used for this secondary data analysis; no power calculation was done because all available data were used. The survey design was a cross-sectional study including Medicare beneficiaries after the implementation of the Medicare drug benefit in October 2007. This survey was an Internet-based survey administered by Harris Interactive® (a marketing research firm; New York, New York) on behalf of the University of Iowa College of Pharmacy (Iowa City, Iowa). The survey was designed by University of Iowa investigators, and the project was approved by the institutional review board of the University of Iowa.

Patients/Setting

Harris Interactive maintains a network of panelists who have consented to participate in telephone and online surveys. The firm invited individuals from their online panel to participate in this survey. An invitation was sent to the panelists by e-mail, and those who were interested responded. Individuals who met the inclusion criteria (aged ≥65 years, English speaking, US residents, and enrolled in the Medicare health plan) were eligible for participation. Data from the survey were provided to University of Iowa researchers from a convenience or nonprobability sample of anonymous respondents nationwide who completed the survey.

Data Collection

The Internet-based survey of Medicare enrollees was administered in October 2007. In this survey, respondents completed 161 questions that took ~23 minutes to complete. Numerous skip patterns were included for questions that did not apply to some respondents. Respondents who could not answer all of the survey initially could return to finish it later. The collected data included sociodemographic, clinical, and behavioral characteristics.

Measures

The dependent variable was self-reported ADEs, which were established by asking the respondents, "Did you see a doctor about any side effects, unwanted reactions, or other problems from medicines you were taking in the past year?" This question had been used in previous studies for the identification of self-reported ADEs and was considered to be a valid measure of patients' experiences with ADEs.[15,33] This measure does not examine the seriousness of the reported ADEs.

Independent variables included important predictors such as the use of an inappropriately prescribed medication and concerns and beliefs about medicines. Control variables included sociodemographic characteristics, clinical characteristics (eg, the number of medicines used), and behavioral characteristics (eg, the number of pharmacies used). These control variables were included because they were used in previous models that examined self-reported ADEs.[11]

In terms of inappropriate medications, the updated Beers criteria[5] and a modified version of the ACOVE quality indicators[34] were applied to self-reported diagnoses and self-reported medication lists to determine the appropriateness of the medications used. Respondents were asked to give the name and strength of the medications they had taken in the past month. They also were asked to provide the directions for use of each prescribed medication, the dosages used, and the reason for taking the medication. This information was used to determine whether the patient received any inappropriate medications (based on the Beers and ACOVE criteria). No attempt was made to validate the respondents' self-reports.

The Beers criteria have been used for older patients in the ambulatory setting.[3,5,14,18,35–37] Both sets of criteria for inappropriate medications (independent of and dependent on diagnoses) were used. The Beers and ACOVE coding systems were used to determine whether respondents had received any inappropriate medications. In addition, if patients did not receive a recommended drug therapy, this was identified as medication underuse and considered to be a failed quality indicator. Because subjects reported the reasons

for taking their medications, their reasons were used as conditions for identifying medications on the Beers list. The data were coded using a MULTUM database (Cerner Corporation, Denver, Colorado), which contains a list of medications marketed in the United States. The MULTUM database assigns a code to each medication used, making the drugs identifiable.

The modified ACOVE quality indicators[34] were also used to identify which medications should be avoided and whether the medications prescribed for patients with specific diagnoses were appropriate for their conditions. This was determined by the authors, based on work by Higashi et al.[34] The original ACOVE criteria contained 43 quality indicators pertaining to pharmacologic care. In this study, only the "prescribing indicated medication" domain (17 indicators) and the "avoiding inappropriate medication" domain (9 indicators) were used, because some of the data that were needed to code the quality indicators in the ACOVE criteria were not available in the data set. For example, information was not available for inpatients. In the final assessment, 11 indicators in the "prescribing indicated medication" domain and 6 indicators within the "avoiding inappropriate medication" domain were used, based on availability of the data. Limited studies have examined the use of inappropriately prescribed medications using the ACOVE criteria.[26,38–41]

In this study, the Beers and ACOVE criteria were combined to determine the appropriateness of medications because it was believed that pooling the criteria might allow identification of a greater number of potentially inappropriate medications. The present study is one of the first to examine the relationship between such explicit criteria and self-reported ADEs, rather than other objective measures for detecting ADEs.[14,18]

To examine the respondents' concerns and necessity beliefs about their medicines, the 10 items from the BMQ–Specific scale were used.[32] Five items addressed concerns and beliefs about medicines such as "Having to take medicines worries me" and "I sometimes worry about the long-term effects of my medicines." Five items addressed necessity beliefs (defined as patients' beliefs that their medicines are necessary for maintaining their health now and in the future) such as "My life would be impossible without my medicines." Five-point Likert scales, anchored with "strongly disagree" and "strongly agree," were used as response options. The scale for this measure was derived by summing the responses from each individual across the 5 questions. The values on the scales ranged from 5 to 25, with a higher score on the concern scale meaning stronger concerns and beliefs about the adverse and long-term effects of their medicines, and a higher score on the necessity scale meaning a stronger perception of the necessity of medicines. Previous studies using these scales reported reliability estimates ranging from 0.65 to 0.86, and its construct validity has been established. The Cronbach α for concerns and beliefs in this study was 0.80.

For the clinical characteristics, self-rated health status was determined using a 5-item response scale anchored with poor and excellent.[42] Respondents were asked to indicate the number of different prescription medications they had used in the past month. Information on the symptoms that the respondents had experienced in the past month (yes/no format) was collected. The predetermined list of symptoms was used because it had been used to identify ADEs in a previous study.[33] Symptoms such as headaches, dizziness/imbalance, and sexual problems could be reported by the respondents. In addition, respondents were given an opportunity to report other (nonlisted) symptoms. The number of symptoms experienced by the respondents was summed to generate the "sum of symptoms experienced." However, the number of symptoms reported may be lacking in reliability because patients were not asked about the severity of the symptoms, which may have altered the results.

For behavioral characteristics, respondents were asked about the number of pharmacies from which they received their prescription medicines in a typical month. They also were asked whether they had stopped taking their medications due to cost or skipped doses to save money in the past year (scale: never, 1 or 2 times, 3 or 4 times, >4 times).

Analysis

Descriptive analyses of the sociodemographic, clinical, and behavioral characteristics of the sample population were completed. The frequencies of inappropriately prescribed medications and medication underuse were calculated using descriptive analyses, based on the Beers criteria and ACOVE quality indicators. Both lists of drugs in the Beers criteria (ie, independent of and dependent on diagnoses) were used. Although medications on both Beers lists and on the ACOVE quality indicators were identified and coded separately, they were summed as inappropriate medications; instances of underuse were not included. In addition, 3 ACOVE quality indicators that were duplicated in the Beers criteria were removed from the total number of inappropriate medications: "avoid chlorpropamide," "avoid

meperidine," and "avoid strongly anticholinergic medications if alternatives exist."

Multiple logistic regression analysis was used to relate the presence of inappropriate medications and failed quality indicators (using the Beers criteria and ACOVE quality indicators) and concerns and beliefs about medicines to self-reported ADEs, controlling for sociodemographic, clinical, and behavioral characteristics. All independent variables were included in a single model rather than using a stepwise approach. Odds ratios (ORs), *P* values, and 95% CIs were obtained, and most independent variables were coded as dummy variables. In addition to the main predictor variables included in the multivariate model, the decision to include other covariates was based on a similar logistic regression model examining the relationship of concern beliefs in medicines to self-reported ADEs.[11]

In the regression analysis, only the medications that should be avoided in the ACOVE quality indicators were used because the "prescribing indicated medications" domain identifies underuse of medicines by patients and cannot lead to an ADE. The first regression analysis included the number of medicines and inappropriate medications used in predicting self-reported ADEs. Then, concerns and beliefs about medicines (the main variable of interest) was entered in a second regression analysis. In addition to being characterized as a linear variable, concerns and beliefs about medicines was also included as a squared variable in the regression analysis because the relationship between concerns and beliefs about medicines and self-reported ADEs may not be linear. Statistical analyses were performed using SPSS version 17.0 (SPSS Inc., Chicago, Illinois) and SAS version 9.2 (SAS Institute Inc., Cary, North Carolina).

RESULTS

A total of 1024 panelists responded to the survey; these respondents reported use of 4025 drugs. However, the study sample (874 patients) included only those respondents who provided the name of the medication(s) being taken, the dosage used, and the medical condition for which the medication was prescribed. The online panelists' age, geographic information, and type of insurance plan were unknown, but respondents ranged in age from 65 to 94 years. Most of the respondents were female (56.6%); white (94.9%); had some college education (66.4%); self-reported good, very good, or excellent health status (79.4%); used ≥1 prescription medicine in the past month (88.7%); and obtained their prescription drugs from 1 pharmacy (68.0%) (**Table I**). In addition, 178 (20.4%) of the respondents self-reported an ADE. It was expected that all respondents, as members of the online panel, would have access to a computer.

Overall, using the Beers criteria and the ACOVE quality indicators and removing duplicate items that appeared in both sets of criteria, the frequency of patients receiving either an inappropriate medication or a medication that failed a quality indicator was 45.8%. Using the Beers criteria only (dependent on as well as independent of diagnoses), 232 respondents received inappropriate medications: 210 received 1 inappropriate medication (mean [SD], 1.10 [0.31]; range, 1–3) and 22 received >1 inappropriate medication.

Using the Beers criteria that were independent of diagnoses, 204 respondents (23.3%) received ≥1 inappropriate medication (**Table II**)[5]; using the Beers criteria that were dependent on diagnoses, 45 respondents (5.1%) received ≥1 inappropriate medication (**Table III**).[5] Patients may have been duplicated if they received similar drugs identified in the Beers criteria independent of diagnoses and the Beers criteria dependent on diagnoses. Each patient received at least 1 inappropriate medication; some could have received >1 inappropriate medication and would have been included. Inappropriate medications with zero values, which represented respondents who had specific diagnoses but no reports of inappropriate medications or medications that failed ACOVE quality indicators, were not included in the tables.

Using the ACOVE quality indicators, 303 respondents (34.7%) received 1 medication that failed a quality indicator (**Table IV**).[34] However, respondents may have received >1 medication that failed a quality indicator. After removing duplicates occurring in both the Beers and ACOVE criteria, 213 respondents had received 1 medication that failed a quality indicator (**Table IV**) and 36 respondents had received >1. The mean (SD) number of medications that failed quality indicators was 1.17 (0.42), ranging from 1 to 3 medications; this included both inappropriate medications that should be avoided and medication underuse (based on underutilization of recommended drug therapy). As in previous studies,[18,23,43] the most frequently prescribed inappropriate medications were oral estrogens (40 patients; 4.6%), muscle relaxants/antispasmodics (37; 4.2%), short-acting nifedipine (22; 2.5%), amitriptyline (21; 2.4%), and fluoxetine (15; 1.7%) (**Table II**).[5] These sums may not add up correctly because duplicates were removed from Beers plus ACOVE criteria but were not removed for both types of Beers criteria (independent of and dependent on diagnoses).

Table I. Descriptive characteristics of the study population (N = 874).*

Variable	No. (%) of Patients	Mean (SD)
Sociodemographic characteristics		
Age		72.69 (5.71)
65–74 y	598 (68.4)	
75–84 y	238 (27.2)	
85–94 y	38 (4.3)	
Sex		
Male	379 (43.4)	
Female	495 (56.6)	
Race		
White	817 (94.9)	
Black/African American	18 (2.1)	
Hispanic	19 (2.2)	
Other	7 (0.8)	
Highest level of education		
High school diploma or less	167 (19.1)	
Some college	312 (35.7)	
College degree	116 (13.3)	
Graduate degree	152 (17.4)	
Other type of degree	127 (14.5)	
Annual household Income		
<$15,000	53 (7.0)	
$15,000–$24,999	112 (14.8)	
$25,000–$34,999	126 (16.6)	
$35,000–$49,999	149 (19.7)	
$50,000–$74,999	161 (21.2)	
≥$75,000	157 (20.7)	
Geographic region (residence)†		
Midwest	253 (28.9)	
Northeast	183 (20.9)	
South	257 (29.4)	
West	181 (20.7)	
Clinical characteristics		
Self-rated health status		
Excellent	59 (6.8)	
Very good	260 (29.7)	
Good	375 (42.9)	
Fair	150 (17.2)	
Poor	30 (3.4)	
Number of medicines used in past month		
0	99 (11.3)	
1 or 2	187 (21.4)	
3 or 4	231 (26.4)	
5 or 6	192 (22.0)	
7 or 8	80 (9.2)	
>8	85 (9.7)	
Sum of symptoms experienced		
0	273 (35.7)	
1	107 (14.0)	
2	118 (15.4)	
3	123 (16.1)	
≥4	144 (18.8)	
Self-reported an adverse drug event	178 (20.4)	
Behavioral characteristics		
Concerns and beliefs about medicines‡		15.11 (3.95)
Necessity beliefs about medicines§		13.75 (3.00)
Number of pharmacies		
0	86 (9.9)	
1	592 (68.0)	
2	176 (20.2)	
≥3	17 (2.0)	
Stopped taking medicines due to cost		
Never	805 (92.4)	
≥1 Time	66 (7.6)	
Skipped doses to save money		
Never	784 (89.7)	
≥1 Time	90 (10.3)	

* Sums that do not total 874 indicate missing data; percentages may not total 100% due to rounding.
† *Midwest*: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. *Northeast*: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. *South*: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. *West*: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.
‡ Range, 5 to 25; lower scores = less concern.
§ Range, 5 to 25; higher scores = more beliefs.

Table II. Use of potentially inappropriate medications among older adults using the Beers criteria, independent of diagnoses (N = 874).[5]*

Inappropriate Medication	No. (%) of Patients
Estrogens (oral)	40 (4.6)
Muscle relaxants/antispasmodics	37 (4.2)
Short-acting nifedipine	22 (2.5)
Amitriptyline, chlordiazepoxide-amitriptyline, perphenazine-amitriptyline	21 (2.4)
Fluoxetine (daily)	15 (1.7)
Doxazosin	14 (1.6)
Propoxyphene and combination products	14 (1.6)
Gastrointestinal antispasmodic drugs	11 (1.3)
Digoxin† (dosage should not exceed 0.125 mg/d except when treating atrial arrhythmias)	10 (1.1)
Anticholinergics/antihistamines	10 (1.1)
Clonidine	10 (1.1)
All barbiturates (except phenobarbital, when used to control seizures)	8 (0.9)
Short-acting benzodiazepines	7 (0.8)
Indomethacin	6 (0.7)
Desiccated thyroid hormone	6 (0.7)
Long-acting benzodiazepines	4 (0.5)
Nitrofurantoin	4 (0.5)
Amiodarone	3 (0.3)
Cimetidine	3 (0.3)
Short-acting dipyridamole	2 (0.2)
Methyldopa‡ or methyldopa-hydrochlorothiazide§	2 (0.2)
Ferrous sulfate (>325 mg/d)	2 (0.2)
Amphetamines/anorexic agents	2 (0.2)
Methyltestosterone	2 (0.2)
Meprobamate	1 (0.1)
Flurazepam	1 (0.1)
Disopyramide	1 (0.1)
Doxepin	1 (0.1)
Chlorpropamide	1 (0.1)
Stimulant laxatives (long term)	1 (0.1)
Amphetamines (excluding methylphenidate hydrochloride and anorexics)	1 (0.1)
Total who received ≥1 medication that failed Beers criteria, independent of diagnoses	204 (23.3)

* Patients may have received >1 inappropriate medication.
† Trademark: Lanoxin® (GlaxoSmithKline, Research Triangle Park, North Carolina).
‡ Trademark: Aldomet® (Merck & Co., Inc., Whitehouse Station, New Jersey).
§ Trademark: Aldoril® (Merck & Co., Inc.).

In the first regression analysis, use of more medicines (OR = 2.28; 95% CI, 1.16–4.48; $P = 0.02$) and having more symptoms (OR = 2.36; 95% CI, 1.28–4.35; $P = 0.00$), rather than receiving an inappropriate medication (OR = 1.07; 95% CI, 0.68–1.69; P = NS), were related to reporting ADEs (Hosmer-Lemeshow goodness-of-fit test: $\chi^2 = 15.27$; P = NS; $R^2 = 0.15$). In the second regression analysis, when concerns and beliefs about medicines were added, having stronger concerns and beliefs about medicines (OR = 1.57; 95% CI, 1.02–2.39; $P = 0.04$) and having more symptoms (OR = 2.26; 95% CI, 1.22–4.22; $P = 0.01$), rather than receiving an inappropriate medication (OR = 1.03; 95% CI, 0.65–1.64; P = NS) or the number of medications received (OR = 1.28; 95% CI, 0.52–3.13; P = NS), were related to self-reporting ADEs (**Table V**). Only concerns and beliefs about medicines as a linear variable was statistically significant in the model (OR = 1.57; 95% CI, 1.02–2.39; $P = 0.04$). The fit of the overall model was good (Hosmer-Lemeshow test: $\chi^2 = 12.77$; $P = 0.12$; $R^2 = 0.17$).

DISCUSSION

In this study, the frequency of inappropriately prescribed medications received by older adults in the outpatient setting was high (45.8%). Stronger concerns and beliefs about medicines ($P = 0.04$) and having more symptoms ($P = 0.01$) were related to self-reporting of ADEs. No significant relationship was found between receiving an inappropriate medication or the number of medicines received and self-reporting of ADEs.

Although the frequency of inappropriate medications was high, as in previous studies,[1,18] it was higher than in studies that had used the Beers criteria only to examine the frequency of using an inappropriate medication among older adults (12%–45%).[3,5,14,18,33–35] This may have occurred because both the Beers criteria and the ACOVE quality indicators were used to determine whether an individual received an inappropriate medication. Previous studies either used only the Beers list of medications independent of diagnoses or both Beers lists (independent of and dependent on diagnoses). The ACOVE quality indicators and Beers criteria were combined to measure appropriateness of prescriptions in this study because the Beers criteria account for inappropriate medications and overuse of medicines, whereas the ACOVE quality indicators identify underutilization of recommended drug therapy. A combination of both quality measures allows for broader evaluations of the quality of medication use and management among older adults. Older adults with prescription medicines obtained in the outpatient setting may be at risk for

Table III. Use of potentially inappropriate medications among older adults using the Beers criteria, dependent on diagnoses (N = 874).[5]*

Disease/Condition	Inappropriate Medication	No. (%) of Patients
Depression	Benzodiazepine (long term)/sympatholytic agents	17 (1.9)
Blood-clotting disorders or anticoagulant therapy	Aspirin, NSAIDs, dipyridamole, ticlopidine, clopidogrel	13 (1.5)
Chronic obstructive pulmonary disease	Long-acting benzodiazepines, β-blockers	7 (0.8)
Bladder outflow obstruction	Anticholinergics/antihistamines, gastrointestinal antispasmodics, muscle relaxants, oxybutynin, flavoxate, anticholinergics, antidepressants, decongestants, tolterodine	6 (0.7)
Insomnia	Decongestants, theophylline, methylphenidate, monoamine oxidase inhibitors, amphetamines	2 (0.2)
Gastric or duodenal ulcers	Aspirin (>325 mg)/NSAIDs (excluding coxibs)	1 (0.1)
Parkinson disease	Metoclopramide, conventional antipsychotics, tacrine	1 (0.1)
Total who received ≥1 medication that failed Beers criteria, dependent on diagnoses		45 (5.1)

*Patients may have received >1 inappropriate medication.

potential medication errors, and the use of 2 sets of quality indicators may allow for detection of overuse and underuse of medicines.

Furthermore, underuse, overuse, and inappropriateness of medications are common problems in this population. It appears that use of >1 set of quality indicators allowed for identification of more inappropriate medications. This is particularly important in the outpatient setting, where older adults are likely to receive a prescription and may be at high risk of receiving an inappropriate medication. However, the frequency of receiving these medications should be interpreted with caution because some of the ACOVE quality indicators that were duplicated in the Beers criteria were removed from the total number of inappropriate medications examined. The number of inappropriate medications reported may be underestimated because of this removal. In addition, some of the ACOVE quality indicators identified underuse among the respondents compared with the Beers criteria, which identified only high-risk medications. Using these criteria, respondents who did not receive prescribed medications based on their diagnoses were also identified and may suggest underprescribing, an area that requires more research.

As hypothesized, no association was found between the use of inappropriate medications and self-reported ADEs, but stronger concerns and beliefs about medicines were related to more self-reported ADEs. Patients are active problem solvers who assign meaning to their symptoms and have specific interpretations of the cause, consequences, and means of controlling the symptoms. Therefore, both symptom and treatment representations guide the behaviors that patients perform for dealing with a symptom, and this could involve reporting the unwanted reaction or side effect to a health care provider.[30,44]

In this study, respondents were asked whether they had seen a doctor about any side effects, unwanted reactions, or problems from taking their medicines in the past year. The performance of this behavior can be described as a coping procedure for dealing with the symptom and a means of detecting whether they had experienced an ADE. Patients with stronger concerns and beliefs about medicines may be thinking about their medicines and worrying about the effects of the medicines; therefore, they may be more likely to attribute their symptoms to an ADE. Furthermore, patients are not aware of the appropriateness of their medications; identifying patients' beliefs may help health care providers encourage self-reports of ADEs and subsequently control medication-related problems.

It is important to note that the older adults in this Internet-based sample were highly educated; therefore, these individuals probably had more access to information on the risks associated with medicines, which

Table IV. Use of medications that failed Assessing Care of Vulnerable Elders (ACOVE) quality indicators (N = 874).[34]*

Quality Indicator Descriptors	No. (%) of Patients
Prescribing indicated medications	
Daily aspirin therapy for patients with diabetes mellitus	111 (12.7)
Calcium and vitamin D for patients taking long-term steroid therapy	26 (3.0)
Hormone replacement therapy, bisphosphonates, or calcitonin for patients with osteoporosis	18 (2.1)
Warfarin or aspirin, as appropriate, for patients with atrial fibrillation	7 (0.8)
Proton-pump inhibitors or misoprostol for patients with ulcers or gastrointestinal bleeding risk factors who are taking NSAIDs	1 (0.1)
β-Blockers for patients with heart failure	1 (0.1)
Calcium and vitamin D for patients with osteoporosis	1 (0.1)
Avoiding inappropriate medications	
Avoid strongly anticholinergic medications if alternatives exist	84 (9.6)
Avoid barbiturates unless patient has a seizure disorder	7 (0.8)
Avoid β-blockers if patient has asthma	7 (0.8)
Avoid chlorpropamide	1 (0.1)
Avoid first- or second-generation, short-acting calcium channel blockers if patient has heart failure	1 (0.1)
Avoid meperidine	0
Total who received 1 medication that failed ACOVE quality indicators	303 (34.7)

*Patients may have received >1 medication that failed ACOVE quality indicators.

might have increased their concerns about the medicines compared with the general population of older adults. Furthermore, they probably were better able to identify when their symptoms were due to medicines and readily report them to their doctor than were older adults with less education.[45] On the other hand, individuals with higher education may have better coping mechanisms available to them; subsequently, the use of these coping strategies may reduce the perceptions of symptoms and reporting of ADEs to health care providers (ie, it remains uncertain whether a higher level of education increases or decreases the propensity to report symptoms and ADEs).[46]

The inclusion of concerns and beliefs about medicines as a polynomial variable in the regression model was not significant, probably because the relationship between patients' concerns about the dependence and adverse effects of their medicines and self-reported ADEs was only linear. The relationship of concerns and beliefs about medicines to health behaviors may vary. For example, studies have reported that increased concerns led to less adherence to medication regimens[41,47] and more self-reported ADEs.[11,12] In this study, more concerns led to more self-reported ADEs.

As in a previous study,[13] use of inappropriate medications was not related to ADEs. The use of an inappropriate medication did not reflect the patients' perceptions of their symptoms. Patients did not know whether they were receiving an inappropriate medication; therefore, the interpretation of the symptoms they were experiencing was not related to the inappropriateness of the medications received, but rather their beliefs about the medicines and how the medicines affected their health. Although many studies have related use of an inappropriate medication to ADEs, those studies used objective measures of ADEs such as chart reviews or medical records.[18,19,48] Self-reported ADEs reflect patients' views of their symptomatology; their perceptions of their treatment and their concerns about the long-term adverse effects of their medications also reflect their views of their medicines. Therefore, both factors may be associated with each other, rather than inappropriate medications, because they assess and represent the patients' perceptions of their treatment and its effects. Patients would not know whether the number of medicines used makes them at higher risk for ADEs.

Patients who had more symptoms were more likely to self-report ADEs. However, patients who had 1 symptom also were more likely than patients who had no symptoms to self-report ADEs. These patients probably could not tolerate their symptoms and therefore decided to seek the help of their doctor. Patients' interpretations of their symptoms may determine the causal attribution to a medicine. Patients with fewer symptoms may believe that their symptoms can be controlled by self-care and therefore would be less likely to report the ADE to their doctor.

This study had limitations. The use of secondary data restricted and minimized the validity of measures such

Table V. Logistic regression analysis of risk factors for a self-reported adverse drug event, considering use of an inappropriate medication (n = 638).*†

Variable	Odds Ratio (95% CI)
Sociodemographic characteristics	
Age	
65–74 y	1.0
75–84 y	1.29 (0.82–2.03)
85–94 y	2.39 (0.98–5.81)
Sex	
Male	1.0
Female	1.21 (0.78–1.86)
Race	
White	1.0
Black/African American	0.86 (0.25–2.99)
Hispanic	1.44 (0.38–5.46)
Other	2.19 (0.41–11.68)
Highest level of education	
High school diploma or less	1.0
Some college	1.48 (0.80–2.75)
College degree	1.08 (0.46–2.50)
Graduate degree	1.51 (0.71–3.23)
Other type of degree	1.48 (0.68–3.24)
Annual household income	
<$15,000	1.0
$15,000–$24,999	0.86 (0.34–2.18)
$25,000–$34,999	1.00 (0.39–2.59)
$35,000–$49,999	1.30 (0.53–3.20)
$50,000–$74,999	1.04 (0.41–2.63)
≥$75,000	1.50 (0.59–3.82)
Geographic region (residence)‡	
Midwest	1.0
Northeast	1.04 (0.57–1.90)
South	1.35 (0.79–2.31)
West	1.30 (0.71–2.38)
Clinical characteristics	
Self-rated health status	
Excellent	1.0
Very good	1.22 (0.33–4.54)
Good	1.58 (0.43–5.82)
Fair	2.46 (0.62–9.69)
Poor	2.47 (0.46–13.31)
Number of medicines used in past month	
1 or 2	1.0
3 or 4	1.75 (0.89–3.45)
5 or 6	1.66 (0.82–3.37)
7 or 8	0.65 (0.26–1.63)
>8	1.28 (0.52–3.13)
Using an inappropriate medication	
No	1.0
Yes	1.03 (0.65–1.64)
Sum of symptoms experienced	
0	1.0
1	2.06 (1.08–3.94)§
2	1.52 (0.79–2.92)
3	1.25 (0.65–2.39)
≥4	2.26 (1.22–4.22)§
Behavioral characteristics	
Concerns and beliefs about medicines (linear variable)	1.57 (1.02–2.39)§
Concerns and beliefs about medicines (squared variable)	0.99 (0.98–1.00)
Necessity beliefs about medicines	0.94 (0.86–1.04)
Number of pharmacies	
0	1.0
1	1.86 (0.38–9.12)
2	1.95 (0.38–9.99)
≥3	1.75 (0.23–13.17)
Stopped taking medicines due to cost	
Never	1.0
≥1 Time	0.70 (0.32–1.53)
Skipped doses to save money	
Never	1.0
≥1 Time	1.53 (0.65–3.58)

* Of 1024 respondents, 150 did not report the name of the medication being taken (final data set = 874); 99 respondents took no prescription drugs in the past month, and 137 respondents had missing data from all other variables, excluding these respondents from analysis.

† Hosmer-Lemeshow goodness-of-fit test: $\chi^2 = 12.77$; $P = 0.12$; $R^2 = 0.17$.

‡ *Midwest*: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. *Northeast*: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. *South*: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. *West*: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

§ $P < 0.05$.

as the Beers criteria and ACOVE quality indicators. For example, in the Beers criteria, some of the information required for identifying an inappropriate medication included the duration of treatment and the dosage prescribed. Because patients self-reported the information about their medicines, the duration of treatment was not included; in some cases, dosages were missing. In addition, because data on inpatients were unavailable, the ACOVE quality indicators were modified for the analysis. This was an Internet-based convenience sample of older adults who were highly educated; therefore, the results are not generalizable to older adults in the general US population.

A bias also may exist for survey respondents to be likely to self-report their symptoms and ADEs. However, the survey also contained many questions about prescription drug insurance and costs and was not limited to ADEs. In addition, the survey did not ask about medical conditions in general, only symptoms experienced in the past month. Underuse and possibly overuse of medications could have occurred if patients were asymptomatic.

Finally, the use of patient self-reports as a means of measuring ADEs may overestimate the occurrence compared with other objective measures such as chart reviews and medical records. It is possible that a symptom or reaction identified by a patient as an ADE may not be identified as an ADE by health care professionals. The time frame for the patient to recall the ADE (within the past year) may also underestimate the measure because of poor recollection.

Self-reporting an ADE also included the reporting of other problems related to medications, which could be interpreted by a patient as a cost or access problem rather than an ADE. A bias may exist in the measure of the relationship between the dependent variable and use of inappropriate medications as an independent variable. Self-reported ADEs were measured in the past year, whereas inappropriate medications were measured in the past month. It is possible that a medication causing an ADE was discontinued in the past year but before the time in which inappropriate use was determined.

Understanding the relationship between concern beliefs in medicines and experiencing ADEs in relation to clinical variables such as the use of an inappropriate medication will help health care providers understand that patients' perceptions of their treatment need to be elicited during clinical consultations. Clinicians and other health care professionals can help patients with strong anxieties and concerns about their medications reframe negative perceptions of treatment using cognitive-behavioral interventions. A positive change in the concerns patients have about their medicines might increase patients' motivation for self-monitoring of their health, symptoms, and ADEs. As patients pay particular attention to the effects of their medicines, they are likely to self-report potential ADEs, thus preventing them from worsening. This is especially important in practice because patients often are unaware that they have received an inappropriate medication. Their symptom attribution to a medicine and ADE is based on their own treatment beliefs, anxieties, worries, and perceptions of dependence on their medicines. Furthermore, patients' concerns and beliefs about medicines may need to be controlled for in studies that examine risk factors predicting ADEs. Even if this variable does not show significant relationships with ADE measures, ruling out its effect may enhance studies methodologically. Future research should examine the relationship between concerns and beliefs about medicines and other health behaviors related to symptoms and medication management. The relationship between use of inappropriate medications in older adults and other ADE measures also should be examined.

CONCLUSIONS

Stronger concerns and beliefs about medicines and having more symptoms were significantly related to self-reporting of ADEs. Receiving an inappropriate medication and the number of medicines received were not significantly related.

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