Health Outcome Priorities Among Competing Cardiovascular, Fall Injury, and Medication-Related Symptom Outcomes

Mary E. Tinetti, MD,[*†] *Gail J. McAvay, PhD,*[*] *Terri R. Fried, MD,*[*‡] *Heather G. Allore, PhD,*[*] *JoAnna C. Salmon, BA,*[§] *Joanne M. Foody, MD,*[*] *Luann Bianco, BA,*[*] *Sandra Ginter, RN,*[*] *and Liana Fraenkel, MD*[*‡]

OBJECTIVES: To determine the priority that older adults with coexisting hypertension and fall risk give to optimizing cardiovascular outcomes versus fall- and medication symptom-related outcomes.

DESIGN: Interview.

SETTING: Community.

PARTICIPANTS: One hundred twenty-three cognitively intact persons aged 70 and older with hypertension and fall risk.

MEASUREMENTS: Discrete choice task was used to elicit the relative importance placed on reducing the risk of three outcomes: cardiovascular events, serious fall injuries, and medication symptoms. Risk estimates with and without antihypertensive medications were obtained from the literature. Participants chose between 11 pairs of options that displayed lower risks for one or two outcomes and a higher risk for the other outcome(s), versus the reverse. Results were used to calculate relative importance scores for the three outcomes. These scores, which sum to 100, reflect the relative priority participants placed on the difference between the risk estimates of each outcome.

RESULTS: Sixty-two participants (50.4%) placed greater importance on reducing risk of cardiovascular events than reducing risk of the combination of fall injuries and medication symptoms; 61 participants did the converse. A lower percentage of participants with chronic obstructive pulmonary disease ($P = .02$), unsteadiness ($P = .02$), functional dependency ($P = .04$), lower cognition ($P = .02$) and depressive symptoms ($P = .03$) prioritized cardiovascular outcomes over fall injuries and medication symptoms than did participants without these characteristics.

CONCLUSION: Interindividual variability in the face of competing outcomes supports individualizing decision-making to individual priorities. In the current example, this may mean forgoing antihypertensive medications or compromising on blood pressure reduction for some individuals. **J Am Geriatr Soc 56:1409–1416, 2008.**

Key words: competing outcomes; fall injuries; hypertension; patient priorities

In patients with multiple conditions, the treatment of one condition may worsen another condition. Incorporating patients' priorities into clinical decisions in which it may be impossible to maximize benefits across all conditions is essential to patient-centered care.[1] Hypertension, fall risk, and adverse medication effects, three common and often coexisting conditions in older adults, illustrate such a potential trade-off situation.

The cardiovascular consequences of hypertension are well known. Less well recognized are the outcomes associating with falling. Falls and fall injuries are major determinants of disability and are the leading cause of restricted activity days.[2–5] Epidemiological studies show that serious fall-related injuries such as fractures and traumatic brain injuries have functional, cognitive, and physical effects similar to myocardial infarction (MI) and stroke,[3–5] two major hypertension-related cardiovascular events. Moreover, the incidences of nonfatal cardiovascular events in older persons with hypertension and of serious fall injury in older persons with fall risk are both approximately 16%.[6–8]

Randomized, controlled trial (RCT) evidence is compelling that treatment of hypertension in elderly patients, at least the young-old, decreases the risk of cardiovascular disease (CVD) outcomes.[6,9–13] Although the reported prevalence of adverse effects of antihypertensive medications in RCTs is low,[6,9–13] extrapolating these data to clinical practice is problematic because of the younger average age and

From the Department of *Internal Medicine and †Epidemiology and Public Health, §School of Medicine, Yale University, New Haven, Connecticut; and ‡Clinical Epidemiology Research Center, Veterans Affairs Connecticut Healthcare System, New Haven, Connecticut.

Address correspondence to Mary E. Tinetti, MD, Gladys Phillips Crofoot Professor of Medicine, Epidemiology and Public Health, Yale University School of Medicine/Section of Geriatrics, 20 York Street–TMP 15, New Haven, CT 06504. E-mail: mary.tinetti@yale.edu

DOI: 10.1111/j.1532-5415.2008.01815.x

0002-8614/08/$15.00

lower prevalence of comorbidity in trial participants than in older patients in practice.[9,11–14] Patients with coexisting conditions may experience higher rates of harmful medication effects than the average trial participant.[14–19]

The relationships between hypertension, antihypertensive medications, and fall injury are complex. Hypertension may exacerbate fall risk factors such as orthostasis and inattention.[20] Observational data suggest that some antihypertensive medications may protect against fall risk factors and fractures,[21,22] but most studies adjusting for appropriate confounders report a greater risk of falls, fall injuries, or fall risk factors with antihypertensive medications.[8,23–26]

Symptoms and signs such as poor balance, dizziness, fatigue, weakness, falls, anorexia, and orthostasis are among the most commonly reported adverse effects of medications, including antihypertensive medications.[27–29] Although referred to by clinicians as side effects, evidence suggests that elderly patients consider these effects to be important health outcomes that they weigh against other health outcomes.[30–32]

Eliciting patients' priorities in the face of these potentially competing outcomes conflicts with known challenges such as difficulty processing complex information, reluctance to articulate feelings about outcomes not yet experienced, and inadequate numeracy skills.[30,33] Despite these challenges, the potential for antihypertensive treatment to increase risk of fall injuries and unwanted symptoms while decreasing risk of cardiovascular outcomes necessitates determining patients' outcome priorities.[30,32] The aim of this study was to determine interindividual variability in the priority that older adults with hypertension and fall risk give to optimizing cardiovascular, versus fall- and medication symptom–related outcomes.

METHODS

Participants and Setting

Participants were recruited from age-aggregated community housing (including public and private senior housing, life care communities, and retirement facilities). To recruit a socioeconomically and racially diverse sample, all age-aggregated housing facilities in south central Connecticut with at least 100 residents were first categorized into two clusters: facilities serving primarily elderly people with incomes below or near the 2000 Census age-referenced medians and facilities serving elderly people above the age-referenced income median. After assigning a random number to each facility, facilities were sorted using the random number to obtain the order of enrollment within each cluster of facilities. All residents aged 70 and older in the randomly selected facilities were contacted by letter and then by telephone to ascertain eligibility and willingness to participate.

Of the 771 individuals aged 70 and older who were contacted, 127 refused screening. Exclusion criteria, ascertained during the telephone interview or during the subsequent face-to-face home interview, were no hypertension or use of antihypertensive medications (n = 222); non-English speaking (n = 77); diagnosis of dementia or a score less than 15 on the telephone version of the Folstein Mini-Mental State Examination (MMSE; <13 if education <high school,[34] n = 58); taking warfarin for possible atrial fibrillation (n = 42; this exclusion was necessary because risk of stroke is much higher in this group and because issues related to anticoagulation would confound the issues related to antihypertensive medications); and nonambulatory or dependent in bathing, dressing, and transferring (n = 12). Of the 233 screened individuals who otherwise met criteria, 43 residents (18.4%) were excluded during the home interview because they could not select an option when presented with a simplified choice, suggesting that they did not comprehend the choice task.[35] Two other individuals failed to complete the choice task and were thus excluded. Of the remaining 188 residents, 123 (65%) agreed to participate and were enrolled. All 123 participants met criteria for fall risk, defined as one or more known fall risk factors, including a fall in the previous year, use of a cane or walker, self-reported or observed balance or walking difficulties, postural hypotension, dependent in at least one activity of daily living (ADL), visual impairment, depressive symptoms, and use of at least four medications.[2,8,24,25,36] There were no significant differences in age, MMSE scores, or ADLs between the 123 residents who were enrolled and the 65 who were eligible but refused. The 43 residents who were eligible but were excluded, because they were unable to complete the simple choice were older, more likely to be dependent in ADLs,[37] and had lower MMSE scores than the 123 enrolled residents.[34]

The human investigation committee at Yale School of Medicine approved the study.

Data Collection

Two trained interviewers collected study data in participants' homes. Sociodemographic and ADL data were obtained.[37] The presence of 10 health conditions (heart failure (HF), MI, stroke, chronic obstructive pulmonary disease (COPD), liver disease, diabetes mellitus, cancer, hip or other fractures, Parkinson's disease, and arthritis) were ascertained according to self-report of whether a doctor had ever told them that they had the condition. Medications were recorded from containers. Depressive symptoms were defined as a score of 2 or higher on the Physician Health Questionnaire—2.[38] Percentage visual impairment was assessed using a Jaeger chart. Additional assessments included postural blood pressure (postural hypotension was defined as change in systolic blood pressure between lying and standing of at least 20 mmHg or to less than 90 mmHg standing) and balance and gait testing.[8] A Short Physical Performance Battery score, based on balance and gait items and timed chair stands, was calculated.[39]

Outcome

The outcome was the relative importance participants placed on reducing the risk of three health outcomes: cardiovascular disease (including stroke, MI, and HF), serious fall injuries (including hip fracture, other fractures, or traumatic brain injury), and medication-related symptoms such as fatigue or dizziness. The relative importance was determined using a discrete choice task, developed using Choice-Based Conjoint Analyses Software (Sawtooth Software Inc., SSI Web Version 3.5, Sequim, WA).[40,41] The development and administration of this choice task has been previously described and briefly summarized.[35] The choice task in-

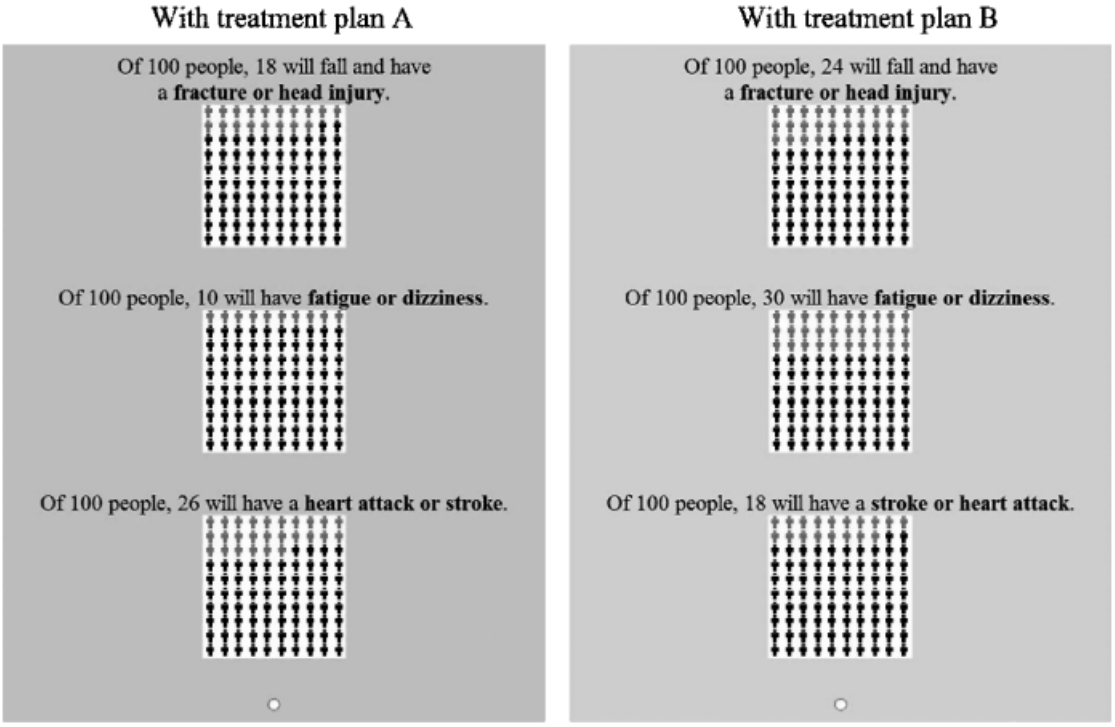

Figure 1. Example of a choice included in the choice task. Participants are asked which option they preferred. The choices are displayed on a large computer screen with the figures in red (number of persons in 100 who will experience the outcome) and black (number of persons in 100 who will not experience the outcome) under each treatment option.

cluded 11 sets of choices to enhance reliability without overburdening participants. Each set consisted of a pair of options that displayed risk for each health outcome under conditions corresponding to use or nonuse of antihypertensive medications. Within each choice set, one option optimized the risk of one or two of the three outcomes at the expense of the other(s); the second option did the reverse. For each choice set, participants were asked which option they preferred. Strategies used to improve understanding of risks and probabilities included presenting risk information using natural frequencies (e.g., 1 in 100 people) that are more easily understood than percentages,[42] describing all risk information using absolute risk differences, and employing human figure graphs to illustrate natural frequencies.[43] The choice task was written in fifth-grade-level English. To minimize problems due to low reading literacy or visual impairment, the interviewer read each question aloud. The choice task was shown to be reliable and free from order or framing effects.[35,40,41] An example of a choice is shown in Figure 1. The complete choice task with explanatory scripts and all choice sets can be found at http://pepper.med.yale.edu/fall_hypertension_choicetask.pdf

Estimates for risk of CVD and serious fall injuries were based on the best available clinical trial and epidemiological evidence. It was estimated that the 5-year risk of CVD outcomes would decrease from 26% to 18% (absolute risk reduction) for the average older individual with antihypertensive medications.[6,9–13,15] The corresponding estimated increase in serious fall injury over 5 years with medication use, based on the available literature, was 18% to 24% for persons with fall risk as defined above.[2,7,8,24,25,36] The risks for medication symptoms were 30% with and 10% without antihypertensive medications, based on literature showing that cardiovascular medications (including antihypertensive medications and diuretics) account for approximately one-third of adverse drug reactions, symptoms and signs that are also fall risk factors (e.g., weakness, dizziness, poor balance, fatigue) are among the most commonly reported adverse drug reactions, and medications are among the most common cause of these symptoms.[16–20,23–29,44]

Results of the choice task were used to calculate three relative importance scores corresponding to CVD, serious fall injury, and medication-related symptom outcomes. The relative importance scores, which summed to 100, reflected the priority participants placed on the difference between the risk estimates of each outcome with and without antihypertensive medications. Relative importance scores are scaled such that, for example, scores of 60, 30, and 10 for CVD, fall injury, and medication symptoms, respectively, would mean that the participant was twice as concerned about reducing the risk of a cardiovascular outcome as reducing the risk of a fall injury outcome and was least concerned about medication symptoms. Relative importance scores were calculated based on the coefficients from a hierarchical Bayes model. The dependent variable for the calculations was the participant's choice when presented with each of the 11 sets of two options. The independent variables were the estimated risks of the three outcomes associated with each option. For interested readers, details related to these calculations and to conjoint analysis are available at http://www.sawtoothsoftware.com/techpap.

Statistical Analysis

Medians and interquartile ranges (IQRs) were calculated to describe the distribution of the three continuous importance scores using SAS Version 9.1.3 (SAS Institute, Inc., Cary, NC). The proportion of participants with a CVD importance score greater than 50, corresponding to a higher priority for avoiding CVD outcomes than for the combination of fall injuries and medication-related symptoms, was calculated, and a 95% confidence interval (CI) was estimated. To account for the clustering according to facility type, SUDAAN Version 9 (Research Triangle Institute, Research Triangle Park, NC) was employed to estimate the standard error using Taylor series linearization. The associations between participants' characteristics and a CVD importance score greater than 50 were estimated using a chi-square test adjusted for clustering with SUDAAN.

RESULTS

The mean age of the 123 participants was 81.5 (range 70–96); 71% were female. Participants reported an average of 2.3 ± 1.4 health conditions in addition to hypertension and fall risk. Other characteristics are shown in Table 1.

The median importance score was 51.0 (IQR = 33–71) for cardiovascular outcomes, 27.0 (IQR = 20–44) for medication symptoms, and 19.0 (IQR = 9–27) for fall injuries. Of the three outcomes, cardiovascular events had the highest importance score for 88 participants (71.5%), medication-related symptoms for 25 participants (20.3%), and fall injuries for 10 participants (8.1%). Figure 2 displays the distribution of importance scores.

Sixty-two participants (50.4%; 95% CI = 41.5–59.3) had an importance score of at least 50 for cardiovascular outcomes, meaning that they placed greater importance on reducing the risk of cardiovascular events than on reducing the risk of the combination of fall injuries and medication-related symptoms. Sixty-one participants did the converse.

The percentage of participants prioritizing cardiovascular outcomes (importance score for CVD outcomes of at least 50) was lower for participants with less than college education ($P = .09$), lower income ($P = .08$), COPD ($P = .02$), balance or walking difficulty ($P = .02$), dependence in any ADL ($P = .04$), low cognitive score ($P = .02$) depressive symptoms ($P = .03$), and poor physical performance ($P = .03$) than for persons without these characteristics (Table 2).

DISCUSSION

Most participants in this diverse sample with hypertension and fall risk were able to complete the choice task and articulate their priority among cardiovascular events, fall injuries, and medication-related symptoms. Approximately 70% assigned the highest individual relative priority to avoiding adverse cardiovascular outcomes, but when considering all three outcomes, approximately half gave the highest priority to avoiding CVD events and half to the combination of avoiding fall injuries or medication-related symptoms. All participants gave some importance to all three outcomes; no one prioritized any outcome to the exclusion of the others. Taken together, these results indicate that most cognitively intact older adults understand the concept of trade-offs between competing heath outcomes

Table 1. Baseline Characteristics (N = 123)

Characteristic	Value
Female, n (%)	87 (70.7)
Age, mean ± standard deviation	81.5 (5.9)
Race, n (%)*	
White	92 (74.8)
African American	29 (23.6)
Other	2 (1.6)
Marital status, n (%)	
Married	33 (26.8)
Widowed	62 (50.4)
Separated, divorced, never married	28 (22.8)
Lives alone, n (%)	94 (76.4)
Education, years, n (%)	
<high school	9 (7.3)
Some high school	14 (11.4)
Completed high school	36 (29.3)
≥some college	64 (52.0)
Income, n (%)	
Missing	9 (7.3)
Less than $25,000	70 (56.9)
≥$25,000	44 (35.7)
Number of health conditions, n (%)†	2.3 (1.4)
0–1	36 (29.3)
2	44 (35.8)
≥3	43 (34.9)
Previous myocardial infarction, n (%)	24 (19.5)
Heart failure, n (%)	8 (6.5)
Previous stroke, n (%)	18 (14.6)
Chronic obstructive pulmonary disease, n (%)	19 (15.4)
Diabetes mellitus, n (%)	35 (28.5)
Previous fracture, n (%)	38 (30.9)
Hospitalized in past year, n (%)	35 (28.5)
Nursing home stay in previous year, n (%)	12 (9.8)
Number of medications, mean ± SD	8.7 ± (3.6)
Takes ≥4 medications, n (%)	115 (94)
Number of antihypertensive medications, n (%)	
0	3 (2.4)
1	32 (26.0)
≥2	88 (71.5)
Any falls in the previous year, n (%)	41 (33.6)
Uses a cane or walker, n (%)	59 (48.0)
Self-reported balance or walking problem or feels unsteady walking, n (%)	91 (74.0)
Dependent in at least one activity of daily living or instrumental activity of daily living, n (%)	63 (51.2)
Folstein Mini-Mental State Examination score <19, n (%)‡	26 (21.1)
Depressive symptoms, n (%)‡	39 (32.0)
Self-reported hearing fair or poor, n (%)	35 (28.4)
Visual impairment at least 50%, n (%)‡	50 (40.6)
Systolic blood pressure (lying), mean ± SD	138.9 ± 18.3
Systolic blood pressure standing, mean ± SD	135.8 ± 20.1
Postural hypotension, n (%)‡	16 (13.4)
Short Physical Performance Battery score, n (%)‡	
0–4	32 (28.6)
5–8	57 (50.9)
9–12	23 (20.5)

* One white and one African-American participant each self-reported Hispanic or Latino ethnicity. The two "other" participants were Asian (n = 1) and American Indian (n = 1).

† Based on 10 self-reported conditions, not including hypertension or fall risk. The conditions are listed in the Methods section.

‡ See Methods for definition and scoring.

SD = standard deviation.

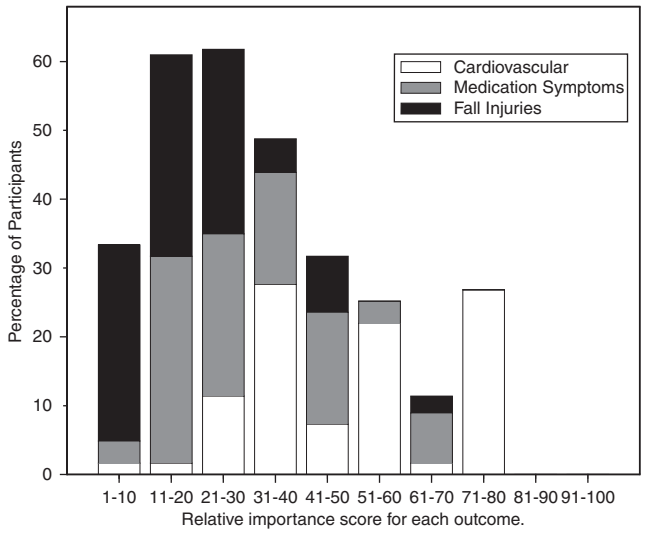

Figure 2. Distribution of relative importance scores for cardiovascular, medication symptom, and fall injury outcomes. Relative importance scores across the three outcomes sum to 100 for each participant.

and that they vary in their priorities but recognize the possibility of striking a balance between competing outcomes.

Outcome priorities did not vary according to age, sex, race, or prior experience with the outcome. For example, persons with prior MI or stroke were no more likely to prioritize avoiding CVD outcomes than were persons who had not experienced these events. The same was true for avoiding fall injuries in participants with a prior fracture. However, priorities varied according to presence of another chronic disease (COPD) and according to physical, psychological, and cognitive functioning.[45,46] These findings need to be corroborated in larger populations.

Results substantiate research dating to the 1980s showing that patients vary in their priorities and in the amount of risk of adverse effects they are willing to tolerate.[30–32,45–51] Older adults have also shown variability in preferences when faced with treatments, such as anticoagulation in atrial fibrillation or surgery in advanced prostate cancer, that may offer substantial benefit in one outcome domain but with concomitant risk of adverse outcomes in other domains.[50,51]

Although existing research confirms the variability in patients' priorities, work has focused primarily on alternative treatments for a single disease or on willingness to endure adverse effects of treatment to gain some treatment benefit.[45–51] The current study, conversely, addressed priorities across different disease and health outcomes, an area that, to the authors' knowledge, has been little explored. The ability to elicit priorities across disease outcomes is crucial to appropriate decision-making in persons with multiple, potentially competing, conditions.

It is unknown whether results would have been the same had other elicitation methods, such as time trade-off, standard gamble, or direct ranking, been used. Conjoint analysis was selected for several reasons. First, reproducibility of individuals' stated priorities has been shown in several previous applications of this approach.[41] Second, conjoint analysis minimizes ordering effects, referring to situations in which the order in which options are presented influence individuals' responses. Third, older adults are more susceptible than younger adults to framing effect; that is, they may chose differently when choices are presented in positive (e.g., presenting only the percentage of people who will experience an outcome) versus negative (e.g., presenting only the percentage of people who will not experience an outcome) formats.[41,52] Conjoint analysis avoids framing effects by presenting what happens to everyone under the two options.[40,41] Fourth, older patients have used conjoint analysis successfully to articulate their priorities for treatment of several conditions, including osteoporosis and arthritis.[47,53] Fifth, discrete choice tasks require direct consideration of trade-offs, which has been shown to improve decision-making and is the precise task that patients must perform to prioritize competing outcomes.[54] Finally, important to informed decision-making, the discrete choice task incorporates the outcome and the estimated risk of experiencing the outcome under different treatment options. Conjoint analysis, therefore, is one proven approach for presenting the pieces necessary for informed decision-making in older adults with multiple health conditions.

Almost 20% of participants who passed the MMSE cognitive screen failed the simple choice, suggesting that they did not comprehend the concept of competing outcomes or were unable to process all the information necessary to make an informed choice. These individuals were older and more dependent in ADLs and had lower cognitive scores than persons who completed the choice task. Further work is needed to explore the reasons why these persons could not perform the choice task and to determine whether alternative strategies would have been more successful.

The study sample was representative of those in whom competing outcomes was relevant—elderly persons from a range of sociodemographic and educational backgrounds. Non-English-speaking participants were not included because ensuring that the concepts were presented in a culturally appropriate manner was beyond the scope of this first investigation. Only two participants reported their ethnicity as Hispanic or Latino, probably because less than 2% of people aged 70 and older in southern Connecticut are Hispanic or Latino, and few English-speaking Hispanics or Latinos reside in age-aggregated housing. It is also likely that African Americans with higher incomes also were underrepresented, because only a small percentage reside in age-aggregated housing. Although no difference was found according to race, it is unclear whether results extrapolate to underrepresented groups. Determining whether other populations of older adults also show variability in their outcome priorities will be crucial.

Identifying the risk estimates of the outcomes to include presented two challenges. The first challenge related to individualizing versus generalizing risk information. Average risk identified from trials and observational studies was used, but an individual's risk may vary according to many factors. Although cumbersome, individualized risk data, if available, could be used in the choice task. The second challenge stemmed from the limits of existing data. The likelihood of benefits and adverse effects in clinical practice differs from those determined in trials because of factors such as older age, greater comorbidity, and consumption of more medications.[13] Furthermore, adverse effects are not

Table 2. Percentage Prioritizing Cardiovascular Outcomes According to Characteristics*

Characteristic	Prioritized Cardiovascular Outcomes n (%)*	*P*-Value†
Sex		.74
Male (n = 36)	19 (52.8)	
Female (n = 87)	43 (49.4)	
Age		.47
70–75 (n = 22)	11 (50.0)	
76–80 (n = 32)	19 (59.4)	
≥81 (n = 69)	32 (46.4)	
Race or ethnicity‡		.57
White (n = 92)	45 (48.9)	
African American or other (n = 31)	17 (54.8)	
Marital status		.49
Married (n = 33)	18 (54.6)	
Widowed (n = 62)	28 (45.2)	
Divorced or never married (n = 28)	16 (57.1)	
Lives alone		.56
Yes (n = 94)	46 (48.9)	
No (n = 29)	16 (55.2)	
Education		.09
≤High school (n = 59)	25 (42.4)	
At least some college (n = 64)	37 (57.8)	
Income, $§		.08
<25,000 (n = 70)	31 (44.3)	
≥25,000 (n = 44)	27 (61.4)	
Number of conditions‖		.94
≤1 (n = 36)	19 (52.8)	
2 (n = 44)	22 (50.0)	
≥3 (n = 43)	21 (48.8)	
Previous myocardial infarction		.59
No (n = 98)	51 (52.0)	
Yes (n = 24)	11 (45.8)	
Previous stroke		.56
No (n = 104)	54 (51.9)	
Yes (n = 18)	8 (44.4)	
Heart failure		.47
No (n = 114)	56 (49.1)	
Yes (n = 8)	5 (62.5)	
Chronic obstructive pulmonary disease		.02
No (n = 103)	56 (54.4)	
Yes (n = 19)	5 (26.3)	
Diabetes mellitus		.29
No (n = 88)	47 (53.4)	
Yes (n = 35)	15 (42.9)	
Previous fracture		.74
No (n = 85)	42 (49.4)	
Yes (n = 38)	20 (52.6)	
Hospitalized in previous year		.89
No (n = 88)	44 (50.0)	
Yes (n = 35)	18 (51.4)	
Number of medications		.59
2–6 (n = 39)	22 (56.4)	
7–10 (n = 45)	23 (51.1)	
≥11 (n = 38)	17 (44.7)	
Fall in previous year		.75
No (n = 81)	42 (51.9)	
Yes (n = 41)	20 (48.8)	
Uses a cane or walker		.33
No (n = 64)	35 (54.7)	
Yes (n = 59)	27 (45.8)	
Balance problem or unsteady		.02
No (n = 32)	22 (68.8)	
Yes (n = 91)	40 (44.0)	
Dependent in any activity of daily living		.04
No (n = 60)	36 (60.0)	
Yes (n = 63)	26 (41.3)	
Mini-Mental State Examination score#		.02
15–18 (n = 26)	8 (30.8)	
19–22 (n = 97)	54 (55.7)	
Depressive symptoms#		.03
No (n = 83)	47 (56.6)	
Yes (n = 39)	14 (35.9)	
Visual impairment >50%#		.66
No (n = 73)	38 (52.1)	
Yes (n = 50)	24 (48.0)	
Lying systolic blood pressure >140 mmHg		.28
No (n = 77)	41 (53.3)	
Yes (n = 42)	18 (42.9)	
Postural hypotension#		.30
No (n = 103)	53 (51.5)	
Yes (n = 16)	6 (37.5)	
Short Physical Performance Battery#		.03
0–4 (n = 32)	10 (31.3)	
5–8 (n = 57)	31 (54.4)	
9–12 (n = 23)	15 (65.2)	

(*Continued*)

Table 2. (Contd.)

* Participants were considered to have prioritized avoiding cardiovascular outcomes such as stroke or myocardial infarction if they had an importance score of 50 or greater for cardiovascular outcomes. Relative importance scores were calculated from the choice task using conjoint analysis. Each participant's scores for the three outcome categories (cardiovascular, fall injury, and medication symptoms) sum to 100. See Methods for details.

† *P*-values from chi-square test adjusted for cluster sampling from the categories of age-aggregated housing.

‡ One white and one African-American participant each self-reported Hispanic or Latino ethnicity. The two "other" participants were Asian (n = 1) and American Indian (n = 1).

§ Income was missing for nine participants.

‖ Based on 10 self-reported conditions, not including hypertension or fall risk.

See Methods for definition and scoring.

assessed in trials with the same precision that benefits are.[55] The advantages and limitations of assessing medication benefits and adverse effects from observational data have been chronicled.[56] The risk estimates used in this study were the best available in the literature. It is hoped that greater attention to the clinical importance of competing outcomes will spur the determination of more-precise risk

estimates of different outcomes under different treatment options.

As presently constructed, choice tasks such as this are probably too complex for use in clinical practice. However, the multiple, often competing, conditions experienced by older patients and the often modest benefits of treatments available for these conditions mandate explicit discussion of the likelihood of various outcomes under available treatment options. The discrete choice task used in the current study represents a starting point. Complexity notwithstanding, recognition of the need for informed decision-making across conditions should foster the evolution of more practical and feasible methods.

These findings have implications not only for the specific clinical situation and competing outcomes studied, but also for the many potentially competing outcomes inherent in clinical care of persons with multiple diseases. If patients' priorities vary, then incorporating these priorities into decision-making is essential to patient-centered care.[1] In the current case, at the very least, this means acknowledging that, as previously demonstrated, older adults consider medication-related symptoms to be health outcomes to be weighed against other outcomes.[30–32] Depending on the feasibility of avoiding medication symptoms or reducing injury risk, therefore, some patients may chose to forgo antihypertensive medications. They should be provided the evidence to make an informed decision.

If this variability in outcome priorities is seen with a supposedly well-studied and widely accepted area such as treatment of hypertension, then greater attention to incorporating individual priorities into decision-making within and across all conditions is imperative. However, timing is crucial, because practice guidelines, medical education, and quality assurance are moving rapidly in the opposite direction, advocating standardized approaches to disease management.[57]

From a research and clinical perspective, incorporating outcome priorities into decision-making will require identifying the important tradeoffs, determining the likelihood of competing outcomes under different treatment options, developing methods for reliably eliciting and making decisions based on variable priorities, and incorporating competing outcomes and individual priorities into disease guidelines and quality assurance. The challenges and complexities notwithstanding, interindividual variability requires individualizing clinical decision-making to meet individual patient priorities when faced with competing outcomes.

ACKNOWLEDGMENTS

The principal investigator, Mary E. Tinetti, attests that everyone who contributed significantly to the work has been listed, had access to all the study data, take responsibility for the accuracy of the analysis, and had authority over manuscript preparation and the decision to submit the manuscript for publication. The views expressed in this article are those of the authors and do not necessarily reflect the position or policy of the Department of Veterans Affairs.

Conflict of Interest: The editor in chief has reviewed the conflict of interest checklist provided by the authors and has determined that the authors have no financial or any other kind of personal conflicts with this manuscript. Dr. Foody has received speaker honoraria from Merck and Pfizer. This study was supported by Grant R21 AG027078 and by the Claude D. Pepper Older Americans Independence Center at Yale School of Medicine (P30AG21342), both from the National Institute on Aging (NIA). Dr. Foody was supported by K08AG20623 from the National Institutes of Health/NIA. Dr. Fraenkel was supported by K23AR048826 from the National Institute of Arthritis and Musculoskeletal and Skin Diseases. Dr. Fried was supported by K02AG20113 from the NIA.

Author Contributions: Mary E. Tinetti: all phases of the study, study concept and design, analysis and interpretation of data, and preparation of the manuscript. Gail J. McAvay, Terri R. Fried, and Liana Fraenkel: all phases of the study. Heather G. Allore: study design and analysis, preparation of the manuscript. JoAnna C. Salmon, Luann Bianco, and Sandra Ginter: acquisition and interview of subjects, preparation of the manuscript. Joanne M. Foody: study concept and design, preparation of the manuscript.

Sponsors' Role: The funders had no role in the design or conduct of the study; collection, management, analysis, or interpretation of the data; or preparation, review, or approval of the manuscript.

REFERENCES

1. Institute of Medicine. Crossing the Quality Chasm: A New Health System for the 21st Century. Washington, DC: National Academies Press, 2001.
2. Nevitt MC, Cummings SR, Hudes ES. Risk factors for injurious falls: A prospective study. J Gerontol 1991;46:M164–M170.
3. Tinetti ME, Williams CS. Falls, injuries due to falls, and the risk of admission to a nursing home. N Engl J Med 1997;337:1279–1284.
4. Tinetti ME, Williams CS. Effects of falls and fall injuries on functioning among community–living older persons. J Gerontol A Biol Sci Med Sci 1998;53A: M112–M119.
5. Gill TM, Desai MM, Gahbauer EA et al. Restricted activities among community-living older persons: Incidence, precipitants and health care utilization. Ann Intern Med 2001;135:313–321.
6. Staessen JA, Gasowski J, Wang JG et al. Risks of untreated and treated isolated systolic hypertension in the elderly: Meta-analysis of outcome trials. Lancet 2000;355:865–872.
7. Centers for Disease Control and Prevention. Web-based Injury Statistics Query and Reporting System (WISQARS) (2003). National Center for Injury Prevention and Control, Centers for Disease Control and Prevention (producer) (on-line). Available at: www.cdc.gov/ncipc/wisqars Accessed July 17, 2007.
8. Tinetti ME, Doucette J, Claus E et al. Risk factors for serious fall injury among community elderly persons. J Am Geriatr Soc 1995;43:1214–1221.
9. Chaudhry SI, Krumholz HM, Foody JM. Systolic hypertension in older persons. JAMA 2004;292:1074–1080.
10. Amery A, Birkenhager W, Brixko P et al. Mortality and morbidity results from the European Working Party on High Blood Pressure in the Elderly Trial. Lancet 1985;1:1349–1354.
11. Mulrow CD, Cornell JA, Herrera CR et al. Hypertension in the elderly. Implications and generalizability of randomized trials. JAMA 1994;272: 1932–1938.
12. Systolic hypertension in the elderly program cooperative research group. Prevention of stroke by antihypertensive drug treatment in older persons with isolated systolic hypertension. JAMA 1991;265:3255–3264.
13. Dahlof B, Lindholm LH, Hansson L et al. Morbidity and mortality in the Swedish Trial in Old Patients with Hypertension (STOP-Hypertension). Lancet 1991;338:1281–1285.
14. Gross CP, Mallory R, Heiat A et al. Reporting the recruitment process in clinical trials: Who are these patients and how did they get there? Ann Intern Med 2002;137:10–16.
15. Gueyffier F, Bulpitt C, Boissel J-P et al. Antihypertensive drugs in very old people: A subgroup meta-analysis of randomized controlled trials. Lancet 1999;353:793–796.
16. Imai Y, Watanabe N, Hashimoto J et al. Muscle cramps and elevated serum creatine phosphokinase levels induced by beta-adrenoceptor blockers. Eur J Clin Pharmacol 1995;48:29–34.

17. Mosenkis A, Townsend RR. Muscle cramps and diuretic therapy. J Clin Hypertens 2005;92:134–135.
18. Chen K, Chiou C-F, Plauschinat CA et al. Patient satisfaction with antihypertensive therapy. J Hum Hypertens 2005;10:793–799.
19. Cheung BM, Wong YL, Lau CP. Queen Mary utilization of antihypertensive drugs study: Side-effects of antihypertensive drugs. J Clin Pharm Ther 2005;4: 391–399.
20. Kuo H-K, Sorond F, Iloputaife I et al. Effect of blood pressure on cognitive functions in elderly persons. J Gerontol A Biol Sci Med Sci 2004;59A:1191–1194.
21. Onder G, Penninx BW, Balkrishnan R et al. Relation between use of angiotensin-converting enzyme inhibitors and muscle strength and physical function in older women: An observational study. Lancet 2002;359:926–930.
22. Wiens M, Etminan M, Gill SS et al. Effects of antihypertensive drug treatments on fracture outcomes: A meta-analysis of observational studies. J Intern Med 2006;260:350–362.
23. Agostini JV, Han L, Tinetti ME. The relationship between number of medications and weight loss or impaired balance in older persons. J Am Geriatr Soc 2004;52:1719–1723.
24. Lord SR, Ward JA, Williams P et al. An epidemiological study of falls in older community-dwelling women: The Randwick Falls and Fractures study. Aust J Public Health 1993;17:240–245.
25. Rozenfeld S, Camacho LA, Veras P. Medication as a risk factor for falls in older women in Brazil. Pan Am J Public Health 2003;13:369–375.
26. Agostini JV, Tinetti ME, Han L et al. Association between antihypertensive medication use and non-cardiovascular outcomes in older persons. J Gen Intern Med 2007;22:1661–1667.
27. Gurwitz JH, Field TS, Harrold LR et al. Incidence and preventability of adverse drug events among older persons in the ambulatory setting. JAMA 2003;289:1107–1116.
28. Weingart SN, Gandhi TK, Seger AC et al. Patient-reported medication symptoms in primary care. Arch Intern Med 2005;165:234–240.
29. Gandhi TK, Weingart SN, Borus J et al. Adverse drug events in ambulatory care. N Engl J Med 2003;348:1556–1564.
30. Epstein RM, Alper BS, Quill TE. Communicating evidence for participatory decision making. JAMA 2004;291:2359–2366.
31. Dickinson D, Raynor DK. What information do patients need about medicines? Ask the patients—they may want to know more than you think. BMJ 2003;327:861–864.
32. Elwyn G, Edwards A, Britten N. What information do patients need about medicines? "Doing prescribing": How doctors can be more effective. BMJ 2003;11:864–867.
33. Lenert L, Kaplan RM. Validity and interpretation of preference-based measures of health-related quality of life. Med Care 2000;38(9 Suppl): II138–II150.
34. Roccaforte WH, Burke WJ, Bayer BL et al. Validation of a telephone version of the mini-mental state examination. J Am Geriatr Soc 1992;40:697–702.
35. Tinetti ME, McAvay G, Fried TR et al. Development of a tool for eliciting patient priority in the tradeoff among cardiovascular, medication symptoms, and fall injury outcomes. J Am Geriatr Soc 2008;56:730–736.
36. Campbell AJ, Borrie M, Spears GF. Risk factors for falls in a community-based prospective study of people 70 years and older. J Gerontol 1989;44: M112–M117.
37. Fillenbaum GG. Multidimensional Functional Assessment of Older Adults: The Duke Older Americans Resources and Services Procedures. Hillsdale, NJ: Erlbaum, 1998.
38. Kroenke K, Spitzer RL, Williams JB. The Patient Health Questionnaire-2. Med Care 2003;41:1284–1292.
39. Guralnik JM, Ferrucci L, Simonsick EM et al. Lower-extremity function in persons over the age of 70 years as a predictor of subsequent disability. N Engl J Med 1995;332:556–561.
40. ACA System for Adaptive Conjoint Analysis (on-line). Available at: www.sawtoothsoftware.com/download/techpap/acatech.pdf Accessed May 16, 2008.
41. Ryan M, McIntosh E, Shackley P. Methodological issues in the application of conjoint analysis in health care. Health Econ 1998;7:373–378.
42. Hoffrage U, Gigerenzer G, Krauss S et al. Representation facilitates reasoning: What natural frequencies are and what they are not. Cognition 2002;84:343–352.
43. Edwards A, Elwyn G, Mulley A. Explaining risks: Turning numerical data into meaningful pictures. BMJ 2002;324:827–830.
44. Field TS, Gurwitz JH, Harrold LR et al. Risk factors for adverse drug events among older adults in the ambulatory setting. J Am Geriatr Soc 2004;52: 1349–1354.
45. Fried TR, Bradley EH, Towle VR et al. Understanding the treatment preferences of seriously ill patients. N Engl J Med 2002;346:1061–1066.
46. Murphy DJ, Burrows D, Santilli S et al. The influence of the probability of survival on patients' preferences regarding cardiopulmonary resuscitation. N Engl J Med 1994;330:545–549.
47. Fraenkel L, Gulanski B, Wittink D. Preference for hip protectors among older adults at high risk for osteoporotic fractures. J Rheumatol 2006;33:2064–2068.
48. McNeil BJ, Weichselbaum R, Pauker SG. Speech and survival: Tradeoffs between quality and quantity of life in laryngeal cancer. N Engl J Med 1981;305:982–987.
49. McNeil BJ, Pauker SG, Sox HC Jr et al. On the elicitation of preferences for alternative therapies. N Engl J Med 1982;306:1259–1262.
50. Devereaux PJ, Anderson DR, Gardner MJ et al. Differences between perspectives of physicians and patients on anticoagulation in patients with atrial fibrillation: Observational study. BMJ 2001;323:1218–1222.
51. Souchek J, Stacks JR, Brody B et al. A trial for comparing methods for eliciting treatment preferences from men with advanced prostate cancer: Results from the initial visit. Med Care 2000;38:1040–1050.
52. Kim S, David Goldstein D, Lynn Hasher L et al. Framing effects in younger and older adults. J Gerontol B Psychol Soc Sci 2005;60B:P215–P218.
53. Fraenkel L, Bogardus ST, Felson DT et al. Treatment options in knee osteoarthritis: The patient's perspective. Arch Intern Med 2004;164:1299–1304.
54. Janis IL, Mann L. Decision-making. A Psychological Analysis of Conflict, Choice, and Commitment. New York: The Free Press, 1985.
55. Ioannidis JP, Lau J. Completeness of safety reporting in randomized trials: An evaluation of 7 medical areas. JAMA 2001;285:437–443.
56. Vandenbrouke JP. When are observational studies as credible as randomized trials? Lancet 2004;363:1728–1731.
57. Physician Quality Reporting Initiative [on-line]. Available at: www.cms.hhs.gov/pqri Accessed February 13, 2008.