Qual Life Res (2007) 16:1179–1191
DOI 10.1007/s11136-007-9216-2

Change in health status and mortality as indicators of outcomes: comparison between the Medicare Advantage Program and the Veterans Health Administration

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Received: 11 August 2006 / Accepted: 6 April 2007 / Published online: 25 May 2007

Abstract
Background Comparing health outcomes with adequate methodology is central to performance assessments of health care systems. We compared the Medicare Advantage Program (MAP) and the Veterans Health Administration (VHA) with regard to changes in health status and mortality.
Methods We used the Death-Master-File for vital status and the Short-Form 36 to determine physical (PCS) and mental (MCS) health at baseline and at 2 years. We compared the probability of being alive with the same or better (than would be expected by chance) PCS (or MCS) at 2 years and mortality, while adjusting for case-mix. Given the geographic variations in MAP enrollment, we did a regional sub-analysis.
Results There were no significant differences in the probability of being alive with the same or better PCS except for the South (VHA 65.8% vs. MAP 62.5%, $P = .0014$). VHA patients had a slightly higher probability than MAP patients of being alive with the same or better MCS (71.8% vs. 70.1%, $P = .002$) but no significant regional variations. The hazard ratios for mortality in the MAP were higher than in the VHA across all regions.
Conclusion With the use of appropriate methodology, we found small differences in 2-year health outcomes that favor the VHA.

Keywords Health status · Mortality · Outcomes · Elderly · Health care system comparison

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Introduction

With growing demands on health care managers to demonstrate greater accountability for the value of the services they provide, comparisons of outcomes of care across health care systems have become increasingly important [1, 2]. Outcome comparisons are often used to determine where the best care is being given and where it needs to be improved. That information sets the stage for deeper analysis to identify best practices that can be more widely adopted to provide better quality of care [3–5].

To date, most cross-system comparison efforts have focused on hospitalizations, examining mortality, length of

stay, and charges [6–8]. While these are clearly important outcomes, they are fairly limited. Especially from many consumers' perspectives, self-perceived health outcomes are more important because they capture the patients' experiences and perspectives [9]. However, cross-system comparison studies with regard to health outcomes raise a number of challenging methodological issues [10–12]. First, the measurement of health status, including change over time, was done differently in these studies. One approach was to calculate change as a simple difference between baseline and follow-up scores. In a second approach, patients were classified into categories of change as the same, better or worse; which has the advantage of describing the proportion of patients with follow-up scores that differ from those at baseline. Second, the presentation of mortality with regard to change in self-reported health status was also done differently. One approach was to present mortality separately from change. Another approach classified patients who died with those with ''worse'' self-reported health status. Third, it proved difficult in these studies to control adequately for patient characteristics (case-mix).

There is an opportunity to address these methodological issues in a cross-system comparison between two large health care organizations: the Medicare Advantage Program (MAP) and the Veterans Health Administration (VHA). The MAP (formerly Medicare + Choice) provides comprehensive health services to 4.6 million enrollees (12% of the Medicare population) through Medicare contracted managed care plans across the US [13]. The VHA is a large fully integrated health care system that provides care to eligible veterans nationwide [14]. These two health care systems serve similar age groups. They have good data sources containing comparable information on patients' sociodemographics and medical conditions, which are important for case-mix adjustment. Furthermore, they use almost identical questionnaire surveys to determine patient health status, which can be used both as a measure of outcome and as a way to adjust for patient differences at baseline.

In an effort to advance the field, we report in this paper on the development and application of new methodologies that incorporate the outcomes of self-reported health status and mortality when making cross-system comparisons. We have demonstrated the use of these methods in a comparison of the MAP and VHA with regard to two-year changes in health status and mortality. To make this comparison, we have examined additional issues such as adjustment for case-mix differences. We also evaluated whether outcomes differ by US geographic region since regional variations do exist regarding health status [15] and Medicare Managed Care enrollment [16]. We examined three specific research questions (1) Are there differences in patient characteristics between the MAP and the VHA? (2) Are there differences in the change in health status and/or mortality between the MAP and the VHA after controlling for differences in case-mix? and (3) Do geographical variations account for differences in change in health status and/or mortality between the MAP and the VHA after controlling for differences in case-mix?

Methods

Study population

The study population from each health care system was restricted to a more comparable subset (Fig. 1).

The MAP cohort was from the Medicare Health Outcomes Survey (HOS) (formerly the Health of Seniors survey), which randomly selected a cohort of 1,000 beneficiaries who were continuously enrolled for at least 6 months in each of the Medicare managed care plans [17]. All Medicare managed care plans participated. The Medicare HOS cohort was limited to those beneficiaries age 65 and older who had personal-level identifiers needed to link the HOS data to other databases. Given the disproportionate male representation in the VHA cohort (97.9% VHA male patients vs. 51.6% MAP male patients), both MAP and VHA analyses were limited to male patients.

The MAP cohort began with a baseline Medicare HOS sample of 62,614 male seniors who completed a baseline HOS survey between 6/5/98 and 7/28/98. A completed survey was defined as a survey with calculable physical and mental health summary scores. Of those patients, 4,582 (7.3%) died during the 2-year follow-up period. Among those alive at 2 years, 26,767 (46.1%) did not have a follow-up survey because their plan no longer participated in Medicare managed care or the beneficiaries themselves were no longer enrolled in the plan. Only Medicare beneficiaries whose plans remained in Medicare managed care were surveyed at 2 years between 4/17/00 and 10/1/00, resulting in a sample size of 31,343 patients. Those who were followed with survey administrations at 2 years had a slightly better health status than those who were not followed (see Appendix A). Among the 31,343 patients surveyed at 2 years, 27,285 (87%) responded. Those who did not respond (N = 4,058) were predominantly older, more likely to be a racial minority, less well educated and low income, and to have worse baseline physical and mental health (Appendix B). Among the respondents, 26,225 (96.1%) had follow-up surveys with calculable physical and mental health summary scores. Those with incomplete follow-up data (N = 1,060) were predominantly older, more likely to be a racial minority, less well educated and

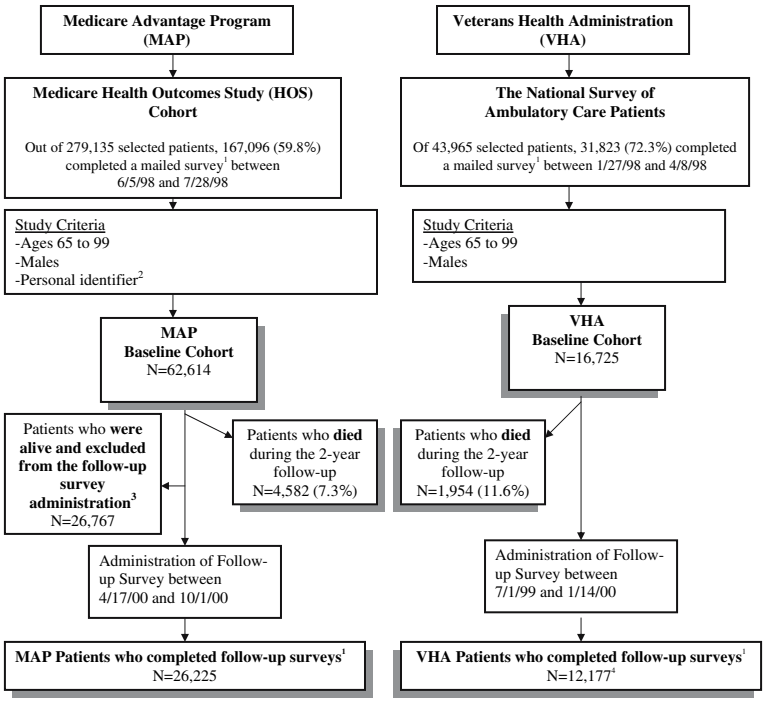

Fig. 1 Formation of Study Cohorts: [1] A completed survey was defined as a survey with calculable physical and mental health summary scores. [2] Spouses of Medicare beneficiaries have the same social security number of the primary Medicare beneficiaries. Therefore, only primary Medicare beneficiaries have personal identifier (SSN) to link them with non-Medicare-HOS databases in the analysis. [3] Patients in the baseline HOS cohort were not surveyed at 2 years because their plan no longer participated in Medicare managed care or the beneficiaries themselves were no longer enrolled in the plan. [4] Among the 12,177 patients with completed surveys, 427 died at 2 years. These 427 patients were included in the group of VHA patients who died during the 2-year follow-up period, making the total number of deaths 1,954 (11.6%) and the VHA follow-up cohort of 11,750

low income, and to have worse baseline physical and mental health (Appendix C).

The VHA cohort was from the National Survey of Ambulatory Care Patients, which randomly surveyed 43,965 veterans from all Veterans Integrated Service Networks (VISNs) who had at least one outpatient visit between 1/1/97 and 12/17/97 [18]. The baseline survey administration took place between 1/27/98 and 4/8/98. For the purpose of this study, analyses were limited to male veterans age 65 and older with completed surveys. A completed survey was defined as a survey with calculable physical and mental health summary scores. Thus, the VHA baseline sample consisted of 16,725 elderly veterans. Of those patients, 13,134 responded to a mailed follow up survey at 18 months (between 7/1/99 and 1/14/00). Those who did not respond (N = 2,114) were more likely to be a racial minority, not married and less well educated, and to have worse baseline mental health (Appendix B). Of the 13,134 veterans, 12,177 had follow-up surveys with calculable physical and mental health summary scores. Those patients with incomplete follow-up surveys (N = 957) were predominantly older, more likely to be less well educated, and had worse physical health (Appendix C). Among 12,177 patients, there were 427 patients who died in the 6 months period between the surveys at 18-month and the end of the 2-year follow-up. For the purpose of analysis, these 427 patients were included in the group of VHA patients who died during the 2-year follow-up period, making the total number of deaths 1,954 (11.6%).

Outcome measures

The Medicare-HOS and the National Survey of Ambulatory Care Patients used the Medical Outcome Study (MOS) SF-36 [19] and the Veterans Rand 36-Item Health Survey (VR-36 formerly called the Veterans SF-36 Health Survey) [20], respectively, to measure health status. The VR-36 is a modification of the RAND 36-Item Health Survey 1.0 that was developed at the RAND Corporation as part of the Medical Outcomes Study [21]. It differs from the MOS SF-36 in the use of 5-point response choices for the role limitations due to physical problems and the role limitations due to emotional problems. There are validated conversion formulas that allow for comparisons of VR-36 scores to studies that have used the MOS SF-36 [22]. These scales were summarized into physical (PCS) and mental component (MCS) scales [23]. For the analysis, we used the ''observed'' PCS and MCS scores [24]. These scores

were calculated by using a linear *t*-score transformation to have a mean of 50 and a standard deviation of 10 based upon the 1998 US population norms.

We used the Death Master File (DMF) from the Social Security Administration (SSA) to ascertain vital status. The SSA DMF is a reliable national source of mortality data [25].

Based on a conceptual framework that patient health lies on a continuum from well-being to death [26], we have chosen three health outcomes: (1) the probability of being alive with the same or better (than would be expected by chance) PCS at 2 years, (2) the probability of being alive with the same or better (than would be expected by chance) MCS at 2 years and (3) mortality. The composite outcome measures of being alive with ''the same or better'' PCS (or MCS) at follow-up reflect the health care goal of maintaining or improving the physical and mental health status of elderly patients [27]. Mortality, our other outcome, is a measure that is particularly relevant to elderly patients and might reflect potentially poor quality of care [28]. Its inclusion also offers unique opportunity to verify and extend the findings from our previous work [29]. These health outcomes were adjusted for case-mix.

Case-mix variables for risk-adjustment

Building upon prior work [30, 31], we used three domains of risk: sociodemographics, co-morbidities and baseline health status. Since the risk for our health outcomes differs by demographic subgroup, we have selected the following sociodemographics variables: age, race/ethnicity, marital status, education and income [32]. Because substantial variations in health status among patients with different diagnoses exist, we have picked a group of conditions that are commonly encountered in clinic visits and are known to be major indicators of health status. These are coronary artery disease, congestive heart failure, stroke, hypertension, diabetes, chronic obstructive pulmonary disease (COPD) and asthma, and cancer (other than skin cancer) [33]. We also included in the risk-adjustment models for mortality baseline physical (PCS) and mental (MCS) health status because they are important predictors of survival [34]. These baseline scores, however, were not included in the PCS and MCS models because their coefficients are influenced by the baseline score measurement error and inter-temporal correlation. All the case-mix variables in our analyses correspond to characteristics of individual patients obtained in their baseline surveys.

Statistical analysis

In order to examine the differences in patient characteristics between the MAP and VHA, we compared them in terms of sociodemographics, comorbid conditions and PCS and MCS scores. Chi-square tests were used to examine differences between the two groups in categorical variables and *t*-tests were used to examine differences in continuous variables.

To compare change in health status between the MAP and VHA, we first calculated the change in PCS (or MCS) points per 2 years because the average follow-up interval was different between the MAP and VHA. Subsequently, we converted the change in PCS (or MCS) points per 2 years into a probability of having PCS (or MCS) the same or better in order to combine them with the probability of being alive. These steps were performed as follows:

Calculating the change in PCS (or MCS) points per 2 years

We took the difference between the PCS (or MCS) baseline and follow-up scores for each health care system using 25,491 MAP and 11,591 VHA patients who completed the baseline and follow-up surveys. We divided it by the median difference, in years, between the baseline and follow-up surveys (in the MAP and the VHA these numbers were 1.58 years and 1.97 years, respectively). The reason for using the median time instead of the actual time is that late surveys tend to be different (in the MAP cohort they tend to be sicker respondents) and follow-up protocols differed. This calculation provided us with the ''unadjusted'' change in PCS (or MCS) points per year, which we multiplied by 2 to get the change in PCS (or MCS) points per 2 years.

Calculating and comparing ''adjusted'' change in PCS (or MCS) points per 2 years

Least Square Means models were used to calculate the adjusted mean change in PCS (or MCS) points per 2 years for each heath care system, so the systems would be as equivalent as possible in terms of sociodemographic characteristics and chronic conditions.

Conversion into a probability of having the same or better PCS (or MCS) at 2 years

To compute the conversion parameter estimates, we used harmonic regression models. This statistical method was selected given the asymptotic variance of a time-varying variable such as change in PCS (or MCS). The harmonic regressions were applied to the Medicare-HOS database that is organized by health plans because the behavior of group change is not immediately derived from the individuals' change. The cut-off points for the operational definition of ''the same or better'' were two standard errors

of measurement for a single score or 1.414 standard errors of change. From this definition, a ''the same or better'' group mean change was calculated to be –5.66 points or higher for PCS and –6.72 points or higher for MCS. The resulting harmonic slope and intercept estimates were used in a linear conversion equation (Probability of having PCS (or MCS) the same or better at 2 years = ''adjusted'' mean change in PCS (or MCS) points per 2 years * slope + intercept).

Calculating the probability of being alive and combining that with the probability of having the same or better PCS (or MCS) at 2 years

We calculated the probability of being alive as (1—probability of death). The model for death was calculated separately from the models for ''the same or better PCS (or MCS) at 2 years'' for two reasons. First, the population on which death can be assessed with reasonable case-mix controls consists of all persons who completed the baseline survey. This is a different sample from those who were followed up with survey administrations. Thus, we used the full baseline sample of 62,614 MAP and 16,725 VHA patients. Second, death outcomes come from a source that is independent from the survey administrations, and therefore do not share any correlated error with baseline assessments. We determined the vital status of each patient during the 2-year follow-up period, starting at the date of the survey. We used an exact match on social security number to identify death records in the DMF. To combine that with the probability of having PCS (or MCS) the same or better at 2 years, we used the following formula: (1—Probability of death) * (Probability of the same or better PCS (or MCS) at 2 years). To compare the composite outcomes between the MAP and VHA, we used tests of significance based on the standard error of the difference.

We used Cox regression models to estimate hazard ratios (HR) of dying with 95% confidence intervals (CI) for the MAP compared with the VHA patients. We calculated the adjusted 2-year mortality rates for each health care system as its observed mortality rate divided by its expected mortality rate, multiplied by the mean of the observed mortality rate for all study patients across both systems.

To examine whether geographical variations account for differences in change in health status and mortality between the MAP and VHA, we grouped the MAP and VHA patients into 4 geographic regions: (1) Northeast region: north of Virginia and east of Ohio; (2) South region: south of (and including) Virginia and east of the Mississippi River; (3) Midwest region: west of (and including) Ohio; and (4) West region: west of (and including) Colorado. The District of Columbia and Puerto Rico were included in the South region. Alaska and Hawaii were included in the West region. These geographic groupings were adapted from the census 2000 veteran population in the US [35]. We examined geographical variations in the patient characteristics, probability of being alive with PCS (or MCS) the same or better and mortality between the MAP and VHA. The test of significance was adjusted for multiple comparisons using a Bonferroni correction. We divided .05 by the 8 group comparisons of being alive with the same or better PCS (or MCS) at 2 years between the MAP and VHA, resulting in a significant level of .006 as the cut-off.

Results

Table 1 shows the sociodemographic and clinical features of the MAP and VHA patients. The VHA patients were less likely to be white and had lower education and income. VHA patients were also significantly more likely than MAP beneficiaries to have a history of various coexisting conditions. As reflected by their low PCS and MCS scores, the VHA patients had significantly lower health status than MAP beneficiaries.

Table 2 shows that the adjusted probabilities of being alive with the same or better PCS at 2 years were comparable between the two health care systems (63.6% and 64.4%, respectively). The adjusted probability of being alive with the same or better MCS at 2 years in the VHA was significantly higher than in the MAP but the magnitude of the difference was small (71.8% vs. 70.1%, respectively).

The adjusted 2-year mortality rates were 9.2% and 7.5% for the MAP and VHA, respectively, with a significantly higher hazard ratio for mortality in the MAP compared with the VHA (HR, 1.363 [95% CI 1.275–1.458]).

Table 3 presents the sociodemographic and clinical features of the MAP and the VHA patients by geographic regions. In the MAP, the West region has the largest population, reflecting a large presence of managed care programs. MAP patients in the South and West regions were more likely to be African-Americans and Hispanics, respectively. The West region had the highest educational and income levels. The frequencies of medical conditions and PCS/MCS scores were similar across the geographic regions. In the VHA, the South region has the largest population. VHA patients were more likely to be African-Americans and Hispanics in the South and West regions, respectively. The South region had higher prevalence of conditions such as cardiovascular, pulmonary and cancer and the lowest PCS and MCS scores compared to the other three geographic regions.

Table 1 Baseline characteristics of MAP and VHA patients

	MAP (N = 62,614)	VHA (N = 16,725)
Age, years (*SD*)	73.5 (±6)	73.5 (±5)
Race/ethnicity		
Whites	92.5%	85.8%
Blacks	5.7%	8.7%
Hispanics	1.8%	5.4%
Marital status		
Married	78.6%	70.4%
Widowed	11.2%	9.0%
Divorced	6.6%	12.1%
Separated	0.9%	2.1%
Never married	2.6%	6.3%
Income		
<$20,000	41.4%	73.6%
Education		
<12 years	30.0%	43.1%
Comorbidities		
Diabetes	18.2%	35.9%
Hypertension	49.3%	71.1%
Angina	20.5%	39.0%
Myocardial infarction/ CAD	15.3%	31.7%
CHF	7.7%	29.6%
Stroke	8.7%	18.4%
COPD	12.9%	30.5%
Cancer	14.2%	24.5%
PCS, points (*SD*)	44.3 (±11.0)	31.7 (±10.6)
MCS, points (*SD*)	52.5 (±9.8)	44.1 (±12.0)

All comparisons between MAP and VHA were significant at $P < .05$ except for age ($P = .3564$)

SD = Standard deviation

PCS = Physical component summary

MCS = Mental component summary

The HR for mortality in the MAP were significantly higher than those in the VHA across all 4 geographic regions (Table 4). The VHA patients in the South had a significantly higher adjusted probability of being alive with the same or better PCS at 2 years than the MAP patients (65.8% vs. 62.5%, $P = .0014$). MAP patients in the Northeast had a higher adjusted probability of being alive with the same or better PCS at 2 years (64.2% vs. 62.3%) but it was not statistically significant after applying the Bonferroni correction. The VHA patients had higher adjusted probabilities of being alive with the same or better MCS at 2 years than the MAP patients in all 4 geographic

Table 2 Change in health status by health care system

Health care system	N (baseline cohorts)	Probability of being alive[b]	N (follow-up cohorts)	Change in PCS points per 2 years		Change in MCS points per 2 years		Probability of the same or better (than would be expected by chance) PCS at 2 years (%)	Probability of being alive with the same or better (than would be expected by chance) PCS at 2 years (%)	Probability of being alive with the same or better (than would be expected by chance) MCS at 2 years (%)*
				Unadjusted	Adjusted[a]	Unadjusted	Adjusted[a]			
MAP	62,614	90.8%	26,225	–2.13	–2.14	–1.10	–1.20	70.0	77.2%	63.6%	70.1%
VHA	16,725	92.4%	11,750	–2.16	–2.21	–1.65	–1.10	69.7	77.7%	64.4%	71.8%

[a] The adjustment variables for PCS (or MCS) the same or better included sociodemographics (age, race/ethnicity, marital status, education, and income), and comorbidities (hypertension, diabetes, angina/myocardial infarction (coronary artery disease), congestive heart failure, stroke, COPD and asthma, and cancer (other than skin cancer))

[b] The adjustment variables for survival/mortality included sociodemographics (age, race/ethnicity, marital status, education, and income), comorbidities (hypertension, diabetes, angina/myocardial infarction (coronary artery disease), congestive heart failure, stroke, COPD and asthma, and cancer (other than skin cancer)), and baseline health status (PCS and MCS scores)

*$P = .002$

PCS = Physical component summary

MCS = Mental component summary

Table 3 Patient Characteristics in the Medicare Advantage Program and Veterans Health Administration Cohorts by Geographic Regions

	MAP				VHA			
	Northeast (*N* = 5,978)	South (*N* = 6,924)	Midwest (*N* = 5,107)	West (*N* = 8,628)	Northeast (*N* = 2,433)	South (*N* = 3,801)	Midwest (*N* = 2,848)	West (*N* = 2,500)
Age, years (*SD*)	73.1 (±5)	72.7 (±5)	73.3 (±5)	73.7 (±5)	73.6 (±5)	73.1 (±5)	73.3 (±5)	73.4 (±5)
Racial/ethnic groups								
Whites	94.9%	90.0%	94.7%	94.6%	94.4%	81.5%	92.3%	85.1%
Blacks	4.7%	7.7%	4.9%	2.0%	7.3%	11.7%	6.4%	5.5%
Hispanics	0.3%	2.2%	0.3%	3.3%	2.2%	6.6%	1.1%	9.3%
Marital status								
Married	79.8%	80.9%	80.7%	80.0%	67.7%	75.9%	72.3%	70.2%
Income								
<$20,000	39.9%	42.0%	38.9%	35.2%	73.2%	74.9%	68.3%	73.9%
Education								
<12 years	31.9%	30.0%	27.9%	21.8%	42.6%	46.9%	46.6%	f32.5%
Comorbidities								
Diabetes	17.1%	18.1%	15.5%	16.0%	33.9%	34.7%	33.9%	31.4%
Hypertension	49.5%	49.5%	49.5%	46.4%	70.0%	74.4%	70.4%	69.5%
Angina	19.3%	19.0%	19.7%	18.8%	37.7%	43.1%	35.8%	36.2%
MI	13.1%	13.5%	14.4%	14.1%	28.6%	34.2%	29.7%	30.5%
CHF	5.5%	6.4%	6.9%	6.3%	23.9%	33.5%	27.5%	25.8%
Stroke	6.5%	7.5%	6.9%	7.6%	15.8%	19.1%	17.4%	18.3%
COPD	11.1%	11.6%	11.0%	12.7%	26.2%	31.7%	28.9%	29.4%
Cancer	12.6%	13.5%	12.8%	14.2%	20.0%	25.3%	22.9%	22.5%
PCS, points (*SD*)	46.1 (±10.2)	45.0 (±10.8)	45.0 (±10.4)	44.8 (±10.7)	34.6 (±10.8)	30.1 (±10.0)	32.5 (±10.4)	33.0 (±10.7)
MCS, points (*SD*)	53.3 (±9.1)	53.3 (±9.4)	53.3 (±9.1)	53.4 (±9.2)	45.1 (±11.8)	43.0 (±12.4)	45.9 (±11.6)	46.0 (±11.9)

20 HOS and 9 VA subjects were unclassified

SD = Standard deviation; PCS = Physical component summary; MCS = Mental component summary

regions but they were not statistically significant after applying the Bonferroni correction.

Discussion

The need for methodological tools to compare health care systems with regard to health outcomes is becoming critical as efforts to contain health care costs and concerns about the quality of care increases [36]. Our study addressed three important methodological issues for cross-system comparisons: (1) measurement of health status, including changes over time, (2) the incorporation of vital status into a comprehensive measure reflecting change in health status and (3) risk adjustment for patient characteristics.

First, the SF-36 and its shorter version (SF-12) and their veteran counterparts (VR-36 and VR12) have been adopted as quality measures by Medicare [37] and VHA [38], and hence are increasingly available for use in cross-system comparisons. As with Medicare and VHA it is unlikely, however, that the administration of health status questionnaires will be performed in a coordinated manner across health care systems. Under these circumstances, our study methods offer a new means to make the health status estimates commensurate for cross-system comparisons. It is a valid methodology as we found that the resulting probabilities of having the same or better PCS (or MCS) at 2 years for Medicare managed care plans calculated by the study methods and the actual probabilities were equivalent. This methodological strategy, therefore, represents an important advance that makes possible such evaluations and the information that comes from them, which may be useful for managers, consumers, and policy makers.

Second, not accounting for vital status may introduce significant bias in cross-system comparisons with regard to change in health status [39]. Most efforts have focused on accounting for death as a change in physical health status using imputation techniques [40, 41]. However, imputation methods that attempt to assign a value of physical health to

Table 4 Change in health status by geographic region

Geographic region	Health care system	Adjusted probability of being alive with the same or better PCS at 2 years*		Adjusted probability of being alive with the same or better MCS at 2 years*		Adjusted 2-year mortality rates*	Hazard ratio (95% CI)
Northeast	MAP	64.2%	$P = .068$	70.5%	$P = .023$	8.8%	1.482 (1.280–1.717)
	VHA	62.3%		73.8%		6.8%	1
South	MAP	62.5%	$P = .001$	68.4%	$P = .053$	9.2%	1.320 (1.171–1.489)
	VHA	65.8%		70.4%		8.0%	1
Midwest	MAP	61.9%	$P = .149$	69.0%	$P = .007$	10.6%	1.427 (1.229–1.656)
	VHA	63.1%		72.0%		8.4%	1
West	MAP	64.5%	$P = .251$	71.8%	$P = .437$	8.7%	1.305 (1.142–1.492)
	VHA	64.9%		72.0%		7.2%	1

* Adjustment for sociodemographics (age, race/ethnicity, marital status, education, and income), comorbidities (hypertension, diabetes, angina/myocardial infarction (coronary artery disease), congestive heart failure, stroke, COPD and asthma, and cancer (other than skin cancer)), and baseline health status (PCS and MCS scores)

The test of significance was corrected for multiple comparisons (Bonferroni correction) at .006 as the cut-off

PCS = Physical component summary

MCS = Mental component summary

death can be affected by the variance of the mortality rates [42]. Our strategy offers several advantages. First, it uses the full sample of patients who completed the baseline survey. This allows obtaining parameter estimates based on the largest number of patients. Second, the combination of the probability of being alive is not limited to physical health. It can be combined with mental health. Third, adjustment for case-mix is possible with a clinically credible risk adjustment model that has good performance properties using sociodemographics, diagnoses, and baseline health status data [43].

Third, the validity of our risk adjustment method is based on the accuracy and completeness of the specific covariates included in the risk adjusted models. Miller et al. analyzed the validity of the information from the Medicare-HOS and VHA databases, and found reliable and valid levels of agreement between self-reported conditions of the HOS and the ICD-9-CM diagnosis codes from VHA databases [44]. Other studies confirm such findings [45, 46]. The associations among sociodemographic characteristics, diagnoses and change in PCS and MCS were consistent with the literature [33]. However, controlling for sociodemographics and comorbid illnesses explained only a fraction of the variance in the outcomes measured. The pseudo R^2 was .0023 for PCS the same or better and .0038 for MCS the same or better. The same has been true in other studies [47]. The mortality model had a c-statistic (discriminative power) of .745, which was equal or superior to values obtained in risk-adjusted mortality models for inpatient populations [48, 49].

After adjusting for their higher prevalence of chronic disease and worse self-reported health in the VHA, we found small differences in 2-year health outcomes that favor the average elderly male patient cared for in the VHA. The same is true of other studies [43, 50]. There are a number of factors that may explain our finding of differences in outcome between the MAP and VHA. Over the past decade, the VHA has undergone substantial reorganization, and has instituted changes that are responsive to the healthcare needs of the veteran community, including improvement in equity of access among ethnic minorities [51]. Studies conducted since this reorganization have documented significant improvements in the management of patients with chronic medical conditions and mental health problems [52, 53].

Regionally, the South showed the average elderly male patient in the VHA had higher probabilities of being alive with the same or better physical health compared to those in the MAP. The VHA budgetary allocation system offers a possible explanation for our finding. Since April 1997, the Veterans Equitable Resource Allocation (VERA) model has been used to determine the medical care budgets for the 21 Veterans Integrated Services Network (VISNs) that comprise the VHA. By 2001, the VISNs that saw the biggest increases in resources were nearly all located in the south and southwest. Our observations reveal that patients in this geographic region were sicker than the others, and hence would be more likely to benefit if improved medical care resulted from these budgetary decisions [54, 55].

There are a number of limitations in this study that might affect our results. First, the SF-36 may be insensitive

to further decline, which would bias against documenting worsening health status in patients who are already severely ill (''floor effect''). Against this is the finding of other investigators that over half of the patients with low health status were able to report that their health status subsequently declined further [56].

Second, the two surveys were conducted using different sampling strategies. The VHA sample was a population-based survey of all patients in the VHA. The MAP sample was based on sampling at the plan level, with follow-up survey data subject to continued plan participation in Medicare and the survey respondent's continuous enrollment in the plan. Since the MAP patients who were followed with survey administrations were healthier, they could bias the MAP sample toward better outcomes. Our results, however, were for worse outcomes in the MAP, indicating that our findings are, if anything, conservative. Third, our risk-adjustment methodology did not control for unobservable variables such as risk preferences that could be correlated with the health care systems. Fourth, there were small variations in the Medicare-HOS response rates by region (Northeast 61.9%, Midwest 61.8%, West 60.9% and South 57.1%). Fifth, studies of the regional and national utilization of the VA and the Medicare health systems report substantial dual Medicare-VA service use by the elderly veterans eligible under both systems [57]. To examine this issue, we conducted a subgroup analysis on 4,603 (43%) veterans who reported receiving dual care during the study period. Compared with MAP patients, the dual care patients had a lower probability of PCS the same or better (70% vs. 68%, respectively) but a similar probability of MCS the same or better (77% vs. 77%, respectively). This is also true in the literature [58]. We found no significant regional variations in the dual care rates (Northeast 45.6%, Midwest 41.1%, West 41.3% and South 42.6%). Except for the South, the probabilities of PCS the same or better for MAP patients were slightly higher than those for dual care patients in other regions. There were no regional differences regarding the probability of MCS the same or better. Sixth, we also did a subgroup analysis on 5,933 (55%) veterans who reported receiving care only in the VHA during the study period. There were no regional differences in the rate of patients with VHA-only care. Those with VHA-only care and the overall VHA cohort had similar probability of PCS (or MCS) the same or better.

In summary, our study methods address a number of methodological complexities in cross-system comparisons and offer promise for advancing the field of assessing health care outcomes. The principal uses of this type of data should be to provide the community at large with timely, comprehensive information about outcomes related to performance assessments of health care systems and to better inform the policymakers, health care administrators, and consumers so they can make informed judgments and choices.

Acknowledgments The research in this article was supported by the Centers for Medicare & Medicaid Services (CMS) and the National Committee for Quality Assurance (NCQA) under Contract Numbers 500-00-0055 with NCQA, Office of Quality and Performance (OQP) of the Department of Veterans Affairs, The Center for Health Quality, Outcomes and Economic Research (CHQOER), Department of Veterans Affairs and Boston University School of Public Health. The views expressed in this article are those of the authors and do not necessarily reflect the views of the US Department of Health and Human Services, Centers for Medicare & Medicaid Services, or the National Committee for Quality Assurance, The Department of Veterans Affairs or Boston University. We are indebted to Drs. Samuel C (Chris) Haffer and Steven M. Wright for careful review of the manuscript.

Appendix

Appendix A Comparisons of baseline patient characteristics between MAP enrollees and disenrollees* during the study period

	MAP Enrollees (N = 31,343)	Disenrollees (N = 26,767)	P-value
Age, years (*SD*)	73.3 (±5)	73.1 (±5)	<.0001
Race/Ethnicity			
Whites	92.6%	92.2%	
Blacks	5.4%	6.1%	
Hispanics	1.9%	1.8%	.0014
Married	79.4%	79.0%	NS
Income <$20,000	40.2%	40.7%	NS
Education <12 years	28.4%	28.7%	NS
Comorbidities			
Diabetes	17.0%	17.7%	.0163
Hypertension	48.4%	49.5%	.0062
Angina	19.2%	20.5%	.0003
Myocardial Infarction/CAD	14.0%	15.0%	.0006
CHF	6.2%	7.0%	.0003
Stroke	6.5%	6.8%	NS
COPD	11.8%	12.2%	NS
Cancer	13.3%	13.1%	NS
PCS, points (*SD*)	45.0 (±10)	44.7 (±10)	.0015
MCS, points (*SD*)	53.9 (±9)	52.7 (±9)	.0002

SD = Standard deviation

NS = non significant

PCS = Physical component summary

MCS = Mental component summary

* Disenrollement during the study period occurred because the plan no longer participated in Medicare managed care or the beneficiaries themselves were no longer enrolled in the plan. These patients were not surveyed at 2 years

Appendix B Comparisons of baseline patient characteristics between respondents and non-respondents at 2 years in the Medicare Advantage Program and Veterans Health Administration

	MAP			VHA		
	Respondents (*N* = 27,285)	Non- respondents (*N* = 4,058)	*P*-value	Respondents (*N* = 13,134)	Non-respondents (*N* = 2,114)	*P*-value
Age, years (*SD*)	73.2 (±5)	73.8(±6)	<.0001	73.4 (±5)	73.5 (±5)	NS
Race/ethnicity						
Whites	93.4%	87.2%		86.5%	80.7%	
Blacks	4.7%	10.1%	<.0001	8.0%	13.1%	<.0001
Hispanics	1.8%	2.5%		5.4%	6.2%	
Married	80.2%	73.6%	<.0001	72.2%	61.8%	<.0001
Income <$20,000	38.8%	49.3%	<.0001	73.0%	75.8%	NS
Education <12 years	27.6%	33.6%	<.0001	42.6%	46.3%	.0016
Comorbidities:						
Diabetes	16.7%	18.5%	.0051	31.3%	33.4%	NS
Hypertension	48.4%	48.4%	NS	68.5%	69.2%	NS
Angina	19.2%	19.1%	NS	11.5%	10.9%	NS
Myocardial	13.8%	15.2%	.0179	6.2%	6.3%	NS
Infarction/CAD	6.3%	7.8%	.0003	11.7%	13.1%	NS
CHF Stroke	7.2%	9.6%	<.0001	7.9%	9.8%	.0021
COPD	11.7%	12.0%	NS	26.1%	26.8%	NS
Cancer	13.3%	13.2%	NS	21.6%	20.4%	NS
PCS, points (*SD*)	45.2 (±10)	44.2 (±11)	<.0001	32.0 (±10)	31.9 (±10)	NS
MCS, points (*SD*)	53.2 (±9)	51.7 (±10)	<.0001	44.6 (±12)	43.6 (±9)	<.0001

SD = Standard deviation

NS = non significant

PCS = Physical component summary

MCS = Mental component summary

Appendix C Comparisons of baseline patient characteristics between respondents with complete and those with incomplete surveys at 2 years in the Medicare Advantage Program and Veterans Health Administration

	MAP			VHA		
	Respondents with complete surveys (*N* = 26,225)	Respondents with incomplete surveys (*N* = 1,060)	*P*-value	Respondents with complete surveys (*N* = 12,177)	Respondents with incomplete surveys (*N* = 957)	*P*-value
Age, years (*SD*)	73.2 (±5)	74.9 (±6)	<.0001	73.3 (±5)	74.3 (±5)	<.0001
Race/ethnicity						
Whites	93.6%	89.7%		86.5%	85.7%	
Blacks	4.5%	7.6%		7.9%	8.9%	
Hispanics	1.7%	2.6%	<.0001	5.4%	5.2%	NS
Married	80.3%	77.5%	.0246	72.0%	74.2%	NS
Income <$20,000	38.4%	51.1%	<.0001	742.9%	73.9%	NS
Education <12 years	27.2%	37.5%	<.0001	42.2%	47.7%	.0013
Comorbidities:						
Diabetes	16.6%	21.1%	.0001	31.2%	33.8%	NS

Appendix C continued

	MAP Respondents with complete surveys (N = 26,225)	Respondents with incomplete surveys (N = 1,060)	P-value	VHA Respondents with complete surveys (N = 12,177)	Respondents with incomplete surveys (N = 957)	P-value
Hypertension	48.3%	51.2%	NS	68.4%	70.6%	NS
Angina	19.1%	21.4%	NS	11.3%	10.7%	NS
Myocardial infarction/ CAD	13.7%	16.8%	.0045	6.2%	6.3%	NS
CHF	6.2%	10.0%	<.0001	11.5%	13.5%	NS
Stroke	7.1%	10.7%	<.0001	7.7%	10.5%	.0017
COPD	11.7%	12.1%	NS	26.0%	28.3%	NS
Cancer	13.4%	12.9%	NS	21.6%	21.3%	NS
PCS, points (*SD*)	45.3 (±10)	42.2 (±10)	<.0001	32.1 (±10)	31.3 (±10)	.0329
MCS, points (*SD*)	53.3 (±9)	51.3 (±10)	<.0001	44.7 (±12)	44.1 (±11)	NS

SD = Standard deviation

NS = non significant

PCS = Physical component summary

MCS = Mental component summary

[a] A completed follow-up survey is defined as a survey that has calculable PCS and MCS scores

References

1. Brook , R. H., McGlynn E. A., & Cleary, P. D. (1996). Quality of health care. Part 2: Measuring quality of care. *The New England Journal of Medicine, 335*, 966–970.
2. Benson, D. S. (1992). *Measuring outcomes in ambulatory care*. Chicago, IL: American Hospital Publishing.
3. Aiken, L. H., Sochalski, J., & Lake, E. T. (1997). Studying outcomes of organizational change in health services. *Medical Care, 35*(11 Suppl), NS6–NS18.
4. Feachem, R. G., Sekhri, N. K., & White, K. L. (2002). Getting more for their dollar: A comparison of the NHS with California's Kaiser Permanente. *BMJ, 324*(7330), 135–141.
5. Talbot-Smith, A., Gnani, S., Pollock, A. M., & Gray, D. P. (2004). Questioning the claims from Kaiser. *The British Journal of General Practice, 54*, 415–421.
6. Miller, R. H., & Luft, H. S. (1997). Does managed care lead to better or worse quality of care? *Health Affairs (Millwood), 16*, 7–25.
7. Luft, H. S. (2003). Variations in patterns of care and outcomes after acute myocardial infarction for Medicare beneficiaries in fee-for-service and HMO settings. *Health Services Research, 38*, 1065–1079.
8. Gordon, H. S., Aron, D. C., Fuehrer, S. M., & Rosenthal, G. E. (2000). Using severity-adjusted mortality to compare performance in a Veterans Affairs (VA) hospital and in private sector hospitals. *American Journal of Medical Quality, 15*, 207–211.
9. Leplege, A., & Hunt, S. (1997). The problem of quality of life in medicine. *JAMA, 278*, 47–50.
10. Porell, F. W., & Miltiades, H. B. (2001). Disability outcomes of older Medicare HMO enrollees and fee-for-service Medicare beneficiaries. *Journal of American Geriatrics Society, 49*, 615–631.
11. Riley, G. (2000). Two-year changes in health and functional status among elderly Medicare beneficiaries in HMOs and fee-for-service. *Health Services Research, 35*, 44–59.
12. Ware, J. E. Jr, Bayliss, M., Rogers, W., et al. (1996). Differences in 4-year health outcomes for elderly and poor, chronically ill patients treated in HMO and fee-for service systems. *JAMA, 276*, 1039–1047.
13. Centers for Medicare & Medicare Services (CMS). (2005). HHS. Medicare program; establishment of the Medicare Advantage Program; interpretation. Final rule; interpretation. *Federal Register, 70*,13401–13402.
14. Kizer, K. W., Demakis, J. G., & Feussner, J. R. (2000). Reinventing VA health care: systematizing quality improvement and quality innovation. *Medical Care, 38*, I7–I16.
15. Au, D. H., McDonell, M. B., Martin, D. C., & Fihn, S. D. (2001). Regional variations in health status. *Medical Care, 39*, 879–888.
16. Penrod, J. D., McBride, T. D., & Mueller, K. J. (2001). Geographic variation in determinants of Medicare managed care enrollment. *Health Services Research, 36*(4), 733–750.
17. HEDIS® (2003). *Specifications for the Medicare Health Outcomes Survey* (Vol. 6). Washington, D.C.: National Committee for Quality Assurance.
18. Kazis, L. E., Skinner, K., Rogers, W., et al. (1998). *Health status and outcomes of Veterans: Physical and Mental component summary scores (SF-36V) 1998 National Survey of Ambulatory Care Patients: Mid-Year Executive Report*. Washington, D.C.: Department of Veterans Affairs: Veterans Health Administration Office of Performance and Quality.
19. Gandek, B., Sinclair, S. J., Kosinski, M., & Ware, J. E. Jr. (2004). Psychometric evaluation of the SF-36 health survey in Medicare managed care. *Health Care Financing Review, 25*, 5–25.

20. Kazis, L. E., Ren, X. S., Lee, A. et al. (1999). Health status in VA patients: Results from the Veterans Health Study. *Am J Med Qual, 14*, 28–38.
21. Kazis, L. E., Miller, D. R., Skinner, K. M., et al. (2004). Patient-reported measures of health: The Veterans Health Study. *J Ambul Care Manage, 27*, 70–83.
22. Kazis, L. E., Miller, D. R., Clark, J. A., Skinner, K. M., Lee, A., Ren, X. S., Spiro, A. III, Rogers, W. H., & Ware, J. E. Jr (2004). Improving the response choices on the veterans SF-36 health survey role functioning scales: results from the Veterans Health Study. *J Ambul Care Manage, 27*(3), 263–280.
23. Kazis, L. E., Lee, A., Spiro, A. 3rd, Rogers, W., et al. (2004). Measurement comparisons of the medical outcomes study and veterans SF-36 health survey. *Health Care Financing Review, 25*, 43–58.
24. Ware, J. E., Kosinski, M., & Dewey, J. E. (2000). *How to Score Version 2 of the SF-36 Health Survey*. Lincoln, RI: QualityMetric Incorporated.
25. Schall, L. C., Buchanich, J. M., Marsh, G. M., et al. (2001). Utilizing multiple vital status tracing services optimizes mortality follow-up in large cohort studies. *Annals of Epidemiology, 11*, 292–296.
26. Nagi, S. Z. (1991). Some conceptual issues in disability and rehabilitation: Appendix A. In A. M. Pope & A. R. Tarlov (Eds.), *Disability in America: Toward a national agenda for prevention* (pp. 309–327). Washington, DC: National Academy Press.
27. Donabedian, A. (1972). Models for organizing the delivery of personal health services, and criteria for evaluating them. *The Milbank Memorial Fund Quarterly, 50*, 103–154.
28. Reason, J. (2000). Human error: models and management. *BMJ, 320*, 768–770.
29. Selim, A. J., Kazis, L. E., Rogers, W., Qian, S., et al. (2006). Risk-adjusted mortality as an indicator of outcomes: Comparison of the Medicare Advantage Program with the Veterans' Health Administration. *Medical Care, 44*, 359–365.
30. Wilson, I. B., & Cleary, P. D. (1995). Linking clinical variables with health-related quality of life: A conceptual model of patient outcomes. *JAMA, 273*, 59–65.
31. Hornbrook, M. C., & Goodman, M. J. (1996). Chronic disease, functional health status, and demographics: A multi-dimensional approach to risk adjustment. *Health Services Research, 31*, 283–307.
32. Williams, D. R. (1996). Race/ethnicity and socieconomic status; measurement and methodological issues. *International Journal of Health Services, 26*, 483–505.
33. Bayliss, E. A., Bayliss, M. S., Ware, J. E. Jr., & Steiner, J. F. (2004). Predicting declines in physical function in persons with multiple chronic medical conditions: What we can learn from the medical problem list. *Health and Quality of Life Outcomes, 2*, 47.
34. Dorr, D. A., Jones, S. S., Burns, L., Donnelly, S. M., Brunker, C. P., Wilcox, A., & Clayton, P. D. (2006). Use of health-related, quality-of-life metrics to predict mortality and hospitalizations in community-dwelling seniors. *Journal of American Geriatrics Society, 54*, 667–673.
35. vaww.va.gov/vetdata/census2000/cendata/US_Regional_vets as of 4/1/2000.
36. Joint Commission on Accreditation of Healthcare Organizations. (1990). *Ambulatory health care standards manual*. Chicago, IL: JCAHO.
37. Cooper, J. K., Kohlmann, T., Michael, J. A., Haffer, S. C., & Stevic, M. (2001). Health outcomes. New quality measure for Medicare. *International Journal for Quality in Health Care, 13*, 9–16.
38. Perlin, J. B., Kolodner, R. M., & Roswell, R. H. (2004). The Veterans Health Administration: Quality, value, accountability, and information as transforming strategies for patient-centered care. *The American Journal of Managed Care, 10*, 828–836.
39. Bowe, S., Young, A. F., Sibbritt, D., & Furuya, H. (2006). Transforming the SF-36 to account for death in longitudinal studies with three-year follow-up. *Medical Care, 44*, 956–959.
40. Diehr, P., Patrick, D. L., Spertus, J., Kiefe, C. I., McDonell, M., & Fihn, S. D. (2001). Transforming self-rated health and the SF-36 scales to include death and improve interpretability. *Medical Care, 39*, 670–680.
41. Sprangers, M. A., Moinpour, C. M., Moynihan, T. J., Patrick, D. L., & Revicki, D. A. (2002). Clinical Significance Consensus Meeting Group. Assessing meaningful change in quality of life over time: A users' guide for clinicians. *Mayo Clinic Proceedings, 77*, 561–571.
42. Revicki, D. A., Gold, K., Buckman, D., Chan, K., Kallich, J. D., & Woolley, J. M. (2001). Imputing physical health status scores missing owing to mortality: Results of a simulation comparing multiple techniques. *Medical Care, 39*, 61–71.
43. Selim, A. J., Berlowitz, D. R., Fincke, G., et al. (2002). Risk-adjusted mortality rates as a potential outcome indicator for outpatient quality assessments. *Medical Care, 40*, 237–245.
44. Miller, D., Rogers, W., Kazis L. E., Spiro, A. III, & Haffer, S. C. (2004). Evaluation of disease status based on patient self-report in the Medicare Health Outcomes Survey: Using linked data from surveys and computerized medical data from the Veterans Health Administration. (NCQA/CMS report issued January 2004 and presented at National Technical Advisory Meeting NCQA/CMS October 2004).
45. Robinson, J. R., Young, T. K., Roos, L. L., & Gelskey, D. E. (1997). Estimating the burden of disease. Comparing administrative data and self-reports. *Medical Care, 35*, 932–947.
46. Okura, Y., Urban, L. H., Mahoney, D. W., Jacobsen, S. J., & Rodeheffer, R. J. (2004). Agreement between self-report questionnaires and medical record data was substantial for diabetes, hypertension, myocardial infarction and stroke but not for heart failure. *Journal of Clinical Epidemiology, 57*, 1096–1103.
47. Stewart, A. L., Greenfield, S., Hays, R. D., Wells, K., Rogers, W. H., Berry, S. D., McGlynn, E. A., & Ware, J. E. (1989). Functional status and well-being of patients with chronic conditions. Results from the Medical Outcomes Study. *JAMA, 262*, 907–913.
48. Best, W. R., & Cowper, D. C. (1994). The ratio of observed-to-expected mortality as a quality of care indicator in non-surgical VA patients. *Medical Care, 32*, 390–400.
49. Schneeweiss, S., Wang, P. S., Avorn, J., & Glynn, R. J. (2003). Improved comorbidity adjustment for predicting mortality in Medicare populations. *Health Services Research, 38*, 1103–1120.
50. Petersen, L. A., Normand, S. L., Daley, J., & McNeil, B. J. (2000). Outcome of myocardial infarction in Veterans Health Administration patients as compared with medicare patients. *The New England Journal of Medicine, 343*, 1934–1941.
51. Asch, S. M., McGlynn, E. A., Hogan, M. M., et al. (2004). Comparison of quality of care for patients in the Veterans Health Administration and patients in a national sample. *Annals of Internal Medicine, 141*, 938–945.
52. Jha, A. K., Perlin, J. B., Kizer, K. W., & Dudley, R. A. (2003). Effect of the transformation of the Veterans Affairs Health Care System on the quality of care. *The New England Journal of Medicine, 348*, 2218–2227.
53. Kerr, E. A., Gerzoff, R. B., Krein, S. L., et al. (2004). Diabetes care quality in the Veterans Affairs Health Care System and commercial managed care: The TRIAD study. *Annals of Internal Medicine, 14*, 272–281.
54. Weeks, W. B., Kazis, L. E., Shen, Y., Cong, Z., Ren, X. S., Miller, D., Lee, A., & Perlin, J. B. (2004). Differences in health-related quality of life in rural and urban veterans. *American Journal of Public Health, 94*, 1762–1767.

55. Perlin, J., Kazis, L. E., Skinner, K., Ren, X. S., et al. (2000). *Health status and outcomes of Veterans: Physical and Mental Component Summary Scores Veterans SF-36 (1999) Large Health Survey of Veteran Enrollees Executive Report*. Washington, D.C.: Department of Veterans Affairs: Veterans Health Administration Office of Performance and Quality.
56. Bindman, A. B., Keane, D., & Lurie, N. (1990). Measuring health changes among severely ill patients. The floor phenomenon. *Medical Care, 28*, 1142–1152.
57. Wright, S. M., Petersen, L. A., Lamkin, R. P., & Daley, J. (1999). Increasing use of Medicare services by veterans with acute myocardial infarction. *Medical Care, 37*, 529–537.
58. Wolinsky, F. D., Miller, T. R., An, H., Brezinski, P. R., Vaughn, T. E., & Rosenthal, G. E. (2006). Dual use of Medicare and the Veterans Health Administration: Are there adverse health outcomes? *BMC Health Services Research, 6*, 131.