Discordance Between Self-report of Physician Diagnosis and Administrative Database Diagnosis of Arthritis and Its Predictors

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ABSTRACT. ***Objective.*** To study predictors of discordance between self-reported physician diagnosis and administrative database diagnosis of arthritis.

Methods. A cohort of all veterans who utilized Veterans Integrated Service Network (VISN)-13 medical facilities were mailed a questionnaire that included patient self-report of physician diagnosis of arthritis and questions regarding demographics, functional limitation, and SF-36V (a validated version of the Medical Outcomes Study Short-Form 36). Kappa coefficient was used to assess the extent of agreement between self-report of physician diagnosis and administrative database definitions that incorporated *International Classification of Diseases* (ICD) codes and use of medications for arthritis. We identified predictors of overall discordance between self-report and administrative database diagnosis using multivariable logistic regression analyses.

Results. Among 70,334 eligible veterans surveyed, 19,749 subjects had an ICD diagnosis of arthritis in the administrative database in the year prior to the survey; 34,440 answered the arthritis question and 18,464 self-reported a physician diagnosis of arthritis. Kappa coefficient showed slight to fair agreement of 0.19–0.32 between self-report and administrative database definitions of arthritis. We found significantly higher overall discordance among veterans with more comorbidities, greater age, worse functional status, lower use of outpatient and inpatient services, lower education level, and among single medical-site users.

Conclusion. Low level of agreement between self-report and database diagnosis of arthritis and its significant association with patient demographic, clinical, and functional characteristics highlights the limitation of use of these strategies for identification of patients with arthritis in epidemiological studies. (J Rheumatol First Release August 15 2009; doi:10.3899/jrheum.090041)

Key Indexing Terms:
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Arthritis constitutes a significant public health problem in the US. In 2001, arthritis and chronic joint symptoms affected an estimated 69.9 million people in the US[1] and arthritis was among the 5 most prevalent conditions in the 3.4 million patients receiving healthcare at Veterans Affairs (VA) healthcare facilities[2]. The 2 most common methods of identifying patients with "arthritis" in large epidemiological studies are patient self-report, as in the Behavioral Risk Factor Survey (BRFSS)[1] and National Health Interview Survey (NHIS)[3], or a diagnosis from administrative/clinical databases. The accuracy of these methods has been debated. Self-reported arthritis has a sensitivity of 75%, specificity of 66%, and kappa statistic of 0.27–0.48, compared to medical records[4-6]. Self-report of specific types of arthritis was slightly better, with specificity of 66%–90%, but positive predictive value was 21%–22%, sensitivity 50%–100%, and kappa 0.08–0.46, compared to medical records or American College of Rheumatology criteria[6-10].

A few studies have examined the factors associated with discordance between these 2 most common methods of identifying patients with arthritis in epidemiologic studies, self-report and databases[5,6,9,11]. These studies reported conflicting results and none were done in a veteran population. VA constitutes the largest integrated healthcare system in the US, serving approximately 4.9 million subjects with a budget of $25 billion[12], providing healthcare to veterans who are socioeconomically disadvantaged and medically underserved[2,13,14]. VA also has one of the most sophisticated national clinical datasets, which can be used to answer important clinical questions. Therefore, we wanted to examine the extent of and factors associated with discordance

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between database diagnosis of and self-reported physician-diagnosed arthritis in a veteran cohort[15]. We hypothesized (1) that the agreement between patient self-report of physician diagnosis of arthritis and the diagnosis of arthritis as recorded in the VA administrative databases would be poor; (2) that database definitions that combine the use of arthritis medications with ICD-9 codes may be associated with better agreement with patient self-report of physician diagnosis of arthritis; and (3) that higher comorbidity load, lower healthcare utilization rate, and poor functional status would be associated with greater discordance between self-report of physician diagnosis of arthritis and administrative database diagnosis of arthritis.

MATERIALS AND METHODS

Prior Veterans' Quality of Life (Vet-QOL) study. The original Vet-QOL study was a cohort study with a survey of the VISN-13 patient population, as described[15]. VISN-13 was a regional network providing healthcare to veterans from all of Minnesota, North Dakota, and South Dakota, and selected counties in Iowa, Nebraska, Wisconsin, and Wyoming. The cohort consisted of all veterans in VISN-13 who had at least 1 outpatient encounter or inpatient stay between October 1, 1996, and March 31, 1998, at a VISN-13 facility and a valid mailing address. A self-administered questionnaire was mailed to each eligible veteran in August 1998, with a second mailing to nonresponders 10 weeks later. Many previous studies have used this dataset for studies of quality of life, healthcare utilization, and mortality outcomes[15-18].

The self-administered survey questionnaire consisted of questions about: (1) demographics: sex, education level, and race/ethnicity; (2) self-report of physician diagnosis of arthritis, chronic obstructive lung disease (COPD)/asthma, heart disease, hypertension, diabetes, and depression; (3) generic measure of activity limitation, Katz's scale of difficulty with 6 basic activities of daily living (ADL): bathing, dressing, eating, getting in or out of a chair, walking, and toileting[19]; (4) current use of cigarettes; and (5) the SF-36V, a validated version of the Medical Outcomes Study Short-Form 36, adapted for use in the VA outpatient population[20-22]. SF-36 has been found to be valid, reliable, and responsive to clinical change in patients with arthritis[23-28]. The SF-36V differs from the SF-36 only in the dichotomous items assessing role limitation due to physical and emotional problems; they were changed to use a 5-level ordinal scale in the SF-36V[21,29]. Physical and mental component summary (PCS and MCS) scores were generated in the standard fashion from the 8 subscales of the SF-36V and standardized to the US population and norm-based with a scoring range of 0–100 (higher score = better health), a mean of 50, and a standard deviation of 10. Generic measures of activity limitation and quality of life were used, since this was a population-based study.

Retrospective and prospective cohort data were obtained for 1 year before and 1 year after the survey from the VA Patient Treatment File (PTF) and the Outpatient Clinic (OPC) datasets (containing data from inpatient and outpatient encounters, respectively). These datasets have been found to be reliable for demographics and most common diagnoses[30] and valid for specific diagnoses[31,32]. Pre-survey data included demographics (age, marital status, and employment status), pre-survey healthcare utilization (inpatient hospitalizations, the number of outpatient encounters in primary care, specialty medical care, surgical care, and mental health), and percentage service connection. Veterans get service connection if they have disability that resulted from or during active military service (due to an injury or a disease condition) and ranges from 0 to 100%, with higher percentage reflecting more disability and ≥ 50% service connection making them eligible for priority in access to VA healthcare. Post-survey data were only used for the diagnostic codes of arthritis and use of arthritis-related medications to test 4 additional database definitions of arthritis (for sensitivity analyses) to allow for delay in diagnosis documentation (see below).

Data collected for our study. The self-report question for arthritis was "Has your doctor ever told you that you have arthritis (including rheumatoid or osteoarthritis)?", very similar to the question "Have you ever been told by a doctor that you have arthritis?" used in the BRFSS, the largest survey of US households to date[1]. In addition to the data collected for the Vet-QOL study, for our study, ICD 9th edition (ICD-9) codes for arthritis and the prescription data were extracted from the VA in-/outpatient and pharmacy datasets, respectively.

The ICD-9 codes for arthritis consisted of the codes for arthritis listed by the National Arthritis Data Workgroup (http://www.cdc.gov/arthritis/data_statistics/pdf/arthritis_codes_2004.pdf), supplemented by an additional search through the ICD-9 coding book: osteoarthrosis (715), rheumatoid arthritis (714), spondyloarthropathy (720, 696, 711.1, 099.3), arthritis not otherwise specified (716.9), spondylosis (721), gout (274), crystal induced arthritis (712, 275.49), infectious arthritis (711, 098.5, 036.82, 056.71, 040.2, 390, 421), arthritis due to endocrine-metabolic disorders (713), hemochromatosis-associated arthritis (275), and unspecified arthritis (716). Pharmacy data were extracted from the prescription file located in the local Veterans Health Information Systems and Technology Architecture (VISTA) data system at each of the VISN-13 facilities. The pharmacy data was searched for the presence of prescriptions with 2 or more refills (i.e., initial prescription + 2 refills) of nonsteroidal antiinflammatory drugs (NSAID) and disease-modifying antirheumatic drugs (DMARD) for the 2-year study period, regardless of presence of arthritis diagnoses. These medications were chosen since they are most commonly used medications for treatment of arthritis; 3-month or longer prescription was chosen since this is the maximum and the most common "days supply" that can be dispensed at the VA and probably represents longterm medication use.

Study participants and case definitions of arthritis and discordance. Veterans were included in our study if they either self-reported a physician-made diagnosis of arthritis or had an administrative database diagnosis of arthritis. The 5 database case definitions based on various combinations of the ICD code and medication use included the following; Definition 1: presence of an ICD code for arthritis in the year before the survey; Definition 2: presence of an ICD code for arthritis in the year after the survey; Definition 3: presence of an ICD code for arthritis in a 2-year period (a year before and a year after the survey); Definition 4: Presence of either an ICD code for arthritis or use of arthritis-medication (NSAID or DMARD) in 2-year period (most inclusive definition); and Definition 5: Presence of both an ICD code for arthritis and use of arthritis medication in 2-year period (most strict definition).

Subjects were classified into 2 groups based on the concordance or discordance between self-report and administrative case definition of presence of ICD code in the year prior to the survey (Definition 1).

Statistical analyses. Kappa statistic[33] was used for assessing the degree of agreement between the administrative and self-report case definitions of arthritis and examined the effect of demographic, clinical, utilization, health, or functional status characteristics on kappa agreement in univariate analyses. Results are presented for administrative case definitions 1, 3, and 4 above, since definitions 2 and 5 gave results very similar to definitions 1 and 4, respectively.

Characteristics of the patients in the discordant and concordant groups were compared using chi-squared tests for categorical variables and Student's t-tests for continuous variables. A multiple logistic regression analysis modeled the odds of discordance using various characteristics including demographic, clinical, healthcare utilization, health status and functional status as predictors or explanatory variables, including: (1) demographics: age in years, sex, race (Caucasian or non-Caucasian), marital status (married or not married), employment status (employed, unemployed, or retired), and education level (< 8th grade, some high school, high school graduate, or beyond high school); (2) self-reported comorbidity: number of self-reported physician diagnoses of the comorbidities COPD/asthma, diabetes, depression, hypertension, and heart disease

(expressed in categories of none, 1, 2, or 3–5 comorbidities) and current smoking status (yes/no); (3) healthcare utilization and access measures: inpatient admission in the year prior to the survey (any or none), total number of outpatient visits for the year prior to the survey (aggregate of all primary care, specialty medical care, surgical care, and mental health visits), medical center site use (multiple-site vs single-site user), percentage service connection; (4) health and functional status: PCS and MCS scores of the SF-36V and ADL limitation (no limitation, or a limitation of 1, 2, or 3–6 ADL). For the purpose of analysis, outpatient visits, PCS scores and MCS scores were divided into tertiles for ease of interpretation, since PCS and MCS were normally distributed. All subjects were included in the main logistic regression analysis.

Additional multivariable logistic regression analyses examined factors associated with potential underdocumentation/overreporting and overdocumentation/underreporting of the diagnosis of arthritis, controlling for covariates listed above. Specifically, these outcomes were defined as: (1) an absence of an ICD-9 code for arthritis in the year prior to the survey in those who self-reported a physician diagnosis of arthritis, i.e., potential underdocumentation/overreporting; and (2) an absence of self-report of physician diagnosis of arthritis in those who had an ICD code for arthritis in the year prior to the survey, i.e., potential overdocumentation/underreporting. A $p < 0.05$ was considered significant.

RESULTS

The survey response rate was 58% (40,508/70,334). The question regarding arthritis was answered by 34,440 (49%) with 18,464 (54%) respondents self-reporting a physician-made diagnosis. Clinical characteristics of these patients are summarized in Table 1. The administrative database search identified 19,749 (28%) subjects with an ICD diagnosis of arthritis in the year prior to the survey.

Level of agreement between self-report of physician diagnosis and administrative database case definitions of arthritis. Kappa statistic for agreement between self-report of physician diagnosis and the 5 administrative database case definitions identifying an arthritis diagnosis ranged from 0.19 to 0.32, being highest for the case definition of ICD code or use of arthritis medication (Table 2). Table 3 shows the variation in kappa agreement across clinical and demographic variables. The largest range in kappa statistics was observed across the tertiles of outpatient visits, ranging from 0.11 in the veterans in the lowest tertile to 0.27 in the highest tertile of outpatient visits (Table 3).

Table 1. Clinical characteristics all survey responders and those with self-reported arthritis.

	All Survey Responders, n = 34,440	Subjects with Self-reported Physician-diagnosed Arthritis, n = 18,464
Age, mean ± SD†	64.4 ± 13.7	65.4 + 12.5
Sex, % male	96	96
Marital status, % married	61	65
Race, % White	90	90
Education, %		
< 8th grade	19	20
Some high school	11	12
High school graduate	35	35
Beyond high school	35	33
Employment status, %		
Employed	32	30
Not employed	18	18
Retired	44	46
Unknown	7	6

All percentages rounded to the nearest digit, so the total may not be exactly 100%.

Discordant groups and predictors of discordance. Univariate comparisons showed that subjects in the discordant group were slightly older, less educated, less likely to be employed or current smokers, had more comorbidities, had higher functional limitation and lower PCS scores, had less inpatient and outpatient healthcare utilization, and were less likely to be a multi-site user than subjects in the concordant group (Table 4).

In the multivariable logistic regression analysis, veterans with greater self-reported comorbidity or older age had higher odds of discordance (Table 5). In addition, veterans with more ADL limitations or worse physical quality of life had higher odds of discordance. Single-site use, no recent inpatient admission, and fewer outpatient visits were also associated with higher odds of discordance.

Predictors of underdocumentation/overreporting. Among those with self-reported arthritis, factors associated with absence of administrative database diagnosis, i.e., underdocumentation/overreporting, were the same as those identified in the main analysis of overall discordance, and exhibited the same direction of association. One additional predictor was identified: a lower percentage of service connection was associated with higher odds of underdocumentation (Table 5). Lower number of outpatient visits had a much stronger association with odds of more underdocumentation than with odds of overall discordance.

Predictors of overdocumentation/underreporting. Factors associated with no self-report among those with an administrative database diagnosis, i.e., overdocumentation/underreporting, were somewhat different from those identified in the main analysis of overall discordance. Older age, worse PCS scores, more comorbidities, and no recent inpatient visit were each associated with lower odds of overdocumentation/underreporting; i.e., the direction of association was opposite to overall discordance (Table 5). In addition, more ADL limitation, single-site use, higher percentage service connection, higher education level, being unmarried, and lower MCS scores were associated with higher odds of overdocumentation/underreporting.

DISCUSSION

Self-report of arthritis had slight to fair agreement with VA administrative database case definitions of arthritis. This range of agreement is similar to the kappa of 0.27 reported

Table 2. Kappa agreement between self-reported arthritis and 5 database definitions including *International Classification of Diseases* (ICD)-9 codes.

	Kappa	95% CI
ICD code for arthritis in the database in the *year prior* to the survey	0.25	0.24, 0.26
ICD code for arthritis in database in the *year after* the survey	0.23	0.22, 0.23
ICD code for arthritis in database in the *2-year* period	0.28	0.27, 0.29
ICD code for arthritis or the use of arthritis medication in 2-year period (the most inclusive administrative case definition)	0.32	0.31, 0.33
Both an ICD code for arthritis and use of an arthritis medication in 2-year period (the most strict administrative case definition)	0.19	0.18, 0.20

for arthritis[6] and 0.37 for musculoskeletal disease[11], but lower than the kappa of 0.48 reported for hip or knee arthritis[4]. The greater degrees of agreement for hip or knee arthritis may be due to specification of the site of involvement by arthritis[4]. This study extends the previous observations of low agreement between self-reported and other database/clinical definitions in non-veteran populations compared to veterans.

The study has many useful implications. First, the finding that self-reported physician diagnosis of arthritis has little agreement with 5 database definitions (incorporating ICD codes and medication data for the first time) indicates that there may be limitations to use of either definition of "arthritis." The case definition of arthritis that required presence of either an ICD code or use of arthritis medication had the highest agreement with self-reported physician diagnosis of arthritis, but kappa was only 0.32. This implies that studies utilizing ICD codes in VA databases for studies of patients with arthritis may be identifying a subset of patients with arthritis.

Second, the association of lower healthcare utilization, poor physical health status, and poor functional status with overall discordance and underdocumentation implies that sicker patients or those with less physician contact are less likely to have their arthritis recognized, diagnosed, and documented by their physician. Incidentally, this group of patients also constitutes a high-risk group with regard to their health in general. It is possible that discordance is a surrogate marker for another prognostic characteristic that is associated with poor health and yet less physician contact.

Predictors of discordance between patient-report and database diagnosis. The overall discordance between self-report and administrative diagnosis was significantly higher among less frequent users of outpatient or inpatient services, single-site users, older veterans, those with more comorbidities, more ADL limitations, or worse physical health, i.e., frail and elderly patients with fewer health encounters had higher discordance. Two previous studies[6,11] reported significant association of increasing age with agreement between self-report and examination[11] and of Caucasian race with higher agreement between self-report and medical records[6]. In contrast to earlier studies, in our study, increasing age was significantly associated with higher odds of discordance. This study extends the findings of correlates of discordance between 2 methods of case identification by including utilization, demographic, and clinical variables simultaneously. These relationships do not imply causality, only that significant associations exist. Our study differed from the earlier studies in patient population and setting (95% male veterans receiving care at VA facilities in Upper Midwest vs population-based survey in Finland[11] vs patients with chronic lymphocytic leukemia in Baltimore[6]) and in the comparison of standard-database ICD diagnoses in this study versus physical examination[11] or medical records[6] in earlier studies. A strong association of outpatient visits with discordance indicates that more health encounters may lead to better physician-patient communication and thus higher concordance between clinical databases and patient self-report.

Predictors of underdocumentation/overreporting. The previously described association of lower outpatient use[34] with more underdocumentation/overreporting in patients with chronic conditions was confirmed in this larger sample of patients with arthritis. Some predictors of underdocumentation differ from a previous study by Kehoe, *et al*, in a cohort of ophthalmology patients from the Boston area[5]. They found that fewer annual physician visits and higher education levels were associated with higher specificity of self-reported arthritis[5], i.e., less overreporting. In contrast, in our study, education level was not associated and fewer outpatient visits were associated with more underdocumentation/overreporting. The previous study obtained diagnosis from primary care physician charts rather than administrative database records and did not adjust analyses to a variety of important explanatory measures, as did our study, which may explain differences in findings.

Many explanations exist for underdocumentation, including low rate of physician documentation of diagnosis of arthritis[35], substantial proportion (22%) of US adults never seeing a healthcare provider for their joint symptoms[36], and veterans receiving arthritis diagnosis in non-VA healthcare settings[37], which may not be documented in VA records. Patient overreporting of arthritis due to self-diagnosis of any musculoskeletal symptom as arthritis may also be partially

Table 3. Effect of key variables on kappa statistic between self-report of physician diagnosis and ICD-9 code for arthritis in administrative diagnosis in the year prior to the survey.

	Kappa Statistic† for Agreement between Self-report of Physician-diagnosis of Arthritis and the Following Database Case Definitions		
	ICD-9 Code in the yr Prior to the Survey	ICD-9 Code in the 2-yr Period	ICD-9 Code or Medication in the 2-yr Period
Physical Component Summary*			
Lowest tertile	0.21	0.24	0.27
Middle tertile	0.20	0.22	0.26
Highest tertile	0.20	0.24	0.26
Mental Component Summary*			
Lowest tertile	0.23	0.26	0.30
Middle tertile	0.25	0.28	0.31
Highest tertile	0.26	0.30	0.34
No. of ADL with limitation			
0	0.22	0.25	0.28
1–2	0.21	0.24	0.28
3–4	0.18	0.23	0.26
5–6	0.22	0.25	0.27
No. of outpatient visits			
Lowest tertile	0.11	0.14	0.19
Middle tertile	0.24	0.29	0.33
Highest tertile	0.27	0.31	0.34
Inpatient hospitalization			
None	0.24	0.27	0.32
1 or more	0.29	0.32	0.33
Percentage Service Connection*			
0%	0.23	0.27	0.32
10–50%	0.26	0.28	0.31
60–100%	0.27	0.30	0.32
Employment status			
Employed	0.25	0.28	0.33
Unemployed	0.25	0.29	0.33
Retired	0.23	0.26	0.30
Unknown	0.21	0.23	0.27
Education			
< 8th grade	0.22	0.24	0.29
Some high school	0.24	0.25	0.30
High school graduate	0.25	0.28	0.33
Beyond high school	0.26	0.29	0.33
Sex			
Female	0.27	0.32	0.34
Male	0.25	0.28	0.32
Age, yrs			
< 50	0.26	0.30	0.33
51–65	0.28	0.29	0.34
66–75	0.23	0.26	0.31
> 75	0.21	0.23	0.27

ADL: activities of daily living. †Kappa statistic: < 0 poor agreement; 0–0.20 slight agreement, 0.21–0.39 fair agreement, 0.41–0.60 moderate agreement, 0.61–0.80 substantial agreement, 0.81–1.00 almost perfect agreement. Outpatient visit tertiles: lowest tertile, 0–2 visits/yr; middle tertile, 3–7 visits/yr; and highest tertile, ≥ 8 visits/yr. Physical Component Summary (PCS) tertiles: lowest, 0–29.04; middle, > 29.04–40.78; highest tertile, > 40.78–71.84. Mental Component Summary (MCS) tertiles: lowest, > 0-40.64; middle, 40.64–54.30; and highest, > 54.30–77.3. A higher score on PCS and MCS indicates better health. * Veterans get service connection if they have disability that resulted from or during active military service (due to an injury or a disease condition) and ranges from 0 to 100%, higher percentage reflecting more disability and ≥ 50% service connection making them eligible for priority in access to VA healthcare.

responsible for instances of underdocumentation and overall discordance.

Predictors of overdocumentation/underreporting. Two small studies (< 1000 patients) of predictors of underreporting of arthritis diagnosis reported that the type of arthritis diagnosis and presence of ADL difficulties predicted underreporting[9] or that none of the examined factors (age, sex, race, education, and physician visits) was associated with underreporting[5]. The previously published studies included patients with cataract[5] or those being followed in rheuma-

Table 4. Characteristics of concordant and discordant groups (and their subgroups) and comparison of concordant and discordant groups.

	Concordant Group			Discordant Group			p*
	Database Diagnosis+, Self-Report+	Database Diagnosis–, Self-Report–	All Concordant	Database Diagnosis–, Self-Report+	Database Diagnosis+, Self-Report–	All Discordant	
Demographic features							
Age, yrs	65 ± 12	60 ± 15	62 ± 14	65 ± 13	61 ± 15	64 ± 13	< 0.001
Sex, % male	96	95	95	96	95	96	0.09
% Married	69	60	64	69	58	66	< 0.001
% White	90	91	91	91	89	90	0.07
Education							< 0.001
8th grade or less	20	13	16	19	14	18	
Some high school	12	9	10	11	10	11	
High school graduate	35	36	36	35	37	35	
Beyond high school	32	42	38	34	40	35	
Employment status, %							< 0.001
Employed	28	40	35	31	36	32	
Unemployed	19	19	19	17	22	18	
Retired	49	33	39	44	39	43	
Unknown	4	9	7	8	4	7	
No. of comorbidities, %							< 0.001
None	22	36	31	20	34	24	
1	31	35	34	32	33	32	
2	25	19	21	26	20	24	
3–5	22	10	14	22	13	20	
% Currently smoking	22	26	25	22	27	23	0.004
Health-related quality of life							
Physical Component Summary (PCS)	30 ± 10	41 ± 12	37 ± 12	33 ± 10	37 ± 11	34 ± 11	< 0.001
Mental Component Summary (MCS)	45 ± 13	48 ± 13	47 ± 13	46 ± 13	46 ± 13	46 ± 13	< 0.001
Activities of daily living (ADL) limitations, %							< 0.001
No ADL limitation	24	62	48	36	49	39	
One ADL with limitation	18	14	16	18	17	18	
Two ADL with limitations	21	9	13	18	13	17	
3–6 ADL with limitations	37	15	23	28	20	27	
Healthcare utilization							
Hospitalization							
≥ 1 hospitalization, %	19	9	13	9	20	11	< 0.001
No. of hospitalizations	0.3 ± 0.7	0.1 ± 0.5	0.2 ± 0.6	0.1 ± 0.5	0.3 ± 0.8	0.2 ± 0.6	0.03
No. of outpatient visits/yr							
All outpatient visits	13.4 ± 27	6.9 ± 22	9.4 ± 24.2	6.9 ± 17	14.9 ± 38	8.6 ± 23	13.4 ± 27
Primary care clinic	4.2 ± 4	1.9 ± 3	2.8 ± 3	2.4 ± 3	4.2 ± 4	2.7 ± 3	4.2 ± 4
Mental health clinic	4.2 ± 26	2.9 ± 21	3.4 ± 23	2 ± 15	6.7 ± 37	3 ± 22	4.2 ± 26
Surgical clinic	3.1 ± 4	1.2 ± 3	1.9 ± 3	1.4 ± 3	3.1 ± 4	1.7 ± 3	3.1 ± 4
Specialty medical care clinic	1.9 ± 4	1 ± 3	1.4 ± 3	1 ± 3	1.9 ± 5	1.3 ± 4	1.9 ± 4
Multiple medical-site user, %	15	6	10	8	12	9	0.006
Mortality, %	3	3	3	4	4	4	< 0.001

* p indicates comparison of all concordant and all discordant groups. In the discordant group, DD+, SR– corresponds to overdocumentation/underreporting and DD–, SR+ corresponds to underdocumentation group. Numbers rounded to the nearest digit. A higher score on PCS and MCS indicates better health.

tology outpatient clinics[9] as compared to a population-based cohort in our study. This study confirmed the association between increasing ADL difficulties and increasing odds of underreporting, and extending this finding from rheumatology clinic outpatients[9] to a general population cohort. Race was not associated with underreporting in our study, similar to the earlier study in a cataract population[5], thus extending this observation to a general population cohort. Lack of physician communication of arthritis diagnosis, patient trivialization of arthritis diagnosis, and/or interpretation that arthritis (especially osteoarthritis) is an age-related phenomenon rather than a chronic disease may contribute to overdocumentation/underreporting of arthritis. The finding that veterans with lower MCS scores, higher PCS scores, higher education level, lower use of medical resources/access (lower multisite use and lower percentage service connection), and who were unmarried had higher odds of overdocumentation/underreporting adds to the literature.

The prevalence of self-reported physician-diagnosed

Table 5. Factors significantly associated with overall discordance, underdocumentation/overreporting and overdocumentation/underreporting of arthritis in multivariate logistic regression analyses.

Predictors	Overall Discordance OR (95% CI)	Underdocumentation/Overreporting OR[a] (95% CI)	Overdocumentation/Underreporting OR[b] (95% CI)
No. of outpatient visits (ref: highest tertile)	*	*	NS
Lowest tertile	1.11 (1.03–1.19)	4.72 (4.23–5.26)	
Middle tertile	1.33 (1.23–1.43)	1.68 (1.52–1.85)	
No. of comorbidities (ref: none)	*	*	*
1	1.17 (1.09–1.26)	1.46 (1.30–1.63)	0.77 (0.67–0.89)
2	1.35 (1.24–1.46)	1.82 (1.61–2.05)	0.69 (0.59–0.82)
3 or more	1.54 (1.40–1.69)	2.18 (1.91–2.49)	0.58 (0.48–0.70)
PCS score (ref: lowest tertile)	*	*	*
Middle tertile	1.13 (1.05–1.22)	1.14 (1.02–1.24)	1.54 (1.34–1.78)
Highest tertile	0.83 (0.76–0.91)	1.05 (0.95–1.16)	3.02 (2.51–3.63)
Age category (ref: 0–50 yrs)	*	*	*
> 50 to 65	1.12 (1.03–1.22)	0.93 (0.82–1.06)	0.57 (0.49–0.67)
> 65	1.38 (1.26–1.52)	1.17 (1.02–1.35)	0.58 (0.48–0.71)
Prior hospitalization (ref: none)	††	*	*
1 or more	0.88 (0.80–0.96)	0.76 (0.68–0.86)	1.45 (1.25–1.68)
No. of ADL limitations (ref: none)	*	*	*
1	0.84 (0.77–0.92)	0.79 (0.70–0.89)	1.84 (1.53–2.21)
2	0.96 (0.88–1.05)	0.71 (0.63–0.81)	1.31 (1.09–1.58)
3–6	1.05 (0.96–1.14)	0.71 (0.62–0.80)	1.05 (0.87–1.26)
Percentage service connection[c] (ref: 0%)	NS	*	*
10–50		0.81 (0.74–0.89)	0.68 (0.60–0.77)
> 50		0.96 (0.85–1.09)	0.86 (0.72–1.03)
Medical site use (ref: multisite user)	†	*	†
Single-site user	1.10 (1.0–1.2)	1.43 (1.27–1.62)	1.22 (1.03–1.44)
MCS score tertile (ref: lowest tertile)	NS	NS	†
Middle tertile			0.84 (0.73–0.97)
Highest tertile			0.87 (0.74–1.01)
Marital status (ref: married)	NS	NS	††
Unmarried			1.23 (1.09–1.38)
Education level (ref: < 8th grade)	NS	NS	††
Some high school			1.11 (0.89–1.40)
High school graduate			1.33 (1.11–1.59)
Beyond high school			1.36 (1.13–1.64)

* $p \leq 0.001$; †† $p < 0.01$; † $p < 0.05$. Sex, race, employment and current smoking status were not significantly associated with any outcome. NS: not significant; PCS: Physical Component Summary; MCS: Mental Component Summary; ADL: activities of daily living. [a] OR < 1 for underdocumentation indicates a characteristic is associated with lower odds of underdocumentation; for example, patients with 1 ADL limitation had 21% lower odds of underdocumentation compared to patients with no ADL limitation and those with PCS scores in middle tertile had 14% higher odds of underdocumentation than PCS scores in lowest tertile. [b] OR < 1 for underreporting indicates that a characteristic is associated with lower odds of underreporting; for example, patients aged 50–65 had 43% lower odds of underreporting arthritis compared to < 50-yr-olds, and those with PCS scores in middle tertile had 54% higher odds of underdocumentation than PCS scores in lowest tertile. [c] Veterans get service connection if they have disability that resulted from or during active military service (due to an injury or a disease condition) and ranges from 0 to 100%, higher percentage reflecting more disability and ≥ 50% service connection making them eligible for priority in access to VA healthcare. A higher score on PCS and MCS indicates better health.

arthritis by 54% of respondent veterans using VA healthcare may seem high to some, but is similar to 43% reported in the BRFSS survey that had a slightly younger cohort of veterans using the VA healthcare system[38].

Limitations. Our study has several limitations including nonresponse bias, an inability to examine agreement by the type of arthritis since we do not have the self-report of type of arthritis, and confounding by unmeasured variables. Given the features of the study population (veterans who are largely elderly and male) and nonresponse bias, the findings may not be generalizable to younger populations or women. A smaller number of women in our sample makes our observations regarding female sex less robust. However, since the sample was a population-based sample of veterans receiving healthcare at VA settings, these findings are at least generalizable to these veteran cohorts. Despite these differences, many results of our study agree with those of other studies in non-veteran, community samples. Thus these results are likely applicable to other elderly populations. The response rate of 57% in our study, although not optimal, is above the average of 54% for such large surveys[39]. Nonresponders were slightly younger and less likely to be married compared to responders, and we are unsure how this may have affected the discordance. It is possible that attitudes and

knowledge regarding arthritis have changed in the last decade since the study was completed, and the concordance is better now, a hypothesis that needs to be tested. Another limitation of not just our study, but this field in general is that there is no "gold standard" definition for diagnosis of arthritis. Therefore, a comparison was performed of the 2 non-gold standard definitions of arthritis commonly used in most large epidemiological studies and surveys. Despite the low concordance between self-report and billing codes, each may be more valuable depending on the particular study. For example, self-report may be the most relevant definition of arthritis if one is interested in assessing the effect of arthritis and arthritis-related symptoms. In contrast, administrative databases may be more appropriate for studying healthcare utilization. Each has limitations and may only identify a subset of patients with arthritis. Since we extracted ICD codes and medication data for a 2-year period, some patients with arthritis who were not seen or treated for arthritis may have been missed. This is unlikely, since these patients had at least 1 healthcare encounter in the 18 months before the survey. Although the discordance was subdivided into useful categories such as underreporting and underdocumentation, the sources of errors cannot be determined accurately.

A low level of agreement was noted between self-report of physician diagnosis of arthritis and the administrative database definitions of arthritis. Age, comorbidity, functional limitation, quality of life, and access to and use of medical services influenced the overall discordance between self-report of physician diagnosis and administrative database definition of arthritis using ICD codes. The high degree of disagreement between these 2 methods commonly used in epidemiological studies and the influence of various demographic and clinical factors underscores the limitations that exist with use of these methods in assessing the presence of arthritis in large epidemiological studies.

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