Medication Prescribing Practices for Older Prisoners in the Texas Prison System

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Objectives. We sought to assess appropriateness of medication prescribing for older Texas prisoners.

Methods. In this 12-month cross-sectional study of 13 117 prisoners (aged ≥55 years), we assessed medication use with Zhan criteria and compared our results to prior studies of community prescribing. We assessed use of indicated medications with 6 Assessing Care of Vulnerable Elders indicators.

Results. Inappropriate medications were prescribed to a third of older prisoners; half of inappropriate use was attributable to over-the-counter antihistamines. When these antihistamines were excluded, inappropriate use dropped to 14% (≥55 years) and 17% (≥65 years), equivalent to rates in a Department of Veterans Affairs study (17%) and lower than rates in a health maintenance organization study (26%). Median rate of indicated medication use for the 6 indicators was 80% (range = 12%–95%); gastrointestinal prophylaxis for patients on nonsteroidal anti-inflammatories at high risk for gastrointestinal bleed constituted the lowest rate.

Conclusions. Medication prescribing for older prisoners in Texas was similar to that for older community adults. However, overuse of antihistamines and underuse of gastrointestinal prophylaxis suggests a need for education of prison health care providers in appropriate prescribing practices for older adults. (*Am J Public Health.* 2010;100:756–761. doi:10.2105/AJPH.2008.154591)

More than 1 in 100 Americans are incarcerated in a US prison or jail[1] and older prisoners are among the most rapidly growing correctional populations.[1–4] With high rates of chronic disease,[5–7] older prisoners cost on average 2 to 3 times more than younger prisoners to incarcerate.[1,8] Yet prisons are often ill-equipped to care for older prisoners with complex medical problems, such as functional or cognitive impairments.[9–12] This is largely because older adults have substantively different health care needs than younger adults who have traditionally been the focus of prison health care.[12] Despite the increasing numbers and cost of older prisoners, research about the quality of geriatric care in prisons is sparse.

One important difference in the care of younger and older adults is medication prescribing.[13,14] Older adults often require medications for multiple chronic diseases, whereas younger adults typically require short-term medications for acute injuries or infection. Although older patients are at increased risk for medication-related adverse events leading to morbidity, mortality, and high costs,[15,16] underuse of indicated medications can deny older adults improved quality and length of life.[15] Despite the safety concerns and high cost associated with inappropriate medication use in older adults, little is known about medication prescribing practices for older prisoners.

We assessed medication prescribing practices among older prisoners in the Texas Department of Criminal Justice (TDCJ)—one of the nation's largest state prison systems. Since 1994, when the TDCJ implemented an academic-based managed care system run by the University of Texas Medical Branch, it has reported substantial improvements in health care and has been proposed as a nationwide model.[17,18] It is unknown if this improved quality has extended to elements of care of the older prisoners, such as medication prescribing quality.

METHODS

Our cross-sectional study included all 13 117 prisoners aged 55 years or older incarcerated in the TDCJ prisons for any duration between September 1, 2006, and August 31, 2007. All TDCJ pharmaceutical services were provided by University of Texas Medical Branch[17,19] and are recorded in the prison-wide electronic medical record, this study's primary data source.

Measures

Demographics. Consistent with prior literature, we defined older prisoners as aged 55 years or older. This is because prisoners tend to have a greater burden of disease and disability at a younger age than community-dwelling adults.[5,7–11] We also performed separate analyses for the subpopulation of prisoners aged 65 years or older to facilitate comparisons to nonincarcerated older populations. The TDCJ database was used to determine self-identified gender and race/ethnicity.

Medical conditions. Each TDCJ prisoner receives a medical and mental health examination by a physician, physician assistant, or nurse practitioner during intake.[7] Diagnoses made in this or in subsequent encounters are coded by using the *International Classification of Diseases, Ninth Revision* (*ICD-9*) system[7,20] and are stored in the patient's medical record. The medical conditions included in our analysis could have been diagnosed at any time during incarceration.

We used a classification scheme from the Healthcare Cost and Utilizatifon Project to cluster *ICD-9* codes.[21] For example, "diabetes" includes all *ICD-9* codes related to type 2 diabetes mellitus. To better represent the concept of cognitive impairment as it relates to medication use, we modified the Healthcare Cost and Utilization Project cognitive disorders category to include senile and presenile mental disorders,

nonpsychotic mental disorders caused by organic brain damage, and cerebral degeneration, and to exclude postconcussion syndrome and psychotic mental disorders following organic brain damage.

Medication classes. We evaluated all medications prescribed to each prisoner over the study period, regardless of the prescription's duration. To avoid overcounting medications dispensed in serial fashion (e.g., a change from one angiotensin-converting enzyme inhibitor to another) we used the Department of Veterans Affairs (VA's) drug class coding system[22] and counted each medication class only once over the study period regardless of the number of drugs dispensed within that class. When assessing the proportion of prisoners prescribed particular inappropriate medications, different medications were counted separately even if they were within the same medication class.

Medication prescribing quality. We examined 2 components of medication prescribing quality: avoidance of potentially inappropriate medications and use of indicated medications. We defined "avoidance of potentially inappropriate medications" by using the Zhan criteria,[23] which list 33 inappropriate medications for older adults on the basis of poor side-effect profiles or efficacy. This list is based on the Beer's criteria,[24] and is divided into 3 categories: "always avoid," "rarely appropriate," and "some indications but often misused."

We assessed "use of indicated medications" with Assessing Care of Vulnerable Elders (ACOVE) quality indicators.[25–27] Among 17 pharmacy-specific ACOVE measures that assess indicated medication use, we chose the 6 that could be evaluated with the available data. These indicators, which were developed specifically to assess care for vulnerable elders aged 75 years or older, also apply generally to the care of all older adults with chronic disease.[25,28] General adherence to the ACOVE measures is associated with better patient survival for older adults.[29] The indicators include use of aspirin or warfarin for atrial fibrillation, daily aspirin for patients with diabetes, daily aspirin for patients with coronary artery disease or myocardial infarction, β-blocker for patients with coronary artery disease or myocardial infarction, medication for hypertension, and gastrointestinal prophylaxis for patients on a nonsteroidal anti-inflammatory also taking warfarin or with a history of peptic ulcer disease or gastrointestinal bleed.

Comparison with nonprison populations. We compared our data on inappropriate medication use with data from previous studies in the VA healthcare system and health maintenance organizations (HMOs). The VA study used administrative data collected from 123 633 patients aged 65 years or older to assess prescribing from April 2002 through September 2003.[30] The HMO study analyzed data for 157 517 patients aged 65 years or older between January 2000 and June 2001.[31] In these studies, as in ours, data were collected serially over a defined study period. Because the VA and HMO studies evaluated adults aged 65 years and older, we restricted these comparative analyses to prisoners meeting this same age cutoff. In subsidiary analyses we excluded over-the-counter medications chlorpheniramine and diphenhydramine in the VA and HMO cohorts and compared these data to the prison cohort. We did not compare our findings of indicated medication use to community practices because we were unable to find a study that reported these data for a comparable population.

Statistical Analysis

Our analyses were primarily descriptive, and included frequencies of demographic and medication characteristics, and the prevalence of prescribing differences. We performed analyses with SAS version 9.1 (SAS Institute Inc, Cary, NC).

TABLE 1—Selected Characteristics of Older Prisoners in the Texas Department of Criminal Justice: September 1, 2006, to August 31, 2007

	Aged ≥55 Years (n = 13 117)	Aged ≥65 Years (n = 2273)
Demographic characteristics		
Age, y, mean (SD), range	60.1 (5.2), 55-91	69.3 (4.3), 65-91
Female, no. (%)	598 (5)	58 (3)
Race/ethnicity, no. (%)		
White	5600 (43)	1109 (49)
Black	4548 (35)	597 (26)
Latino	2935 (22)	561 (25)
Other	34 (0.3)	6 (0.3)
Duration of time incarcerated, no. (%)		
<1 y	1728 (13)	265 (12)
1–5 y	4017 (31)	641 (28)
>5 years	7333 (56)	1356 (60)
Medical or mental health diagnoses		
Chronic medical conditions,[a] no. (%)		
Type 2 diabetes mellitus	2449 (19)	538 (24)
Cognitive disorders[b]	5305 (40)	939 (41)
Hypertension	7680 (59)	1613 (71)
Coronary artery disease or history of acute myocardial infarction	1520 (12)	467 (21)
Chronic obstructive pulmonary disease or chronic respiratory disease	1726 (13)	456 (20)
HIV or AIDS	174 (1)	15 (1)
Hepatitis C	3076 (23)	276 (12)
Psychiatric disorders,[c] no. (%)	1530 (12)	196 (9)

[a]Health conditions were classified according to *International Classification of Diseases, Ninth Edition* (*ICD-9*) code categories defined by the Healthcare Cost and Utilization Project, which maps medical conditions to clusters of *ICD-9* codes.
[b]The Healthcare Cost and Utilization Project cognitive disorders category was modified to include senile and presenile mental disorders, nonpsychotic mental disorders caused by organic brain damage, and cerebral degeneration, and to exclude postconcussion syndrome and psychotic mental disorders following organic brain damage.
[c]Psychiatric disorders include depression, bipolar disorder, schizophrenia, and posttraumatic stress disorder.

RESULTS

Of the 233 954 individuals incarcerated in the TDCJ, 6% (n=13 117) were aged 55 years or older, among whom the median age was 60 years (range=55–91 years; Table 1). The majority (95%) of older prisoners were male and 43% were White. Thirteen percent had been incarcerated for less than 1 year, 31% for 1 to 5 years, and 56% for more than 5 years. Chronic medical conditions were common, including hypertension (59%), cognitive disorders (40%), and psychiatric disorders (12%).

Medications

Most older prisoners (89%) were prescribed at least 1 medication, including 93% of prisoners aged older than 65 years. On average, older prisoners received medications from 7.3 classes, whereas those aged older than 65 years received an average of medications from 9.1 classes. The most common classes were nonsteroidal anti-inflammatories or aspirin (65%) and angiotensin-converting enzyme inhibitors (42%).

Potentially Inappropriate Medications

Of 33 Zhan list medications, 15 were not on the Texas prison pharmaceutical formulary, including 7 of the 11 "always avoid," 3 of the 8 "rarely appropriate," and 5 of the 14 "some indications" medications. Zhan medications were more commonly prescribed to prisoners aged 65 years and older (36%) than to adults aged 65 years and older in the VA study (21%; prevalence difference=14.5%; 95% confidence interval [CI]=12.5%, 15.5%) or the HMO study (29%; prevalence difference=7.0%; 95% CI=5.0%, 9.0%). Among prisoners, the prescription rates of Zhan list medications in the "always avoid" or "rarely appropriate" categories were similar to rates in the VA study and lower than in the HMO study (Table 2). In contrast, prescription rates for medications in the "some indications but often misused" category were substantially higher for prisoners, driven largely by 2 medications: chlorpheniramine (19%) and diphenhydramine (9%). Additionally, 1591 (30%) older prisoners diagnosed with cognitive impairment were prescribed an antihistamine.

TABLE 2—Potentially Inappropriate Medications Prescribed to Older Texas Department of Criminal Justice (TDCJ) Prisoners Compared With Older Veteran's Affairs (VA) and Health Management Organization (HMO) Patients

	TDCJ Prisoners		VA Patients[a]	HMO Patients[b]
Medication	Aged ≥55 y (n=13 117), %	Aged ≥65 y (n=2273), %	Aged ≥65 y (n=123 633), %	Aged ≥65 y (n=157 517), %
Any Zhan medication[c]	32.1	35.8	21.3	28.8
Always avoid	1.2	2.1	1.5	5.1
Barbiturates[d]	0.2	0.4	0.0	0.1
Flurazepam	0.0	0.0	0.0	0.2
Meprobamate[d]	0.0	0.0	0.0	0.1
Chlorpropamide[d]	0.0	0.0	0.0	0.1
Meperidine[d]	0.0	0.0	0.0	0.6
Pentazocine[d]	0.0	0.0	0.0	0.0
Trimethobenzamide[d]	0.0	0.0	0.0	0.1
Belladonna alkaloids	0.0	0.0	1.1	2.3
Dicyclomine	0.9	1.5	0.3	1.1
Hyoscyamine	0.2	0.2	0.1	1.1
Propantheline[d]	0.0	0.0	0.0	0.1
Rarely appropriate	6.0	6.0	7.6	13.4
Chlordiazepoxide	0.1	0.04	0.3	0.4
Diazepam	0.0	0.0	1.7	2.8
Propoxyphene	2.3	2.6	3.0	7.0
Carisoprodol[d]	0.0	0.0	0.1	0.5
Chlorzoxazone	0.3	0.2	0.0	0.1
Cyclobenzaprine[d]	0.02	0.0	2.1	2.9
Metaxalone[d]	0.0	0.0	0.0	0.1
Methocarbamol	3.6	3.3	1.5	1.9
Some indications	28.8	32.4	14.8	17.1
Amitriptyline[d]	0.1	0.0	2.4	3.7
Doxepin[d]	0.1	0.04	0.7	0.8
Indomethacin	0.1	0.1	1.9	2.4
Dipyridamole	0.7	1.6	0.8	0.7
Ticlopidine[d]	0.0	0.0	0.1	0.2
Methyldopa	0.0	0.0	0.1	0.3
Reserpine[d]	0.0	0.0	0.1	0.2
Disopyramide[d]	0.0	0.0	0.1	0.1
Oxybutynin	0.6	1.1	3.2	3.4
Chlorpheniramine	18.6	21.2	1.2	1.7
Cyproheptadine	5.5	5.5	0.1	0.2
Diphenhydramine	8.9	8.3	3.3	0.9
Hydroxyzine	0.1	0.0	2.4	2.7
Promethazine	2.1	2.8	0.5	2.8

Note. This list is based on the Beer's criteria,[24] and is divided into 3 categories: "always avoid," "rarely appropriate," and "some indications but often misused."
[a]VA data from Barnett et al.[30]
[b]HMO data from Simon et al.[31]
[c]Zhan medications are a list of 33 inappropriate medications for older adults based on poor side-effect profiles or efficacy.[23]
[d]Medication is not available on the TDCJ formulary.

Because over-the-counter medications are commonly not recorded in the VA and HMO databases, we conducted an exploratory analysis excluding chlorpheniramine and diphenhydramine. After this exclusion, Zhan list prescriptions among prisoners (17% for those aged ≥65 years) more closely resembled prescribing in the VA cohort (16.8%, assuming total prescribing overlap between the 2 medications) with a prevalence difference of −0.04% (95% CI= −1.6%, 1.5%) and was superior to prescribing in the HMO study (26.2%, assuming total prescribing overlap) with a prevalence difference of −9.4% (95% CI=−11.0%, −7.9%).

Indicated Medications

The proportion of eligible patients prescribed indicated medications measured by ACOVE indicators ranged from 12% to 95%, with a median rate of 80% across the 6 indicators (Table 3). The highest completion rate was the use of daily aspirin or warfarin for patients with atrial fibrillation (95%); the lowest rate was gastrointestinal prophylaxis for high-risk patients on a nonsteroidal anti-inflammatory (12%).

DISCUSSION

We found medication prescribing practices for older prisoners in the TDCJ to be similar to those in the community, with several elements that were better than that reported in the community and others in need of improvement. Overall, 32% of older prisoners were prescribed a potentially inappropriate medication, compared with 21% of patients from a VA study and 29% from an HMO study.[31] However, prescriptions of inappropriate medications in the TDCJ were largely attributable to antihistamines, often dispensed over-the-counter outside prison and, thus, not readily captured in studies that have evaluated prescribing in other settings. When these medications were excluded, the prescribing pattern in prison was similar to that of the VA and better than that for HMOs. When indicators of "prescribing indicated medications" were assessed, we again found generally high rates of recommended prescribing for chronic diseases, although performance was low for gastrointestinal prophylaxis for high-risk individuals on nonsteroidal anti-inflammatory drugs (12%).

Several characteristics of the Texas prison health care system may help explain these findings. First, the relatively high rates of prescribing inappropriate medications were largely attributable to antihistamines, commonly considered innocuous when prescribed to younger adults but associated with adverse outcomes in older patients.[32,33] As noted above, these medications are likely to be largely undercounted in administrative data from the VA and HMOs; after accounting for these drugs, we found that prescribing patterns closely resembled those reported in the VA study. Still, this finding suggests a possible knowledge gap among correctional health care providers about the side-effect profile of antihistamines in older adults and underscores the importance of providing elder-focused training to providers, especially for medications whose safety profiles differ in younger and older adults.

Second, the relatively low rates of potentially inappropriate medications available only by prescription may be attributed partly to the restrictive TDCJ medication formulary, created in a joint effort between an academic institution and the prison medical system,[34] which excludes prescribing of 15 of the 33 Zhan list medications that are contraindicated for older adults. Most studies about the effects of restrictive medication formularies on healthcare quality have been hampered by limitations in their methodology and have yielded mixed results.[35] Nonetheless, our findings are consistent with those of small studies that have suggested that restricting a formulary's medications can have a positive impact on decreasing inappropriate medication prescribing in older individuals.[36]

Third, relatively low rates of inappropriate medication use may in part be attributable to an ongoing, mandatory continuing education and performance evaluation system for the University of Texas Medical Branch–operated central prison pharmacy.[19] Under this system, pharmaceutical care quality indicators are used as part of an incentive program and are tracked monthly and shared with all pharmacists.[19] One requirement of the system is that each pharmacist is expected to make and document at least 10 clinical interventions per day, including assessing potential misuse of medications and instances of polypharmacy. The system rewards pharmacists for conducting medication profile review for potential pharmacotherapy-related problems.[19]

The use of such strategies in the TDCJ may also have contributed to generally good performance rates in the 6 ACOVE indicators for "prescribing indicated medications," with adherence rates of 76% to 95% for 4 of 6 measures. Differences in data collection methods, measurement specifications, and population age precluded direct comparison of

TABLE 3—Proportion of Older Texas Department of Criminal Justice Prisoners Prescribed Indicated Medications: September 1, 2006, to August 31, 2007

Comorbidity–Medication Combination	Aged ≥55 Years (n=13 117), No. (%)	Aged ≥65 Years (n=2273), No. (%)
Atrial fibrillation—on aspirin or warfarin	79 (95)	42 (95)
Diabetes—on daily aspirin[a]	1817 (76)	401 (78)
Coronary artery disease or history of myocardial infarction—on daily aspirin[a]	1283 (84)	392 (84)
Coronary artery disease or history of myocardial infarction—on β blocker[b]	845 (62)	257 (63)
Hypertension—on any antihypertensive	7157 (93)	1528 (95)
GI prophylaxis[c] during NSAID therapy in patients also taking warfarin or with a history of peptic ulcer disease or GI bleeding	63 (12)	10 (10)

Notes. GI = gastrointestinal; NSAID = nonsteroidal anti-inflammatory drug.
[a]Excludes patients receiving warfarin.
[b]Excludes patients with history of asthma.
[c]GI prophylaxis defined as use of proton pump inhibitor or misoprostol.

our results with results obtained by the ACOVE investigators. However, as a rough benchmark, performance on these indicators for the TDCJ geriatric population was roughly equal or superior to results from a community-dwelling sample of vulnerable older adults.[25] In this study, much like in ours, the highest rate of completion was in the use of daily aspirin or warfarin for patients with atrial fibrillation (94%, compared with our finding of 95%); the indicator with the lowest rate of completion was gastrointestinal prophylaxis for any high-risk patient on a nonsteroidal anti-inflammatory (11%, compared with our finding of 12%).[25]

The quality of medication prescribing for older adults in the TDCJ may be influenced by the system's academic–correctional medicine partnership. For prison systems that are unable to partner with an academic hub, some of the quality achieved is likely attributable to systems-based interventions, including the restrictive medication formulary and the pharmacy practice incentives—interventions that could be applied to other prison health care systems. Our findings also suggest that the academic–correctional partnership may not be taking full advantage of local medical education opportunities to train prison health care providers in geriatrics.

Strengths and Limitations

The findings from this study should be assessed in the context of several limitations. Because we relied on administrative data, some of the diagnoses could reflect undercoding or miscoding. In addition, data on potentially inappropriate medication use in the VA and HMO studies were collected several years prior to our study period, precluding a strictly contemporaneous comparison. We did not have access to prisoner release dates, so we were unable to determine length of stay for the participants. Finally, we cannot ascertain the generalizability of our findings to current practices in other states' prison healthcare systems. Nonetheless, our findings suggest the possibility that the academic–correctional partnership and systems-based interventions implemented by the Texas Department of Criminal Justice—one of the nation's largest state prison systems—can result in quality of medication prescribing that, although imperfect, is generally favorable compared with community norms and with the history of major quality problems in US prisons.

Conclusions

Because of the rapid aging of the prison population, understanding the barriers to efficient, quality health care for incarcerated older adults holds increasing importance. Older prisoners contribute disproportionately to the escalating costs of correctional health care.[1,8] Appropriate medication prescribing for older adults may help cut these costs. We found medication prescribing for older prisoners in the TDCJ to be generally consistent with community practice. However, elements of prescribing that are unique to older adults, such as frequent use of antihistamines and underuse of gastrointestinal prophylaxis needed improvement, suggesting a need for education of prison health care providers in appropriate prescribing practices for older adults. ■

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Contributors

B.A. Williams designed the study, planned and interpreted the analysis, and drafted the article. J.G. Baillargeon, K. Lindquist, and M.A. Steinman helped design the study. J.G. Baillargeon acquired the data. J.G. Baillargeon, K. Lindquist, L.C. Walter, K.E. Covinsky, H.E. Whitson, and M.A. Steinman performed critical revisions of the article. K. Lindquist performed statistical analysis and data management. M.A. Steinman supervised all aspects of study design, analysis planning, interpretation, and article preparation.

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This study was reviewed and approved by the University of Texas Medical Branch institutional review board, the Committee of Human Research at the University of California, San Francisco, and the Research and Development Committee at the San Francisco Veterans Affairs Medical Center.

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