Epidemiologic Reviews
Vol. 40, 2018
DOI: 10.1093/epirev/mxx020
Advance Access publication:
March 23, 2018

The Health of America's Aging Prison Population

Kimberly A. Skarupski, Alden Gross*, Jennifer A. Schrack, Jennifer A. Deal, and Gabriel B. Eber

*Correspondence to Dr. Alden Gross, Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, 2024 E. Monument Street, Baltimore, MD 21205 (e-mail: agross14@jhu.edu).

Accepted for publication December 1, 2017.

Older incarcerated individuals comprise the fastest growing demographic in the US prison system. Unhealthy lifestyles among incarcerated individuals and inadequate health care lead to earlier onset and more rapid progression of many chronic conditions that are prevalent among community-living older adults. There are limited peer-reviewed epidemiologic data in this area; however, there is growing interest in identifying strategies for housing aging incarcerated individuals, delivering appropriate health care in prisons, and coordinating after-release health care. In this systematic review, we summarize the epidemiologic evidence of the health challenges facing the aging US prison population. Our comprehensive literature search focused on health outcomes, including diseases, comorbid conditions, mental health, cognition, and mobility. From 12,486 articles identified from the literature search, we reviewed 21 studies published between 2007 and 2017. All the studies were observational and cross-sectional, and most (n = 17) were based on regional samples. Sample sizes varied widely, ranging from 25 to 14,499 incarcerated people (median, 258). In general, compared with their younger counterparts, older incarcerated individuals reported high rates of diabetes mellitus, cardiovascular conditions, and liver disease. Mental health problems were common, especially anxiety, fear of desire for death or suicide, and depression. Activities of daily living were challenging for up to one-fifth of the population. We found no empirical data on cognition among older incarcerated individuals. The findings of this review reveal few empirical data in this area and highlight the need for new data to drive policy and practice patterns that address critical health issues related to the aging prison population.

aging; epidemiology; gerontology; health status; incarcerated individuals

Abbreviations: ADL, activities of daily living; PADL, prison activities of daily living.

INTRODUCTION

The US detention system is possibly the largest in the world, housing more than 2.3 million people in approximately 6,000 state and federal prisons, juvenile correctional facilities, local jails, Indian country jails, military prisons, immigration detention facilities, civil commitment centers, and prisons in US territories (1). Among that total, approximately 1,527,000 (66%) are housed in the state and federal prisons (2). Prisons house incarcerated people for longer terms than jails, which are designed to house incarcerated people temporarily or for a short time while awaiting trial or serving a short sentence. Incarcerated individuals age 50 years and older constitute approximately 16% of the state and federal prison population (3) and this number is expected to increase, given the aging of the population, longer sentences, and reduction of parole or early release because of more stringent "tough on crime" laws (4). Older incarcerated individuals require a different level of care than do younger incarcerated individuals, because of increased comorbidity burden and physical and cognitive disabilities (5). Accordingly, our goal in this systematic search and review was to summarize the literature describing the health status of older, incarcerated individuals in state and federal prisons in the United States.

As in the general US population, older incarcerated individuals make up the fastest growing demographic in the US prison system. Various estimates predict that the number of older incarcerated individuals increased by 79% between 2000 and 2009 (6, 7) and 282% from 1995 to 2010 (4). In 2011, there were 14 times as many incarcerated individuals who were at least 55 years old in the US as in 1981, and it has been estimated that by 2030, incarcerated individuals aged 55 years or older will constitute more than one-third of the entire prison population (3, 4, 8). In 1990, after the release of a Department of Justice report on prisoner demographics, a primetime news correspondent stated that absent intervention, American prisons would become "maximum

security nursing homes" (9). Nearly 25 years later, this remark proved prescient when the National Academy of Science, in its landmark report on mass incarceration, lamented a present in which "prisons increasingly are becoming a critical delivery site for nursing home-level care" (10).

One of the challenges in assessing and understanding aging in prison is determining the appropriate cutoff to define "old age." Although 65 years is the conventional cutoff used to define older age in the general US population, unhealthy lifestyles and inadequate health care often accelerate the onset and progression of many chronic conditions associated with aging; thus, old age in prison typically commences at ages 50 or 55 years (5, 8, 11, 12).

The US Department of Justice's Bureau of Justice Statistics periodically generates a prison and jail census and other reports on incarcerated populations, which include limited health-related information. Data from the 2011–2012 National Prisoner Survey (13) indicate that 50% of all US federal incarcerated individuals report ever having 1 or more chronic medical conditions, including cancer, hypertension, or history of stroke, diabetes, heart disease, kidney disease, arthritis, asthma, or cirrhosis. According to the Bureau of Justice Statistics' "Medical Problems of Prisoners," a 2004 survey of prisoners in state and federal correctional facilities providing self-reported prevalence rates of medical problems (14), 64.3% of state and federal incarcerated individuals age 45 years or older reported having a current medical problem. The most prevalent reported medical problems were arthritis (30.5%), hypertension (29.5%), heart problems (13.1%), tuberculosis (13.0%), diabetes (12.1%), and hepatitis (9.8%). According to the same report, 37.5% of incarcerated individuals reported having a chronic impairment or condition, including the following: vision (17.4%), learning (13.3%), hearing (11.4%), mobility (6.1%), mental (5.0%), and/or speech (3.5%) (14). Together, these reports indicate that the health data available from the US Department of Justice are limited to semiperiodic self-reports of symptoms and diagnoses, and are inconsistently stratified by standard age categories; and that there is sparse reporting of cognition and mobility data—2 primary metrics of aging.

In this review, we sought to profile the health status of older incarcerated individuals in state and federal prisons via a comprehensive review of the peer-reviewed, original research over the last 10 years. To be consistent with the gerontological literature, we chose to focus on the major challenges facing the community-dwelling aging population: chronic diseases or conditions, comorbid conditions, mental health, cognition, and mobility.

METHODS

Reporting in this review conforms to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (15).

Eligibility criteria

The focus of the systematic search was the health of older incarcerated individuals in US state and federal prison populations. We did not include articles related to jailed or civilly detained populations, which typically comprise individuals with shorter-term sentences; these facilities are run by local law enforcement agencies. Confining our review to prisons provided somewhat greater homogeneity in sentence length, health care, daily schedules and extracurricular programming, and nutrition. To be included, articles had to provide information on the age of the prison population being studied and include older adults (age 50 years or older); present health-related data collected via primary or secondary data collection methods (i.e., no anecdotal reports, commentaries, or editorials); have English-language availability; be a US-based sample; and have been published within 10 years of review (June 2017) to maximize consistency with the demographics of the current older prison population. Furthermore, we chose to focus on specific health diseases and conditions that are broadly relevant for older adults, namely, chronic diseases, comorbid conditions; mental health; cognition; and mobility. Thus, we excluded studies that focused solely on other important aspects of health care or outcomes of incarceration, including, but not limited to, factors associated with incarceration, medication prescribing, hospice care, parolee access to health care, emergency department use, homelessness, or death rates.

Search strategy

In collaboration with a trained information scientist, we conducted a systematic search of electronic databases, including Ovid Medline (which has an adjacency feature that PubMed does not have), Cochrane, Embase, Sociological Abstracts (Proquest), and Criminal Justice Abstracts, using search terms related to older age and prisoners (e.g., prison, inmate, incarceration). Date, language, and outcome restrictions were not used in the electronic search but were imposed during review. The last search was conducted on June 7, 2017. The Web Appendix (available at https://academic.oup.com/aje) details the full list of search terms.

Data analysis

Reviewers extracted characteristics of each article, including the year of study publication; year of data collection (allowing us to determine the age of the data at publication); sample size of older incarcerated individuals; mean, minimum, and maximum age of the incarcerated individuals; number of facilities sampled; whether analyses were adjusted or stratified for control covariates; and study outcomes (Table 1). We developed tables to summarize this information. Because of the heterogeneity of study outcomes and analytic plans, meta-analysis was not attempted.

RESULTS

Data extraction

Our initial search yielded 12,486 articles, which were screened by title for inclusion in this review according to specified eligibility criteria. A total of 500 abstracts (4%) were then independently reviewed by 2 reviewers. Reviewers chose to include an article for the review, exclude it, or retain it to be used for background reference only. Of the 500 abstracts reviewed, the reviewer pair

Table 1. Summary Characteristics of Included Studies ($n = 21$), 2007–2017

Characteristic	No. of Studies With Available Data	Mean	Minimum Value	Maximum Value
Year of data collection	17	2008.2	2004	2015
Year of study publication	20	2012.7	2008	2017
Age of data at publication, years	19	4.7	1	12
Sample size, no. of subjects	21	258.0	25	14,499
Mean age, years	20	57.7	52	71.5
Minimum age, years	21	48.3	39	55
Maximum age, years	21	79.7	64	100
No. of facilities	21	47.4	1	326

agreed on the disposition of 433 articles (87%). Disagreements between reviewers were resolved via group consensus; most disagreements involved whether to exclude or use an article for background information only. The inter-rater reliability was high, with an intraclass correlation coefficient (type 1, 4) of 0.74 (16). From the 500 abstracts, 85 were selected for full-text review; an additional 64 articles were excluded, primarily due to the lack of original data, resulting in a total of 21 articles included in this review.

The average mean age of incarcerated persons across studies was 57.8 years, and mean ages ranged from 52 to 72 years (Table 2). Samples comprised primarily men, with the exception of 2 studies that focused on women in prison (17, 18). The number of facilities included in studies ranged from 1 to 326 (median, 4 facilities). Studies were published, on average, approximately 5 years after the data being reported were collected (range, 1 to 12 years). Study outcomes are listed in Table 3.

Chronic diseases and comorbid conditions

Older incarcerated individuals are more likely than their younger counterparts to have chronic health conditions, including hypertension, diabetes mellitus, liver disease, arthritis, cancer, emphysema, decreased kidney function, and heart conditions (8, 19, 20). In their study of 759 newly admitted incarcerated individuals in 2 maximum security prisons in New York, Bai et al. (21) reported high rates of diabetes mellitus, cardiovascular conditions, liver disease, asthma, and sexually transmitted diseases among incarcerated individuals age 40 years and older (34% of their sample). In their study of 458 incarcerated women in Georgia age 50 years and older, Leigey and Johnston (17) reported that 34% were overweight and 36% were obese, although this was not substantially different from the rates found in the general population (22). Older incarcerated women report, on average, 4 having chronic medical conditions and receiving 5 daily medications (18, 23). In their study of 327 incarcerated women (mean age, 56 years), Aday and Farney (24) found that the most common chronic illnesses mentioned were arthritis (61%), hypertension (53%), menopause issues (30%), digestive disorders and ulcers (29%), and heart conditions (26%); furthermore, 66% reported a hearing problem and 84% reported a vision problem. As expected, comorbid conditions are common among older incarcerated individuals.

Mental health

Among incarcerated individuals age 55 years and older, approximately 8%–19% have a psychiatric disorder (25). In fact, correctional facilities are commonly considered the largest mental health service providers in the United States (26–28). In our review, most studies of mental health outcomes were association studies designed to identify groups at elevated risk for treatment or to elucidate mechanisms underlying relationships for potential intervention work. The most common mental health outcomes studied in the empirical literature included anxiety, depression, and fear of or desire for death or suicide.

With respect to depression, anxiety, and related mood disorders, Barry et al. (29) reported that alcohol dependence before imprisonment and poor self-rated health were associated with suicidal ideation; however, Gates et al. (30) reported that compared with incarcerated individuals younger than 45 years, older incarcerated individuals had lower odds of a history of substance use (Table 2). Deaton et al. (18), using quantitative and qualitative methods, found that poor physical and mental health were related to elevated anxiety about death; furthermore, they found that these concerns about death stemmed from perceived lack of adequate health care and perceived indifference of prison staff to instances of injury and illness. In their study, Aday and Farney (24) found that a substantial number of women reported high or severe levels of depression (46%), anxiety (43%), and interpersonal sensitivity (42%), which are indicative of hypervigilance, distrust, and posttraumatic stress. One-half of the women reported a history of sexual or physical abuse and more than three-quarters (78%) reported a fear of getting sick and dying while in prison. The majority (64%) reported their physical health to be fair or poor, 30% reported good health, and 6% reported excellent health (24).

Allen et al. (31) found less depression and anxiety among incarcerated individuals who had more spiritual experiences; the latter were associated with more years of incarceration. In a follow-up study, Allen et al. (32) examined religious coping as a moderator of the relationship among physical limitations, depression, and desire for hastened death, and found that greater positive religious coping was associated with less depression, whereas more physical functioning coupled with greater negative religious coping was associated with a heightened desire for hastened death. The same group of researchers

Table 2. Detailed Characteristics of Each Study Included in the Review ($n = 21$), 2007–2017

First Author, Year (Reference No.)	Primary Data Collection	Year of Data Collection	Year of Study Publication	Cross-Sectional Data	No. in Sample	Mean Age, Years	Minimum Age, Years	Maximum Age	Male Sex, No.	Male Sex, %
Aday, 2014 (24)	Yes	Not reported	1	Yes	327	56	50	77	0	0
Binswanger, 2009 (20)	No	2004	5	Yes	1,474	57.5	50	65	1,132	77[a]
Bishop, 2011 (78)	Yes	2006	5	Yes	261	57.59	45	82	261	100
Nowotny, 2016 (79)	No	2004	12	Yes	14,499	56.28	50	84	14,499	100
Bai, 2015 (21)	Yes	2011	4	Yes	255	52	40	64	130	51[a]
Loeb, 2011 (80)	Yes	2009	2	Yes	42	55.8	50	68	42	100
Leigey, 2015 (17)	Yes	2013	2	Yes	458	56	50	95	0	0
Allen, 2013 (32)	Yes	2005	8	Yes	94	57.7	45	84	94	100
Allen, 2008 (31)	Yes	2005	3	Yes	73	63.7	50	84	73	100
Barry, 2016 (29)	Yes	2014	2	Yes	124	56.4	50	83	78	63
Bishop, 2014 (35)	Yes	2006	8	Yes	261	57.6	45	82	261	100
Deaton, 2009 (18)	Yes	Not reported		Yes	327	56.6	50	78	0	0
Gates, 2017 (30)	Yes	2011	6	Yes	2,940	52.8	45	67	2,649	90[a]
Liem, 2013 (81)	Yes	2012	1	Yes	25	55.8	39	70	23	92
Merten, 2012 (34)	Yes	2005	7	Yes	261	57.6	45	80	261	100
Maschi, 2015 (36)	Yes	2010	5	Yes	677	57.8	50	100	626	92
Loeb, 2008 (37)	Yes	Not reported		Yes	51	57.3	50	71	51	100
Phillips, 2009 (33)	Yes	2005	4	Yes	73	62	55	84	72	99
Barry, 2016 (82)	Yes	2015	1	Yes	167	57.2	50	83	110	66
Filinson, 2014 (44)	Yes	Not reported		Yes	67	71.5	55	88	67	100
Leigey, 2012 (45)	Yes	2004	8	Yes	1,139	56	50	84	997	88

[a] The number of men was extrapolated on the basis of the full sample and percentage of men, because the study did not report the number of older men studied.

(33) also evaluated preferences for end-of-life care, reporting that ethnic minority incarcerated individuals who did not have a life sentence and who had greater anxiety about death, had a greater desire for a feeding tube, whereas white incarcerated individuals were more likely to seek palliative care. Merten et al. (34), using data collected in 2005 from 261 incarcerated individuals ages 45–80 years, found that loneliness and lower valuation of life were associated with greater depressed mood, which, in turn, was associated with more medical comorbidity. Using the same data set of 261 incarcerated individuals, Bishop et al. (35) reported a different age range and year of data collection, and found that less spirituality, loneliness, and depressed mood were each associated with less forgiveness and poorer self-rated health. Maschi et al. (36) found that a variety of stronger coping resources, was protective against stressful life experiences and poor subjective well-being among older incarcerated individuals.

Loeb et al. (37) found that levels of self-efficacy did not differ between a sample of older incarcerated individuals and a group of even older community-dwelling individuals; the authors speculated that incarcerated individuals engage less often in health promotion because of lack of awareness of available programs.

Cognition

In our systematic review, we identified no published studies in which a primary outcome was cognitive functioning or dementia. Prevalence estimates of dementia in prisons, from surveys older than 10 years or from studies otherwise ineligible for our review, range widely, from 1% to 30%; these studies are limited by small sample sizes, selection bias, and failure to use standardized screening instruments (38–41). Making inferences from the general population, common dementia risk factors such as advanced age, traumatic brain injury, low educational attainment, and substance abuse suggest a potentially high prevalence of and risk for cognitive impairment among older incarcerated individuals.

Mobility

In the general community population, preserving mobility is essential to maintaining independent living. Difficulty with activities of daily living (ADL) include inability to bathe, dress, transfer from a bed to a chair, feed oneself, or use the toilet (42). Aging

Table 3. Study Outcomes of Each Study Included in the Review ($n = 21$), 2007–2017

Citation	No. of Facilities	Sample Representation	Study Outcomes	Statistical Adjustment in Analysis
Aday, 2014 (24)	7	Regional	Health status, mental health symptoms	No
Binswanger, 2009 (20)	326	National	Hypertension, diabetes, obesity, angina, myocardial infarction, arthritis, cancer, cervical cancer, hepatitis	Yes
Bishop, 2011 (78)	10	Regional	Comorbidity index	Yes
Nowotny, 2016 (79)	287	National	Comorbidity index, alcohol, disabilities, mental/behavioral health	Yes
Bai, 2015 (21)	2	Regional	Comorbidity index	Yes
Loeb, 2011 (80)	1	Regional		
Leigey, 2015 (17)	31	National	Body mass index	Yes
Allen, 2013 (32)	1	Regional	Depression, desire for a hastened death	Yes
Allen, 2008 (31)	1	Regional	Depression, desire for a hastened death, anxiety	Yes
Barry, 2016 (29)	3	Regional	Suicidal ideation	Yes
Bishop, 2014 (35)	10	Regional (OK)	Forgiveness, perceived health	Yes
Deaton, 2009 (18)	5	National	Anxiety	Yes
Gates, 2017 (30)	99[a]	Regional (KY)	Substance use disorder, cardiovascular disease, dementia, depression, hepatitis C virus, hypertension, osteoporosis	Yes
Liem, 2013 (81)	1	Regional	Post-traumatic stress disorder	No
Merten, 2012 (34)	8	Regional (OK)	Number of health conditions, loneliness, depressed mood, valuation of life	Yes
Maschi, 2015 (36)	99[a]	Regional (NY)	Trauma and stressful life events	
Loeb, 2008 (37)	1	Regional (PA)	Self-efficacy, health status	
Phillips, 2009 (33)	1	Regional (AL)	Brief symptom inventory, Death Anxiety Scale, preference for type of end of life care	
Barry, 2016 (82)	3	Regional (CT)	Depression, suicide	Yes
Filinson, 2014 (44)	1	Regional	Prison activities of daily living	No
Leigey, 2012 (45)	99[a]	National	Physical health, mental health	Yes

Abbreviations: AL, Alabama; CT, Connecticut; KY, Kentucky; NY, New York; OK, Oklahoma; PA, Pennsylvania.
[a] If data from many facilities were included but the number of facilities was not specifically stated, the number is given as 99.

incarcerated individuals must maintain the ability to perform these tasks, as well as those specific to life in prison (prison activities of daily living (PADL)). These tasks include dropping to the floor for alarms, standing for count, walking while handcuffed, getting to the dining hall for meals, hearing orders from staff, and climbing on and off the top bunk (43).

Estimates of the prevalence of PADL disability vary widely. In a recent study of older incarcerated individuals in Connecticut prisons, 12.6% of incarcerated individuals reported difficulty with mobility and 7.8% reported disability with 1 or more ADL (29). In another study of older incarcerated individuals based in the northeastern United States, 21% reported difficulty with 1 or more PADL (43). Incarcerated women are generally more likely to report difficulty with ADL or PADL compared with men (29, 44). Using data from the Bureau of Justice Statistics, Leigey, et al. (45) estimated that 11.5% of older incarcerated women needed help with 1 or more daily activities, compared with 8.7% of men. The hierarchy of disability with PADL tended to be as follows: 1) hearing orders from the staff (59%), 2) dropping to the floor for alarms (57%), 3) standing for count (35%), and 4) getting to the dining hall for meals (31%) (42). Aday and Farney (24) found that most women reported problems walking independently (89%), problems with stairs (66%), needing ground-level housing (49%), and needing a lower-level bunk (86%).

Although efforts to improve PADL are possible, efforts to prevent disability are generally nonexistent and accommodations for PADL vary widely by facility, including modifications to physical space (43). Less than half of older incarcerated individuals report consistent engagement in physical activity; Leigey et al. (45) estimated that only 33.8% of women and 48.0% of men reported engaging in physical activity within the previous 24 hours. Often, correctional officials may hesitate to provide older incarcerated individuals with assistive devices (e.g., walkers, canes), because they may also be used or perceived as a weapon. As such, some incarcerated individuals report missing meals because they are unable to get to the dining hall in time (43). Although newer prisons are compliant with the Americans with Disabilities Act and, hence, provide standard assistive modifications, the prevalence of bathroom modifications (i.e., shower or toilet handrails) to assist with basic ADL in older prisons is unknown. Older incarcerated

individuals with deficits in PADL also tended to report have hearing and/or visual impairments, and to take more medications because of overall poor health (44), all of which may accentuate difficulties with mobility.

DISCUSSION

Our systematic review identified 20 studies published within the last 10 years that reported original data about health characteristics of older incarcerated individuals in US state or federal prisons. These studies show, based on limited samples, that this population reports more chronic diseases, comorbid conditions, mental health issues, and mobility challenges than their younger counterparts. We found no empirical data on cognitive status of older prisoners. Periodic reports issued from the US Department of Justice also document only limited data on health status.

The dearth of original, empirical data collection on aging incarcerated individuals is not surprising. Ahalt et al. (46) reviewed National Institutes of Health grants issued between 2008 and 2012, and found that less than 0.1% of grants addressed the health of criminal justice–involved populations and that the overwhelming majority of these grants were for studies involving HIV and substance abuse; the authors did not examine the proportion of grants that were focused on older incarcerated individuals. Given that the realization of the needs of older incarcerated individuals is fairly recent, creating new, or modifying existent, validated prison health instruments and increasing data collection efforts are warranted (47, 48).

Despite the implications of the growing number of older incarcerated individuals for health and society, little has been done to research solutions. Greater than 95% of incarcerated individuals are eventually released to the community (49); however, reentry planning for older incarcerated individuals is sparse and the outlook is grim, given that many are released to urban communities characterized by health disparities and inadequate health care resources (50). Earlier identification, prevention, and treatment of physical health, mental health, and substance abuse problems while incarcerated may mitigate burden on the health care system upon prisoner release, as well as reduce recidivism and re-arrest rates (51–55).

The costs associated with caring for the aging US incarcerated population are high and increasing. In 2015, total annual prison spending for health care was estimated at $8.1 billion, much of which was largely attributed to the aging segment of the population (56–59). Older prisoners' higher rates of disability contribute to overall health care costs estimated at 3–9 times greater than that of younger inmates (8, 20, 50). Increases in health care expenditures have been reported. In its 2005 audit report, the Federal Bureau of Prisons reported a $210.87 million increase for total health care costs between 2000 and 2004; the largest drivers were hospital care, physician and clinical services, and prescription medications (59). In its 2007 audit report, the Federal Bureau of Prisons allocated approximately $737 million for inmate health care (60) Although better prison health care may be difficult to justify in prison budgets, better care ultimately may save taxpayer dollars when the 95% of inmates who are eventually released from prison (49) return to their communities.

There are challenges to understanding the burden and management of chronic diseases among older adults incarcerated in state and federal prisons. One challenge is the survey methods and tools used by both federal and academic researchers. Validated or uniform health screening tools were not used in most of the studies we reviewed. For example, from their systematic review, Martin et al. (61) identified 22 correctional mental health screening instruments, of which only 6 had published replication studies using separate samples. Of those 6, none was designed to measure cognitive impairment (62). A standardized, supplemental intake assessment tool for older incarcerated individuals, perhaps one incorporating variables from the Minimum Data Set (63) used to screen all nursing home residents, would provide vital baseline health status data and facilitate development of an appropriate care plan. Annual or periodic standardized assessments of older incarcerated individuals or brief evaluations after a sentinel event (e.g., fall, injury, health event) of older incarcerated individuals could be used to measure changes over time and for advanced care planning upon probation or release into the community.

As with any special populations, investigators who wish to conduct ethical research in prisons must be aware of human subjects review processes designed to protect incarcerated individuals (Health and Human Services Common Rule (or subpart A) is supplemented by the protections of subpart C) (64). Furthermore, prison research requires heightened awareness of literacy and cognitive capacity of study participants in order to develop and obtain meaningful informed consent, make proper disclosures, and collect meaningful data (65, 66). Loss to follow-up is also challenging for longitudinal research, because incarcerated individuals are often relocated to solitary confinement or other prisons (67). For example, in our review, we found no longitudinal studies published in the last 10 years that included primary data.

Finally, although the theme of this *Epidemiologic Reviews* issue is prisoner health, older adults are also incarcerated in jails and other facilities. Future research should include jail-based studies and be mindful of the nuances of reporting jail findings (e.g., assessing an incarcerated individual's status as either a pretrial detainee or sentenced). Policy implementation at the state and federal prison level for older incarcerated individuals should be evaluated for feasible application at the level of the local jail.

We provide 3 considerations for future research of older incarcerated individuals. First, because it is commonly agreed that aging in prison is accelerated, a universally adopted cutpoint for what is considered older age (i.e., age 50 years) among incarcerated individuals would make comparisons with the general population more straightforward. Second, research in prison requires heightened sensitivity to the concept of diversity in prisons (68). In addition to the more traditional indicators of diversity such as age, sex, gender identity, race, ethnic origin, religion, and disability, diversity in prison also includes first-time incarcerated people versus recidivists, individuals with shorter sentences versus longer and death sentences, and the diversity of family relationships (68). Thus, the aging prisoner population is particularly heterogeneous; therefore, these diversity data should be considered in analytic models and be reported as appropriate. Third, the current chronic care clinic treatment model, in which incarcerated individuals are seen for appropriate diagnostics, monitoring, and care planning at

a frequency designed to reflect their level of control for a specified disease (69), may be inefficient as currently implemented. For example, a mobility-impaired 60-year-old prisoner with hyperlipidemia, diabetes, hepatitis C infection, and 2 stents would attend 4 chronic care clinics, typically at a minimum frequency of 4 times per year, for each of those conditions. Those 16 visits must be scheduled, staffed, and accompanied by a mobility assistant, if necessary. Prison guards are often viewed as a possible liaison for conveying health challenges, but they may be unaware of the severity of the condition or disability of incarcerated older adults, as is indicated by data showing high discordance between guard reports and prisoner self-reports of disability (70).

In addition, the increased number of comorbid conditions typically results in expanded polypharmacy and increased attendant medication management problems, including medication interruption, administration error, missed dosing schedules, and adverse medication reactions (71, 72). Medication-prescribing patterns in prisons are often not standardized. In their study of 13,117 incarcerated individuals aged 55 years or older, 40% of whom were classified with cognitive disorders, Williams et al. (73) reported that most (89%) were prescribed at least 1 medication and a one-third were prescribed inappropriate medications, one-half of which were attributable to over-the-counter antihistamines.

More research is needed to develop more effective and efficient models of care (74), such as a more unified system of scheduled monitoring supplemented by episodic care and case management for those patients with multiple comorbid conditions who are particularly fragile and prone to preventable trips to the emergency department (69). For example, whereas chronic care models relying on the evaluation of 1 particular disease or organ system at a time may serve younger patients, older adults with multiple comorbid conditions and concomitant multiple prescription medications are ill suited to the single-disease treatment model. Geriatricians are best trained to diagnose, treat, and cure older patients. Case managers could be used to coordinate clinical encounters and reduce medication interruptions.

The definitional regulations promulgated under the Americans with Disabilities Act, as amended in 2008, now bring myriad PADL under their purview and older incarcerated individuals under their protection (75). Jurisdictions and their required Americans with Disabilities Act coordinators should enforce the protections guaranteed to all disabled persons in addition to those protections designed specifically to safeguard the rights of detained persons (§§ 35.151(k), 35.152) (76). More research in this area will likely confirm the Department of Justice's multiple findings of noncompliance and, hopefully, begin remedial measures that will benefit all disabled incarcerated individuals in addition to those who fall into the category of "older."

We also need additional examination of end-of-life care among incarcerated individuals. There is evidence that there are growing and unique hospice care needs in prisons. In their retrospective chart review of 79 patients, Cloyes et al. (77) found that, compared with community hospice patients, prison hospice patients were younger, more likely to be black, admitted to hospice earlier, and stayed longer and died at a younger age. The results of this systematic review echo the findings of a 2011 national roundtable meeting that resulted in a comprehensive policy agenda for the health care of older incarcerated adults (48): Namely, that old age in prisons should be defined as age 50 years. That panel also identified the following other priority areas: train staff and health care providers; define functional impairment; screen for dementia; identify needs of older, incarcerated women; create uniform policies for geriatric housing units; identify release and reentry challenges; improve medical release policies; and enhance palliative care programs (48). Our study also makes the point that diversity data are important and should be collected at time of incarceration and incorporated into research projects and prison census reporting. These findings underscore the dearth of research in this area despite a rapidly rising, exceedingly expensive patient population. There is a critical and immediate need for aggressive progress toward accomplishing these priorities and a heightened attention to research in this area.

ACKNOWLEDGMENTS

Author affiliations: School of Medicine, Johns Hopkins University, Baltimore, Maryland (Kimberly A. Skarupski); Department of Epidemiology, Bloomberg School of Public Health, Johns Hopkins University, Baltimore, Maryland (Kimberly A. Skarupski, Alden Gross, Jennifer A. Schrack, Jennifer A. Deal, Gabriel B. Eber); Center on Aging and Health, Johns Hopkins University, Baltimore, Maryland (Kimberly A. Skarupski, Alden Gross, Jennifer A. Schrack, Jennifer A. Deal); the Center for Public Health and Human Rights, Bloomberg School of Public Health, Johns Hopkins University, Baltimore, Maryland (Gabriel B. Eber); and the National Prison Project, the American Civil Liberties Foundation, Washington, DC (Gabriel B. Eber).

A.G. was supported by grant K01-AG050699 from the National Institute on Aging. J.A.S. was supported by grants K01AG048765, R21AG053198, and P30AG021334 from the National Institute on Aging.

We thank Lori Rosman, informationist at the Johns Hopkins University, Welch Medical Library. We thank Logan Campbell for assistance with formatting the manuscript.

Conflict of interest: none declared.

REFERENCES

1. Wagner P, Rabuy B. Mass incarceration: the whole pie 2017. https://www.prisonpolicy.org/reports/pie2017.html. Accessed October 19, 2017.
2. Bureau of Justice Statistics. Prisoners in 2015: presents final counts of prisoners under the jurisdiction of state and federal correctional authorities at year end 2015. Part of the Prisoners Series. NCJ 250229. Washington, DC: Department of Justice, Office of Justice Programs. https://www.bjs.gov/content/pub/pdf/p15_sum.pdf. Accessed October 19, 2017.
3. Chettiar IM, Bunting WC, Schotter G. *At America's Expense: The Mass Incarceration of the Elderly*. New York, NY: American Civil Liberties Union; 2012.
4. Fellner J, Vinck P. *Old Behind Bars: The Aging Prison Population in the United States*. New York, NY: Human Rights Watch; 2012.
5. Loeb SJ, AbuDagga A. Health-related research on older inmates: an integrative review. *Res Nurs Health*. 2006;29(6):556–565.

6. Bureau of Justice Statistics, US Department of Justice. Prisoners in 2000. Washington, DC: Bureau of Justice Statistics; 2001. https://www.bjs.gov/content/pub/pdf/p00.pdf. Accessed November 22, 2017.
7. Bureau of Justice Statistics, US Department of Justice. Prisoners in 2009. Washington, DC: Bureau of Justice Statistics; 2010. https://www.bjs.gov/content/pub/pdf/p09.pdf. Accessed November 22, 2017.
8. Aday RH. *Aging Prisoners: Crisis in American Corrections*. University Park, PA: Penn State Press; 2003.
9. Prison population. *ABC Evening News*. ABC television. October 8, 1990. https://tvnews.vanderbilt.edu/broadcasts/125663.
10. National Academy of Sciences. *The Growth of Incarceration in the United States: Exploring Causes and Consequences*. Washington, DC: The National Academies Press; 2014.
11. Aday RH. Aging in prison: a case study of new elderly offenders. *Int J Offender Ther Comp Criminol*. 1994;38(1): 79–91.
12. Gallagher EM. Elders in prison. Health and well-being of older inmates. *Int J Law Psychiatry*. 2001;24(2–3):325–333.
13. Bureau of Justice Statistics, US Department of Justice. National inmate survey, 2011–2012. Ann Arbor, MI: Bureau of Justice Statistics; 2015. https://doi.org/10.3886/ICPSR35009.v1. Accessed March 1, 2018.
14. Bureau of Justice Statistics, US Department of Justice. Medical problems of prisoners. Washington, DC: Bureau of Justice Statistics; 2008. https://www.bjs.gov/index.cfm?ty=pbdetail&iid=1097. Accessed August 29, 2017.
15. Moher D, Liberati A, Tetzlaff J, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Ann Intern Med*. 2009;151(4):264–269.
16. Shrout PE, Fleiss JL. Intraclass correlations: uses in assessing rater reliability. *Psychol Bull*. 1979;86(2):420–428.
17. Leigey ME, Johnston ME. The prevalence of overweight and obesity among aging female inmates. *J Correct Health Care*. 2015;21(3):276–285.
18. Deaton D, Aday RH, Wahidin A. The effect of health and penal harm on aging female prisoners' views of dying in prison. *Omega (Westport)*. 2009–2010;60(1):51–70.
19. Binswanger IA, Stern MF, Deyo RA, et al. Release from prison–a high risk of death for former inmates. *N Engl J Med*. 2007;356(2):157–165.
20. Binswanger IA, Krueger PM, Steiner JF. Prevalence of chronic medical conditions among jail and prison prisoners in the USA compared with the general population. *J Epidemiol Community Health*. 2009;63(11):912–919.
21. Bai JR, Befus M, Mukherjee DV, et al. Prevalence and predictors of chronic health conditions of inmates newly admitted to maximum security prisons. *J Correct Health Care*. 2015;21(3):255–264.
22. Flegal KM, Carroll MD, Ogden CL, et al. Prevalence and trends in obesity among US adults, 1999–2000. *JAMA*. 2002; 288(14):1723–1727.
23. Aday RH, Krabill JJ. *Women Aging in Prison: A Neglected Population in the Correctional System*. Boulder, CO: Lynne Rienner Publishers; 2011.
24. Aday R, Farney L. Malign neglect: assessing older women's health care experiences in prison. *J Bioeth Inq*. 2014;11(3): 359–372.
25. Dilton PM. *Mental Health and Treatment of Prisoners and Probationers*. Washington, DC: Bureau of Justice Statistics. 1999. https://www.bjs.gov/content/pub/pdf/mhtip.pdf. Accessed November 22, 2017.
26. American Psychiatric Association. *Position Statement on Segregation of Prisoners With Mental Illness*. Arlington, VA: American Psychiatric Association; 2012. https://www.psychiatry.org/file%20library/about-apa/organization-documents-policies/policies/position-2012-prisoners-segregation.pdf. Accessed May 4, 2017
27. Torrey EF, Kennard AD, Eslinger D, et al. More mentally ill persons are in jails and prisons than hospitals. A survey of the states. Arlington, VA: Treatment Advocacy Center. 2010 May. http://www.treatmentadvocacycenter.org/storage/documents/final_jails_v_hospitals_study.pdf. Accessed October 20, 2017.
28. Wilper AP, Woolhandler S, Boyd JW, et al. The health and health care of US prisoners: results of a nationwide survey. *Am J Public Health*. 2009;99(4):666–672.
29. Barry LC, Wakefield DB, Trestman RL, et al. Active and passive suicidal ideation in older prisoners. *Crisis*. 2016;37(2): 88–94.
30. Gates ML, Staples-Horne M, Walker V, et al. Substance use disorders and related health problems in an aging offender population. *J Health Care Poor Underserved*. 2017;28(2S): 132–154.
31. Allen RS, Phillips LL, Roff LL, et al. Religiousness/spirituality and mental health among older male inmates. *Gerontologist*. 2008;48(5):692–697.
32. Allen RS, Harris GM, Crowther MR, et al. Does religiousness and spirituality moderate the relations between physical and mental health among aging prisoners? *Int J Geriatr Psychiatry*. 2013;28(7):710–717.
33. Phillips LL, Allen RS, Salekin KL, et al. Care alternatives in prison systems: factors influencing end-of-life treatment selection. *Crim Justice Behav*. 2009;36(6):620–634.
34. Merten MJ, Bishop AJ, Williams AL. Prisoner health and valuation of life, loneliness, and depressed mood. *Am J Health Behav*. 2012;36(2):275–288.
35. Bishop AJ, Randall GK, Merten MJ. Consideration of forgiveness to enhance the health status of older male prisoners confronting spiritual, social, or emotional vulnerability. *J Appl Gerontol*. 2014;33(8):998–1017.
36. Maschi T, Viola D, Morgen K, et al. Trauma, stress, grief, loss, and separation among older adults in prison: the protective role of coping resources on physical and mental well-being. *J Crim Justice*. 2015;38(1):113–136.
37. Loeb SJ, Steffensmeier D, Lawrence F. Comparing incarcerated and community-dwelling older men's health. *West J Nurs Res*. 2008;30(2):234–249.
38. Barak Y, Perry T, Elizur A. Elderly criminals: a study of the first criminal offence in old age. *Int J Geriatr Psychiatry*. 1995; 10(6):511–516.
39. Fazel S, Hope T, O'Donnell I, et al. Hidden psychiatric morbidity in elderly prisoners. *Br J Psychiatry*. 2001;179(6):535–539.
40. Heinik J, Kimhi R, Hes JP. Dementia and crime: a forensic psychiatry unit study in Israel. *Int J Geriatr Psychiatry*. 1994; 9(6):491–494.
41. Rosner R, Wiederlight M, Harmon RB, et al. Geriatric offenders examined at a forensic psychiatry clinic. *J Forensic Sci*. 1991;36(6):1722–1731.
42. Katz S, Ford AB, Moskowitz RW, et al. Studies of illness in the aged. The index of ADL: a standardized measure of biological and psychosocial function. *JAMA*. 1963;185(12):914–919.
43. Williams BA, Lindquist K, Sudore RL, et al. Being old and doing time: functional impairment and adverse experiences of geriatric female prisoners. *J Am Geriatr Soc*. 2006;54(4):702–707.
44. Filinson, R. Age versus function in assessing aging on "the inside". *Corrections Today*. 2014;2(6):20.
45. Leigey ME, Hodge JP. Gray matters: gender differences in the physical and mental health of older inmates. *Women Crim Justice*. 2012;22(4):289–308.

46. Ahalt C, Bolano M, Wang EA, et al. The state of research funding from the National Institutes of Health for criminal justice health research. *Ann Intern Med*. 2015;162(5):345–352.
47. Ahalt C, Binswanger IA, Steinman M, et al. Confined to ignorance: the absence of prisoner information from nationally representative health data sets. *J Gen Intern Med*. 2012;27(2): 160–166.
48. Williams BA, Stern MF, Mellow J, et al. Aging in correctional custody: setting a policy agenda for older prisoner health care. *Am J Public Health*. 2012;102(8):1475–1481.
49. Freeman R. Can we close the revolving door?: Recidivism vs employment of ex-offenders in the US. Presented at May Urban Institute Roundtable, New York University Law School, New York, NY, May 19–20, 2003.
50. Ahalt C, Trestman RL, Rich JD, et al. Paying the price: the pressing need for quality, cost, and outcomes data to improve correctional health care for older prisoners. *J Am Geriatr Soc*. 2013;61(11):2013–2019.
51. Mallik-Kane K, Visher C. Health and prisoner reentry: how physical, mental, and substance abuse conditions shape the process of reintegration. The Urban Institute; 2008. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.951.2599&rep=rep1&type=pdf. Accessed November 22, 2017.
52. Visher CA, Mallik-Kane K. Reentry experiences of men with health problems. In: Greifinger RB, ed. *Public Health Behind Bars*. New York, NY: Springer; 2007:434–460.
53. Rich JD, Wakeman SE, Dickman SL. Medicine and the epidemic of incarceration in the United States. *N Engl J Med*. 2011;364(22):2081–2083.
54. National Commission on Correctional Health Care. *The Health Status of Soon to be Released Prisoners: A Report to Congress*. Chicago, IL: National Commission on Correctional Health Care; 2004. https://www.ncchc.org/health-status-of-soon-to-be-released-inmates. Accessed November 22, 2017.
55. Visher CA, Travis J. Transitions from prison to community: understanding individual pathways. *Annu Rev Sociol*. 2003;29: 89–113.
56. Bureau of Justice Statistics, US Department of Justice. State prison expenditures, 2001. Washington, DC: Bureau of Justice Statistics; 2004. https://www.bjs.gov/index.cfm?ty=pbdetail&iid=5869. Accessed May 4, 2017.
57. Bureau of Justice Statistics, US Department of Justice. *Special Report: Aging of the State Prison Population, 1993–2013*. Washington, DC: Bureau of Justice Statistics; 2016. https://www.bjs.gov/content/pub/pdf/aspp9313.pdf. Accessed August, 23, 2017.
58. Office of the Inspector General, US Department of Justice. *Audit of the Federal Bureau of Prisons Pharmacy Services* (Audit Report 06-03). Washington, DC: Office of the Inspector General; 2005. http://www.justice.gov/oig/reports/BOP/a0603/final.pdf. Accessed May, 4, 2017.
59. The Pew Charitable Trusts. Prison health care: costs and quality. http://www.pewtrusts.org/~/media/assets/2017/10/sfh_prison_health_care_costs_and_quality_final.pdf?la=en. Accessed October 31, 2017.
60. Office of the Inspector General, US Department of Justice. *The Federal Bureau of Prison's Efforts to Manage Inmate Health Care* (Audit Report 08-08). Washington DC: Office of the Inspector General; 2007. https://oig.justice.gov/reports/BOP/a0808/final.pdf. Accessed October 31, 2017.
61. Martin MS, Colman I, Simpson AI, et al. Mental health screening tools in correctional institutions: a systematic review. *BMC Psychiatry*. 2013;13:275.
62. National Institute of Justice, United States Department of Justice. *Mental Health Screens for Corrections*. Washington, DC: National Institute of Justice; 2007.
63. Centers for Medicare & Medicaid Services. Nursing home quality initiative. https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/NursingHomeQualityInits/index.html?redirect=/NursingHomeQualityInits/25_NHQIMDS30.asp. Accessed October 31, 2017.
64. Protection of Human Subjects, 45 CFR §46 (2009).
65. Institute of Medicine. *Ethical Considerations for Research Involving Prisoners*. Washington, DC: The National Academies Press; 2006.
66. Ahalt C, Sudore R, Bolano M, et al. "Teach-to-goal" to better assess informed consent comprehension among incarcerated clinical research participants. *AMA J Ethics*. 2017;19(9): 862–872.
67. Freudenberg N. Health research behind bars: a brief guide to research in jails and prisons. In: Greifinger R, ed. *Public Health Behind Bars*. New York, NY: Springer; 2006:415–433.
68. Aday RH. Examining critical health issues for aging prisoners. In: Cohen F, ed. *Correctional Health Care: Practice, Administration, and the Law*. Kingston, NJ: Civic Research Institute; 2017:9-1–9-22.
69. Puisis M, Appel H. Chronic disease management. In: Puisis M, ed. *Clinical Practice in Correctional Medicine*. 2nd ed. Philadelphia, PA: Mosby Elsevier; 2006:66–88.
70. Williams BA, Lindquist K, Hill T, et al. Caregiving behind bars: correctional officer reports of disability in geriatric prisoners. *J Am Geriatr Soc*. 2009;57(7):1286–1292.
71. Knox CM, Burrow GF. *Quick Start for Correctional Nurses: Medication Management in the Correctional Setting*. Genessee, PA: Enchanted Mountain Press; 2016.
72. Chutka DS, Takahashi PY, Hoel RW. Inappropriate medications for elderly patients. *Mayo Clin Proc*. 2004;79(1): 122–139.
73. Williams BA, Baillargeon JG, Lindquist K, et al. Medication prescribing practices for older prisoners in the Texas prison system. *Am J Public Health*. 2010;100(4):756–761.
74. Voermans P. Chronic conditions. In: Schoenly L, Knox CM, eds. *Essentials of Correctional Nursing*. New York, NY: Springer Publishing Co.; 2013:97–121.
75. Definition of disability, 28 CFR § 35.108 (2016).
76. New construction and alterations, 28 CFR § 35.151 (2011).
77. Cloyes KG, Berry PH, Martz K, et al. Characteristics of prison hospice patients: medical history, hospice care, and end-of-life symptom prevalence. *J Correct Health Care*. 2015:21(3): 298–308.
78. Bishop AJ, Merten MJ. Risk of comorbid health impairment among older male inmates. *J Correct Health Care*. 2011;17(1): 34–45.
79. Nowotny KM, Cepeda A, James-Hawkins L, et al. Growing old behind bars: health profiles of the older male inmate population in the United States. *J Aging Health*. 2016;28(6): 935–956.
80. Loeb SJ, Steffensmeier D. Older inmates' pursuit of good health: a focus group study. *Res Gerontol Nurs*. 2011;4(3): 185–194.
81. Liem M, Kunst M. Is there a recognizable post-incarceration syndrome among released "lifers"? *Int J Law Psychiatry*. 2013; 36(3–4):333–337.
82. Barry LC, Wakefield DB, Trestman RL, et al. Disability in prison activities of daily living and likelihood of depression and suicidal ideation in older prisoners. *Int J Geriatr Psychiatry*. 2017;32(10):1141–1149.