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Prevalence and Predictors of Chronic Health Conditions of Inmates Newly Admitted to Maximum Security Prisons

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Abstract

This study estimated the prevalence of chronic medical conditions and risk predictors of 759 newly admitted inmates in two New York State maximum-security prisons. The most prevalent conditions were respiratory (34.1%), cardiovascular (17.4%), and sexually transmitted diseases (STD; 16.1%); least prevalent were HIV (3.6%), cancer (1.7%), and kidney disease (1.7%). Results of the multivariable logistic regression showed that females had higher risk for all conditions except cardiovascular and liver disease; individuals aged 40 years and older had significantly higher risk for all conditions except asthma and STD; non-Hispanic Black inmates had higher risk for respiratory disease and STD; cigarette smoking was associated with asthma; and obesity was significantly associated with diabetes, asthma, and cardiovascular conditions. These findings highlight the heavy burden of chronic illnesses among newly admitted inmates and the need to address adequate screening, prevention, and treatment services.

Keywords

chronic medical conditions; prevalence; correctional facilities; incarcerated population; newly admitted inmates

Background

In 2011, approximately 2.3 million U.S. inmates were held in custody in state or federal prisons or in local jails, and approximately 4.6 million offenders were under probation or parole supervision, representing 1 in 34 adults (Glaze & Parks, 2012). According to several

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reports, chronic health conditions are much more prevalent in the incarcerated population compared with the general population (Baillargeon, Black, Pulvino, & Dunn, 2000; Binswanger, Krueger, & Steiner, 2009; Fazel & Baillargeon, 2011; Wilper et al., 2009), but some publications have focused primarily on specific conditions such as asthma, arthritis, diabetes, hypertension, or myocardial infarction rather than assessing the overall prevalence and cumulative burden of chronic health conditions (Baillargeon et al., 2000; Binswanger et al., 2009; Harzke et al., 2010; Swartz, 2011; Wilper et al., 2009). Furthermore, data regarding potential risk factors or predictors such as race/ethnicity, obesity, and cigarette smoking have not been reported (Ellis, Crowe, & Lawrence, 2013; Hoffmann et al., 2013; Price, Khubchandani, McKinney, & Braun, 2013; Talikka et al., 2012; Tarleton, Smith, Zhang, & Kuo, 2013; Tian, He, & Cai, 2013). Furthermore, while recent studies have reported data on the resident inmate population, only a few have assessed newly admitted inmates, which are important for estimating the economic implications and health resource needs of incoming inmates. The purpose of this article is to examine the prevalence of chronic health conditions and potential risk predictors among newly admitted inmates in two maximum-security prisons in New York State (NYS) using both medical records and inmate interviews.

Methods

Study Population

Data for this project were obtained from two maximum-security prisons: Bedford Hills Correctional Facility for Women, which houses about 900 inmates at Bedford Hills, NY, and Sing Sing Correctional Facility for Men, with about 1,800 inmates in Ossining, NY. The intake processes and the characteristics of the inmate population are described in detail elsewhere (Mukherjee et al., 2014). As part of a parent study, Risk Factors for Spread of *Staphylococcus aureus* in Prisons, funded by the National Institutes of Health (ROI AI82536), we reviewed both medical records and interview questionnaires of inmates newly admitted to the facility between November 2, 2009, and January 10, 2011. As described in detail in Mukherjee et al. (2014), inmates during their initial intake process were invited by trained research assistants to volunteer for the study and signed written consent forms if they were willing to participate. Participation rates were 89% at the women's facility and 80% at the men's. The study was approved by the institutional review boards of NYS Department of Corrections and Columbia University Medical Center, and a Certificate of Confidentiality was obtained.

Data Collection

Consenting inmates were interviewed by full-time trained research assistants using a structured questionnaire. Data collected during interview included demographics, medical history, and risk behaviors, with specific items including residence prior to incarceration; general health status; disease conditions (diabetes, heart condition, pulmonary condition, kidney disease, liver disease, cancer, HIV/AIDS, and skin conditions such as eczema, acne, dermatitis, or psoriasis); history of use of oral or topical antibiotics, steroids, and nasal spray during the previous 6 months; presence of tattoos or piercings; sexual activity in the previous 6 months; and tobacco and other substance use.

The demographic variables assessed were gender, age, race/ethnicity, and education. Age was categorized as 16 to 27, 28 to 39, and 40 years. Race/ethnicity was categorized as non-Hispanic White, non-Hispanic Black, Hispanic, and other. Individuals in the other race category included those who reported two or more racial/ethnic groups and those of Asian, Indian, and/or Native American descent. Education was categorized as less than high school, high school graduate or equivalent, and some college/ college graduate. To assess obesity, body mass index (BMI; kg/m²) was calculated and categorized based on World Health Organization (2014) obesity standards as < 25: normal weight, 25 < 30: overweight, and 30: obese. The other variables considered for this analysis were smoking, past/current injection drug use (IDU), past/current crack/cocaine use, and past or current heroin use.

In addition to the interviews, the medical records of each consenting inmate were reviewed, including a medical problem list, clinician notes, laboratory results, medication prescriptions, and reports of physical examinations. Data were obtained regarding the following chronic health conditions: diabetes mellitus, cardiovascular and respiratory conditions, kidney disease, liver disease, cancer, HIV, sexually transmitted disease (STD), and an “other” category that included hypothyroidism, gastroesophageal reflux disease, arthritis, and epilepsy. Chronic obstructive pulmonary disease (COPD) was defined as a diagnosis of chronic bronchitis, emphysema, in the medical record.

In a separate validation study, we found that medical conditions were more frequently reported by chart review and behavioral factors more frequently by self-report (Bai et al., 2014), so for this study we report medical conditions from chart review and behavioral factors such as smoking or sexual practices from self-report.

Statistical Analyses

Among the 832 newly admitted inmates assessed, 72 (8.6%) did not have medical charts available and were therefore excluded from the current analysis. Among inmates with medical chart data available, STD was the dependent variable that exhibited the most missing data (0.5%). Data were also missing for smoking status (1.2%), heroin use (1.1%), crack/cocaine use (0.8%), and IDU (3.0%). Complete case analysis was conducted for each multivariable regression model; therefore, 1.3%, 0.9%, 1.3%, 1.2%, and 1.4% of observations were excluded in the multivariate analysis assessing diabetes, cardiovascular disease, asthma, liver disease, and STD, respectively.

Inmate demographic, behavioral, and health-related characteristics were summarized by gender. Bivariate analysis using chi-square statistics was used to assess factors associated with the prevalence of specific conditions (diabetes, cardiovascular disease, asthma, liver disease, and STD) separately. A separate multivariable logistic regression model was fitted for each condition to assess factors independently associated with its prevalence among newly admitted New York City maximum-security inmates. Demographic variables—gender, age, and race—were included in each multivariable logistic regression model fitted. Additionally, factors associated with each condition with a 10% level of significance in bivariate analysis were also included in the final multivariable logistic regression models. Multicollinearity between covariates was assessed for each fitted regression model. Due to indications of multicollinearity between IDU and heroin as well as crack/cocaine use in the

assessment of factors associated with the prevalence of liver disease, IDU was excluded from the final model. All statistical analyses were performed using SAS (Version 9.3, SAS Institute, Cary, NC).

Because numbers were small, we excluded kidney disease, cancer, HIV, and other conditions from analyses, and age was categorized in tertiles based on the lower, middle, and upper third of inmate ages as follows: 16 to 27 (reference group), 28 to 39, 40 years. The estimated odds ratios (*OR*) and 95% confidence intervals (*CI*s) were calculated.

Results

Population Characteristics

For our analyses, we excluded 18 participants who had missing medical record data, resulting in a total of 759 inmates, 387 males and 372 females (Table 1). The mean age of the women was 35.6 years (range: 16–61 years) and for males, 33.9 years (range: 17–64 years). The female population was predominantly non-Hispanic Black inmates (41.9%) and non-Hispanic White inmates (40.0%), whereas the male population was primarily non-Hispanic Black inmates (51.6%) and Hispanic inmates (36.5%). In both facilities, roughly 80% of the population had an education high school/GED.

Prevalence of Chronic Medical Conditions

Among those entering maximum-security prison, respiratory conditions such as asthma, COPD, and emphysema were the most prevalent chronic condition (34.1%), followed by other chronic conditions (7.8%), cardiovascular conditions (17.4%), and STD (16.4%; Table 1). HIV was reported in only 3.6% of inmates; cancer (1.7%) and kidney disease (1.7%) were the least prevalent conditions. Overall, females had a higher prevalence than males for all conditions with the exception of kidney disease. The largest disparities between men and women were seen for diabetes mellitus (2.9% and 7.8% respectively) and STD (9.3% and 23.8% respectively). Bivariate analyses are summarized in Table 2.

Multivariate Analysis of Combined Facilities

Females had significantly higher risk of diabetes mellitus, respiratory condition, and STD than males (*OR* = 2.49, 95% *CI* = [1.17, 5.32]; *OR* = 1.64, 95% *CI* = [1.16, 2.34]; and *OR* = 3.32, 95% *CI* = [2.08, 5.28], respectively; Table 3). Individuals aged 28 years and older had higher risk of cardiovascular conditions whereas those older than 40 years had significantly higher risk not only for cardiovascular conditions but also for diabetes mellitus and liver disease. Compared to the non-Hispanic White group, non-Hispanic Black inmates had higher risk for respiratory conditions and STD, while the Hispanic group showed higher risk only for STD. However, non-Hispanic Black inmates had lower odds than non-Hispanic White inmates for liver disease (*OR* = 0.44, 95% *CI* = [0.23, 0.85]). Individuals who smoked cigarettes reported higher risk for respiratory conditions (*OR* = 1.71, 95% *CI* = [1.22, 2.40]). Lastly, obesity, described as BMI ≥ 30, was associated with significantly greater risk for diabetes mellitus and cardiovascular and respiratory conditions.

Because we lost a significant amount of power when we stratified by gender, particularly among males, we were unable to draw reliable conclusions for males with regard to diabetes, liver disease, and STD. Upon looking at cross-product terms assessing heterogeneity, the only condition that we were able to stratify by gender was asthma, for which there were significant gender differences. Women aged 40 years and older were significantly more likely than younger women to have asthma ($OR = 1.78$, 95% CI = [1.02, 3.08]), but that was not the case for older men ($OR = 0.75$, 95% CI = [0.40, 1.39]). Similarly, non-Hispanic Black women had higher odds of asthma than women of other races ($OR = 1.73$, 95% CI = [1.05, 2.84]), and obese women were more likely than normal weight women to have asthma ($OR = 1.70$, 95% CI = [1.07, 2.49]), as were current smokers ($OR = 1.93$, 95% CI = [1.20, 3.10]). None of these factors were significant for men. We found no other conditions with significant heterogeneous effects by gender.

Discussion

To our knowledge, this is the first report to examine the overall prevalence and cumulative burden of chronic health conditions among inmates newly admitted into maximum-security correctional facilities. However, the individual risk predictors we identified were generally consistent with those previously reported among inmates following admission. With the exception of kidney disease, females had higher prevalence of chronic conditions than males, which has also been reported previously (Binswanger et al., 2010; Booth, Prevost, & Gulliford, 2014; Freudenberg, Moseley, Labriola, Daniels, & Murrill, 2007; Tarleton et al., 2013). It is possible that females are more willing to report health conditions or agree to screening, or they may, in fact, be less healthy or more susceptible to certain chronic medical conditions when they enter the prison system (Lwebuga-Mukasa, Oyana, & Wydro, 2004). This finding warrants further examination.

Consistent with previous reports, individuals 40 years of age and older and those who were obese were at significantly higher risk for diabetes mellitus and cardiovascular conditions (Ritter, Vetter, & Sarwer, 2012; Rodbard et al., 2012). Similarly, cigarette smoking has been consistently shown to increase risk of developing respiratory conditions (Chang & Rivera, 2013; van Dijk et al., 2013). Unlike other studies, however, we did not find an association between cardiovascular conditions and smoking, perhaps because of the relatively younger age of the inmates or because of inaccurate reporting of smoking by inmates (Altamirano & Bataller, 2010; Hamabe et al., 2011; McLeish & Zvolensky, 2010; Prescott, 2008).

Overall, rates of the majority of chronic health conditions identified among this inmate population exceeded rates among those of similar age reported for the general population. For example, the estimated national HIV prevalence reported by Centers for Disease Control and Prevention (CDC) HIV surveillance data in 2009 was 0.42% for persons aged 25 to 34 years as compared to 3.5% in the inmates (CDC, 2012). Similarly, 2012 rates of respiratory conditions including emphysema, hay fever, sinusitis, bronchitis, and chronic obstructive pulmonary disease among 18- to 44-year-olds were estimated to be 19.2% in the general population as compared to 34.1% in the inmates; diabetes mellitus rates were 2.4% in the general population as compared to 4.9% in the inmates; kidney disease rates were 0.6% and 1.6%, respectively; and liver disease rates were 0.6% and 9.8% (CDC, 2014). Since some of

these categories such as respiratory conditions are broad, any conclusions about differences between incarcerated and nonincarcerated rates should be made with caution, but it seems clear nevertheless that incoming prisoners are a considerably less healthy group than the general population.

Limitations

This study has potential limitations and biases. Although we combined the male and female inmates in this multivariate analysis, many of the male inmates had been transferred from other prisons whereas most of the females were admitted from other facilities such as jails since Bedford Hills was the only female maximum-security prison in NYS. Hence, combining the two facilities may have distorted our interpretation of risk predictors present solely among inmates first entering the correctional system. The drastic differences in percentages between the general and incarcerated populations could simply relate to the different ethnicity composition. The incarcerated population is composed of mostly non-Hispanic Black and Hispanic groups, which could have inflated the overall prevalence rates. Furthermore, the low numbers of individuals in some categories of medical conditions and the fact that some categories were very general and potentially included several diagnoses limited our analysis to capture *ORs* of risk predictors that were previously established. Lastly, because of the small sample sizes, the multivariable analyses could only include broad categories of chronic medical conditions such as cardiovascular conditions. Thus, it would be necessary to conduct larger studies of newly admitted inmates to examine specific conditions such as asthma, COPD, and emphysema.

As with any study using medical record reviews and self-report interviews, there is the potential of underreporting. In the case of HIV, for example, testing was voluntary. Although this likely resulted in an underestimate of the true prevalence of HIV (Davis & Pacchiana, 2004), our findings were similar to another study conducted in the U.S. prison population (Spaulding et al., 2009).

The important finding of this study is the high burden of chronic health problems among the relatively young men and women entering prison. While this is certainly not a surprise to those within the correctional system, understanding the demographics and medical history of newly incarcerated inmates is crucial to addressing the health needs and challenges of a population at higher risk than the general population. This study highlights the heavy burden of chronic disease among this population and provides investigators and correctional facility health care providers with data to plan for adequate screening, prevention, and treatment services.

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Table 1

Characteristics of Inmates Newly Admitted to Maximum-Security Prisons in New York State.

	Female, <i>n</i> = 372	Male, <i>n</i> = 387	Total, <i>N</i> = 759
Age			
16–27	115 (30.2)	127 (32.8)	242 (31.9)
28–39	109 (29.3)	153 (40.0)	262 (34.5)
40+	148 (39.8)	107 (27.6)	255 (33.6)
Race			
Non-Hispanic White	149 (40.0)	27/386 (7.0)	176/758 (23.2)
Non-Hispanic Black	156 (41.9)	199/386 (51.6)	355/758 (46.8)
Hispanic	49 (13.2)	141/386 (36.5)	190/758 (25.1)
Other	18 (4.8)	19/386 (4.9)	37/758 (4.9)
Education			
Less than high school	172 (46.2)	170 (43.9)	342 (45.1)
High school graduate	114 (30.6)	157 (40.6)	271 (35.7)
Some college/college graduate	86 (23.1)	60 (15.5)	146 (19.2)
Obese	151 (40.6)	113 (29.2)	264 (34.7)
Current smoker	216/363 (59.5)	267 (69.0)	483/750 (64.4)
Heroin use ever	72/368 (19.6)	49/383 (12.8)	121/751 (16.1)
Crack/cocaine use ever	195/369 (52.8)	99/384 (25.8)	294/753 (39.0)
IDU ever	45/357 (12.6)	20/379 (5.28)	65/736 (8.8)
Diabetes	29 (7.8)	10 (2.9)	39 (5.1)
Cardiovascular disease	67 (18.0)	65 (16.8)	132 (17.4)
Asthma	128 (34.4)	107 (27.6)	235 (31.0)
COPD	9 (2.4)	1 (0.3)	10 (1.3)
Kidney disease	5 (1.3)	8 (2.1)	13 (1.7)
HIV	19 (5.1)	8 (2.1)	27 (3.6)
STD	88/370 (23.8)	36/385 (9.3)	124/755 (16.4)
Liver disease	40 (10.8)	35 (9.0)	75 (9.9)
Hepatitis C	34 (9.1)	27 (7.0)	61 (8.0)
Cancer	10/371 (2.7)	3 (0.8)	13/758 (1.7)
Other	36 (9.7)	23 (5.9)	59 (7.8)
Arthritis	15 (4.0)	5 (1.3)	20 (2.6)
GERD	18 (4.8)	14 (3.6)	32 (4.2)
Hypothyroidism	7 (1.8)	2 (0.5)	9 (1.2)
Epilepsy	3 (0.8)	4 (1.0)	7 (0.9)

Note. COPD includes a diagnosis of chronic bronchitis, emphysema, or chronic obstructive pulmonary disease. Cardiovascular disease includes hypertension, atherosclerosis, or heart disease. Obese refers to individuals with a body mass index ≥ 30. Kidney disease includes individuals with frequent kidney stones, renal failure, and/or on dialysis. Other race/ethnicity includes individuals reporting multiple race/ethnicities and those of Native American or Asian background. IDU = injection drug use; COPD = chronic obstructive pulmonary disease; STD = sexually transmitted disease; GERD = gastroesophageal reflux disease.

Table 2

Characteristics of Inmates Newly Admitted to Maximum-Security Prisons by Chronic Disease of Interest (Bivariate Analysis).

	Diabetes	Cardiovascular Disease	Asthma	Liver Disease	STD
Female	29 (74.4)**	67 (50.8)	128 (54.5)**	40 (53.3)	88 (71.0)****
Age					
16–27	4 (10.3)	10 (7.6)	60 (29.4)	11 (14.7)	37 (29.8)
28–39	6 (15.3)	36 (27.3)	79 (33.6)	24 (32.0)	42 (33.9)
40+	29 (74.4)****	86 (65.2)****	87 (37.0)	40 (53.3)****	45 (36.3)
Race					
Non-Hispanic White	10 (25.6)	27 (20.4)	46 (19.8)	25 (33.3)	25 (20.3)
Non-Hispanic Black	21 (53.8)	73 (55.3)	119 (50.6)	25 (33.3)	76 (61.8)
Hispanic	6 (15.8)	25 (18.9)	62 (26.3)	22 (29.3)	20 (16.3)
Other	2 (5.1)	7 (5.3)	8 (3.4)	3 (4.0)*	2 (1.6)**
Education					
Less than high school	21 (53.8)	52 (39.4)	108 (46.0)	35 (46.7)	65 (52.4)
High school graduate	9 (23.1)	50 (37.9)	90 (38.3)	28 (37.3)	37 (29.8)
Some college/college graduate	9 (23.1)	30 (22.7)	37 (15.7)	12 (16.0)	22 (17.7)
Obese	26 (66.7)****	71 (53.8)****	103 (43.8)****	24 (32.0)	41 (33.1)
Current smoker	23 (59.0)	77 (58.3)	167 (71.4)**	54 (72.0)	77 (63.1)
Heroin use	6 (15.4)	21 (15.9)	36 (15.4)	40 (53.3)****	21 (17.5)
Crack/cocaine use	22 (56.4)**	61 (46.2)*	101 (43.3)	50 (66.7)****	63 (51.6)**
IDU ever	3 (8.3)	9 (7.0)	16 (7.0)	34 (46.6)****	14 (12.0)

Note. Cardiovascular disease includes individuals diagnosed with hypertension, atherosclerosis, or heart disease. Obese refers to individuals with a body mass index reporting multiple race/ethnicities and those of Native American or Asian background. IDU = injection drug use; STD = sexually transmitted disease.

* $p < .1$.

** $p < .05$.

*** $p < .001$.

**** $p < .0001$.

Table 3
Multivariate Analysis of Factors Associated With Specific Chronic Conditions Among Prison Inmates.

	Diabetes <i>n</i> = 749 <i>OR</i> (95% CI)	Cardiovascular Disease <i>n</i> = 752 <i>OR</i> (95% CI)	Asthma <i>n</i> = 749 <i>OR</i> (95% CI)	Liver Disease <i>n</i> = 750 <i>OR</i> (95% CI)	STD <i>n</i> = 748 <i>OR</i> (95% CI)
Female	2.49 [1.17, 5.32]	0.87 [0.55, 1.36]	1.64 [1.16, 2.34]	0.89 [0.50, 1.58]	3.32 [2.08, 5.28]
Age					
16–27	Ref	Ref	Ref	Ref	Ref
28–39	1.25 [0.34, 4.55]	3.63 [1.74, 7.61]	1.05 [0.71, 1.56]	1.64 [0.7, 3.58]	1.07 [0.64, 1.79]
40+	5.85 [1.99, 17.23]	11.92 [5.83, 24.38]	1.25 [0.83, 1.85]	2.61 [1.24, 5.46]	0.88 [0.51, 1.50]
Race					
Non-Hispanic White	Ref	Ref	Ref	Ref	Ref
Non-Hispanic Black	1.31 [0.57, 3.00]	1.60 [0.93, 2.75]	1.79 [1.08, 2.97]	0.88 [0.44, 1.75]	3.07 [1.78, 5.27]
Hispanic	0.93 [0.30, 2.85]	0.89 [0.46, 1.73]	1.66 [1.08, 2.57]	1.03 [0.49, 2.15]	3.07 [1.78, 5.27]
Other	1.87 [0.36, 9.72]	1.60 [0.59, 4.37]	1.03 [0.43, 2.47]	0.85 [0.22, 3.25]	0.51 [0.11, 2.32]
Obese	3.16 [1.56, 6.39]	2.14 [1.42, 3.23]	1.70 [1.20, 2.41]	N/A	N/A
Current smoker	1.13 [0.56, 2.27]	N/A	1.62 [1.16, 2.26]	N/A	N/A
Heroin use	N/A	N/A	N/A	5.96 [3.35, 10.64]	
Crack/cocaine use	N/A	0.84 [0.55, 1.31]	N/A	1.70 [0.93, 3.11]	1.74 [1.10, 2.74]

Note. Cardiovascular disease includes individuals diagnosed with hypertension, atherosclerosis, or heart disease. Obese refers to individuals with a body mass index reporting multiple race/ethnicities and those of Native American or Asian background. STD = sexually transmitted disease; *OR* = odds ratio; CI = confidence interval. Bolded items are statistically significant. NA = not applicable