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Chronic Medical Conditions Among Jail Detainees in Residential Psychiatric Treatment: A Latent

Class Analysis

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Abstract

Studies of incarcerates with serious mental illnesses (SMI) have found elevated rates of chronic medical conditions such as asthma and diabetes and of infectious diseases such as tuberculosis compared with general population rates. This study explored the pattern of chronic medical conditions in a sample of adult detainees in psychiatric treatment in a large urban jail to develop a clinical profile encompassing the full range of medical. A total of 431 male and female detainees were sampled with certainty from admissions to a residential psychiatric treatment program (overall recruitment rate = 67%). Interviews used the World Mental Health version of the Composite International Diagnostic Interview (WMH-CIDI) to assess psychiatric and substance use disorders per DSM-IV criteria and chronic medical conditions. Latent class analysis (LCA) was conducted using 17 medical conditions as class indicators yielding a 3-class model composed of: a latent class with a high to intermediate probability of multiple medical conditions (HMC; 12.5% of the sample); an intermediate class with a lower probability of having a smaller number of medical conditions (MMC; 43.2%); and a class with a low probability of any medical condition (LMC; 44.3%). Those in the HMC class were more likely to report respiratory problems, severe headaches, musculoskeletal pain, hypertension, and arthritis, have greater functional impairment, and have a higher number of co-occurring psychiatric disorders. Being older (50+ years) and female were associated with higher odds of being in the HMC or MMC classes. The policy implications for providing medical care to incarcerates with complex mixtures of medical conditions and psychiatric disorders are considered.

Co-occurring medical conditions among jail detainees in psychiatric treatment:

A Latent Class Analysis

National surveys conducted over the past decade have found that co-occurring psychiatric and substance use disorders (CODs) cluster in a relatively small but significant number of individuals.[1] For instance, in the National Comorbidity Survey – Replication study, 40 percent of 12-month cases (i.e., those having any psychiatric disorder including a substance use disorder within the past year) were comorbid for one or more additional disorders. Moreover, disorder severity was strongly associated with comorbidity; that is, persons with two or more disorders tended to have more serious symptomatic manifestations of their disorders than persons with a single disorder.[2] Similarly, a meta-analysis of studies published in the medical literature between 2000 and 2007 concluded that 21 percent of Americans have co-occurring chronic medical conditions (i.e., multiple morbidity), defined as illnesses or disabilities expected to last longer than a year, and that with the aging of the U.S. population, the prevalence of multi-morbidity is likely to increase.[3] As with co-occurring psychiatric conditions, those with co-occurring chronic medical conditions tended to be more functionally impaired and to use a disproportionate number of services.

Rates of multi-morbidity that include co-occurring medical as well as psychiatric and substance use disorders may be especially high among those under the supervision of the criminal justice system and higher still among incarcerates with serious mental illnesses (SMI) and CODs. Studies of jail, prison, and probation populations have consistently found elevated rates of both psychiatric and substance use disorders relative to the general population.[4-7] Most recently, studies of incarcerate populations

have also found elevated rates of chronic medical conditions as well as infectious diseases relative to comparison groups derived from the general population. These studies have also found that those with an SMI have among the highest rates of chronic medical conditions, particularly infectious diseases such as hepatitis C, HIV/AIDS, and tuberculosis.[8-17]

To date, as with many studies of the general population, research examining the prevalences of chronic medical conditions in incarcerate populations has documented single disorders or factors related to single disorders but have not investigated how conditions might cluster both within as well as across different classes of disorders (i.e., medical conditions, infectious diseases, psychiatric and substance use disorders). However, as noted by Vogeli et al., many patients in need of medical and psychiatric care present with multiple conditions that create treatment complexities.[3] Arguably, treatment could be more effective if the prevalence and mutual associations among co-occurring conditions were better understood leading to the development of clinical guidelines for treating medically complex cases.

The present study sought to examine multi-morbidity in a population with a high likelihood of having multiple medical and psychiatric conditions: adult jail detainees in residential psychiatric treatment for an SMI. Specifically, we used latent class analysis (LCA) to empirically determine if we could identify a clinically meaningful subgroup or subgroups with a high probability of having multi-morbid medical and psychiatric conditions and, if so, to explore further the particular conditions most likely to co-occur as well as to identify distinguishing demographic and other characteristics of the high risk group(s).

Methods

All procedures and materials used for this study were reviewed and approved by the

University of Illinois at Chicago and Cook County Institutional Review Boards. We also

obtained a Federal Certificate of Confidentiality from the National Institute on Drug

Abuse to protect study data confidentiality. Greater detail on study context, sampling

recruitment, weighting, instrumentation, and procedures are available elsewhere.[18]

Context

Cermak Health Services of Cook County (CHS). CHS provides psychiatric and medical

care at the Cook County Department of Corrections (CCDOC) a large, single site urban

jail located in Chicago, Illinois. CHS is housed in a 100,000 square foot facility within

CCDOC. Services provided include primary medical care, dental and mental health

services, substance abuse treatment, laboratory work, pharmaceutical dispensing,

rehabilitative care, and same-day surgery. During the period study data were collected

(February through October 2007) the average daily census at the jail ranged from

10,500 to 11,000 detainees with approximately 300 daily admissions.

Admissions are screened for medical and psychiatric problems that may require

treatment. Those screening positive for a psychiatric disorder because of a history of

such care, because of flagrant psychiatric symptoms (e.g., hallucinations or suicidal

ideation), or because they self-report taking prescribed psychiatric medications or

needing such care, are referred to an acute care unit in the CHS facility for a diagnostic

assessment by a psychiatrist who makes a final determination of treatment need.

Following the assessment and acute-care period that for most detainees lasts 1 to 2

weeks, those determined to need only medication management are returned to the jail

general population. In general population they receive the appropriate prescribed drugs and return to the outpatient clinic on at least a monthly basis for medication monitoring. Detainees in need of more intensive care are sent to residential treatment units (RTU); intermediate care settings operated and staffed by CHS and located on the CCDOC campus. At the time of the study, the daily census in the women's RTU was about 120 whereas the daily census in the men's RTU was about 300, including a subgroup of those needing medical and psychiatric care. The average length of stay in the RTUs was about 50 days but was somewhat shorter for the women.

Participants

Men and women at least 18 years of age receiving psychiatric services in the CCDOC RTUs composed the target population. The sampling frame included psychiatric patients receiving medical care in the mixed-use medical-psychiatric treatment dorms. To avoid an overrepresentation of longer-staying detainees in the study sample, we excluded participants who had been in the treatment dorms for longer than a month at the start of the study and only recruited recent admissions from monthly treatment rosters. Post-recruitment, we also excluded those who were unable to comprehend the informed consent process due to language difficulties or to cognitive or psychiatric problems that affected their general comprehension.

Measures

Mini-Mental State Exam (MMSE). We used a 6-item version of the MMSE during informed consent to check on competence to understand the consent process and as a measure of general comprehension.[19] The full MMSE has been validated for use with

substance abusing populations.[20] A study of the abbreviated version found it to be as accurate as the full version.[21]

Time-Line Follow-Back Calendar**.** To aid participant recall, we began each interview using a variation of the time-line follow-back interview procedure whereby we created a paper-based calendar of the two years preceding each participant's arrest and current detention.[22] The calendar-based timeline was constructed to show significant events in each participant's life such as birthdays, arrests, births, detentions, imprisonment or hospitalizations over the preceding two years. During the main part of the interview, when questions about the time preceding detention were asked (e.g., drugs used or experiencing psychiatric symptoms over the past year or 30 days), interviewers were instructed to refer the participant to the calendar to help them understand the questions referenced the 12-months prior to their current detention and accounting for when they were not in another institutional setting such as a prison, hospital, or residential treatment program. Questions on the main study instrument (see below) were also reworded to improve relevance for a detainee sample by altering language about the *preceding 12 months* to be the *12 months preceding jail detention*.

World Mental Health – Composite International Diagnostic Interview (WMH-CIDI). Selected sections of the computerized version of the World Mental Health Survey Initiative version of the Composite Diagnostic Interview (WMH-CIDI) composed the main study instrument. The WMH-CIDI is a fully structured interview schedule designed for administration by lay interviewers for the purpose of obtaining valid lifetime and past-year psychiatric diagnoses consistent with DSM-IV-TR and ICD-10 diagnostic criteria.[23-24] Reliability and validity studies of the WMH-CIDI have found it to be valid when

compared with less structured clinical interviews administered by trained clinicians.[25-26] The version of the WMH-CIDI used for the study (v20.21) included a number of improvements over previous versions to enhance diagnostic validity by increasing question comprehensibility, respondent motivation, and task comprehension.[25]

The full WMH-CIDI is composed of 41 modules and averages 2 hours administration time with a general population sample, although the time varies widely depending on the number of different sections into which a participant screens. To reduce participant burden, we selected 21 WMH-CIDI modules for administration to the jail sample. Selections were made on clinical relevance of the disorder as well as study goals. For instance, we opted to assess for major depressive episode (MDE) and disorder (MDD), bipolar disorder (BP), conduct disorder (CD), and post-traumatic stress disorder (PTSD) because of the likely high prevalence and clinical severity of these conditions. Conversely, we opted not to assess for disorders like neurasthenia, phobias, eating disorders, or intermittent explosive disorder either because they were thought not to be as relevant for a population in jail psychiatric treatment or because of their low expected prevalences. Chronic medical conditions were assessed through the WMH-CIDI chronic conditions module. Seventeen conditions were assessed as shown in table 1 below.

K6 Screening Scale. Severity of psychological distress as a covariate in the LCA models was assessed using the K6 screening scale from the WMH-CIDI 30-day symptoms section. The K6 assesses past-year psychological distress associated with SMI with scores of 13 and above (on a scale that ranges from 0 to 24) indicating severe psychological distress and at least moderate functional impairment.[27] Validation studies

of the K6 have found good validity (ROC-AUC of about .86) and internal consistency

(.89).[27-28]

<u>Sheehan Disability Scale for Chronic Medical Conditions (SDS).</u> We measured

functional impairment using the SDS for chronic medical conditions per an item that was

embedded in the WHO-CIDI.[29] On the SDS, scores range from 1 to 10 with higher

scores indicating greater functional impairment. Because of extreme skew in the

distribution of scores on the SDS and a preponderance of zeros, we dichotomized the

measure to reflect no (a score of 0) versus any (scores from 1 thru 10) functional

impairment.

Procedures

Recruitment and Interviewing. Participant recruitment and data collection were done

between February and October 2007. During recruitment, the monthly rosters of men

and women entering residential psychiatric treatment composed the sampling frame.

New admissions to the residential treatment dorms were recruited with certainty; that is,

each month we attempted to recruit and interview all eligible RTU admissions.

Recruitment followed a two-step process. Using computerized dormitory rosters,

we identified all monthly admissions, filled out a recruitment request form for each, and

submitted the forms to jail clinical staff for approval and initial recruitment. Detainees

declining participation at this stage or who were deemed clinically ineligible due to the

severity of their psychiatric symptoms were not contacted further. This process was

repeated until we exhausted the list of potential recruits for the month. For all recruits,

we recorded the recruitment outcome, reasons for non-recruitment if applicable, and

demographic data from the computerized rosters (e.g., age, sex, race/ethnicity) in a

recruitment log. For participants who agreed to be interviewed and who were clinically

eligible, a meeting with one of the study research assistants was scheduled to obtain informed consent and to conduct the interview.

Those who consented were administered the time-line follow-back calendar followed by the WMH-CIDI. Interview times varied but most ranged from 2 to 4 hours. Research assistants with at least a bachelors degree in the social sciences who were trained on the WMH-CIDI using recommended instructional materials and observed and critiqued mock and pilot interviews prior to the start of the study, conducted the jail interviews. All interviews were done in private rooms within the RTU dormitories to enhance confidentiality and increase candidness. For their time, participants were paid a stipend of $40.00 on their jail commissary account.

These procedures yielded a sample of 459 participants and an overall recruitment rate of 67.5% among eligible cases. The recruitment rate varied by gender. For the women 271 were eligible and were recruited with 155 (57%) completing an interview. Of the women who were eligible but not interviewed, 71 (60.7%) consented to be interviewed but were discharged before an interview could be done; 39 (33%) refused; 4 (3.5%) were not able or decided not to complete their interview; and 2 (1.7%) did not speak English. For the men, 408 were eligible at initial recruitment with 305 (75%) completing an interview. Of the men who were eligible but not interviewed, 44 (42.8%) consented to be interviewed but were discharged before an interview could be done; 42 (40.8%) refused; 13 (12.6%) began the interview but did not complete it because they or the interviewer stopped the interview; and 4 (3.9%) were non-English speaking.

Post-data collection, we excluded another 28 participants (6% of the sample) who, in the estimation of the interviewers, did not appear to understand the questions or whose psychiatric symptoms (e.g., hallucinations, severe depression) interfered with their ability to comprehend the interview questions and/or who were uncooperative and appeared to be giving perfunctory rather than candid responses. Exclusion of these cases yielded the final analytic sample of 431 detainees: 149 women and 282 men. African-Americans composed the majority of participants (58.9%), followed by whites (24.1%), and Hispanics (13.8%).

On average, study participants were thirty-eight years of age with the men several years older (39.3 years) than the women (37.0 years). Most participants (50.6%) had never been married, and had a high school education or less (70.3%). About nineteen percent of participants reported being homeless for at least part of the month prior to their arrest and about sixty-one percent said they had received public assistance or welfare at some point in their lives with women more likely to indicate they had done so. The average participant had about two living biological children.

Sample Weights. To adjust for potential bias owing to recruitment issues (e.g., noncoverage and non-response), we kept a detailed recruitment log and used the log information to create sample weights.[30] Weights for non-response (i.e., participants who refused to be interviewed) were calculated by comparing and then adjusting for differences in the distributions of age, gender, and race/ethnicity for study participants and for non-respondents. Using a similar process, we also accounted for non-coverage (i.e., participants who left the treatment dorms before they could be recruited) in the weights by comparing and then adjusting for the differences in the distribution of these

same demographics for participants and those we were unable to recruit. The two weights were then multiplied together to get a final sample weight for use in calculating simple prevalence estimates and in the latent class models.

Psychiatric and Substance Use Diagnoses. At the conclusion of data collection, diagnostic algorithms programmed in SAS and provided for use with the WHO-CIDI were run against the interview data to generate DSM-IV psychiatric and substance use diagnoses.[31] A separate SAS module written for the study was implemented to generate the ASP and CD diagnoses based on AUDADIS-IV questions and also used DSM-IV diagnostic criteria.

Because of validity concerns, the WMH-CIDI diagnostic algorithms do not produce a DSM-IV diagnosis for non-affective psychosis (NAP); an umbrella term that includes schizophrenia, schizoaffective disorder, delusional disorder, and psychosis not otherwise specified.[32] Based on responses to NAP screening scale questions included in the WMH-CIDI, consideration of current psychiatric medications, and review of open-ended responses to the psychotic symptoms questions, we developed a provisional diagnosis for NAP using two trained clinical raters to review the data and reach consensus on each diagnosis.[18]

The most common lifetime DSM-IV disorders for all participants were (in order of decreasing prevalence): substance use disorders including alcohol and drug abuse and dependence (81.8%); nicotine dependence (64.5%); conduct disorder (56.5%); anti-social personality disorder (ASP) (47.2%); post-traumatic stress disorder (44%); and major depressive episode (50%). Aggregating across the 4 affective disorders assessed, 61 percent of all participants met DSM-IV criteria for a major affective

disorder at some time in their lives (53.1% in the past year). Women were more likely

than men to have met the DSM-IV criteria for a major depressive episode or disorder,

and for PTSD. Conversely, the men were more likely to have met DSM-IV diagnostic

criteria for NAP, gambling disorder, and alcohol abuse.[18]

Analyses. Analyses were conducted using SPSS version 16.0, [33] Stata version

11.0, [34] and Mplus version 5.2. [35] For simple prevalence estimates and bivariate

comparisons, standard errors were estimated using the sample weights with

stratification on gender.

We conducted a latent class analysis (LCA) to classify participants according to their

self-reported chronic medical conditions. Such analyses are included in a family of

analytic procedures that are sometimes called "mixture models" because the observed

variation in the indicator variables (i.e., in this case the medical conditions) is attributed

to unobserved heterogeneity (the mixture) in the sample of participants. For the LCA

modeling, we used 17 lifetime chronic medical conditions captured by the WMH-CIDI

questionnaire as class indicators, coded as present or absent. We determined the

number of latent classes using standard model fit indices such as the Bayesian

Information Criterion (BIC) along with *a posteriori* interpretability of the resulting latent

classes.[36] We also examined another statistical measure available for LCA models,

entropy, which indicates the degree of ambiguity in how well the model classifies

participants. Entropy scores range in value from 0 to 1, with higher values indicating

better (i.e., less ambiguous) classification results.

Once a latent class model had been determined, we added a set of covariate

predictors to examine the relationships between being in a given latent class and the

covariates, which included: sex, age (in years), a dummy variable to represent ethnicity (Black/African-American as compared with all other ethnicities); lifetime alcohol, other drugs, and tobacco dependence; obesity as indicated by a body mass index (BMI) greater than or equal to 30; and a dummy indicator to represent having two or more DSM-IV lifetime psychiatric disorders from among those assessed with the version of the WMH-CIDI administered for our study. A multinomial logistic regression was then run regressing latent medical class on each of these predictors using the group with the lowest number of reported medical conditions as the reference category. Figure 1 depicts the conceptual relationships among the indicator variables (the chronic medical conditions), the latent classes, and the covariate predictors for the latent class model estimated in these analyses.

Finally, we examined the relationship between latent classes and the type and number of psychiatric diagnoses, infectious conditions, and degree of functional impairment by classifying participants *a posteriori* into their most probable latent class. To compare diagnoses and infectious conditions, we ran bivariate comparisons of the cross-classifications of each lifetime psychiatric diagnosis and infectious conditions by latent class using the weighted and stratified data. Analysis of functional impairment used the dichotomous SDS chronic conditions score as the dependent variable in a logistic regression model that included age and gender as covariates and dummy variables to represent medium and high number of medical conditions against the reference category of low or no medical conditions.

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Insert Figure 1 about here

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Results

The lifetime prevalence rates of chronic medical conditions are shown in Table 1. The

most common conditions were as follows: frequent and severe headaches (42.7%),

back and neck problems (36.8%), and arthritis (29.4%). These results suggest that

physical pain and musculoskeletal problems, perhaps secondary to trauma, are among

the primary medical concerns among the population of jail detainees in psychiatric

treatment. Just below these conditions in terms of prevalence were a variety of

disorders that included hypertension (25.8%), asthma (24.4%), and ear, nose, or throat

problems (19.5%; i.e., persistent sore throat, eye or ear infections, deviated septum).

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Insert Table 1 about here

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All of the statistically significant bivariate comparisons between male and female

participants were due to higher percentages of women reporting ever having a given

chronic medical condition as compared with the men. Women were more likely to report

frequent or severe headaches, asthma, chronic lung diseases (i.e., bronchitis,

emphysema, chronic obstructive pulmonary disease), and cancer of any kind. These

results are consistent with a recent study that compared a national sample of male and

female jail detainees and found that women had higher prevalence rates of multiple

chronic medical conditions (measured somewhat differently than in the present study)

and psychiatric disorders including drug dependence.[37]

Medical Conditions LCA.

The LCA began by exploring models ranging from 2 to 5 classes using a standard set of statistics to compare model fit and determine the optimum number of classes. Model fit statistics are shown in Table 2 and, with some ambiguity, support a 3-class model as optimal. We selected the 3-class model based on interpretability, classification results, and post-hoc analyses that suggested important distinctions between the groups in terms of the estimated probability of having multiple medical conditions, degree of functional impairment, and co-occurring psychiatric disorders. Addition of the covariates to the model, shown in the last row in table 2, improved model fit for all of the evaluated fit statistics suggesting these covariates as a group are reliably related to latent medical class.

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Insert Table 2 about here

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According to the 3-class model, just over 44 percent of study participants can be classified as likely having no or a relatively low number of chronic medical conditions (LMC), 43.2 percent as likely having a moderate number of conditions (MMC) and 12.5 percent have a high number of medical conditions (HMC). Overall, out of the 17 conditions assessed and adjusting for age, those in the HMC group reported an average of 9.5 medical conditions; those in the MMC group reported an average of 6.3 conditions; and those in the LMC group reported an average of 5.8 conditions ($F_{(2,427)}$ = 70.86, p < .001).

The estimated probability of having any particular medical condition given membership in a latent class is shown in figure 2. Higher points on each line correspond

to a higher probability that participants in that class would report having a given medical condition. For those with the highest number of medical conditions, figure 2 indicates they were most likely to report musculo-skeletal conditions such as arthritis, back or neck problems, neurological problems such as severe headaches, hypertension, and respiratory conditions such as asthma and other chronic lung diseases (e.g. bronchitis or emphysema). Approximately this same set of conditions, excepting asthma and other chronic lung diseases had moderately higher probabilities in the MMC group relative to those reporting few or no medical conditions. The main distinctions between the HMC and MMC groups thus appears to be – aside from an overall general increased likelihood of reporting any condition – that those in the HMC group had a higher probability of having respiratory illnesses and an especially high probabilities of having severe headaches, arthritis, and back and neck problems.

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Insert Figure 2 about here

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To assess the validity of the latent classes, we compared the latent class groups on their dichotomized SDS score for chronic medical conditions. If the latent class groupings have clinical significance, those in the groups with higher numbers of medical conditions should report a greater degree of functional impairment. The logistic model regressing the dichotomous indicator for functional disability on medical latent class supports this hypothesis. Controlling for the effects of gender and age, those in the HMC group were near three times more likely (OR = 2.8, 95% CI = 1.3 – 3.6, p < .01) and those in the MMC group were over twice as likely (OR = 2.09, 95% CI = 1.32 – 3.6,

p < .01) to report any functional impairment owing to a medical condition compared with those in the LMC group.

Analysis of the covariates included in the latent class model shown in figure 1 provides additional insight into which detainees are more likely to have complex medical profiles marked by multiple disorders. Table 3 shows the multinomial logistic regression results after regressing medical latent class on the selected covariates. Significant results indicate that a covariate was associated with increased or decreased odds of being in the HMC or MMC latent class relative to the LMC class. Being female and older increased the odds of being in either the HMC or MMC classes. In addition, having two of more DSM-IV lifetime psychiatric conditions from among those assessed increased the odds of being in the HMC class whereas being black/African-American was associated with lower odds of being in the HMC and hence, increased odds of being in the LMC. None of the other covariates – lifetime alcohol, drug or tobacco dependence or obesity – were statistically significant.

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Insert Table 3 about here

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Inspection of the change in probabilities for being in a given class with increasing years of age (not shown) reveals that the probability of being in the LMC latent class was highest for participants 20 through 30 years of age, with the odds of being in the MMC latent class increasing sharply thereafter, peaking at about age 50. After the age of 50, the odds of being in the HMC class increase substantially and by the age of 65, participants have the highest probability of being in the HMC class. This finding

supports the intuitive conclusion that the number of medical problems (and corresponding functional severity) increases with age and supports the validity of the self-reported data.

The last issue examined was the relationship between latent medical class and DSM-IV psychiatric disorders and between latent medical class and infectious diseases. The results of these analyses are shown in table 4 and indicate an association between psychiatric and medical morbidity as well as infectious diseases and medical morbidity. In both cases, the association was in the predicted direction; those with a higher probability of having multiple medical conditions met the criteria for multiple DSM-IV lifetime psychiatric disorders than those with fewer medical conditions and to have a higher prevalence of infectious diseases such as tuberculosis and sexually transmitted diseases such as gonorrhea and syphilis. In particular, those most likely to have the highest number of medical conditions were also more likely to meet DSM-IV criteria for a major depressive disorder, dysthymia, GAD, PTSD, and substance use disorders (excepting nicotine dependence). Moreover, the relationship between medical conditions and psychiatric disorders was linear for the conditions where the relationship was statistically significant; those with the highest number of medical conditions had the highest prevalence for a given psychiatric disorder, those with the lowest probabilities of having any medical condition had the lowest prevalence of psychiatric disorder and infectious diseases, and those with an intermediate probability for having multiple medical conditions were also intermediate with respect to psychiatric disorders and infectious diseases.

Multi-psychiatric morbidity was also associated with medical class. Those in the HMC class met DSM-IV criteria for 6.2 lifetime psychiatric disorders; those in the MMC class met DSM-IV criteria for 4.5 lifetime psychiatric disorders; and those in the LMC class met DSM-IV criteria for 4.0 lifetime disorders ($F_{(2,428)}$ = 15.8, p < .001). The same pattern pertained with respect to the severity of psychological distress in the past year as measured by the K6. Those in the HMC class had the highest level of psychological distress (mean K6 score = 15.1), those in the MMC class had a lower (but still severe) level of psychological distress (mean K6 score = 13.0) and those in the LMC class had the lowest K6 score indicating a lower level of psychological distress, albeit one still in the moderate range (mean K6 score = 11.7; $F_{(2,428)}$ = 6.4, p < .005).

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Discussion

The current study examined co-occurring psychiatric, substance use, and chronic medical conditions among adult detainees in psychiatric treatment in a large urban jail. The primary finding was that the burden of co-occurring medical conditions is not shared evenly among study participants. An LCA model of the medical conditions assessed for the study revealed that about thirteen percent of participants fell into what we have termed the "high number of medical conditions" group. These individuals were likely to report multiple medical conditions including respiratory problems such as asthma and other chronic lung diseases such as emphysema as well as severe headaches, hypertension, back and neck pain, and arthritis. These participants tended

to be older (> 50 years of age), female, white, and had a lifetime history of two or more psychiatric disorder. They reported being more functionally impaired because of their medical problems as well as suffering greater psychological distress.

We believe the findings indicate two priority populations as being in particular need of improved access to health care while in detention and also when in transition back to the community: detainees over 50 years of age and women. Older detainees reported a disproportionate number of medical conditions relative to other detainees and were more functionally impaired. The straightforward clinical implication is that community-based aftercare for medical problems on release from the jail is most important for inmates 50 years of age and older who are the most likely to be medically and psychiatrically complex, suffering from a range of medical and psychiatric conditions that will be extremely challenging to manage but in need of close and continuing medical and psychiatric monitoring.

The women in our study, as has been found in other studies, reported a higher number of medical conditions relative to men.[37] At the same time, in analyses not shown in this paper, the women also reported having less access to medical and psychiatric care than the men, an issue worth exploring further in research on service access, health care disparities, and availability.[18]

The lack of any statistically significant relationship between any kind of substance use including alcohol, other drugs, and tobacco, and having multiple medical conditions was somewhat surprising. Given the known association between obesity and hypertension, heart disease, and cancer, among other illnesses, the failure to find a statistical association for being obese and latent medical class was also surprising. It

might be that the mixture of conditions composing the latent class indicators, some of which would be related to substance use (heart disease) and obesity (heart disease, hypertension, diabetes) and others which would not be related (chronic pain, arthritis, epilepsy) worked against finding a statistical association for the overall mixture of conditions considered. It might also be that the effects of obesity begin to accrue only over time and have not yet become manifest in a sample that was relatively youthful from a chronic medical conditions perspective. This may also be why the prevalence rates of diabetes were relatively low among participants and diabetes was not a good indicator of class membership.

The exact reasons why individuals with psychiatric disorders, regardless of their degree of criminal justice involvement, have higher rates of co-occurring medical conditions are not clear. There are likely multiple pathways such as: lack of access to regular medical care, poor lifestyle choices, poor adherence to treatment regimens, and the iatrogenic effects from psychiatric medications, particularly the atypical antipsychotic drugs. Those in the criminal justice system in particular, as evidenced by the high rates of PTSD found in this study, are also frequently exposed to trauma and to witnessing traumatic events such as domestic violence, beatings, and shootings and to being the victims of violence.[38] These experiences could contribute to having chronic pain, arthritis, and, if head injuries have been involved, to epilepsy and seizures.

Multiple morbidities and attendant medical complexity appears to ultimately affect mortality rates. For instance, individuals with schizophrenia have life expectancies 13 years shorter than a person who does not have schizophrenia.[39] Across individuals with varying SMIs, life expectancy is thirty percent shorter than for the general population.[40]

Given the identified priority populations and the finding that many individuals have multiple psychiatric, substance use, and medical conditions, there is a question as to how best to deliver care to most effectively meet the complex clinical needs of those with multiple morbidities as well as the needs of detainees with psychiatric disorders generally. Contact with the criminal justice system, particularly within jails and prisons, may ironically represent one of the best opportunities for treating individuals with multiple and complex health care needs. Even adequately addressing one set of conditions, such as chronic medical conditions, could produce benefits for related cross-class conditions. For instance, one study found that providing adequate primary healthcare to people with substance use disorders reduced addiction severity.[41] Similarly, having adequate mental health and substance use treatment pre- and post-release could result in improvements in primary medical conditions. In addition, as some have argued, providing adequate care would not only directly benefit recipients, it might also have the potential to reduce rates of transmission of infectious diseases (e.g., Hepatitis C) in the general population that can occur when offenders return to their communities post-incarceration.[13, 16, 42]

We believe that the emerging trend of offering "co-located" services whereby health care for medical, psychiatric, and substance use disorders are delivered in the same location by a coordinated team of practitioners has great promise. Comprehensive care delivered in a single location would alleviate confusion about where to get care for any given problem and provide individuals in need of care with a regular place for routine medical and psychiatric care as well as a primary-care physician with knowledge of their medical history. Moreover, as the transition period from incarceration to release

represents a period of especially high risk for mortality,[43] we would argue further that a key point for providing health care for incarcerates with co-occurring psychiatric and medical disorders is during the first several months post-release.[44]

Because the provision of services in a co-located care model is not identified as being specific to psychiatric and substance use treatment and as being about general health, stigma associated with receiving behavioral health care could potentially be lessened. In addition, individuals with psychiatric or substance use problems who may not be inclined to seek treatment for these problems, may still be inclined to seek care for their medical conditions, providing the opportunity for health care providers to use evidence-based techniques such as motivational interviewing to encourage them to address their psychiatric and substance use problems.

As co-located services are still evolving as a treatment paradigm, a best-practices model has not yet been identified for the general population let alone for criminal justice populations. In an evaluation of randomized controlled trials of various models for delivering medical care to persons with psychiatric and substance use disorders, the findings for six different models were reviewed.[39] Examples of the variations in service delivery for each model include onsite delivery of medical care in a methadone clinic to an onsite primary care provider, nurse practitioner, and nurse case manager providing and managing medical care in a Veteran's Association mental health clinic. Each model was evaluated on the dimensions of linkage, quality, outcomes, and cost of care. Findings were that all of the models evaluated were more-or-less equally effective in improving medical care and outcomes for the target population. Among the study's conclusions, the authors write: "Regardless of whether services are co-located, the key

element of these collaborative care approaches is that they involve functionally integrated care teams" (p. 150).

The study has a number of methodological limitations. One is that detainees who cycled in and out of the jail's psychiatric treatment units rapidly were undersampled before they could be interviewed due mainly to space and staffing limitation. Although we weighted the data to correct for any bias owing to problems with coverage and refusals, bias in the sample may remain. Data on various conditions and symptoms are based on participant self-report, sometimes of events that happened many years prior to the interview, introducing the possibility of recall bias and simple inaccuracy. Participants may not be aware they have a medical condition such as hypertension, as the condition may as yet be asymptomatic or undiagnosed owing to lack of access to medical care. Conversely, there may have been a tendency to over-report medical conditions and psychiatric symptoms for some participants. In addition, the fact that most participants had an SMI serious enough to warrant residential treatment in jail may have also affected their ability to recall events, diagnoses, and symptoms accurately although the analyses presented excluded participants who were assessed as being obviously confused, uncooperative, or unable to comprehend or attend to the interview questions. The diagnosis of non-affective psychosis was done based on our analyses of screening questions and medication histories and is, at best, provisional and suggestive only. A full clinical interview and careful review of the participant's psychiatric history would be needed to make a definitive diagnosis.

Another limitation was that we did not focus on infectious disease such as HIV/AIDS, other sexually transmitted diseases, or tuberculosis. Testing for these conditions was

done primarily on a voluntary basis at the jail during the time of this study and hence,

biological test results were not reliably available for most study participants. We believe

infectious diseases need to be treated as a separate issue from the medical conditions

considered in this study given how such diseases are transmitted as opposed to the

more complex etiologies of the medical conditions studied. We did find that the

probability of having an infectious disease, based on self-reported data, was elevated

among those likely to have the highest number of medical conditions. This is consistent

with other research on incarcerate populations,[9-10] highlighting the importance of

studying infectious diseases among prisoners and detainees.

The recommendations for more coordinated care across disorder and disease

classes and across community and institutional boundaries occur within the context of

the first substantial change in health care policy and insurance coverage at the federal

level in nearly half a century. Among the uninsured with limited access to health care

that the policy change could potentially benefit are those with SMI and CODs and those

in the criminal justice system transitioning back to the community. Further study on how

best to leverage expanded insurance coverage and medical care to address the high

rates of multi-morbidity in these populations will be needed to determine how to make

optimal use of the newly available coverage and access.

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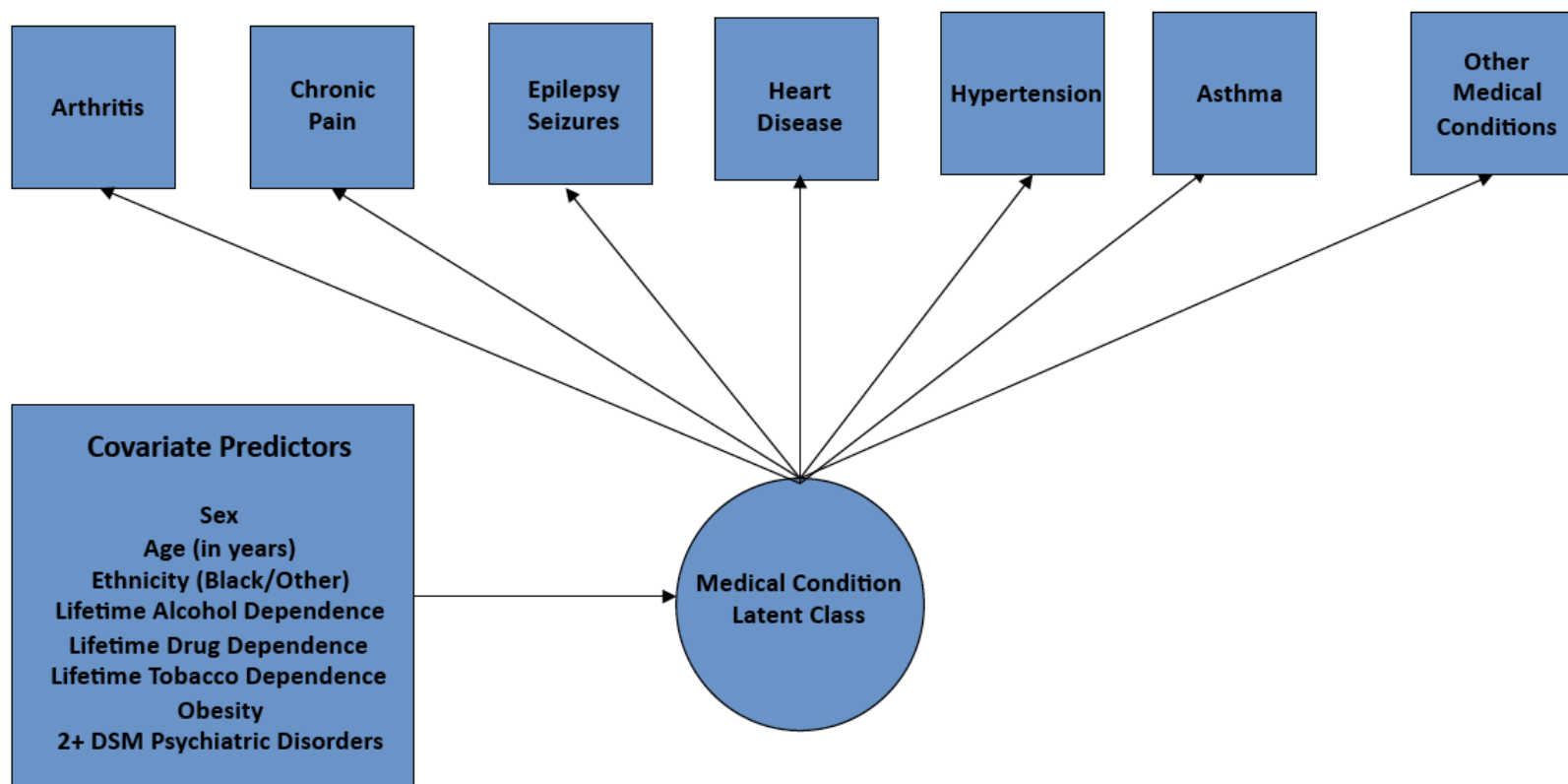Figure 1. Latent Class Model of Chronic Medical Conditions with Covariate Predictors

Table 1.
DSM-IV Lifetime Medical Conditions by Gender for CCDOC Participants

	Male (N = 282)		Female (N = 149)		Totals (N = 431)	
	%	(SE)	%	(SE)	%	(SE)
Arthritis or rheumatism	25.7	(2.7)	33.8	(4.1)	29.4	(2.4)
Back or neck problems	35.4	(2.9)	38.4	(4.2)	36.8	(2.5)
Frequent or severe headaches	35.4	(3.0)	51.4	(4.3)	42.7	(2.5) **
Epilepsy or seizures	13.1	(2.0)	12.2	(2.8)	12.7	(1.7)
Chronic pain[a]	11.4	(1.9)	15.4	(3.1)	13.2	(1.7)
Stroke	5.5	(1.4)	5.4	(1.9)	5.4	(1.2)
Heart attack	5.0	(1.3)	8.0	(2.5)	6.3	(1.4)
Heart disease	5.6	(1.4)	8.9	(2.6)	7.1	(1.4)
Hypertension	24.7	(2.6)	27.2	(3.9)	25.8	(2.3)
Asthma	16.8	(2.2)	33.5	(4.0)	24.4	(2.2) ***
Chronic lung disease[a]	4.4	(1.3)	22.4	(3.5)	12.5	(1.7) ***
Diabetes or high blood sugar	10.4	(1.8)	14.6	(3.2)	12.3	(1.8)
Ulcers	9.9	(1.8)	10.1	(2.6)	10.0	(1.5)
Liver problems[a]	8.0	(1.7)	11.1	(2.5)	9.4	(1.4)
Eye, ear, nose or throat problems[a]	24.1	(2.7)	13.9	(3.1)	19.5	(2.0) *
Skin problems[a]	12.5	(2.0)	14.9	(3.0)	13.6	(1.7)
Cancer (any kind)	3.1	(1.1)	9.6	(2.8)	6.0	(1.4) **

Note. Column N's are based on the unweighted detainee data, excluding 28 cases with likely invalid data. Percentages and standard errors are based on data weighted for sampling probabilities and stratified by gender. All tests of significance are based on a modified Pearsons chi-square converted to an F statistic using a second order Rao and Scott correction.

[a] General condition categories were defined as follows: 'Chronic lung disease includes chronic obstructive pulmonary disease, bronchitis, or emphysema; 'Liver problems' includes hepatitis, jaundice or cirrhosis; 'Eye, ear, nose, and throat problems' includes persistent sore throat, ear infections, eye infections, or a deviated septum. 'Skin problems' includes abscesses, cellulitis, skin ulcers, rashes, or infections.

*p < .05; **p < .01; ***p < .001

Table 2. Fit Statistics for 2 to 5 Class Mixture Models of Latent Medical Class

Model Classes	Akaike (AIC)	Bayesian (BIC)	Sample-Size Adjusted BIC	Likelihood Ratio Chi-square	Entropy
2-class	5820.95	5963.26	5852.19	900.06	0.70
**3-class	5766.81	5982.31	5814.12	788.51	0.73
4-class	5743.18	6031.88	5806.56	820.56	0.68
5-class	5726.02	6087.90	5805.47	910.15	0.75
3-class with covariates	5627.35	5924.18	5692.52	780.74	0.80

Note. All latent class analyses are based on the weighted detainee data, excluding 28 cases with likely invalid data.
** Selected latent class model.

Figure 2. Medical Condition Latent Class and Estimated Probabilities by Condition.
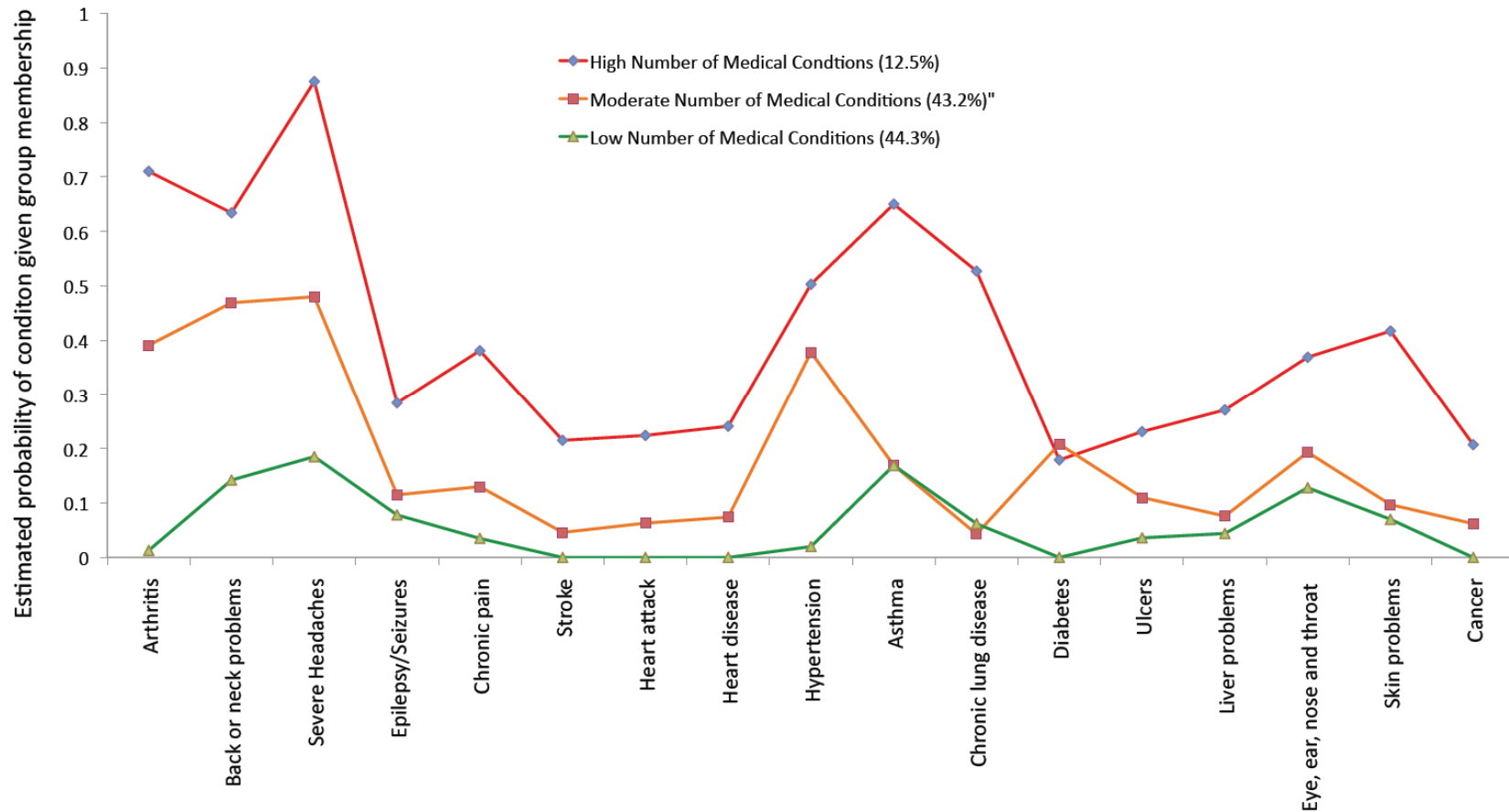
Note. The latent class model is based on 431 cases using weighted data and excluding 28 cases with likely invalid data.

General condition categories were defined as follows: 'Chronic lung disease' includes chronic obstructive pulmonary disease, bronchitis, or emphysema; 'liver problems' includes hepatitis of any kind, jaundice, or cirrhosis; 'eye, ear nose and throat' includes persistent sore throat, ear infections, or a deviated septum; 'skin problems' include cellulitis, skin ulcers, rashes, or infections.

Table 3.

Mutinomial Logistic Regression Results for Covariates by Latent Medical Class

	High number of medical problems				Medium number of medical problems		
	OR	(95% CI)	Sig		OR	(95% CI)	Sig
Sex (male = reference category)	13.30	(2.31 - 77.10)	**		3.81	(1.05 - 13.79)	*
Age	1.27	(1.17 - 1.38)	**		1.17	(1.04 - 1.31)	*
Black/African-American (All other ethnicities = reference category)	0.20	(0.05 - 0.78)	**		0.87	(0.31 - 2.42)	
Lifetime alcohol dependence	2.90	(0.68 - 12.40)			2.64	(0.74 - 9.42)	
Lifetime drug dependence	2.76	(0.73 - 10.46)			0.82	(0.17 - 4.02)	
Lifetime tobacco dependence	0.88	(0.29 - 2.66)			0.97	(0.41 - 2.28)	
Obesity[a]	2.83	(0.74 - 10.83)			2.79	(0.98 - 7.88)	
Two or more DSM-IV lifetime diagnoses[b]	6.18	(1.02 - 37.46)	*		1.48	(0.33 - 6.51)	

Note. Multinomial logistic regression analyses are based on the weighted detainee data, excluding 28 cases with likely invalid data. Odds ratios reflect the increase or decrease in being in a latent class relative to being in the latent classwith the lowest number of medical conditions.

[a]Obesity is defined as having a body mass index (BMI) greater than or equal to 30.

[b]Two or more DSM-IV lifetime conditions is based on having ever had two or more of the following conditions: major depressive disorder, major depressive episode, bipolar disorder, dysthymia, generalized affective disorder, post-traumatic stress disorder, or attention deficit disorder.

*p < .05; **p < .01; ***p < .001

Table 4.
DSM-IV Psychiatric, Substance Use Diagnoses and Infectious Diseases by Medical Disorder Latent Class

| | Number of Medical Problems | | | | | | |
| | Low (N = 191) | | Medium (N = 186) | | High (N = 54) | | |
	%	(SE)	%	(SE)	%	(SE)	Sig
Non-Affective Psychotic Disorder[a]	27.6	(3.3)	25.4	(3.3)	36.0	(6.9)	
Affective Disorders							
Major Depressive Episode	42.6	(3.8)	48.3	(3.9)	76.8	(6.4)	***
Major Depressive Disorder[b]	29.3	(2.5)	34.0	(3.7)	57.7	(7.1)	**
Dysthymia	12.7	(2.5)	17.1	(3.0)	34.8	(6.7)	**
Bipolar - 1 Disorder	18.4	(3.1)	16.5	(2.8)	13.7	(4.4)	
Hypomania	7.9	(1.9)	5.5	(1.6)	10	(4.0)	
Any Affective Disorder	57.9	(3.8)	57.7	(3.9)	81.4	(6.2)	**
Other Psychiatric Disorders							
Post-Traumatic Stress Disorder	37.9	(3.7)	40.9	(3.9)	72.9	(6.1)	***
Generalized Anxiety Disorder	19.3	(3.0)	24.3	(3.3)	30.9	(6.6)	
Attention Deficit Disorder	28.1	(3.5)	30.6	(3.7)	34.8	(7.0)	
Conduct Disorder	14.1	(1.7)	11.6	(2.3)	14.9	(5.5)	
Antisocial Personality Disorder	30.4	(3.7)	20.7	(3.2)	40.9	(7.1)	*
Addiction Disorders							
Gambling Disorder	9.7	(2.1)	13.2	(2.5)	10.3	(3.8)	
Nicotine Dependence	61.7	(3.8)	67.0	(3.7)	62.2	(7.0)	
Alcohol Dependence	22.7	(3.2)	36.8	(3.6)	47.1	(7.2)	**
Drug Dependence	41.2	(3.8)	47.1	(3.9)	74.6	(6.1)	***
Infectious Diseases							
HIV/AIDS	2.1	(1.1)	4.1	(1.4)	9.5	(3.8)	
Other STDs[c]	14.2	(2.7)	24.3	(3.4)	37.5	(7.2)	**
Tuberculosis	5.7	(1.2)	7.7	(2.1)	1.5	(1.5)	

Note. Column N's are based on the weighted detainee data, excluding 28 cases with likely invalid data. Percentages and standard errors are based on data weighted for sampling probabilities and stratified by gender. All tests of significance are based on a modified Pearsons chi-square converted to an F statistic using a second order Rao and Scott correction. All diagnoses except conduct disorder and antisocial personality are past-year.

[a] The diagnosis of nonaffective psychotic disoder includes schizophrenia, schizoaffective disorder, and psychotic disorder not otherwise specified. It is based on clinician reviews of the open-ended responses to the psychotic screening section of the WMH-CIDI.

[b] Based on the hierarchy rule for assessing major depressive disoder, which excludes cases that also meet the criteria for bipolar disorder.

[c] Other STDs include syphilis, gonorrhea, chlamydia, or venereal warts.

*p < .05; **p < .01; ***p < .001