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Health profiles and racial disparities among individuals on probation in Hennepin County, 2016: a cross-sectional study

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ABSTRACT

Objectives: To estimate the health characteristics and racial/ethnic health disparities among a probation cohort in Hennepin County. We hypothesized the probation population would have higher health needs compared to the general population as well as significant racial/ethnic health disparities.

Design: Cross-sectional study using linked administrative records.

Participants: Of 7,992 eligible individuals on high-level probation, 5,873 met inclusion criteria including six or more months of eligibility for full-benefit Minnesota health care plan. Individuals on warrant status were excluded.

Setting: High-level probation system in Hennepin County in 2016.

Outcomes: We compared health condition prevalence among our probation cohort to survey data from the general population and analyzed by race/ethnicity. We also measured sociodemographic characteristics, including the use of safety-net services.

Results: Individuals were predominantly male (80.5%), young (mean age: 35.5), and disproportionately Black or African American (52.9%). A majority of individuals enrolled in Medicaid were eligible via Medicaid expansion (65.9%). Rates of substance use disorders were more than eight times higher (66.5% vs 8.1%) and rates of mental illness were nearly four times higher (55.3% vs 14.4%) compared with the general population. White individuals on probation were significantly more likely than Black or African American individuals to have a diagnosed substance use disorder (71.6% vs 62.0%) or mental health disorder (64.9% vs 48.5%), but less likely to have chronic physical health conditions.

Conclusions: Individuals on probation have high health needs, which vary substantially by race/ethnicity. Without attention to this variation, interventions to address health conditions in this population could worsen racial/ethnic disparities.

ARTICLE SUMMARY

Strengths and limitations of this study

- This study describes the probation population using linked county administrative and electronic health record data sets.
- Health conditions were determined by electronic health record diagnosis codes and probation status was determined by county data, eliminating recall and social desirability bias.
- Analyzing linked data sets provides county-specific, granular information that can inform local policies.
- Results were restricted to individuals in Hennepin County, Minnesota, and may not be generalizable.

INTRODUCTION

More than 3.5 million individuals are on probation in the United States, accounting for nearly 1 in 70 US citizens and totaling more than jail and prison populations combined.[1-3] Probation is an alternative to incarceration, meaning continued criminal justice reform measures may shift more individuals to serve sentences outside of prisons and jails.[4] People on probation have higher rates of many health conditions, including physical health, mental health, and substance use conditions, compared to the general population.[5] Nearly one-quarter of people recently on probation report having a disability.[6] Age-adjusted studies have also shown that individuals on probation have a higher mortality rate than the general public.[7] In addition to their complex health needs, individuals on probation also experience increased barriers to accessing outpatient medical care and disproportionately use emergency department and inpatient care, regardless of insurance status.[5] Justice-involved populations also have considerable social barriers, with high rates of housing insecurity, poverty, and unemployment.[8]

To date, estimates of the health and health care use patterns of probation populations have largely relied on national survey data and include both people currently on probation as well as people who were recently on probation.[5, 6] These studies are scarce in number and limited by self-reporting bias, social desirability bias, and an inability to verify both disease diagnoses and probation status. Additionally, these approaches require primary data collection and do not capture local patterns in disease prevalence or corrections practices. Local and regional data are needed to inform tailored health interventions that improve access and health outcomes for individuals on probation.

Relative to periods of incarceration, there are unique challenges and opportunities to improve care and reduce health inequities during probation. While health care is constitutionally required for individuals who are incarcerated, no such obligation exists for individuals on probation.[9] Yet, because individuals on probation are not incarcerated, they are able to access services in the community that do not exist in jails and prisons. For example, the Medicaid inmate exclusion policy prohibits incarcerated individuals from receiving care through Medicaid.[10] Because people on probation serve sentences in the community, they are able to maintain Medicaid eligibility and enrollment. Thus, individuals on probation represent a large group with poorly defined health profiles that could benefit from well-designed health interventions implemented within the civilian health care system.

To address gaps in the extant literature, we estimated the health characteristics and racial/ethnic health disparities among a probation cohort in Hennepin County using linked administrative records. By linking administrative data, we sought to utilize individual-level data to provide granular information about health to inform interventions and practice at the county level. We hypothesized that individuals on probation would have more health needs than general population estimates and that there would be substantial differences in health conditions by race and ethnicity.

METHODS

Participants and data sources

We used health care claims and administrative probation data to describe health characteristics and disparities among individuals assigned to high-level probation at any point in 2016 with the

Hennepin County Department of Community Corrections and Rehabilitation (DOCCR). High-level probation supervision is designed for individuals assessed as being at higher risk of re-offense and assigns one probation officer to oversee 40 individuals on probation. Clients typically meet with their probation officer once a month to discuss compliance with their probation conditions and other needs or problems they might have. We included individuals under violation status (i.e., those who were in violation of their probation conditions) because they likely still had contact with their probation officer and thus remained on probation in a meaningful way. We excluded people on warrant status because warrants are typically issued when someone cannot be located, and thus cannot actively be involved in probation. Individuals were included in our final cohort if they had six or more months of enrollment for a full-benefit Minnesota public health insurance program between Jan 1, 2013 and Dec 31, 2016 and were adults age 18 or older on probation in 2016.

Health and health insurance enrollment data were drawn from claims from any Minnesota public health care plan, but primarily consisted of programs available through the Affordable Care Act: Medicaid expansion, for individuals with incomes ≤ 138% of the federal poverty level (FPL), and MinnesotaCare, the basic health plan for individual > 138% FPL and ≤ 200% FPL. Criminal justice data came from multiple sources, including DOCCR probation records, court administrative data, and statewide incarceration data. Housing and social service data came from Hennepin County administrative records. Health and criminal justice data were linked using *Link Plus* to probabilistically match on name and date of birth. Social service and housing data were linked to health data using a county-assigned, person-specific ID.

For our general population comparisons, we used the Behavioral Risk Factor Surveillance System (BRFSS) to ascertain the general population prevalence of several physical health conditions in Minnesota. BRFSS is conducted by the US Centers for Disease Control and Prevention and is a telephone-based survey.[11] We used the 2015-2016 National Survey on Drug Use and Health (NSDUH) for national rates of substance use disorder (SUD) and mental health conditions in the general population. [12, 13] NSDUH does not provide state-level variables in its public use data file. NSDUH is conducted by the US Substance Abuse and Mental Health Services Administration and is a household survey conducted by a trained interviewer. Both BRFSS and NSDUH are widely used, population-based surveys that are intended to provide national and state-level estimates of physical health, mental health, and substance use conditions. Though NSDUH does not contain granular information about mental health conditions, the survey does estimate levels of current depression in the United States, as well as any mental illness and any serious mental illness.

Patient and Public Involvement

Patients or the public were not involved in designing, conducting, reporting, or plans for disseminating our research.

Outcomes

We used International Classification of Diseases (ICD) codes to assess physical health, mental health, and substance use diagnoses. ICD ninth revision codes (ICD-9) were used for conditions documented between January 1, 2013 and September 30, 2015 and ICD tenth revision codes (ICD-10) were used for diagnoses documented between October 1, 2015 and December 31, 2016. Chronic Condition Data Warehouse (CCW) Chronic Condition Categories were used to group diagnosis codes to describe physical and mental health conditions.[14] Physical health

conditions included hypertension, heart disease, cancer, asthma, arthritis, diabetes, chronic kidney disease, chronic obstructive pulmonary disease (COPD), and viral hepatitis. We also estimated pregnancy within the last twelve months of ending probation. Mental health diagnoses included depression, anxiety, bipolar disorder, post-traumatic stress disorder (PTSD), and schizophrenia and other psychotic disorders. The latter category, schizophrenia and other psychotic disorders, we defined as a comparator to NSDUH's estimates of serious mental illness. SUD groupings were derived from Healthcare Cost and Utilization Project definitions.[15, 16] Conditions included alcohol, cannabis, opioid, methamphetamine, cocaine/crack, sedatives, or unspecified/other SUDs.

Sociodemographic characteristics

We examined a range of sociodemographic factors including age, gender, race/ethnicity, health insurance enrollment, employment status, education level, number of children, and marital status. Health insurance type was determined by any full or partial month of enrollment at any point while on probation in 2016. Sociodemographic variables, with the exception of health insurance enrollment, were determined based on DOCCR administrative data.

To better understand the non-health care needs of individuals on probation, we also examined use of other safety-net services. We estimated the number of individuals who used a variety of social programs, including the supplemental nutrition assistance program (SNAP), general assistance, temporary assistance for needy families (TANF), or cash assistance. We also assessed the proportion of individuals who used emergency shelter or supportive housing services.

Statistical Analysis

We first described sociodemographic characteristics among all individuals on high-level probation and then stratified characteristics by race/ethnicity.

Next, we described the proportion of individuals on probation who used social services and housing supports. We examined use of these services at any point while an individual who met our health insurance enrollment criteria was on probation in 2016.

We then analyzed the unadjusted prevalence of health conditions among our probation cohort using ICD9 and ICD10 codes. To provide comparisons to disease prevalence data in the general population, we compared rates of physical health conditions among individuals in our probation cohort to the general population in Minnesota using data from BRFSS. Similarly, we compared rates of certain substance use and mental health diagnoses to similar conditions among a national population in NSDUH. Comparisons between our probation cohort and survey populations were estimated using linear probability models and were adjusted for age and gender to eliminate confounding health risk factors. For comparisons to national data, each observation in the high-supervision probation data was assigned single unit weight. Weights for observations from national and state survey data were re-scaled to match the size of the high-level supervision probation cohort before performing comparisons. We generated predicted probabilities adjusted for age and gender using Stata's *margins* command and set covariates at mean values of our probation cohort.

Finally, we evaluated rates of health conditions among individuals on probation by race and ethnicity and assessed the significance of these differences after adjusting for age and gender.

This study was approved by the Hennepin Healthcare Institutional Review Board. All analyses used *Stata* 15.1 (College Station, TX). We considered $P < .05$ to be statistically significant.

RESULTS

Sociodemographic characteristics of individuals on high-level probation

Of the 7,992 adults on high-level probation in Hennepin county in 2016, our sample consisted of 5,873 adults who met enrollment criteria (**Table 1**). Individuals on high level probation in Hennepin County were predominantly young (mean age 35.5), male (80.5%) and Black or African American (52.9%). They were frequently unemployed (38.2%) and, among those with available data, the majority had one or more children (72.4%). Most individuals were enrolled in Medicaid (**Table 1**) while on probation in 2016 (80.7%). Of the individuals enrolled in Medicaid, a majority (65.9%) were eligible via Medicaid expansion under the Affordable Care Act. Sociodemographic profiles varied considerably by race and ethnicity (**Supplemental 1.**)

Social service and housing services among individuals on probation

Over half of individuals on probation received food support (**Table 2**), and 39.2% received some form of income support while on probation. General Assistance was the most common at 27.1%. Approximately 6.8% utilized shelter or supportive housing services while on probation in 2016.

Health characteristics of individuals on high-level probation

In unadjusted analyses, 35.0% of individuals on probation in Hennepin County had one or more chronic physical health condition despite a mean age of 35.5 (**Table 3**). Hypertension (17.3%) and asthma (14.3%) were the most common physical health conditions. A majority of individuals had either a diagnosed SUD (66.4%) or mental health diagnosis (55.0%). Among the diagnosed SUDs, alcohol use disorder was the most common (41.2%), followed by cannabis (29.0%) and opioids (18.3%). Among diagnosed mental health conditions, anxiety and depression were most common (42.9% and 41.9%, respectively). Close to half of the individuals on probation had both a diagnosed SUD and mental health condition (44.9%).

Health characteristics of individuals on high-level probation compared to general population estimates

In adjusted analyses, individuals on probation in Hennepin County were significantly more likely (P<.001) to have nearly all physical health conditions measured in this study as compared to the general population in Minnesota, with the exception of arthritis (**Table 4**).

Individuals on probation in Hennepin County were significantly more likely (P<.001) to have any of the reported diagnosed SUDs (66.5% vs. 8.1%), as well as any mental health condition (55.3% vs. 14.4%) compared with a national sample from NSDUH (**Table 4**). Specifically, individuals on probation in Hennepin County were more likely to have a diagnosis of severe mental illness (12.5% vs. 4.3%) and depression (41.6% vs. 9.4%) as compared to the general population. Individuals on probation in Hennepin County were nearly twenty times more likely to have both a diagnosed SUD and mental health condition compared with the general population (44.7% vs. 2.6%).

Health characteristics of individuals on probation by race/ethnicity

Among individuals on probation in Hennepin County, Black or African American individuals had significantly higher rates of physical health diagnoses when compared with white, non-Hispanic individuals (**Table 5**). Black or African American individuals were less likely to have a diagnosed SUD or mental health conditions when compared with white, non-Hispanic individuals, (62.0% vs. 71.6%, *P*<.001; 48.5% vs. 64.9%, *P*<.001), but had significantly higher rates of several select conditions, including cannabis use (30.7%), cocaine use (17.6%) and severe mental illness (13.6%). White, non-Hispanic individuals had the highest rates of diagnosed methamphetamine use disorders (29.1%) compared with other race/ethnicity subcategories. Native American individuals had the highest rates of diagnosed opioid use disorder compared to other race or ethnic groups, with rates nearly double that of white, non-Hispanics. However, white, non-Hispanic individuals had diagnosed opioid use disorder at over twice the rate of Black or African American and Asian or Pacific Island individuals. Overall, white, non-Hispanic and Native American individuals had the highest rates of many mental health condition diagnoses.

DISCUSSION

In this analysis of linked cross-sector administrative data, we found that individuals on probation had high rates of chronic physical, mental health, and substance use conditions compared to general population estimates. Individuals on probation had poorer health compared with the general population in nearly every assessed category. Substance use and mental health conditions were particularly prevalent, with 44.9% of individuals on probation having simultaneous

diagnoses for substance use and mental health conditions. These findings add to a growing body of literature that indicate individuals on probation have substantial physical and behavioral health needs, which necessitate access to quality health care while on supervision. We additionally show that local administrative data can be used to glean important insights about the health of this key population, without requiring primary data collection, and provide more detailed information related to mental health and substance use diagnoses. For example, we quantified the prevalence of specific SUDs and mental health diagnoses to show that use of multiple different substances is common within this population, as are numerous coexisting mental health diagnoses, suggesting that interventions focused on one particular substance or mental health condition may not be effective.

Consistent with previous studies of health in justice-involved populations, we found significant health differences between racial and ethnic groups in our probation cohort.[17,18] Unlike previous national studies which found similar rates of chronic disease among white, Black, and Native American individuals, we found higher levels of physical health conditions among Black and Native American individuals compared with white, non-Hispanic individuals.[4] However, our findings are consistent with other work using NSDUH that found self-reported mental illness was higher among white, non-Hispanic individuals compared with other racial and ethnic groups.[19-21] We build on this work using diagnosed conditions to show that anxiety, bipolar disorder, and depression were more highly diagnosed among white, non-Hispanic individuals on probation in Hennepin County, but not PTSD nor schizophrenia and other psychotic disorders. We found that, in fact, severe mental illness (e.g., schizophrenia and other psychotic disorders) was more highly diagnosed among Black individuals, while lower severity mental illness (e.g.,

anxiety and depression) was less diagnosed compared with white, non-Hispanics. White, non-Hispanic and Native American individuals on probation were far more likely to have any diagnosed SUD compared with other racial or ethnic groups. However, for certain SUDs, such as cannabis and cocaine, Black or African American and Native American individuals had higher rates compared with white, non-Hispanic individuals.

Our findings can inform interventions specific to the unique barriers and opportunities that exist during a period of probation. For example, given the rates of physical, mental, and substance use conditions, individuals on probation should have the opportunity to connect with a trusted health care partner to assess, diagnose, and treat underlying medical conditions. These assessments should be free of coercion and should not be predicated on the conditions of supervision. Probation offices should prioritize programs that help clients enroll in and maintain health insurance, particularly in Medicaid expansion states, and social services. Finally, the disaggregation of health conditions by race and ethnicity can inform interventions that mitigate rather than exacerbate existing health inequities. For example, there is a potential for interventions to unintentionally worsen racial/ethnic disparities when access to substance-specific treatment is prioritized. Our data suggest that an isolated focus on more prevalent substances, such as opioids or methamphetamine, could contribute to and perpetuate racial inequities without expanding interventions to substances more common among non-white populations. Programs that provide access to treatment for any type of substance use are likely to be more equitable.

This study has several limitations. First, individuals were only included if they had six or more months of eligibility for a full-benefit Minnesota state health care plan in the previous three years. Omitting individuals who did not qualify for public health care plans could potentially drop individuals who have incomes too high to qualify for such plans. Second, although we controlled for age and gender, our comparison populations of BRFSS for physical conditions and NSDUH for mental health conditions and SUDs were self-reported conditions and we did not have access to diagnosis information for a general population cohort. Finally, our study focused on an urban, Midwest county and it is possible that our findings do not generalize when assessed nationally, though they should be comparable to other urban jurisdictions.

Our study describes the unique health needs of people on probation and highlights the racial/ethnic differences that exist within this population. By linking local administrative data across public sectors, jurisdictions can identify opportunities to improve programs and connect individuals to needed resources. This work also highlights the importance of disaggregating diagnoses by race and ethnicity to inform policy decisions. Often overlooked in discussions of correctional health care, people on probation represent a key population for whom targeted public health interventions could improve health and address existing inequities.

FUNDING

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DATA AVAILABILITY

Data are not available.

CONTRIBUTORS

TNW was responsible for the study design, funding, and initial analysis. PB and JW performed the analyses. MGO, RJS, and TNW drafted the manuscript. CH critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

CONFLICT OF INTEREST

The authors have nothing to disclose.

ETHICS APPROVAL

This study was approved by the Hennepin Healthcare Research Institute Institutional Review Board.

Table 1. Demographics and public health insurance prevalence of individuals on high-level probation in Hennepin County, Minnesota, any time during 2016 and met MHCP enrollment criteria.

	HC probation cohort	
	n	%
Cohort		
High-level probation meeting enrollment criteria	5873	-
Median age	33.0	
Mean age	35.5	
Male	4726	80.5%
Race/ethnicity		
White, non-Hispanic	2055	35.0%
Black or African American	3104	52.9%
Native American	324	5.5%
Asian or Pacific Islander	114	1.9%
Hispanic	212	3.6%
Other	64	1.1%
Health insurance enrollment (While on high-level probation in 2016)		
Any MHCP	5116	87.1%
Consolidated treatment fund	1346	22.9%
Any full-benefit MHCP	4931	84.0%
Medicaid	4742	80.7%
MinnesotaCare	5116	4.6%
Medicaid Eligibility Types (among those enrolled in Medicaid in 2016)		
Expansion	3126	65.9%
Disability, no Medicare/SS	472	10.0%
Disability, with Medicare/SS	327	6.9%
Parent	808	17.0%
Other	328	6.9%
Employment		
Part-time	1039	17.7%
Full-time	1347	22.9%
Unemployed	2242	38.2%
Other	131	2.2%
Unknown	1114	19.0%
Education		
High school, not completed	1258	21.4%
High school, completed	1360	23.2%

GED	725	12.3%
Some college or higher education	1442	24.6%
Unknown	1088	18.5%
Children		
0 Children	1622	27.6%
1 Child	998	17.0%
2 Children	812	13.8%
3+ Children	1272	21.7%
Unknown	1169	19.9%
Marital Status		
Married	408	6.9%
Single	4399	74.9%
Unknown	1066	18.2%

Counts for people on high-level probation any time during 2016.

Includes people with violation status, but not warrant status.

Minnesota Health Care Plans (MHCP) includes any full or partial month while on high-level probation in 2016. Counts are not exclusive and do not add up to 100 percent.

Table 2. Participation in social service programs of individuals while on high-level probation in Hennepin County, Minnesota, any time during 2016 and met MHCP enrollment criteria.

	HC probation cohort	
	n	%
Food Support (SNAP)	3189	54.3%
Cash Support	2305	39.2%
General Assistance	1593	27.1%
Minnesota Family Investment Program (TANF)	491	8.4%
Other income support	328	5.6%
Group Residential Housing	873	14.9%
Shelter	398	6.8%

Counts for people on high-level probation any time during 2016.

Includes people with violation status, but not warrant status.

Minnesota Health Care Plans (MHCP) includes any full or partial month while on high-level probation in 2016. Counts are not exclusive and do not add up to 100 percent.

Table 3. Health conditions of individuals on high-level probation in Hennepin County, Minnesota, any time during 2016 and met MHCP enrollment criteria.

	HC probation cohort	
	n	%
Cohort	5873	
Women of childbearing age who meet prior enroll criteria	932	11.7%
Physical Conditions		
Hypertension	1015	17.3%
Asthma	842	14.3%
Arthritis	513	8.7%
Diabetes	346	5.9%
Cancer	29	0.5%
Heart Disease	157	2.7%
Chronic Kidney Disease	337	5.7%
COPD	211	3.6%
Viral Hepatitis	276	4.7%
Number of Chronic Physical Conditions*		
0	3815	65.0%
1	1146	19.5%
2+	912	15.5%
Pregnant in last 12 mos. (% of women)	99	10.6%
Substance Use Disorders (SUD)		
Any SUD	3901	66.4%
Alcohol	2417	41.2%
Cannabis	1703	29.0%
Opioid	1074	18.3%
Methamphetamine	936	15.9%
Cocaine/crack	852	14.5%
Sedatives	182	3.1%
Unspecified/other SUD	1732	29.5%
Two or more SUD	1957	33.3%
Mental Health		
Any mental health	3233	55.0%
Depression	2461	41.9%
Anxiety	2517	42.9%
Bipolar	1195	20.3%

PTSD	1000	17.0%
Severe mental illness	748	12.7%
SUD + MI		
Any SUD and any MI	2635	44.9%

Counts for people on high-level probation any time during 2016 meeting enrollment criteria

Includes people with violation status, but not warrant status

Conditions among those with 6+ months full-benefit public health insurance eligibility in past three years in Minnesota

Conditions from ICD9 diagnosis codes 2013-2015, ICD10 codes 2015-2016. Physical and mental health conditions grouped according to CCW specifications. SUD conditions grouped according to HCUP specifications, excluding remission codes.

*Chronic physical conditions include hypertension, chronic kidney disease, coronary artery disease, diabetes, cancer, stroke, asthma, arthritis, and chronic obstructive pulmonary disease

Table 4. Comparative rates of health conditions of individuals on high-level probation in Hennepin County, Minnesota, any time during 2016 and met MHCP enrollment criteria, versus general population.

	HC probation cohort, adjusted for age and sex (95% CI)	BRFSS comparison, adjusted for age and sex (95% CI)	NSDUH comparison, adjusted for age and sex (95% CI)
	***n* = 5873**		
Physical Conditions			
Hypertension	17.0% (16.0% - 18.0%)	12.5% (11.4% - 13.6%)	
Asthma	14.5% (13.6% - 15.4%)	5.5% (4.9% - 6.1%)	
Arthritis	7.8% (7.0% - 8.5%)†	8.2% (7.6% - 8.8%)†	
Diabetes	5.7% (5.1% - 6.4%)	3.2% (2.8% - 3.7%)	
Chronic Kidney Disease	5.8% (5.1% - 6.4%)	0.2% (-0.1% - 0.5%)	
COPD	3.4% (2.9% - 4.0%)	1.2% (0.8% - 1.5%)	
Substance Use Disorders (SUD)			

Any SUD	66.5% (65.3% - 67.7%)	8.1% (7.6% - 8.5%)
Alcohol	40.9% (39.7% - 42.2%)	6.3% (5.9% - 6.7%)
Cannabis	28.3% (27.1% - 29.5%)	1.7% (1.5% - 1.8%)
Opioid	17.6% ((16.6% - 18.6%)	0.7% (0.6% - 0.8%)
Methamphetamine	14.9% (14.0% - 15.9%)	0.2% (0.2% - 0.3%)
Cocaine/crack	13.2% (12.3% - 14.1%)	0.2% (0.2% - 0.3%)
Sedatives	2.9% (2.5% - 3.4%)	0.1% (0.0% - 0.1%)
Mental Health		
Any mental health condition	55.3% (54.0% - 56.6%)	14.4% (13.4% - 15.1%)
Depression	41.6% (40.4% - 42.9%)	9.4% (8.9% - 10%)
Severe mental illness	12.5% (11.7% - 13.4%)	4.3% (3.9% - 4.6%)
SUD + MI		
Any SUD and any MI	44.7% (43.4% - 46.0%)	2.6% (2.3% - 2.8%)

Counts for people on high-level probation any time during 2016

Includes people with violation status, but not warrant status

Conditions among those with 6+ months full-benefit public health insurance eligibility in past three years in Minnesota

Conditions from ICD9 diagnosis codes 2013-2015, ICD10 codes 2015-2016. Physical and mental health conditions grouped according to CCW specifications. SUD conditions grouped according to HCUP specifications, excluding remission codes.

Adjusted to age and gender distributions for the high-level cohort. Physical condition comparisons use BRFSS 2015-2016 values for Minnesota, SUD and MI conditions use NSDUH values for the U.S. Based on bivariate statistical testing, all values were significant (p <.0001) with the exception of those marked with †, which were not significantly different

Table 5. Health conditions of individuals on high-level probation in Hennepin County, Minnesota, any time during 2016 and met MHCP enrollment criteria, by race and ethnicity

	HC probation cohort				
	White, non-Hispanic (N=2055)	**Black or African American (N=3103)**	**Native American (N=324)**	**Asian or Pacific Islander (N=114)**	**Hispanic (N=212)**
Physical Conditions	**%**	**%**	**%**	**%**	**%**
Asthma	10.8% (9.5% - 12.2%)	17.4%*** (16.1% - 18.8%)	12.9% (9.5% - 16.4%)	11.0% (5.2% - 16.9%)	12.9% (8.4% - 17.5%)
Diabetes	4.2% (3.4% - 5.0%)	6.8%*** (5.9% - 7.7%)	10.2%*** (7.0% - 13.4%)	3.9% (0.2% - 7.5%)	8.4% (4.3% - 12.5%)
Hypertension	13.7% (12.4% - 15.0%)	20.5%*** (19.1% - 21.8%)	20.1%** (16.2% - 24.1%)	9.8% (4.4% - 15.1%)	16.2% (11.1% - 21.3%)
Arthritis	7.2% (6.2% - 8.1%)	10.2%*** (9.1% - 11.2%)	12.4%** (9.1% - 15.7%)	2.1%** (-0.7% - 4.9%)	5.9% (2.2% - 9.6%)
CKD	5.2% (4.3% - 6.1%)	6.0% (5.1% - 6.8%)	7.7% (4.8% - 10.6%)	5.4% (1.2% - 9.5%)	5.5% (2.2% - 8.8%)
COPD	3.7% (2.9% - 4.4%)	3.7% (3.0% - 4.4%)	3.4% (1.4% - 5.3%)	2.8% (-0.3% - 5.9%)	2.5% (0.1% - 4.9%)
Viral Hepatitis	6.1% (5.1% - 7.0%)	3.1%*** (2.5% - 3.8%)	10.1%* (6.9% - 13.3%)	0.9%*** (-0.8% - 2.6%)	5.7% (2.3% - 9.1%)
IHD	2.6%*** (1.9% - 3.2%)	2.8%*** (2.2% - 3.3%)	2.7%** (0.9% - 4.6%)	2.8% (-0.3% - 5.9%)	3.8%* (0.9% - 6.7%)
Cancer	0.3%** (0.1% - 0.5%)	0.7%*** (0.4% - 1.0%)	0.7% (-0.2% - 1.6%)	-	0.5% (-0.5% - 1.5%)
Average # of chronic physical conditions (0-9)*	0.52 (0.48 - 0.55)	0.73 (0.69 - 0.76)***	0.75 (0.63 – 0.87)***	0.42 (0.25 – 0.59)	0.56 (0.41 – 0.71)
Substance use disorders					
Any SUD	71.6% (69.7% - 73.6%)	62.0%*** (60.3% - 63.7%)	85.9%*** (82.0% - 89.7%)	47.7%*** (38.6% - 56.8%)	66.3% (60.1% - 72.5%)
Alcohol	43.3% (41.2% - 45.4%)	38.5%** (36.8% - 40.2%)	59.2%*** (53.9% - 64.4%)	24.8%*** (17.0% - 32.7%)	42.5% (35.9% - 49.1%)
Cannabis	27.3% (25.3% - 29.2%)	30.7%** (29.1% - 32.3%)	35.8%** (30.6% - 40.9%)	8.8%*** (3.6% - 13.9%)	21.5%* (16.2% - 26.9%)
Cocaine	10.1% (8.9% - 11.3%)	17.6%*** (16.2% - 18.9%)	20.5%*** (16.3% - 24.7%)	5.6%* (1.3% - 9.9%)	16.4%* (11.2% - 21.5%)
Methamphetamine	29.1% (27.1% - 31.1%)	5.5%*** (4.7% - 6.3%)	27.9% (23.1% - 32.7%)	17.4%** (10.6% - 24.3%)	15.0%*** (10.2% - 19.8%)
Opioids	24.8% (22.9% - 26.6%)	11.5%*** (10.3% - 12.6)	41.2%*** (35.9% - 46.5%)	7.2%*** (2.4% - 12.0%)	23.5% (17.7% - 29.2%)
Sedatives	5.8% (4.8% - 6.9%)	1.1%*** (0.7% - 1.4%)	3.9% (1.9% - 5.9%)	1.8%** (-0.7% - 4.2%)	6.4% (3.1% - 9.6%)
Unspecified SUD	35.6% (33.6% - 37.7%)	24.8%*** (23.3% - 26.4%)	41.7%* (36.4% - 47.1%)	17.1%*** (10.2% - 24.0%)	23.4%*** (17.7% - 29.2%)
Mental Health					
Any MI	64.9% (62.8% - 66.9%)	48.5%*** (46.8% - 50.3%)	67.5% (62.3% - 72.6%)	34.6%*** (26.1% - 43.1%)	52.8%** (46.3% - 59.3%)

Anxiety	53.0% (50.9% - 55.1%)	35.4%*** (33.7% - 37.0%)	55.1% (49.7% - 60.6%)	28.3%*** (20.1% - 36.4%)	44.0%* (37.5% - 50.6%)
Bipolar	23.5% (21.7% - 25.3%)	18.6%*** (17.2% - 20.0%)	19.4% (15.3% - 23.5%)	10.9%*** (5.2% - 16.7%)	20.2% (14.7% - 25.6%)
Depression	49.0% (46.9% - 51.1%)	36.8%*** (35.2% - 38.5%)	51.4% (46.0% - 56.7%)	24.0%*** (16.3% - 31.7%)	42.3% (35.9% - 48.7%)
PTSD	17.3% (15.7% - 18.8%)	16.6% (15.3% - 17.9%)	22.2%* (17.9% - 26.4%)	9.1%** (3.8% - 14.4%)	17.6% (12.4% - 22.7%)
Severe mental illness	11.2% (9.9% - 12.6%)	13.6%* (12.4% - 14.9%)	16.6%* (12.6% - 20.7%)	9.8% (4.3% - 15.2%)	10.9% (6.5% - 15.2%)
SUD + MI					
Any SUD and any MI	53.2% (51.1% - 55.3%)	38.5%*** (36.8% - 40.1%)	63.9%*** (58.7% - 69.2%)	21.8%*** (14.3% - 29.4%)	42.9%** (36.3% - 49.4%)
Other conditions					
Personality disorders	15.4% (13.9% - 16.9%)	10.0%*** (8.9% - 11.0%)	11.0%* (7.8% - 14.3%)	7.3%** (2.5% - 12.2%)	13.0% (8.3% - 17.7%)

Race and ethnicity designations from data maintained by Hennepin County Corrections

* $p < .05$ in bivariance comparison with White, Non-Hispanic

** $p < .01$ in bivariance comparison with White, Non-Hispanic

*** $p < .001$ in bivariance comparison with White, Non-Hispanic

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Supplemental 1. Demographics and public health insurance prevalence of individuals on high-level probation in Hennepin County, Minnesota, any time during 2016 and met MHCP enrollment criteria by race and ethnicity.

	HC probation cohort									
	White, non-Hispanic		Black or African American		Native American		Asian or Pacific Islander		Hispanic	
Cohort	n	%	n	%	n	%	n	%	n	%
High-level probation meeting enroll criteria	2055	35.0%	3104	52.9%	324	5.5%	114	1.9%	212	3.6%
Median age	35.4		31.5		32.7		32.3		29.2	
Average age	37.7		34.4		34.7		35.2		32.6	
Male	1580	76.9%	2629	84.7%	201	62.0%	97	85.1%	175	82.5%
Health Insurance Enrollment (While on High-Level Probation in 2016)										
Any MHCP	1821	88.6%	2670	86.0%	292	90.1%	95	83.3%	188	88.7%
Consolidated treatment fund	466	22.7%	666	21.5%	129	39.8%	24	21.1%	55	25.9%
Any full-benefit MHCP	1769	86.1%	2558	82.4%	282	87.0%	92	80.7%	181	85.4%
Medicaid	1676	81.6%	2487	80.1%	279	86.1%	87	76.3%	167	78.8%
MinnesotaCare	141	6.9%	97	3.1%	--	--	--	--	18	8.5%
Medicaid Eligibility Types										
Expansion	1218	72.7%	1524	61.3%	191	68.5%	54	62.1%	116	69.5%
Disability, no Medicare/SS	107	6.4%	323	13.0%	23	8.2%	--	--	--	--
Disability, with Medicare/SS	129	7.7%	177	7.1%	--	--	--	--	--	--
Parent	247	14.7%	441	17.7%	50	17.9%	28	32.2%	29	17.4%
Other	70	4.2%	204	8.2%	17	6.1%	--	--	--	--
Employment										
Part-time	363	17.7%	574	18.5%	28	8.6%	22	19.3%	39	18.4%
Full-time	539	26.2%	675	21.7%	31	9.6%	27	23.7%	55	25.9%
Unemployed	685	33.3%	1251	40.3%	184	56.8%	35	30.7%	70	33.0%
Other	49	2.4%	68	2.2%	--	--	--	--	--	--
Unknown	419	20.4%	536	17.3%	--	--	--	--	--	--
Education										
High school, not completed	259	12.6%	792	25.5%	112	34.6%	--	--	57	26.9%
High school, completed	439	21.4%	759	24.5%	66	20.4%	29	25.4%	49	23.1%
GED	247	12.0%	403	13.0%	48	14.8%	--	--	17	8.0%
Some college or higher education	631	30.7%	688	22.2%	36	11.1%	12	10.5%	33	15.6%
Unknown	479	23.3%	462	14.9%	52	16.0%	28	24.6%	45	21.2%
Children										
0 Children	703	34.2%	729	23.5%	75	23.1%	38	33.3%	66	31.1%
1 Child	330	16.1%	564	18.2%	61	18.8%	--	--	25	11.8%
2 Children	238	11.6%	470	15.1%	52	16.0%	--	--	31	14.6%
3+ Children	264	12.8%	859	27.7%	84	25.9%	--	--	36	17.0%
Unknown	520	25.3%	482	15.5%	52	16.0%	32	28.1%	46	21.7%
Marital Status										
Married	157	7.6%	197	6.3%	14	4.3%	--	--	17	8.0%
Single	1473	71.7%	2415	77.8%	252	77.8%	--	--	156	73.6%
Unknown	425	20.7%	492	15.9%	58	17.9%	30	26.3%	39	18.4%

Counts for people on high-level probation any time during 2016.

Includes people with violation status, but not warrant status.

Minnesota Health Care Plans (MHCP) includes any full or partial month while on high-level probation in 2016. Counts are not exclusive and do not add up to 100 percent.

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Title. **Page 1.**
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Abstract, Methods and Findings. **Page 2.**
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Introduction, paragraphs 1-3. **Pages 4-5.**
Objectives	3	State specific objectives, including any prespecified hypotheses	Introduction, paragraph 4. **Page 5.**
Methods			
Study design	4	Present key elements of study design early in the paper	Methods, paragraphs 1-3. **Pages 5-7.**
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Methods, paragraphs 1-3. **Pages 5-7.**
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	Methods, paragraphs 1-2. **Pages 5-6.**
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Methods, paragraphs 5-7. **Pages 7-8**
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Methods, paragraphs 3 and 5. **Pages 7-8.**
Bias	9	Describe any efforts to address potential sources of bias	Methods,

			paragraphs 10-11. **Pages 9-10.**
Study size	10	Explain how the study size was arrived at	Methods, paragraph 1. **Page 5.**
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Methods, paragraphs 5-7. **Pages 7-8.**
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Methods, paragraphs 8-11. **Pages 9-10.**
		(*b*) Describe any methods used to examine subgroups and interactions	Methods, paragraph 10. **Pages 9.**
		(*c*) Explain how missing data were addressed	Methods, paragraph 10. **Page 9.**
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Results, paragraph 1. **Page 10.**
		(b) Give reasons for non-participation at each stage	Methods, paragraph 1. **Page 5.**
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Results, paragraph 1 Table 1. **Page 10.**
		(b) Indicate number of participants with missing data for each variable of interest	Some sociodemographic variables had missing data, 'unknown' noted in Table 1. **Page 17.** N/A for adjusted

			analyses.
Outcome data	15*	Report numbers of outcome events or summary measures	Probation group: Results, paragraph 3; Table 3. **Pages 10, 19.** Comparison group: Results, paragraph 4-5; Table 4. **Pages 11, 20.**
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Methods, paragraph 10; Results, paragraph 3-4, Table 3, Table 4. **Pages 9-11, 19-20.**
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Results, paragraph 6. **Page 12.**
Discussion			
Key results	18	Summarise key results with reference to study objectives	Discussion, paragraph 1. **Page 12.**
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Discussion, paragraph 4. **Pages 14-15.**
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Discussion, paragraphs 2-3. **Pages 13-14.**
Generalisability	21	Discuss the generalisability (external validity) of the study results	Discussion, paragraph 4. **Pages 14-15.**

Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Funding, paragraph 1. **Page 15.**

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Health profiles and racial disparities among individuals on probation in Hennepin County, 2016: a cross-sectional study

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Health profiles and racial disparities among individuals on probation in Hennepin County, 2016: a cross-sectional study

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ABSTRACT

Objectives: To estimate the health characteristics and racial/ethnic health disparities among a probation cohort in Hennepin County. We hypothesized the probation population would have higher health needs compared to the general population as well as significant racial/ethnic health disparities.

Design: Cross-sectional study using linked administrative records.

Participants: Of 7,992 eligible individuals, 5,873 met inclusion criteria including six or more months of eligibility for full-benefit Minnesota health care plan.

Setting: Probation system in Hennepin County in 2016.

Outcomes: We compared health condition prevalence among our probation cohort to survey data from the general population and analyzed by race/ethnicity. We also measured sociodemographic characteristics, including the use of safety-net services.

Results: Individuals were predominantly male (80.5%), young (mean age: 35.5), and disproportionately Black or African American (52.9%). A majority of individuals enrolled in Medicaid were eligible via Medicaid expansion (65.9%). Compared with the general population, individuals on probation had higher rates of substance use disorders (66.5% vs 8.1%), mental illness (55.3% vs 14.4%), and many physical conditions (e.g. asthma: 17.0% vs 12.5%, chronic kidney disease: 5.8% vs 0.2%). White individuals on probation were significantly more likely than Black or African American individuals to have a diagnosed substance use disorder (71.6% vs 62.0%) or mental health disorder (64.9% vs 48.5%), but fewer chronic physical health conditions (average: 0.52 vs 0.73 chronic physical conditions).

Conclusions: Individuals on probation have high health needs, which vary substantially by race/ethnicity. Without attention to this variation, interventions to address health conditions in this population could worsen racial/ethnic disparities.

ARTICLE SUMMARY

Strengths and limitations of this study

- This study describes the probation population using linked county administrative and electronic health record data sets.
- Health conditions were determined by electronic health record diagnosis codes and probation status was determined by county data, eliminating recall and social desirability bias.
- Analyzing linked data sets provides county-specific, granular information that can inform local policies.
- Results were restricted to individuals in Hennepin County, Minnesota, and may not be generalizable.

INTRODUCTION

More than 3.5 million individuals are on probation in the United States, accounting for nearly 1 in 70 US citizens and totaling more than jail and prison populations combined.[1-3] Probation is an alternative to incarceration, meaning continued criminal justice reform measures may shift more individuals to serve sentences outside of prisons and jails.[4] People on probation are disproportionately from racial and ethnic minority groups and have higher rates of many health conditions, including physical health, mental health, and substance use conditions, compared to the general population.[5,6] Nearly one-quarter of people recently on probation report having a disability.[7] Age-adjusted studies have also shown that individuals on probation have a higher mortality rate than the general public.[8] In addition to their complex health needs, individuals on probation also experience increased barriers to accessing outpatient medical care and disproportionately use emergency department and inpatient care, regardless of insurance status.[6] Justice-involved populations also have considerable social barriers, with high rates of housing insecurity, poverty, and unemployment.[9]

To date, estimates of the health and health care use patterns of probation populations have largely relied on national survey data and include both people currently on probation as well as people who were recently on probation.[6,7] These studies are scarce in number and limited by self-reporting bias, social desirability bias, and an inability to verify both disease diagnoses and probation status. Additionally, these approaches require primary data collection and do not capture local patterns in disease prevalence or corrections practices. Local and regional data are needed to inform tailored health interventions that improve access and health outcomes for individuals on probation.

Relative to periods of incarceration, there are unique challenges and opportunities to improve care and reduce health inequities during probation. While health care is constitutionally required for individuals who are incarcerated, no such obligation exists for individuals on probation.[10] Yet, because individuals on probation are not incarcerated, they are able to access services in the community that do not exist in jails and prisons. For example, the Medicaid inmate exclusion policy prohibits incarcerated individuals from receiving care through Medicaid.[11] Because people on probation serve sentences in the community, they are able to maintain Medicaid eligibility and enrollment. Thus, individuals on probation represent a large group with poorly defined health profiles that could benefit from well-designed health interventions implemented within the civilian health care system.

To address gaps in the extant literature, we estimated the health characteristics and racial/ethnic health disparities among a probation cohort in Hennepin County using linked administrative records. Using a comprehensive and cross-sector data source, we sought to provide granular information about health to inform interventions and practice at the county level. Our primary aim was to describe the sociodemographic and health characteristics of individuals on probation. Our secondary aim was to compare health characteristics to a national sample using survey data. We hypothesized that individuals on probation would have complex sociodemographic profiles, high health needs compared to general population estimates, and substantial differences in health conditions by race and ethnicity.

METHODS

Participants and data sources

We used health care claims and administrative probation data to describe health characteristics and disparities among individuals assigned to high-level probation at any point in 2016 with the Hennepin County Department of Community Corrections and Rehabilitation (DOCCR). High-level probation supervision is designed for individuals assessed as being at higher risk of re-offense and assigns one probation officer to oversee 40 individuals on probation. Clients typically meet with their probation officer once a month to discuss compliance with their probation conditions and other needs or problems they might have. We chose to examine individuals on high-level supervision because they frequently interact with probation officers. Thus, there are more opportunities for modifications to programming and outreach than for individuals on low- or mid-level supervision. We excluded people on warrant status because warrants are typically issued when someone cannot be located, and thus cannot actively be involved in probation. Individuals were included in our final cohort if they had six or more months of enrollment for a full-benefit Minnesota public health insurance program (Minnesota Health Care Plan [MHCP]) between Jan 1, 2013 and Dec 31, 2016 and were adults age 18 or older on probation in 2016.

Health and health insurance enrollment data were drawn from claims from any MHCP, but primarily consisted of programs available through the Affordable Care Act: Medicaid expansion, for individuals with incomes £ 138% of the federal poverty level (FPL), and MinnesotaCare, the basic health plan for individual > 138% FPL and £ 200% FPL. Criminal justice data came from multiple sources, including DOCCR probation records, court administrative data, and statewide incarceration data. Housing and social service data came from Hennepin County administrative

records. Health and criminal justice data were linked using *Link Plus* to probabilistically match on name and date of birth. Social service and housing data were linked to health data using a county-assigned, person-specific ID.

Patient and Public Involvement

Patients or the public were not involved in designing, conducting, reporting, or plans for disseminating our research.

Outcomes

We used International Classification of Diseases (ICD) codes to assess physical health, mental health, and substance use diagnoses. ICD ninth revision codes (ICD-9) were used for conditions documented between January 1, 2013 and September 30, 2015 and ICD tenth revision codes (ICD-10) were used for diagnoses documented between October 1, 2015 and December 31, 2016. Chronic Condition Data Warehouse (CCW) Chronic Condition Categories were used to group diagnosis codes to describe physical and mental health conditions.[12] Physical health conditions included hypertension, heart disease, cancer, asthma, arthritis, diabetes, chronic kidney disease, chronic obstructive pulmonary disease (COPD), and viral hepatitis. We also assessed pregnancy among women of childbearing age (ages 18-44) within the last twelve months of ending probation. Mental health diagnoses included depression, anxiety, bipolar disorder, post-traumatic stress disorder (PTSD), and schizophrenia and other psychotic disorders. The latter category, schizophrenia and other psychotic disorders, we defined as a comparator to NSDUH's estimates of serious mental illness. SUD groupings were derived from Healthcare Cost and Utilization Project definitions.[13,14] Conditions included alcohol, cannabis, opioid, methamphetamine, cocaine/crack, sedatives, or unspecified/other SUDs.

Sociodemographic characteristics

We examined a range of sociodemographic factors including age, gender, race/ethnicity, health insurance enrollment, employment status, education level, number of children, and marital status. Health insurance type was determined by any full or partial month of enrollment at any point while on probation in 2016. Sociodemographic variables, with the exception of health insurance enrollment, were determined based on DOCCR administrative data.

To better understand the non-health care needs of individuals on probation, we also examined use of other safety-net services. We estimated the number of individuals who used a variety of social programs, including the supplemental nutrition assistance program (SNAP), general assistance, temporary assistance for needy families (TANF), or cash assistance. We also assessed the proportion of individuals who used emergency shelter or supportive housing services.

Statistical Analysis

We first described sociodemographic characteristics among all individuals on high-level probation and then stratified characteristics by race/ethnicity.

Next, we described the proportion of individuals on probation who used social services and housing supports. We examined use of these services at any point while an individual who met our health insurance enrollment criteria was on probation in 2016.

We then analyzed the unadjusted prevalence of health conditions among our probation cohort using ICD9 and ICD10 codes.

For our general population comparisons, we used the Behavioral Risk Factor Surveillance System (BRFSS) to ascertain the general population prevalence of several physical health conditions in Minnesota. BRFSS is conducted by the US Centers for Disease Control and Prevention and is a telephone-based survey.[15] We used the 2015-2016 National Survey on Drug Use and Health (NSDUH) for national rates of substance use disorder (SUD) and mental health conditions in the general population. [16, 17] NSDUH does not provide state-level variables in its public use data file. NSDUH is conducted by the US Substance Abuse and Mental Health Services Administration and is a household survey conducted by a trained interviewer. Both BRFSS and NSDUH are widely used, population-based surveys that are intended to provide national and state-level estimates of physical health, mental health, and substance use conditions. Though NSDUH does not contain granular information about mental health conditions, the survey does estimate levels of current depression in the United States, as well as any mental illness and any serious mental illness.

To provide comparisons to disease prevalence data in the general population, we compared rates of physical health conditions among individuals in our probation cohort to the general population in Minnesota using data from BRFSS. Similarly, we compared rates of certain substance use and mental health diagnoses to similar conditions among a national population in NSDUH. Comparisons between our probation cohort and survey populations were estimated using linear probability models and were adjusted for age and gender to eliminate confounding health risk

factors. For comparisons to national data, each observation in the high-supervision probation data was assigned single unit weight. Weights for observations from national and state survey data were re-scaled to match the size of the high-level supervision probation cohort before performing comparisons. We generated predicted probabilities adjusted for age and gender using Stata's *margins* command and set covariates at mean values of our probation cohort.

Finally, we evaluated rates of health conditions among individuals on probation by race and ethnicity and assessed the significance of these differences after adjusting for age and gender.

This study was approved by the Hennepin Healthcare Institutional Review Board. All analyses used *Stata* 15.1 (College Station, TX). We considered $P < .05$ to be statistically significant.

RESULTS

Sociodemographic characteristics of individuals on high-level probation

Of the 7,992 adults on high-level probation in Hennepin county in 2016, our sample consisted of 5,873 adults who met enrollment criteria (**Table 1**). Individuals on high level probation in Hennepin County were predominantly young (mean age 35.5), male (80.5%) and Black or African American (52.9%). They were unemployed at higher rates than the general public (38.2% among individuals on probation vs 3.9% in Minnesota [not reported in table]).[18] Among those with available data, the majority had one or more children (72.4%). Most individuals were enrolled in Medicaid (**Table 1**) while on probation in 2016 (80.7%). Of the individuals enrolled in Medicaid, a majority (65.9%) were eligible via Medicaid expansion under the Affordable Care Act. Sociodemographic profiles varied considerably by race and ethnicity (**Supplemental 1.**)

Social service and housing services among individuals on probation

Over half of individuals on probation received food support (**Table 1**), and 39.2% received some form of income support while on probation. General Assistance was the most common at 27.1%. Approximately 6.8% utilized shelter or supportive housing services while on probation in 2016.

Health characteristics of individuals on high-level probation

In unadjusted analyses, 35.0% of individuals on probation in Hennepin County had one or more chronic physical health condition despite a mean age of 35.5 (**Table 2**). Hypertension (17.3%) and asthma (14.3%) were the most common physical health conditions. A majority of individuals had either a diagnosed SUD (66.4%) or mental health diagnosis (55.0%). Among the diagnosed SUDs, alcohol use disorder was the most common (41.2%), followed by cannabis (29.0%) and opioids (18.3%). Among diagnosed mental health conditions, anxiety and depression were most common (42.9% and 41.9%, respectively). Close to half of the individuals on probation had both a diagnosed SUD and mental health condition (44.9%).

Health characteristics of individuals on high-level probation compared to general population estimates

In adjusted analyses, individuals on probation in Hennepin County were significantly more likely ($P<.001$) to have nearly all physical health conditions measured in this study as compared to the general population in Minnesota, with the exception of arthritis (**Table 3**).

Individuals on probation in Hennepin County were significantly more likely ($P<.001$) to have any of the reported diagnosed SUDs (66.5% vs. 8.1%), as well as any mental health condition

(55.3% vs. 14.4%) compared with a national sample from NSDUH (**Table 3**). Specifically, individuals on probation in Hennepin County were more likely to have a diagnosis of severe mental illness (12.5% vs. 4.3%) and depression (41.6% vs. 9.4%) as compared to the general population. Individuals on probation in Hennepin County were nearly twenty times more likely to have both a diagnosed SUD and mental health condition compared with the general population (44.7% vs. 2.6%).

Health characteristics of individuals on probation by race/ethnicity

Among individuals on probation in Hennepin County, Black or African American individuals had significantly higher rates of physical health diagnoses when compared with white, non-Hispanic individuals (**Table 4**). Black or African American individuals were less likely to have a diagnosed SUD or mental health conditions when compared with white, non-Hispanic individuals, (62.0% vs. 71.6%, $P<.001$; 48.5% vs. 64.9%, $P<.001$), but had significantly higher rates of several select conditions, including cannabis use (30.7%), cocaine use (17.6%) and severe mental illness (13.6%). White, non-Hispanic individuals had the highest rates of diagnosed methamphetamine use disorders (29.1%) compared with other race/ethnicity subcategories. Native American individuals had the highest rates of diagnosed opioid use disorder compared to other race or ethnic groups, with rates nearly double that of white, non-Hispanics. However, white, non-Hispanic individuals had diagnosed opioid use disorder at over twice the rate of Black or African American and Asian or Pacific Island individuals. Overall, white, non-Hispanic and Native American individuals had the highest rates of many mental health condition diagnoses.

DISCUSSION

In this analysis of linked cross-sector administrative data, we found that individuals on probation had complex sociodemographic profiles as well as high rates of chronic physical, mental health, and substance use conditions. Individuals on probation had poorer health compared with the general population in nearly every assessed category. Substance use and mental health conditions were particularly prevalent, with 44.9% of individuals on probation having simultaneous diagnoses for substance use and mental health conditions. These findings add to a growing body of literature that indicate individuals on probation have substantial physical and behavioral health needs, which necessitate access to quality health care while on supervision. Additionally, the frequent use of safety-net services highlights the considerable social barriers faced by people on probation. We show that local administrative data can be used to glean important insights about the health of this key population, without requiring primary data collection, and provide more detailed information related to mental health and substance use diagnoses. For example, we quantified the prevalence of specific SUDs and mental health diagnoses to show that use of multiple different substances is common within this population, as are numerous coexisting mental health diagnoses, suggesting that interventions focused on one particular substance or mental health condition may not be effective.

Consistent with previous studies of health in justice-involved populations, we found significant health differences between racial and ethnic groups in our probation cohort.[19,20] Unlike previous national studies which found similar rates of chronic disease among white, Black, and Native American individuals, we found higher levels of physical health conditions among Black and Native American individuals compared with white, non-Hispanic individuals.[4] However, our

findings are consistent with other work using NSDUH that found self-reported mental illness was higher among white, non-Hispanic individuals compared with other racial and ethnic groups.[21-23] We build on this work using diagnosed conditions to show that severe mental illness (e.g., schizophrenia and other psychotic disorders) was more often diagnosed among Black individuals, while lower severity mental illness (e.g., anxiety and depression) was less diagnosed compared with white, non-Hispanics. It is important to consider how structural racism may contribute to these differences in physical and mental health conditions and SUDs between racial and ethnic groups. A growing body of evidence points to public policies and institutional practices that perpetuate disparities in who becomes involved in the criminal legal system and how individuals are diagnosed with and treated for their health conditions.[24,25] Future research should consider how policies and practices in the criminal legal and health care systems can promote health and reduce inequities among people on probation.

Our findings can inform interventions specific to the unique barriers and opportunities that exist during a period of probation. For example, given the rates of physical, mental, and substance use conditions, individuals on probation should have the opportunity to connect with a trusted health care partner to assess, diagnose, and treat underlying medical conditions. These assessments should be free of coercion and should not be predicated on the conditions of supervision. Probation offices should prioritize programs that help clients enroll in and maintain health insurance, particularly in Medicaid expansion states, and social services. Next, the high rates of safety-net service use in our cohort argue for collaboration between health care services and community services in order to address unmet needs relating to social determinants of health. Finally, the disaggregation of health conditions by race and ethnicity can inform interventions

that recognize and address existing health inequities. For example, because of different rates of specific substance use between racial/ethnic groups, focusing an intervention on only the most prevalent substance use disorder has the potential to disproportionately benefit one racial/ethnic group and unintentionally exacerbate disparities.. Our data suggest that an isolated focus on more prevalent substances, such as opioids or methamphetamine, could unintentionally contribute to and perpetuate racial inequities. Programs that provide access to treatment for any type of substance use are likely to be more equitable than programs focusing on a single common substance.

This study has several limitations. First, individuals were only included if they had six or more months of eligibility for a full-benefit MHCP in the previous three years. Omitting individuals who did not qualify for public health care plans could potentially drop individuals who have incomes too high to qualify for such plans. Second, although we controlled for age and gender, our comparison populations of BRFSS for physical conditions and NSDUH for mental health conditions and SUDs were self-reported conditions and we did not have access to diagnosis information for a general population cohort. Third, our study focused on an urban, Midwest county and it is possible that our findings do not generalize when assessed nationally, though they should be comparable to other urban jurisdictions. Finally, while we stratified our findings by race/ethnicity, we do not directly measure the contribution of racism to the disparities we identified.

Our study describes the unique health needs of people on probation and highlights the racial/ethnic differences that exist within this population. By linking local administrative data

across public sectors, jurisdictions can identify opportunities to improve programs and connect individuals to needed resources. This work also highlights the importance of disaggregating diagnoses by race and ethnicity to inform policy decisions. Often overlooked in discussions of correctional health care, people on probation represent a key population for whom targeted public health interventions could improve health and address existing inequities.

FUNDING

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DATA AVAILABILITY

Data are not available.

CONTRIBUTORS

TNW was responsible for the study design, funding, and initial analysis. PB and JW performed the analyses. MO, RJS, and TNW drafted the manuscript. CH critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

CONFLICT OF INTEREST

The authors have nothing to disclose.

ETHICS STATEMENT

This study was approved by the Hennepin Healthcare Research Institute Institutional Review Board (Study ID: 18_4509). All data were obtained from preexisting records and no individual consent was required.

Table 1. Demographics, public health insurance prevalence, and social service use of individuals on high-level probation in Hennepin County, Minnesota, any time during 2016

	HC probation cohort	
	n	**%**
Cohort		
High-level probation meeting enrollment criteria	5873	-
Median age	33.0	
Mean age	35.5	
Male	4726	80.5%
Race/ethnicity		
White, non-Hispanic	2055	35.0%
Black or African American	3104	52.9%
Native American	324	5.5%
Asian or Pacific Islander	114	1.9%
Hispanic	212	3.6%
Other	64	1.1%
Health insurance enrollment (while on high-level probation in 2016)		
Any Minnesota Health Care Plan (MHCP)	5116	87.1%
Consolidated treatment fund	1346	22.9%
Any full-benefit MHCP	4931	84.0%
Medicaid	4742	80.7%
MinnesotaCare	5116	4.6%
Medicaid Eligibility Types (among those enrolled in Medicaid in 2016)		
Expansion	3126	65.9%
Disability, no Medicare/SS	472	10.0%
Disability, with Medicare/SS	327	6.9%
Parent	808	17.0%
Other	328	6.9%
Employment		
Part-time	1039	17.7%
Full-time	1347	22.9%
Unemployed	2242	38.2%
Other	131	2.2%
Unknown	1114	19.0%
Education		
High school, not completed	1258	21.4%
High school, completed	1360	23.2%
GED	725	12.3%
Some college or higher education	1442	24.6%
Unknown	1088	18.5%
Children		
0 Children	1622	27.6%
1 Child	998	17.0%
2 Children	812	13.8%
3+ Children	1272	21.7%
Unknown	1169	19.9%
Marital Status		
Married	408	6.9%
Single	4399	74.9%
Unknown	1066	18.2%
Social Service Use		
Food Support (SNAP)	3189	54.3%
Cash Support	2305	39.2%
General Assistance	1593	27.1%
Temporary Assistance for Needy Families	491	8.4%
Other income support	328	5.6%
Group Residential Housing	873	14.9%
Shelter	398	6.8%

Counts for people on high-level probation any time during 2016 and with 6+ months full-benefit public health insurance eligibility between 2013 and 2016 in Minnesota.
Minnesota Health Care Plans (MHCP) includes any full or partial month while on high-level probation in 2016. Counts are not exclusive and do not add up to 100 percent.

Table 2. Health conditions of individuals on high-level probation in Hennepin County, Minnesota, any time during 2016

	HC probation cohort	
	n	**%**
Cohort	5873	
Women of childbearing age (18-44 years)	932	11.7%
Physical Conditions		
Hypertension	1015	17.3%
Asthma	842	14.3%
Arthritis	513	8.7%
Diabetes	346	5.9%
Cancer	29	0.5%
Heart Disease	157	2.7%
Chronic Kidney Disease	337	5.7%
COPD	211	3.6%
Viral Hepatitis	276	4.7%
Number of Chronic Physical Conditions*		
0	3815	65.0%
1	1146	19.5%
2+	912	15.5%
Pregnant in last 12 mos. (% of women age 18-44)	99	10.6%
Substance Use Disorders (SUD)		
Any SUD	3901	66.4%
Alcohol	2417	41.2%
Cannabis	1703	29.0%
Opioid	1074	18.3%
Methamphetamine	936	15.9%
Cocaine/crack	852	14.5%
Sedatives	182	3.1%
Unspecified/other SUD	1732	29.5%
Two or more SUD	1957	33.3%
Mental Health		
Any mental health	3233	55.0%
Depression	2461	41.9%
Anxiety	2517	42.9%
Bipolar	1195	20.3%
PTSD	1000	17.0%
Severe mental illness	748	12.7%
SUD + MI		
Any SUD and any MI	2635	44.9%

Counts for people on high-level probation any time during 2016 and with 6+ months full-benefit public health insurance eligibility between 2013 and 2016 in Minnesota

Includes people with violation status, but not warrant status

Conditions from ICD9 diagnosis codes 2013-Q3 2015, ICD10 codes Q4 2015-2016. Physical and mental health conditions grouped according to CMS Chronic Conditions Warehouse specifications. SUD conditions grouped according to Healthcare Cost and Utilization Project specifications, excluding remission codes.

*Chronic physical conditions include hypertension, chronic kidney disease, coronary artery disease, diabetes, cancer, stroke, asthma, arthritis, and chronic obstructive pulmonary disease

Table 3. Health condition prevalence of individuals on high-level probation in Hennepin County, Minnesota, any time during 2016, versus general population

	HC probation cohort, adjusted for age and sex (95% CI)	BRFSS comparison, adjusted for age and sex (95% CI)	NSDUH comparison, adjusted for age and sex (95% CI)
	***n* = 5873**		
Physical Conditions			
Hypertension	17.0% (16.0% - 18.0%)	12.5% (11.4% - 13.6%)	
Asthma	14.5% (13.6% - 15.4%)	5.5% (4.9% - 6.1%)	
Arthritis	7.8% (7.0% - 8.5%)†	8.2% (7.6% - 8.8%)†	
Diabetes	5.7% (5.1% - 6.4%)	3.2% (2.8% - 3.7%)	
Chronic Kidney Disease	5.8% (5.1% - 6.4%)	0.2% (-0.1% - 0.5%)	
COPD	3.4% (2.9% - 4.0%)	1.2% (0.8% - 1.5%)	
Substance Use Disorders (SUD)			
Any SUD	66.5% (65.3% - 67.7%)		8.1% (7.6% - 8.5%)
Alcohol	40.9% (39.7% - 42.2%)		6.3% (5.9% - 6.7%)
Cannabis	28.3% (27.1% - 29.5%)		1.7% (1.5% - 1.8%)
Opioid	17.6% ((16.6% - 18.6%)		0.7% (0.6% - 0.8%)
Methamphetamine	14.9% (14.0% - 15.9%)		0.2% (0.2% - 0.3%)
Cocaine/crack	13.2% (12.3% - 14.1%)		0.2% (0.2% - 0.3%)
Sedatives	2.9% (2.5% - 3.4%)		0.1% (0.0% - 0.1%)
Mental Health			
Any mental health condition	55.3% (54.0% - 56.6%)		14.4% (13.4% - 15.1%)
Depression	41.6% (40.4% - 42.9%)		9.4% (8.9% - 10%)
Severe mental illness	12.5% (11.7% - 13.4%)		4.3% (3.9% - 4.6%)
SUD + MI			
Any SUD and any MI	44.7% (43.4% - 46.0%)		2.6% (2.3% - 2.8%)

Counts for people on high-level probation any time during 2016 and with 6+ months full-benefit public health insurance eligibility between 2013 and 2016 in Minnesota.

Includes people with violation status, but not warrant status.

Conditions from ICD9 diagnosis codes 2013-Q3 2015, ICD10 codes Q4 2015-2016. Physical and mental health conditions grouped according to CMS Chronic Conditions Warehouse specifications. SUD conditions grouped according to Healthcare Cost and Utilization Project specifications, excluding remission codes.

Adjusted to age and gender distributions for the high-level cohort. Physical condition comparisons use Behavioral Risk Factor Surveillance System 2015-2016 values for Minnesota, SUD and MI conditions use National Survey on Drug Use and Health values for the U.S.

Based on bivariate statistical testing, all values were significant (p <.0001) with the exception of those marked with †, which were not significantly different.

Table 4. Health conditions of individuals on high-level probation in Hennepin County, Minnesota, any time during 2016, by race and ethnicity

	HC probation cohort				
	White, non-Hispanic (N=2055)	**Black or African American (N=3103)**	**Native American (N=324)**	**Asian or Pacific Islander (N=114)**	**Hispanic (N=212)**
Physical Conditions	**%**	**%**	**%**	**%**	**%**
Asthma	10.8% (9.5% - 12.2%)	17.4%*** (16.1% - 18.8%)	12.9% (9.5% - 16.4%)	11.0% (5.2% - 16.9%)	12.9% (8.4% - 17.5%)
Diabetes	4.2% (3.4% - 5.0%)	6.8%*** (5.9% - 7.7%)	10.2%*** (7.0% - 13.4%)	3.9% (0.2% - 7.5%)	8.4% (4.3% - 12.5%)
Hypertension	13.7% (12.4% - 15.0%)	20.5%*** (19.1% - 21.8%)	20.1%** (16.2% - 24.1%)	9.8% (4.4% - 15.1%)	16.2% (11.1% - 21.3%)
Arthritis	7.2% (6.2% - 8.1%)	10.2%*** (9.1% - 11.2%)	12.4%** (9.1% - 15.7%)	2.1%** (-0.7% - 4.9%)	5.9% (2.2% - 9.6%)
CKD	5.2% (4.3% - 6.1%)	6.0% (5.1% - 6.8%)	7.7% (4.8% - 10.6%)	5.4% (1.2% - 9.5%)	5.5% (2.2% - 8.8%)
COPD	3.7% (2.9% - 4.4%)	3.7% (3.0% - 4.4%)	3.4% (1.4% - 5.3%)	2.8% (-0.3% - 5.9%)	2.5% (0.1% - 4.9%)
Viral Hepatitis	6.1% (5.1% - 7.0%)	3.1%*** (2.5% - 3.8%)	10.1%* (6.9% - 13.3%)	0.9%*** (-0.8% - 2.6%)	5.7% (2.3% - 9.1%)
IHD	2.6%*** (1.9% - 3.2%)	2.8%*** (2.2% - 3.3%)	2.7%** (0.9% - 4.6%)	2.8% (-0.3% - 5.9%)	3.8%* (0.9% - 6.7%)
Cancer	0.3%** (0.1% - 0.5%)	0.7%*** (0.4% - 1.0%)	0.7% (-0.2% - 1.6%)	-	0.5% (-0.5% - 1.5%)
Average # of chronic physical conditions (0-9)*	0.52 (0.48 - 0.55)	0.73 (0.69 - 0.76)***	0.75 (0.63 – 0.87)***	0.42 (0.25 – 0.59)	0.56 (0.41 – 0.71)
Substance use disorders					
Any SUD	71.6% (69.7% - 73.6%)	62.0%*** (60.3% - 63.7%)	85.9%*** (82.0% - 89.7%)	47.7%*** (38.6% - 56.8%)	66.3% (60.1% - 72.5%)
Alcohol	43.3% (41.2% - 45.4%)	38.5%** (36.8% - 40.2%)	59.2%*** (53.9% - 64.4%)	24.8%*** (17.0% - 32.7%)	42.5% (35.9% - 49.1%)
Cannabis	27.3% (25.3% - 29.2%)	30.7%** (29.1% - 32.3%)	35.8%** (30.6% - 40.9%)	8.8%*** (3.6% - 13.9%)	21.5%* (16.2% - 26.9%)
Cocaine	10.1% (8.9% - 11.3%)	17.6%*** (16.2% - 18.9%)	20.5%*** (16.3% - 24.7%)	5.6%* (1.3% - 9.9%)	16.4%* (11.2% - 21.5%)
Methamphetamine	29.1% (27.1% - 31.1%)	5.5%*** (4.7% - 6.3%)	27.9% (23.1% - 32.7%)	17.4%** (10.6% - 24.3%)	15.0%*** (10.2% - 19.8%)
Opioids	24.8% (22.9% - 26.6%)	11.5%*** (10.3% - 12.6)	41.2%*** (35.9% - 46.5%)	7.2%*** (2.4% - 12.0%)	23.5% (17.7% - 29.2%)
Sedatives	5.8% (4.8% - 6.9%)	1.1%*** (0.7% - 1.4%)	3.9% (1.9% - 5.9%)	1.8%** (-0.7% - 4.2%)	6.4% (3.1% - 9.6%)
Unspecified SUD	35.6% (33.6% - 37.7%)	24.8%*** (23.3% - 26.4%)	41.7%* (36.4% - 47.1%)	17.1%*** (10.2% - 24.0%)	23.4%*** (17.7% - 29.2%)
Mental Health					
Any MI	64.9% (62.8% - 66.9%)	48.5%*** (46.8% - 50.3%)	67.5% (62.3% - 72.6%)	34.6%*** (26.1% - 43.1%)	52.8%** (46.3% - 59.3%)
Anxiety	53.0% (50.9% - 55.1%)	35.4%*** (33.7% - 37.0%)	55.1% (49.7% - 60.6%)	28.3%*** (20.1% - 36.4%)	44.0%* (37.5% - 50.6%)
Bipolar	23.5% (21.7% - 25.3%)	18.6%*** (17.2% - 20.0%)	19.4% (15.3% - 23.5%)	10.9%*** (5.2% - 16.7%)	20.2% (14.7% - 25.6%)
Depression	49.0% (46.9% - 51.1%)	36.8%*** (35.2% - 38.5%)	51.4% (46.0% - 56.7%)	24.0%*** (16.3% - 31.7%)	42.3% (35.9% - 48.7%)
PTSD	17.3% (15.7% - 18.8%)	16.6% (15.3% - 17.9%)	22.2%* (17.9% - 26.4%)	9.1%** (3.8% - 14.4%)	17.6% (12.4% - 22.7%)
Severe mental illness	11.2% (9.9% - 12.6%)	13.6%* (12.4% - 14.9%)	16.6%* (12.6% - 20.7%)	9.8% (4.3% - 15.2%)	10.9% (6.5% - 15.2%)
SUD + MI					
Any SUD and any MI	53.2% (51.1% - 55.3%)	38.5%*** (36.8% - 40.1%)	63.9%*** (58.7% - 69.2%)	21.8%*** (14.3% - 29.4%)	42.9%** (36.3% - 49.4%)
Other conditions					
Personality disorders	15.4% (13.9% - 16.9%)	10.0%*** (8.9% - 11.0%)	11.0%* (7.8% - 14.3%)	7.3%** (2.5% - 12.2%)	13.0% (8.3% - 17.7%)

Race and ethnicity designations from data maintained by Hennepin County Corrections.
Counts for people on high-level probation any time during 2016 and with 6+ months full-benefit public health insurance eligibility between 2013 and 2016 in Minnesota
Includes people with violation status, but not warrant status.
Conditions from ICD9 diagnosis codes 2013-Q3 2015, ICD10 codes Q4 2015-2016. Physical and mental health conditions grouped according to CMS Chronic Conditions Warehouse specifications. SUD conditions grouped according to Healthcare Cost and Utilization Project specifications, excluding remission codes.

* $p < .05$ in bivariance comparison with White, Non-Hispanic

** $p < .01$ in bivariance comparison with White, Non-Hispanic

*** $p < .001$ in bivariance comparison with White, Non-Hispanic

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Supplemental 1. Demographics and public health insurance prevalence of individuals on high-level probation in Hennepin County, Minnesota, any time during 2016 and met MHCP enrollment criteria by race and ethnicity.

	HC probation cohort									
	White, non-Hispanic		Black or African American		Native American		Asian or Pacific Islander		Hispanic	
Cohort	n	%	n	%	n	%	n	%	n	%
High-level probation meeting enrollment criteria	2055	35.0%	3104	52.9%	324	5.5%	114	1.9%	212	3.6%
Median age	35.4		31.5		32.7		32.3		29.2	
Average age	37.7		34.4		34.7		35.2		32.6	
Male	1580	76.9%	2629	84.7%	201	62.0%	97	85.1%	175	82.5%
Health Insurance Enrollment (While on high-level probation in 2016)										
Any Minnesota Health Care Plan (MHCP)	1821	88.6%	2670	86.0%	292	90.1%	95	83.3%	188	88.7%
Consolidated treatment fund	466	22.7%	666	21.5%	129	39.8%	24	21.1%	55	25.9%
Any full-benefit MHCP	1769	86.1%	2558	82.4%	282	87.0%	92	80.7%	181	85.4%
Medicaid	1676	81.6%	2487	80.1%	279	86.1%	87	76.3%	167	78.8%
MinnesotaCare	141	6.9%	97	3.1%	--	--	--	--	18	8.5%
Medicaid Eligibility Types (among those enrolled in Medicaid in 2016)										
Expansion	1218	72.7%	1524	61.3%	191	68.5%	54	62.1%	116	69.5%
Disability, no Medicare/SS	107	6.4%	323	13.0%	23	8.2%	--	--	--	--
Disability, with Medicare/SS	129	7.7%	177	7.1%	--	--	--	--	--	--
Parent	247	14.7%	441	17.7%	50	17.9%	28	32.2%	29	17.4%
Other	70	4.2%	204	8.2%	17	6.1%	--	--	--	--
Employment										
Part-time	363	17.7%	574	18.5%	28	8.6%	22	19.3%	39	18.4%
Full-time	539	26.2%	675	21.7%	31	9.6%	27	23.7%	55	25.9%
Unemployed	685	33.3%	1251	40.3%	184	56.8%	35	30.7%	70	33.0%
Other	49	2.4%	68	2.2%	--	--	--	--	--	--
Unknown	419	20.4%	536	17.3%	--	--	--	--	--	--
Education										
High school, not completed	259	12.6%	792	25.5%	112	34.6%	--	--	57	26.9%
High school, completed	439	21.4%	759	24.5%	66	20.4%	29	25.4%	49	23.1%
GED	247	12.0%	403	13.0%	48	14.8%	--	--	17	8.0%
Some college or higher education	631	30.7%	688	22.2%	36	11.1%	12	10.5%	33	15.6%
Unknown	479	23.3%	462	14.9%	52	16.0%	28	24.6%	45	21.2%
Children										
0 Children	703	34.2%	729	23.5%	75	23.1%	38	33.3%	66	31.1%
1 Child	330	16.1%	564	18.2%	61	18.8%	--	--	25	11.8%
2 Children	238	11.6%	470	15.1%	52	16.0%	--	--	31	14.6%
3+ Children	264	12.8%	859	27.7%	84	25.9%	--	--	36	17.0%
Unknown	520	25.3%	482	15.5%	52	16.0%	32	28.1%	46	21.7%
Marital Status										
Married	157	7.6%	197	6.3%	14	4.3%	--	--	17	8.0%
Single	1473	71.7%	2415	77.8%	252	77.8%	--	--	156	73.6%
Unknown	425	20.7%	492	15.9%	58	17.9%	30	26.3%	39	18.4%

Counts for people on high-level probation any time during 2016 and with 6+ months full-benefit public health insurance eligibility between 2013 and 2016 in Minnesota

Includes people with violation status, but not warrant status.

Minnesota Health Care Plans (MHCP) includes any full or partial month while on high-level probation in 2016. Counts are not exclusive and do not add up to 100 percent.

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	Title. **Page 1.**
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	Abstract, Methods and Findings. **Page 2.**
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	Introduction, paragraphs 1-3. **Pages 4-5.**
Objectives	3	State specific objectives, including any prespecified hypotheses	Introduction, paragraph 4. **Page 5.**
Methods			
Study design	4	Present key elements of study design early in the paper	Methods, paragraphs 1-3. **Pages 5-7.**
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Methods, paragraphs 1-3. **Pages 5-7.**
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	Methods, paragraphs 1-2. **Pages 5-6.**
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	Methods, paragraphs 5-7. **Pages 7-8**
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Methods, paragraphs 3 and 5. **Pages 7-8.**
Bias	9	Describe any efforts to address potential sources of bias	Methods,

			paragraphs 10-11. **Pages 9-10.**
Study size	10	Explain how the study size was arrived at	Methods, paragraph 1. **Page 5.**
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Methods, paragraphs 5-7. **Pages 7-8.**
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	Methods, paragraphs 8-11. **Pages 9-10.**
		(*b*) Describe any methods used to examine subgroups and interactions	Methods, paragraph 10. **Pages 9.**
		(*c*) Explain how missing data were addressed	Methods, paragraph 10. **Page 9.**
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	Results, paragraph 1. **Page 10.**
		(b) Give reasons for non-participation at each stage	Methods, paragraph 1. **Page 5.**
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	Results, paragraph 1 Table 1. **Page 10.**
		(b) Indicate number of participants with missing data for each variable of interest	Some sociodemographic variables had missing data, 'unknown' noted in Table 1. **Page 17.** N/A for adjusted

			analyses.
Outcome data	15*	Report numbers of outcome events or summary measures	Probation group: Results, paragraph 3; Table 3. **Pages 10, 19.** Comparison group: Results, paragraph 4-5; Table 4. **Pages 11, 20.**
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Methods, paragraph 10; Results, paragraph 3-4, Table 3, Table 4. **Pages 9-11, 19-20.**
		(*b*) Report category boundaries when continuous variables were categorized	N/A
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Results, paragraph 6. **Page 12.**
Discussion			
Key results	18	Summarise key results with reference to study objectives	Discussion, paragraph 1. **Page 12.**
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Discussion, paragraph 4. **Pages 14-15.**
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Discussion, paragraphs 2-3. **Pages 13-14.**
Generalisability	21	Discuss the generalisability (external validity) of the study results	Discussion, paragraph 4. **Pages 14-15.**

Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	Funding, paragraph 1. **Page 15.**

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.