CENTER FOR HEALTH INFORMATION AND ANALYSIS

Behavioral Health & Readmissions in Massachusetts Acute Care Hospitals

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Technical Appendix

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Behavioral Health and Readmissions in Massachusetts Acute Care Hospitals, SFY 2018

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TECHNICAL APPENDIX

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Introduction

This Technical Appendix provides an overview of the data source and analytic methods that were used in the report, *Behavioral Health and Readmissions in Massachusetts Acute Care Hospitals SFY 2018 (October 2020)*, by the Center for Health Information and Analysis (CHIA).

The aforementioned publication reports on the prevalence of behavioral health comorbidities and readmission rates among hospitalized patients in Massachusetts acute care hospitals on an all-payer, all-condition basis.

Data Source

For this report, the Hospital Inpatient Discharge Database (HIDD) of CHIA's Acute Hospital Case Mix Database was used as the source data. This case mix discharge dataset is a stay-level file including patient socio-demographics, diagnostic information, treatment and service information, and hospital charges. The data is submitted to CHIA quarterly by all Massachusetts acute care hospitals, and undergoes a cleaning and verification process at CHIA that includes the feedback of verification reports to hospitals for confirmation of their information. Once quarterly data has been processed and verified, CHIA produces and makes available annual files.

Study Population

The study population is adult patients (age 18+) who were discharged from Massachusetts acute care hospitals from July 1, 2017 to June 30, 2018 (SFY 2018). Discharges from Massachusetts psychiatric hospitals were not included in this study.

For this report, exclusion criteria were adapted from the Yale/CMS readmissions methodology (for details, see Readmissions Methodology in the technical appendix to CHIA's *Hospital-wide Adult All-Payer Readmissions in Massachusetts: 2011-2018*). Exclusion criteria included the following cases: obstetric admission, treatment for cancer, leave against medical advice, and rehabilitative admission. Unlike the Yale/CMS readmission methodology, discharges from acute care hospitals for primary psychiatric admissions were included. After exclusions were applied, a total of 386,978 unique patients, representing 570,616 eligible index admissions and 89,197 readmissions, were included in the analytic dataset.

For this year's report, CHIA utilized an enhanced patient identifier (EPI) for both its readmissions analyses and behavioral health readmissions analyses. For full information on the EPI, please see section on Patient Identification in the technical appendix to CHIA's annual readmissions report.

Unit of Analysis

With the exception of the analyses by discharge setting and length of stay, the unit of analysis for this study is the patient. In the discharge setting and length of stay analyses, it is more appropriate to calculate prevalence and readmission rates at the discharge level because discharge setting and length of stay can vary from visit to visit for the same patient.

For patients, the values of age, sex, region of residence, and payer type were taken from the most recent visit in the discharge analytic dataset.

Behavioral Health Comorbidity

To examine the prevalence of behavioral health comorbidity among hospitalized patients, CHIA developed a list of behavioral health-related diagnoses, including ten categories of mental health-related diagnoses and eight categories of substance use disorders (see detail, below). Diagnosis information from patient's discharge records was used to classify patients into these four mutually exclusive categories of behavioral health:

- Mental health conditions (MH) only
- Substance use disorders (SUD) only
- Both MH and SUD or co-occurring behavioral health conditions (CO)
- No mention of MH or SUD (None)

Development of List of Behavioral Health-Related Diagnoses

CHIA employs a broad approach in defining behavioral health conditions, using the following three sources to identify behavioral health-related codes:

1. AHRQ Beta Clinical Classifications Software (CCS) for ICD-10-CM (v. 2017.1 and 2018.1)[1]: categories 650-670
2. Condition Categories (CCs) from the CMS-HCC risk adjustment model for ICD-10-CM (v. 2018 7.0)[2,3]: categories 54, 55, 57-59, 61, 63
3. AHRQ Statistical Brief #249, Appendix B (ICD-10-CM)[4]

The Clinical Classifications Software (CCS) is a diagnosis and procedure categorization scheme originally developed for ICD-9-CM; beta versions released since October 2015 provide a similar categorization scheme for ICD-10-CM. A statistical brief developed by AHRQ provides additional behavioral health-related codes that are grouped in CCS categories other than the primary behavioral health-related CCS range (650-670) and provide classifications for substance use disorders. CHIA also adapted behavioral health-related diagnosis codes using CCs from the CMS-HCC risk adjustment model, which are groupings of ICD-10-CM diagnosis codes in clinically relevant categories used by CHIA for its core readmissions reporting on an all-payer, all-condition basis.

All behavioral health codes classified as behavioral health-related in any of the three source lists were combined into a single list of behavioral health-related diagnoses. CHIA adapted this list in the following ways:

[1] AHRQ Beta Clinical Classification Software (CCS) for ICD-10-CM , (v. 2016.2 and 2017.1): categories 650-670

[2] Yale New Haven Health Services Corporation/Center for Outcomes Research & Evaluation (YNHHSC/CORE). "2018 All-Cause Hospital-Wide Measure Updates and Specifications Report: Hospital-Level 30-Day Risk Standardized Readmission Measure – Version 7.0" (March 2018). Accessed 10/31/2018. Available at https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/Measure-Methodology.html.

[3] Condition Categories (CCs): Groupings of ICD-9-CM/ICD-10-CM diagnosis codes in clinically relevant categories, from the HCCs system. CMS uses the grouping but not the hierarchical logic of the system to create risk factor variables. Mappings which show the assignment of ICD-9 and ICD-10 codes to the CCs are available on the QualityNet website.

[4] Owens, P.L. (AHRQ), Fingar, K.R. (IBM Watson Health), McDermott, K.W. (IBM Watson Health), Muhuri, P.K. (AHRQ), Heslin, K.C. (AHRQ). Inpatient Stays Involving Mental and Substance Use Disorders, 2016. HCUP Statistical Brief #249. March 2019. Agency for Healthcare Research and Quality, Rockville, MD. Available at https://www.hcup-us.ahrq.gov/reports/statbriefs/sb249-Mental-Substance-Use-Disorder-Hospital-Stays-2016.pdf

1. Consistent with the analytic approach of AHRQ, dementia (CCS=653) and intellectual disability/development disorders (CCS=654) are not classified as mental health conditions in this analysis and all ICD-10-CM codes in these CCS categories were excluded.

2. Although tobacco use represents an important public health and personal health issue, we excluded codes pertaining to tobacco or nicotine (ICD-10-CM: F17.-, O99.33-, Z72.0, Z87.891) for the purposes of describing the prevalence of comorbid behavioral health conditions among the adult hospitalized population in Massachusetts, except where the code represented intentional self-harm (T65.212-, T65.222-, T65.292). These were retained and classified as mental health-related under the sub-category of 'Intentional Self-harm, suicidal ideation, or suicide attempt'.

3. Six codes listed in CCS 661 were found to be invalid because they do not exist in any current or former version of ICD-10-CM. These were labeled as 'Adverse effects of heroin' (T40.1X5A-) and 'Adverse effects of lysergide [LSD]' (T40.8X5-). These codes were removed.

4. CHIA determined that after combining source lists, substance types were handled inconsistently for diagnoses pertaining to subsequent encounters, sequelae, and underdosing. To maintain consistency of reporting across all types of substance use disorders, and in consultation with clinicians, CHIA included diagnosis codes for subsequent encounters, sequelae, and underdosing events in cases where the equivalent diagnoses for other substance types were already present.

Development of Sub-Type Classifications for Behavioral Health Diagnoses

Mutually exclusive sub-categories of behavioral health-related codes were adapted from the aforementioned three sources of data. Beta Clinical Classifications Software (CCS) for ICD-10-CM, was used to define mental health conditions. CCS categories were used to classify ICD codes into 10 distinct sub-categories. The detailed CCS categories used in the categorization are listed in Table 1. Three adaptations to these categories were made:

- One ICD-10-CM code, 'Z72.6 Gambling and betting', was reclassified from 'Miscellaneous mental health' to 'Impulse control disorders not elsewhere classified' because all other codes pertaining to gambling disorders were already classified as impulse-related.
- ICD-10-CM code Z91.5 'Personal history of self-harm' was reclassified as 'Miscellaneous mental health' to align with the categorization of all other codes pertaining to personal history of mental health conditions.
- ICD-10-CM codes T43.642- 'Poisoning by ecstasy, intentional self-harm' was reclassified under mental health as 'Intentional Self-harm, suicidal ideation, or suicide attempt' to align with other intentional self-harm diagnoses.

Table 1. Sub-Types of Mental Health-Related Diagnoses

CCS CODE(S)	DESCRIPTION
650	Adjustment Disorders
651	Anxiety Disorders
652	Attention-deficit, conduct, and disruptive behavior disorders
655	Disorders usually diagnosed in infancy, childhood, or adolescence
656	Impulse control disorders not elsewhere classified
657	Mood disorders
658	Personality disorders
659	Schizophrenia and other psychotic disorders
662	Intentional self-harm, suicidal ideation, or suicide attempt
181, 195, 259, 663, 670	Miscellaneous mental health

ICD-10-CM codes were used to define substance use disorders (SUD). SUD diagnoses were divided into substance-specific groupings based on categories in AHRQ Statistical Brief #249 for ICD-10-CM. For codes that did not appear in this brief, the name of the substance listed in the ICD code was used to assign SUD sub-type. The diagnosis codes used in the categorization of SUD are listed in Table 2. For the purpose of these analyses, we classified personal history of substance use disorders and screening for substance use in the category of the relevant substance.

Table 2. Sub-Types of Substance-Related Diagnoses

ALCOHOL-RELATED DISORDERS

F10.-	Alcohol related disorders
G62.1	Alcoholic polyneuropathy
I42.6	Alcoholic cardiomyopathy
K29.2-	Alcoholic gastritis
K70.-	Alcoholic liver disease
O35.4-	Maternal care for (suspected) damage to fetus from alcohol
O99.31-	Alcohol use complicating pregnancy, childbirth, and the puerperium
P04.3	Newborn affected by maternal use of alcohol
Q86.0	Fetal alcohol syndrome (dysmorphic)
R78.0	Finding of alcohol in blood

CANNABIS-RELATED DISORDERS	
F12.-	Cannabis related disorders
T40.7X1-	Poisoning by cannabis (derivatives), accidental (unintentional)
T40.7X3-	Poisoning by cannabis (derivatives), assault
T40.7X4-	Poisoning by cannabis (derivatives), undetermined
T40.7X5-	Adverse effect of cannabis (derivatives)
T40.7X6-	Underdosing of cannabis (derivatives)

OPIOIDS-RELATED DISORDERS	
F11.-	Opioid related disorders
R78.1	Finding of opiate drug in blood
T40.0X1-	Poisoning by opium, accidental (unintentional)
T40.0X3-	Poisoning by opium, assault
T40.0X4-	Poisoning by opium, undetermined
T40.0X5-	Adverse effect of opium
T40.0X6-	Underdosing of opium
T40.1X1-	Poisoning by heroin, accidental (unintentional)
T40.1X3-	Poisoning by heroin, assault
T40.1X4-	Poisoning by heroin, undetermined
T40.2X1-	Poisoning by other opioids, accidental (unintentional)
T40.2X3-	Poisoning by other opioids, assault
T40.2X4-	Poisoning by other opioids, undetermined
T40.2X5-	Adverse effect of other opioids
T40.2X6-	Underdosing of other opioids
T40.3X1-	Poisoning by methadone, accidental (unintentional)
T40.3X3-	Poisoning by methadone, assault
T40.3X4-	Poisoning by methadone, undetermined
T40.3X5-	Adverse effect of methadone
T40.3X6-	Underdosing of methadone
T40.4X1-	Poisoning by other synthetic narcotics, accidental (unintentional)
T40.4X3-	Poisoning by other synthetic narcotics, assault
T40.4X4-	Poisoning by other synthetic narcotics, undetermined
T40.4X5-	Adverse effect of other synthetic narcotics
T40.4X6-	Underdosing of other synthetic narcotics
T40.601-	Poisoning by unspecified narcotics, accidental (unintentional)

T40.603-	Poisoning by unspecified narcotics, assault
T40.604-	Poisoning by unspecified narcotics, undetermined
T40.605-	Adverse effect of unspecified narcotics
T40.606-	Underdosing of unspecified narcotics
T40.691-	Poisoning by other narcotics, accidental (unintentional)
T40.693-	Poisoning by other narcotics, assault
T40.694-	Poisoning by other narcotics, undetermined
T40.695-	Adverse effect of other narcotics
T40.696-	Underdosing of other narcotics

SEDATIVES-RELATED DISORDERS

F13.-	Sedative, hypnotic, or anxiolytic related disorders

COCAINE-RELATED DISORDERS

F14.-	Cocaine related disorders
P04.41	Newborn affected by maternal use of cocaine
R78.2	Finding of cocaine in blood
T40.5X1-	Poisoning by cocaine, accidental (unintentional)
T40.5X3-	Poisoning by cocaine, assault
T40.5X4-	Poisoning by cocaine, undetermined
T40.5X5-	Adverse effect of cocaine
T40.5X6-	Underdosing of cocaine

OTHER STIMULANT-RELATED DISORDERS

F15.-	Other stimulant related disorders
T43.601-	Poisoning by unspecified psychostimulants, accidental (unintentional)
T43.603-	Poisoning by unspecified psychostimulants, assault
T43.604-	Poisoning by unspecified psychostimulants, undetermined
T43.605-	Adverse effect of unspecified psychostimulants
T43.606-	Underdosing of unspecified psychostimulants
T43.621-	Poisoning by amphetamines, accidental (unintentional)
T43.623-	Poisoning by amphetamines, assault
T43.624-	Poisoning by amphetamines, undetermined
T43.625-	Adverse effect of amphetamines

T43.626-	Underdosing of amphetamines
T43.631-	Poisoning by methylphenidate, accidental (unintentional)
T43.633-	Poisoning by methylphenidate, assault
T43.634-	Poisoning by methylphenidate, undetermined
T43.635-	Adverse effect of methylphenidate
T43.636-	Underdosing of methylphenidate
T43.641-	Poisoning by ecstasy, accidental (unintentional)
T43.643-	Poisoning by ecstasy, assault
T43.644-	Poisoning by ecstasy, undetermined
T43.691-	Poisoning by other psychostimulants, accidental (unintentional)
T43.693-	Poisoning by other psychostimulants, assault
T43.694-	Poisoning by other psychostimulants, undetermined
T43.695-	Adverse effect of other psychostimulants
T43.696-	Underdosing of other psychostimulants

HALLUCINOGEN-RELATED DISORDERS

F16.-	Hallucinogen related disorders
R78.3	Finding of hallucinogen in blood
T40.8X1-	Poisoning by lysergide [LSD], accidental (unintentional)
T40.8X3-	Poisoning by lysergide [LSD], assault
T40.8X4-	Poisoning by lysergide [LSD], undetermined
T40.901-	Poisoning by unspecified psychodysleptics [hallucinogens], accidental (unintentional)
T40.903-	Poisoning by unspecified psychodysleptics [hallucinogens], assault
T40.904-	Poisoning by unspecified psychodysleptics [hallucinogens], undetermined
T40.905-	Adverse effect of unspecified psychodysleptics [hallucinogens]
T40.906-	Underdosing of unspecified psychodysleptics [hallucinogens]
T40.991-	Poisoning by other psychodysleptics [hallucinogens], accidental (unintentional)
T40.993-	Poisoning by other psychodysleptics [hallucinogens], assault
T40.994-	Poisoning by other psychodysleptics [hallucinogens], undetermined
T40.995-	Adverse effect of other psychodysleptics [hallucinogens]
T40.996-	Underdosing of other psychodysleptics [hallucinogens]

MISCELLANEOUS SUBSTANCE-RELATED DISORDERS	
F18.-	Inhalant related disorders
F19.-	Other psychoactive substance related disorders
F55.-	Abuse of non-psychoactive substances
O35.5-	Maternal care for (suspected) damage to fetus by drugs
O99.32-	Drug use complicating pregnancy, childbirth, and the puerperium
P04.49	Newborn affected by maternal use of other drugs of addiction
P96.1	Neonatal withdrawal symptoms from maternal use of drugs of addiction
P96.2	Withdrawal symptoms from therapeutic use of drugs in newborn
R78.4	Finding of other drugs of addictive potential in blood
R78.5	Finding of other psychotropic drug in blood

Note: ICD-10-CM codes listed in this table ending with a hyphen are non-billable (parent) codes, under which all billable (specific) codes below it are included. For instance, "F10.-" indicates that all codes in the range starting with F10 (F10.10 through F10.99) are included.

Development of Visit-Level and Patient-Level Behavioral Health Indicators

Visit-level behavioral health indicators for each of the ten categories of mental health conditions and eight categories of substance use disorder conditions were calculated from ICD-10-CM diagnoses on hospital discharge records. Each visit was assigned an indicator for each behavioral health category using secondary diagnoses on the eligible discharge within the study period, as well as any available diagnosis information for a patient within the preceding 12 months.

Patient-level behavioral health indicators were aggregated from a patient's visit-level behavioral health indicators. If a behavioral health indicator appeared on any of a patient's visits within the study period (as described above), that patient was flagged as having that behavioral health indicator.

The patient-level indicators were used to group patients into four mutually exclusive behavioral health groups:

- Mental health conditions (MH) only
- Substance use disorders (SUD) only
- Both MH and SUD or co-occurring behavioral health conditions (CO)
- No mention of MH or SUD (None)

Readmission Methodology

For this report, CHIA amended the readmission methodology from CHIA's annual readmission report published in December 2018, *Hospital-wide Adult All-Payer Readmissions in Massachusetts: 2011-2018* to include psychiatric admissions. Admissions for obstetric care, cancer treatment, and rehabilitation care were similarly excluded for the purposes of calculating readmissions-related measures. For full specification on the readmission methodology, please see section on Readmissions Methodology in the technical appendix to the annual readmission report.

For more information, please contact:

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