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TECHNICAL APPENDIX

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Behavioral Health and Readmissions in Massachusetts Acute Care Hospitals, SFY 2017

(October 2019)

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 2017 (October 2019)*, 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, 2016 to June 30, 2017 (SFY 2017). 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: 2011-2017*). 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 352,904 unique patients, representing 528,945 eligible index admissions and 85,741 readmissions, were included in the analytic dataset.

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 five sources to identify behavioral health-related codes:

1. AHRQ Clinical Classifications Software (CCS) for ICD-9-CM (v. 2015)[1]: categories 650-670
2. AHRQ Beta Clinical Classifications Software (CCS) for ICD-10-CM (v. 2016.2 and 2017.1)[2]: categories 650-670
3. Condition Categories (CCs) from the CMS-HCC risk adjustment model for ICD-9-CM and ICD-10-CM (v. 2018 7.0)[3,4]: categories 54, 55, 57-59, 61, 63
4. AHRQ Statistical Brief #191: Hospitalizations Involving Mental and Substance Use Disorders among Adults 2012, Tables 4-5[5]
5. AHRQ Statistical Brief #249, Appendix B (ICD-10-CM)[6]

The Clinical Classifications Software (CCS) is a diagnosis and procedure categorization scheme based on ICD-9-CM; beta versions released since October 2015 provide a similar categorization scheme for ICD-10-CM. Two additional statistical briefs, also developed by AHRQ, provide 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-9-CM/ICD-10-CM diagnosis codes in clinically relevant categories used by CHIA for its core readmissions reporting on an all-payer, all-condition basis.

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[1] HCUP CCS. Healthcare Cost and Utilization Project (HCUP). March 2017. Agency for Healthcare Research and Quality, Rockville, MD. Available at https://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp.

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

[3] 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.

[4] 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.

[5] Heslin, K.C. (AHRQ), Elixhauser, A., (AHRQ), Steiner, C.A. (AHRQ). Hospitalizations Involving Mental and Substance Use Disorders among Adults, 2012. HCUP Statistical Brief #191. June 2015. Agency for Healthcare Research and Quality, Rockville, MD. Available at http://www.hcup-us.ahrq.gov/reports/statbriefs/sb191-Hospitalization-Mental-Substance-Use-Disorders-2012.pdf

[6] 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

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

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-9-CM and 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-9-CM: 305.1; 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' (T401X5A-) and 'Adverse effects of lysergide [LSD]' (T408X5-). These codes were removed.

4. In "AHRQ Statistical #191: Hospitalizations Involving Mental and Substance Use Disorders among Adults, 2012", ICD-9-CM code 968.5 was incorrectly labeled as "Poisoning by cocaine". This code refers to poisoning by surface (topical) and infiltration anesthetics other than cocaine when used as a central nervous stimulant. CHIA replaced 968.5 with 970.81, 'Poisoning by cocaine'. Similarly, CHIA determined in consultation with clinicians that ICD-9-CM E-code E938.5 'Surface and infiltration anesthetics causing adverse effects in therapeutic use', labeled in AHRQ brief 191 as cocaine-related, is likely not reflective of substance use disorder. This code was removed.

5. 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 five sources of data. The Clinical Classifications Software (CCS), a diagnosis and procedure categorization scheme[7] based on ICD-9-CM, and the Beta CCS for ICD-10-CM, were 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:

[7] HCUP CCS Fact Sheet. Healthcare Cost and Utilization Project (HCUP). January 2012. Agency for Healthcare Research and Quality, Rockville, MD. Available from www.hcup-us.ahrq.gov/toolssoftware/ccs/ccsfactsheet.jsp

- 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-9-CM and 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 #191 for ICD-9-CM and AHRQ Statistical Brief #249 for ICD-10-CM. For codes that did not appear in either of these briefs, 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. Two adaptations to these categories were made:

- Because ICD-10-CM contained a greater level of detail for certain stimulant-related conditions than ICD-9-CM, stimulant-related diagnoses other than cocaine ("amphetamines", "methylphenidate", "ecstasy", "other [psycho]stimulant", "unspecified [psycho]stimulant") were combined into a single grouping to maximize the comparability of these categories over time.
- 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. One ICD-9-CM code, V65.42 `Counseling for Substance' is non-specific to a substance and therefore classified as 'Miscellaneous substance-related disorders'.

Table 2. Sub-Types of Substance-Related Diagnoses

ALCOHOL-RELATED DISORDERS		
ICD-9-CM	291.-	Alcohol-induced mental disorders
	303.-	Alcohol dependence syndrome
	305.0-	Nondependent alcohol abuse
	357.5	Alcoholic polyneuropathy
	425.5	Alcoholic cardiomyopathy
	535.3-	Alcoholic gastritis
	571	Alcoholic fatty liver
	571.1	Acute alcoholic hepatitis
	571.2	Alcoholic cirrhosis of liver
	571.3	Alcoholic liver damage, unspecified
	790.3	Excessive blood level of alcohol
	E860.0	Accidental poisoning by alcoholic beverages
	V11.3	Personal history of alcoholism
	V79.1	Screening for alcoholism
ICD-10-CM	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		
ICD-9-CM	304.3-	Cannabis dependence
	305.2-	Nondependent cannabis abuse
ICD-10-CM	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		
ICD-9-CM	304.0-	Opioid type dependence
	305.5-	Nondependent opioid abuse
	965.0-	Poisoning by opiates and related narcotics
	E850.0	Accidental poisoning by heroin
	E935.0	Heroin causing adverse effects in therapeutic use

ICD-10-CM	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		
ICD-9-CM	304.1-	Sedative, hypnotic or anxiolytic dependence
	305.4-	Nondependent sedative, hypnotic or anxiolytic abuse
ICD-10-CM	F13.-	Sedative, hypnotic, or anxiolytic related disorders
COCAINE-RELATED DISORDERS		
ICD-9-CM	304.2-	Cocaine dependence
	305.6-	Nondependent cocaine abuse

	970.81	Poisoning by cocaine
ICD-10-CM	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		
ICD-9-CM	304.4-	Amphetamine and other psychostimulant dependence
	305.7-	Nondependent amphetamine or related acting sympathomimetic abuse
ICD-10-CM	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		
ICD-9-CM	304.5-	Hallucinogen dependence
	305.3-	Nondependent hallucinogen abuse
	969.6	Poisoning by psychodysleptics (hallucinogens)
	E854.1	Accidental poisoning by psychodysleptics [hallucinogens]
	E939.6	Psychodysleptics [hallucinogens] causing adverse effects in therapeutic use

ICD-10-CM	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		
ICD-9-CM	292.-	Drug-induced mental disorders
	304.6-	Other specified drug dependence
	304.7-	Combinations of opioid type drug with any other drug dependence
	304.8-	Combinations of drug dependence excluding opioid type drug
	304.9-	Unspecified drug dependence
	305.9-	Nondependent other mixed or unspecified drug abuse
	648.3-	Drug dependence complicating pregnancy, childbirth, or the puerperium
	V65.42	Counseling on substance use and abuse
ICD-10-CM	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

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-9-CM or 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 2017, *Hospital-wide Adult All-Payer Readmissions in Massachusetts: 2011-2017* 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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