The Hilltop Institute

analysis to advance the health of vulnerable populations

Opioid Use Disorders in Baltimore City: Prevalence and Treatment Rates

February 9, 2016

UMBC

AN HONORS UNIVERSITY IN MARYLAND

Suggested Citation: Abrams, M. T., Vanderwerker, L. C., Smith, J. K., & Arbelaez, J. J. (2016, February 9). *Opioid use disorders in Baltimore City: Prevalence and treatment rates*. Baltimore, MD: The Hilltop Institute, UMBC.

Acknowledgements

Hilltop would like to thank Behavioral Health Systems Baltimore for financially supporting this report and for inviting Hilltop's participation in the broader Mayoral Taskforce effort surrounding its production.

Opioid Use Disorders in Baltimore City: Prevalence and Treatment Rates

Table of Contents

Opioid Use Disorders in Baltimore City: Prevalence and Treatment Rates

Introduction

This report provides what are believed to be the most detailed estimates of opioid (including heroin) abuse, dependence, and treatment in Baltimore City from July 1, 2013, to June 30, 2014. The Hilltop Institute at the University of Maryland, Baltimore County wrote this report with financial support from Behavioral Health System Baltimore (BHSB). BHSB is responsible for oversight of the public mental health and substance use treatment systems serving Baltimore City. Hilltop programmers and analysts used three data sources to generate this report: Medicaid administrative claims, substance abuse service tracking data from publicly financed clinics that target such morbidity, and regulated hospital discharge data. Accordingly, this work offers a fairly comprehensive assessment of opioid use disorders that come to the attention of both public and private medical treatment systems in Baltimore City.

Hilltop found that, as of June 30, 2014, there were 24,887 unique individuals with opioid-related morbidity in Baltimore City, and 59 percent of those individuals received at least one form of standardized outpatient treatment in the 12 months leading up to that date. This seemingly high rate of treatment engagement is believed to be inflated because it is based on a medical treatment sample rather than a broader population sample. Additionally, the presence of ≥1 is a "low bar" threshold for adequate provision of care. Accordingly, these results suggest that at least 41 percent of Baltimore City residents have opioid-related morbidity absent adequate care.

This report further details rates of different levels of care for opioid-related problems, including inpatient and emergency department (ED) service use, and puts forth regression results that estimate the extent to which different factors correlate with engagement in standard opioid treatment.

Background

Opioid drugs include legal prescription pain killers (e.g., oxycontin or hydrocodone) and heroin, a substance that is illegal and has no authorized medical application in the U.S. (Center for Behavioral Health Statistics and Quality, 2015). Over the past decade, prescription opioid abuse has peaked (especially among adolescents and young adults) and has been at least anecdotally correlated to increasing rates of heroin use, dependence, and overdose deaths (Jones, Logan, Gladden, & Bohm, 2015; Lipari & Hughes, 2015). Specifically, national survey data that are considered a standard for substance abuse tracking (Center for Behavioral Health Statistics and Quality, 2015) show that, between 2002 and 2014, non-medical use of prescription opioids ranged from 1.6 to 2.1 percent of the general, non-institutionalized population, with apparent peaks in years 2006, 2007, and 2009, and a singular low point in 2014. Potentially related to that decline in illicit prescription opioid use, heroin use increased from 0.2 to 0.3 percent of the U.S. population from 2009 to 2014, corresponding to nearly 1 million persons in 2014. Moreover, and perhaps most dramatically, overdose deaths attributed to heroin increased substantially while

analogous events related to opioid pain medications declined. According to the Centers for Disease Control and Prevention (CDC), between 2011 and 2013, heroin overdose deaths rose nationally from 4,397 to 8,857, while deaths related to pain killers remained flat and even decreased slightly during the same period (from 16,917 to 16,235) (Office of the Assistant Secretary for Planning and Evaluation in the Department of Health and Human Services, 2015).

In many U.S. cities, including Baltimore, aggregate use of opioids—including heroin—is intensified. Multiple regression analysis of national survey data from 2011 to 2013 found that, after adjusting for regional differences in age, sex, race/ethnicity, income, insurance coverage, and other substance abuse or dependence, urban regions had 2.4 times increased odds of heroin abuse or dependence than less densely populated areas (Jones et al., 2015). Baltimore's challenges with heroin remain high and date back to at least the 1990s, when its overdose deaths exceeded those in other major U.S. cities (Schwartz et al., 2015).

Baltimore has developed an enduring problem and reputation related to opiate abuse and dependence that is comingled with its challenges related to violent crime and racial unrest. Such a reputation is reinforced by violence related to drug trafficking in the city, and by extraordinary civil unrest in the wake of Freddie Gray's death—unrest that is said to have included the looting of pain medications from 27 drug stores, yielding an estimated black market supply of 175,000 doses of illicit drugs (Hermann, 2015; Oppel, 2015) .

These realities and perceptions have prompted Baltimore City government to make its opioid and heroin problem a matter of high importance. The current city health commissioner, Dr. Leana Wen, recently said this to the New York Times columnist Nicholas Kristof:

> Heroin is actually the underlying problem behind so many issues in Baltimore. It's why people can't find employment, why people go to jail, why people don't get educated. People lose their whole families because of heroin. (Kristof, 2015)

One recent effort to address the heroin problem in Baltimore City involved the deliberations and studies conducted by a multi-stakeholder task force convened by the city's mayor to consider data, access to care, practice standards, and neighborhood issues that are germane to the opioid problem in Baltimore City. The Heroin Treatment and Prevention Task Force completed its work in July 2015 and produced a report with its recommendations (City of Baltimore, Baltimore City Health Department, & BHSB, 2015). Among its recommendations was one that provides the principal rationale for this report. The Task Force called for the development of a system to monitor the prevalence of substance use disorders and to further monitor the treatment capacity to deal with such morbidity. This report addresses this recommendation by providing recent baseline information regarding the magnitude of the current opioid abuse/dependence problems in Baltimore City, as well as the current rate at which different types of care are being accessed by those with such problems.

Determining the prevalence of any disease is challenging, and even more so for substance use disorders because many of the behaviors directly associated with the illness are illegal, or at least

stigmatized by societal norms. There is no centralized database in Baltimore City that records all cases of heroin or other opioid abuse/dependence. There are, however, several state-run medical databases that can be used to estimate such prevalence among the following three key populations: Medicaid (i.e., low-income) enrollees, persons using state-licensed substance abuse treatment providers, and persons using any hospital (across the income/wealth spectrum). These three data sources jointly offer a substantial window into the opioid abuse problem by capturing persons who are uninsured, publicly insured, and privately insured as long as they are diagnosed or being directly treated for such problems by a hospital (e.g., in an ED), general medical practitioner, or substance abuse provider.

Accordingly, this report provides opioid abuse and treatment prevalence rates based on individual-level information obtained from three administrative health care databases maintained by the state of Maryland. Specifically, the work presented here derives opioid and heroin use and treatment prevalence numbers directly from the following data sources:

1. Medicaid administrative claims maintained by the state's authority over that program
2. Substance use episodic transactions (SMART data) maintained by the state's Behavioral Health Administrative (BHA) to track individual-level episodes of care in state-supported substance abuse clinics[1]
3. Hospital discharge transactions maintained by the state's Health Services Cost Review Commission (HSCRC), the entity in Maryland that sets rates for all such transactions across the state (Maryland Health Services Cost Review Commission, 2016).

Use of these three data sources provides a reasonably comprehensive view of opioid dependence and treatment in Baltimore City because it includes essentially all publicly financed substance abuse services (by way of the Medicaid claims and licensed clinical enrollment records), as well as many private and Medicare-covered transactions (by way of the hospital discharge transactions). For this study, Hilltop used the three data sources to address the following questions:

1. What is the prevalence of opioid and heroin use disorders (OUDs) in Baltimore City?
2. What is the treatment prevalence among those identified in Question 1?
    a. What are the levels of care accessed? (i.e., American Society for Addiction Medicine (ASAM) Levels I-III (standard, intensive, and residential treatment), inpatient services, and ED services).

[1] This is the Statewide Maryland Automated Tracking (SMART) system, which was discontinued January 1, 2015, and supplanted by data collection efforts by an Administrative Service Organization (ASO) newly retained by the state to track substance use disorders. Source: http://bha.dhmh.maryland.gov/Documents/Publications/FY14OandO_6edited2.pdf, slide 1.

b. Which public and private payers are financing that care (i.e, Medicare; Medicaid (state/federal); private; self; state only)?

3. What individual characteristics (i.e., demographics, payment source, crisis service use) visible in the administrative records are related to increased use of opioid treatment services?

Hilltop's research is partially inspired by a recent effort to coalesce similar information for New York City. McNeely et al. (2012) found that, as of 2006, New York City had approximately 92,000 illicit opioid users, with only 21,600 persons (23 percent) engaged in some form of treatment. These New York City estimates highlight a substantial gap between the likely need and actual use of opioid addiction treatment services.

According to the data workgroup of Heroin Treatment and Prevention Task Force (2015), there were an estimated 18,919 persons in Baltimore City using heroin in 2012. This includes a generous estimate of homeless users, but it excludes an additional 8,506 individuals who likely suffer from non-heroin related opioid use disorders. As for treatment, the Task Force did not estimate those rates directly, though it did allude to treatment system shortfalls by citing that average wait times for entry into state-licensed opioid treatment centers was four days in 2014, and "secret shopper" reviews found that the waiting time for an appointment ranged from one day to two weeks (City of Baltimore, Baltimore City Health Department, & BHSB, 2015, p. 22).

Another study reviewed government-supplied data from 1999 to 2009 and found that buprenorphine or methadone treatment surged in 2009 to a range between 8,359 and 15,383 unique persons in Baltimore City (Schwartz et al., 2015)- the broad range is attributable to the fact that they reported methadone and buprenorphine treatment separately without considering overlap. Assuming this trend either flattened or continued to 2012, it would seem that the availability of medication assistance therapy (MAT) slots for Baltimore City residents using illicit opioids is on the order of 30 to 56 percent[2] of the estimated need. This represents an apparent treatment rate that is above that of New York but also well below complete (i.e., 100 percent) access for all in need.

Accordingly, this report aims to provide new data and analysis regarding the need and availability of treatment for opioid and heroin abuse and dependence in Baltimore City.

[2] Numerator is 8,359 or 15,383 per sentence above; denominator is the totality of opioid users in Baltimore City per the paragraph above the one containing this footnote (18,919+8,506=27,425).

Methods

Data Sources

The three administrative data sets Hilltop used for this study are described in detail below. They represent nearly all publically financed (state or federal grants or matching dollars) substance abuse treatment, and they also capture most hospital-based clinics that treat such illness, including EDs, for all payers (Medicaid, Medicare, private, and those without insurance).

MMIS2. The Medicaid Management Information System[3] (MMIS) contains data on all transactions covered by Maryland Medicaid, including those under third-party managed care. Data include patient demographics, diagnoses, and procedure codes, which allow assessment of morbidity and treatment information. Further included are prescription events, which show fills for the addiction medications buprenorphine and disulfiram. Individuals are assigned a unique Medicaid ID that allows their enrollment and service use to be tracked over time. Medicaid enrollees with concurrent Medicare enrollment (i.e., dual-eligible beneficiaries) are also included in this data set, and Social Security Number (SSN) is available for linking to the SMART data (described below).

SMART. The Statewide Maryland Automatic Record Tracking (SMART) system is a database that allows individual-level tracking of clients engaged in state-supported, ASAM level treatment venues. The database includes fields that record the specific type and duration of care, and up to three substances of abuse (e.g., heroin, prescription opioids, and alcohol). This data system has recently been replaced by a newer one maintained by the state's behavioral health Administrative Service Organization (ASO), which began covering substance abuse services in 2015 (University of Maryland Institute for Government Service and Research, 2016). Because of that transition, which was accompanied by increasing reliance on Medicaid payments to cover substance abuse services statewide, the SMART data reviewed is known to reflect shrinking numbers of unique patient entries. Still, SMART is a singular source of information regarding persons who are treated in public-funded and licensed substance abuse clinics absent Medicaid or hospital-based connections. The inclusion of a unique client ID in the SMART data allows an individual to be followed over time and into different venues/episodes of care. Additionally, because a SSN is evident in more than 99 percent of the SMART records, they can be matched to the Medicaid data to minimize "double counting" errors (Maryland Behavioral Health Administration Department of Health and Mental Hygiene, c2014).

HSCRC. The HSCRC collects patient-level data on all inpatient discharges and hospital outpatient encounters, including clinical, demographic, and billing data. These data include diagnostic and procedure codes corresponding to each transaction, dates of service, and

[3] https://www.cms.gov/Research-Statistics-Data-and-Systems/Computer-Data-and-Systems/MMIS/index.html, accessed 11/2015

anticipated source of primary and secondary payment. Unlike the MMIS2 and SMART data, SSNs are not available in this data source; rather, they are unique within hospital-year IDs, so limited individual tracking is possible, and "double counting" of persons moving between hospitals is expected.

Sample Selection

Each of the three data sets described above were used to draw state fiscal year (FY) 2013 and 2014 data (covering July 2012 to June 2014). The goal was to obtain recent information that was far enough in the past that all transactions considered had at least six months of lag for claim adjudication. Cohorts from each fiscal year were persons who met the following general criteria:

1. Aged 12 years or older
2. Baltimore City Resident
3. Some evidence in the medical record of opioid abuse or dependence (i.e., opioid use disorder (OUD)).

The age constraint is applied because the diagnosis of substance use disorder (SUD) is not generally assigned to pre-adolescence due to the fact that use and various risk factors for such pathology are generally apparent only after the onset of puberty (Substance Abuse and Mental Health Services Administration, 2014; Tarter, 2002). Baltimore City is the focus of this study for the reasons described in the Background section of this report, and opioid abuse or dependence are both considered to be maximally sensitive to any medical records, suggesting that use of heroin or related substances might be of concern.

In the Medicaid and HSCRC data, the sample was identified using ICD-9 codes or E-codes indicative of opioid use, abuse, or dependence (see Appendix A). Additionally, individuals with a claim including a procedure code for methadone or an indicator for buprenorphine pharmacotherapy (Medicaid or SMART data) were selected for the sample. For the SMART sample, enrollments with either heroin or other opiates as the primary, secondary, or tertiary drug at enrollment were also included.

Definition of Key Outcome Variables

Beyond the presence of an OUD or treatment event, this work further distinguished between claims in which opioid abuse appeared as a primary diagnosis or in any other (i.e., in a secondary) diagnostic position. For SMART data, which does not contain ICD-9 codes, enrollees were included if they either were receiving medication assisted therapy (MAT) specific to opioid addiction (methadone or buprenorphine) or if they had at least one record indicating that an opioid was the substance they were abusing at enrollment. Since the SMART data do not utilize diagnostic codes, all instances of heroin or opioid treatment were assumed to correlate with a primary diagnosis regarding that issue.

Residential placements or inpatient hospitalizations related to opioid use were identified in MMIS2 and HSCRC by the presence of a revenue code consistent with ASAM Level III placement or more intensive care (see Appendix B) and an ICD-9 code consistent with opioid treatment. For these and all other service use variables, we counted claims with the relevant ICD-9 diagnosis regardless of whether it appeared as the primary or secondary diagnosis because the revenue codes themselves are specific to substance abuse or behavioral health transactions. In the SMART data, enrollments are explicitly labeled with ASAM Level of care (Maryland Behavioral Health Administration, Department of Health and Mental Hygiene, 2014); in MMIS2 and HSCRC data, revenue or venue codes were used to isolate such intensive events including those pertaining to medical care in a hospital setting. Days of residential/inpatient placement were counted based on the "length of stay" variables evident in the database or on the use of admission and discharge dates evident in those reports.

ED visits related to opioid use were present only in the MMIS2 and HSCRC data because licensed addiction clinics (using the SMART system) do not serve as emergency care centers for their clients. ED visits are classified as inpatient or outpatient, depending on the discharge outcome of the visit. That is, a claim for an ED visit that resulted in an inpatient hospital admission would be classified as ED-to-inpatient event, whereas a claim for an ED visit that did not lead to an admission would be classified as an ambulatory ED. For both inpatient and outpatient visits, we selected ED visits related to opioid abuse based on revenue codes (Appendix B) accompanied by any ICD-9 codes related to opioid treatment (Appendix A).

Intensive outpatient treatment (IOP), partial hospitalization (PH), and assertive community treatment (ACT) related to opioid use were identified in MMIS2 and HSCRC by the presence of venue, revenue codes (Appendix B), and an ICD-9 diagnosis consistent with opioid use (Appendix A). In SMART data, IOP, PH, and ACT were enrollments with a level of care of "Level II.*x*." Treatment days were summed based on length of enrollment entries.

OMT (opioid maintenance treatment, usually methadone clinic-based) was identified by the presence of procedure code H0020 in HSCRC and MMIS2 and the presence of the OMT codes per ASAM assignment in the SMART data. For the MMIS2 and HSCRC data, each uniquely dated claim was multiplied by 7 to determine days of service, as each claim likely represents bundled payments for one week of service (Maryland Department of Health and Mental Hygiene, 2011; Tucker, 2014).

Buprenorphine prescription fills were only available in MMIS2 and SMART data. With MMIS2, buprenorphine prescriptions were identified by National Drug Code (NDC) occurrence. All NDCs associated with generic drug names that contained "buprenorphine" were included. In the SMART data, buprenorphine therapy was indicated by a yes/no flag recording such pharmaceutical use. Buprenorphine prescriptions were not evident in the HSCRC record as that data set does not record outpatient pharmacy transactions.

Table 1. Summary or Methods to Differentiate Levels of Care by Data Source

	Data Source		
Level of Care	**MMIS**	**SMART**	**HSCRC**
Residential Placement/ Inpatient Hospitalization	revenue code consistent w/ ASAM Level III or more intensive care, and ICD-9 diagnosis consistent with OUD	explicitly labeled ASAM Level of care	revenue code consistent w/ ASAM Level III or more intensive care, and ICD-9 diagnosis consistent with OUD
ED Visit	revenue codes accompanied by any ICD-9 diagnoses related to OUD	Not recorded in this dataset	revenue codes accompanied by any ICD-9 diagnoses related to OUD
IOP, PH, and ACT	venue, revenue codes, and an ICD-9 diagnosis consistent with OUD	"Level II.*x*" level of care	venue, revenue codes, and an ICD-9 diagnosis consistent with OUD
OMT (methadone)	procedure code H0020	presence of the OMT codes per ASAM assignment	procedure code H0020
Buprenorphine Prescription Fills	NDC occurrence	yes/no flag	Not available in this database

Statistical Analysis

A statistical model was used to consider the presence or absence of standard maintenance level (ASAM Level I including methadone or buprenorphine) treatment based on the visible factors: age, race, sex, heroin use, and insurance status. Logistic regression was used to model the dependent binary variable (presence or absence of treatment) against these listed factors. Logistic regression is a standard method to deal with a binary outcome variable and yields odds ratios for each level of the independent variables (Hosmer & Lemeshow, 1989; Studenmund, 2006). The general form of the regression model employed is as follows:

Probability (Standard Outpatient Treatment) = *function* (age, race, sex, overdose history, insurance coverage status, other ASAM treatment levels, crisis service use)

This statistical analysis is put forth as a first exploration of correlates to treatment. Standard maintenance level treatment was selected to consider the extent to which secondary prevention efforts were in place for persons with opioid diagnoses because such care presumably helps prevent more intensive use of services, including crisis services such as inpatient and ED use.

Results

MMIS2 Data

Table 2 shows that the Medicaid administrative records (MMIS2) reveal 16,000 to 18,000 persons with some evidence of opioid use or dependence (OUD) in Baltimore City, and that 6 to 8 percent of those Medicaid enrollees also received some financial support for their opioid-related treatment from Medicare. The table further shows that opioid users in Baltimore City who are Medicaid beneficiaries are predominantly male and black, with a mean age of 46 years.

Table 2. Medicaid Administrative Data Summary of Persons with Opioid Use

	FY 2013		FY 2014	
	Freq	**Percent**	**Freq**	**Percent**
Total	16,846	100	17,667	100
Gender				
Male	9,054	53.75	9,431	53.38
Female	7,792	46.25	8,236	46.62
Race/Ethnicity				
Black	11,930	70.82	12,678	71.76
White	3902	23.16	3,812	21.58
Other	145	0.86	130	0.74
Hispanic*	49	.29	44	.25
Unknown	820	4.87	1,003	5.68
Any Medicare Paid Opioid Treatment Days	1,132	6.72	1,350	7.64
Age (Years)	mean=	45.51		46.05
	stdev=	10.5		10.69
	min=	12		13
	max=	86		87

*mutually exclusive assignment

Table 3 shows various types of OUD-related service utilization evident in Medicaid records for both fiscal years studied. For example, just over 50 percent of opioid users in FY 2014 received at least one OMT service, and nearly 22 percent filled at least one buprenorphine prescription. These specific treatment rates are consistent with previous work carried out at Hilltop (Abrams, Kim, & Miller, 2012). The information in Table 3 further reveals that opioid dependence—rather than abuse—dominates the diagnoses assigned to persons with OUD, that overdoses are recorded in 5 to 6 percent of individuals with OUD, and that aggregate outpatient treatment rates (corresponding to at least one non-inpatient, non-emergent event) are seemingly quite high, at 70 to 72 percent (McNeely et al., 2012; Saloner & Karthikeyan, 2015).

Table 3. Service Use Associated with Opioid Use Disorders, Based on Medicaid Administrative Data (MMIS2)

	FY 2013					FY 2014				
	yes/no flag	days of service among users				yes/no flag	days of service among users			
Measure	n (%)	mean	st. dev.	min.	max.	n (%)	mean	st. dev.	min.	max.
Primary dx (PDX) abuse (all)	351 (2.08)	4.52	10.31	1	144	490 (2.77)	4.57	9.25	1	108
PDX abuse (w/o dependence)	108 (0.64)	6.2	15.7	1	144	139 (0.79)	4.27	10.02	1	96
PDX dependence (all)	14,374 (85.33)	40.66	35.63	1	365	14,774 (83.62)	48.05	47.42	1	365
Secondary dx (Dx2) abuse (all)	2,140 (12.70)	2.49	6.47	1	228	2,467 (13.96)	5.81	18.98	1	237
Dx2 abuse (w/o dependence)	1,201 (7.13)	2.4	4.86	1	59	1,216 (6.88)	3.85	11.74	1	168
Dx2 dependence (all)	6,512 (38.66)	7.91	14.55	1	308	7,727 (43.74)	11.8	22.77	1	321
heroin overdose	184 (1.09)	2.21	2.44	1	21	245 (1.39)	2.3	2.23	1	22
opioid overdose	997 (5.92)	6.27	7.67	1	57	1,100 (6.23)	8.36	11.72	1	83
Inpatient	390 (2.32)	18.44	45.39	1	345	534 (3.02)	12.83	31.81	1	293
Emergent-to-inpatient	1,871 (11.11)	1.44	1	1	13	2,153 (12.19)	1.42	1.08	1	17
Emergent, ambulatory	1,612 (9.57)	1.87	2.64	1	92	1,622 (9.18)	2.05	2.91	1	86
Intensive outpatient (IOP)	601 (3.57)	18.55	20.87	1	181	747 (4.23)	19.08	22.7	1	256
Other outpatient opioid	750 (4.45)	32.04	64.74	1	363	851 (4.82)	30.18	61.05	1	364
Other SUD treatment	476 (2.83)	34.02	29.55	1	314	487 (2.76)	37.59	31.58	1	319
OMT (methadone clinic)	8,587 (50.97)	261.42	117.77	7	365	8,854 (50.12)	265.64	119.62	7	365
Buprenorphine prescriptions	3,810 (22.62)	10.57	8.06	1	56	3,860 (21.85)	10.71	8.49	1	66
Disulfiram prescription	141 (0.84)	2.33	2.2	1	14	139 (0.79)	2.55	2.52	1	14
Standard outpatient or medication assistance treatment*	12,142 (72.08)	n/a	n/a	n/a		12,430 (70.36)	n/a	n/a	n/a	n/a

*Buprenorphine or OMT, or outpatient treatment that is not emergent.
Dx= diagnosis

SMART Data

Table 4 shows that the Behavioral Health Administration's (BHA's) SMART data indicate that in FYs 2013 and 2014, there were 4,116 and 3,451 opioid users enrolled in state-funded substance abuse treatment centers, respectively. The Medicaid sub-populations were 2,317 in FY 2013 and 1,922 in FY 2014. As these Medicaid numbers are well below those discerned from the MMIS2 data, it seems that Medicaid administrative data are far more sensitive to persons with OUDs in Baltimore City than in BHA's SMART data, likely because the Medicaid administrative data is a record of all medical care, whereas the SMART data only capture state-certified substance use disorder clinics. It should further be emphasized that the unit of reporting for the SMART data is the unique person level, with separate records for each episode and level of care. Accordingly, as a person can have more than one admission in a year to the same or different levels or types of care, at least one previous report before this one has likely over-estimated opioid treatment prevalence in Baltimore City when analyzing summaries of the SMART data (Schwartz et al., 2015). Whatever the case, Table 4 reveals data on only a subset of Medicaid enrollees with opioid use disorders, and it shows that the demographics of these Medicaid enrollees are similar to those of the greater MMIS2-defined Medicaid population.

Table 4. BHA's Summary Data* for Persons with Opioid Use Disorders

	FY 2013		FY 2014	
	Freq	**Percent**	**Freq**	**Percent**
Total	4,116	100	3,451	100
Gender				
Male	2,616	63.56	2,193	63.55
Female	1,478	35.91	1,243	36.02
Unknown (inconsistent between entries)	22	0.53	15	0.43
Race				
Black	2,860	69.48	2,469	71.54
White	1,140	27.7	890	25.79
Other	116	2.82	92	2.67
Opioid treatment payer				
Medicaid	2,317	56.29	1,922	55.69
Medicare	94	2.28	91	2.64
Private insurance	123	2.99	99	2.87
Self Pay	115	2.79	64	1.85
Block Grant or Other**	1,903	46.23	1,689	48.94
Age (years)	mean=	42.17		43.06
	stdev=	11.09		11.07
	min=	4		14
	max=	76		105

* Data source: Maryland Behavioral Health Administration SMART data.
** State or federal funds earmarked for Public Substance Abuse Treatment.

Table 5 demonstrates that the SMART data contrast the Medicaid data with regard to its sensitivity to heroin use and its treatment-level case mix. Specifically, the SMART data "substance at enrollment or discharge" fields indicate that 85 to 89 percent of the individuals used heroin. This information is not evident in most of the MMIS2 records because the diagnostic indicators are for opiate abuse/dependence only, without indicators for heroin or otherwise (with the exception of the overdose code, which is sometimes heroin-specific). Regarding case mix, review of the treatment rates for IOP, for example, shows that the SMART enrollees use this service 45 to 48 percent of the time, while the MMIS2 population uses this service less than 5 percent of the time (Table 3). This striking difference is almost certainly due to the fact that the SMART data capture a narrow population of persons with OUD engaged in treatment specific to substance use disorders, whereas the MMIS2 data capture a broader population of persons with OUDs who may or may not be engaged in such treatment. Higher mean spans of methadone (i.e., OMT) treatment for the MMIS2 population are plausibly related to the fact that this data tracking system contains a higher proportion of methadone users who are not in the same year engaged in residential or intensive outpatient services that supplant (or break up) free-standing methadone clinic care.

Table 5. BHA's Data* on Service Use Associated with Opioid Use Disorders

	FY 2013					FY 2014				
	yes/no flag	days of service among users				yes/no flag	days of service among users			
	n (%)	mean	st. dev.	min.	max.	n (%)	mean	st. dev.	min	max
Heroin use at enrollment (all)	3,523 (85.59)	103.13	96.1	1	365	3,047 (88.29)	98.04	94.39	1	365
Opiate use at enrollment (w/o heroin)	593 (14.41)	87.44	93.42	1	362	404 (11.71)	83.95	86.82	1	362
Opiate use at enrollment (all)	667 (16.21)	85.38	91.45	1	362	452 (13.10)	82.01	85.88	1	362
Inpatient/residential**	1,360 (33.04)	65.22	73.08	1	355	1,206 (34.95)	57.01	72.32	1	364
Intensive outpatient	1,869 (45.41)	69.71	67.29	1	346	1,628 (47.17)	61.9	57.35	1	350
Other outpatient opioid	882 (21.43)	108.65	85.94	1	353	699 (20.25)	117.64	85.69	1	353
OMT (methadone clinic)	1,153 (28.01)	119.83	104.19	1	365	934 (27.06)	117.33	100.69	1	365
Buprenorphine (≥1 prescription)	1,373 (33.36)	n/a	n/a	n/a	n/a	1,190 (34.48)	n/a	n/a	n/a	n/a
Outpatient or medication assistance treatment***	3,547 (86.18)	n/a	n/a	n/a	n/a	3,021 (87.54)	n/a	n/a	n/a	n/a

*Source: Behavioral Health Administration (BHA) SMART database.
**Any ASAM Level III service; note that Level IV is not covered by BHA for substance use as a primary indication.
***Buprenorphine, OMT, or any other Level I-II service.

Direct comparison of the differential sensitivity of the MMIS2 and SMART data to heroin and buprenorphine use is possible in 2,013 cases in each year that, by SSN matching, had records in both systems. Two-by-two tables for FY 2014 show that the percentage agreement (the diagonal corresponding to yes/yes and no/no), is 75 percent for the buprenorphine flag (Table 6) and only 12 percent for heroin (Table 7), which is mainly recorded only in the SMART data. These database discrepancies demonstrate the utility of using both sources in order to maximize sensitivity to such variables, even among persons entered into both systems. FY 2013 data are similar to the FY 2014 data presented.

Table 6. Buprenorphine Flags in FY 2014, by Database

	Behavioral Health Administration (SMART) - Yes	Behavioral Health Administration (SMART) - No
Medicaid (MMIS2) - Yes	477	286
Medicaid (MMIS2) - No	220	1030

Table 7. Heroin Use Flags in FY 2014, by Database

	Behavioral Health Administration (SMART) - Yes	Behavioral Health Administration (SMART) - No
Medicaid (MMIS2) - Yes	36	1
Medicaid (MMIS2) - No	1,774	202

HSCRC Data

Table 8 shows that just over 13,000 persons with OUDs were admitted to regulated Maryland hospital inpatient or outpatient clinics in each of the two years studied, and that just over half (51 to 55 percent) of those persons had an expected payer that included Medicaid. Accordingly, the approximate number of 7,350 persons identified as opioid abusers or dependents in the HSCRC data correspond to approximately 42 percent of the Medicaid opioid population (see Table 1), a reasonable figure considering that many providers and clinics serving Medicaid enrollees are not hospital-based but instead are free-standing primary or specialty care clinics or pharmacies. As was the case with the MMIS2 and SMART demographic tabulations, the HSCRC tabulations indicated that over half of the opioid abusers or dependents were male, black, and had a mean age in the mid-40s. It is further notable that "Other race" was noted with increasing frequency in FY 2014 likely reflecting the use of more nuanced racial categorization in this year versus one year earlier.

Table 8. Regulated Hospital Discharge Summary Data (HSCRC*) for Persons with Opioid Use Disorders

	FY 2013		FY 2014	
	Freq	**Percent**	**Freq**	**Percent**
Total	13,366	100	13,828	100
Gender				
Male	7,850	58.73	8,174	59.11
Female	5,515	41.26	5,652	40.87
Unknown	1	0.01	2	0.02
Race				
Black	8,100	60.6	6,155	44.51
White	3,417	25.56	2,643	19.11
Hispanic	72	0.54	53	0.38
Other	1,749	13.08	4,111	30.73
Unknown	28	0.21	866	6.26
Opioid treatment payer**				
Medicaid	6,931	51.86	7,685	55.58
Medicare	5,372	40.19	5,932	42.9
Private	4,404	32.95	4,904	35.46
Self Paid	4,527	33.87	3,851	27.85
Other***	1,283	9.6	1,151	8.32
Age (years)	mean=	44.95		46.04
	stdev=	11.38		11.4
	min=	12		13
	max=	91		113

*Data source: Maryland's Health Services Cost Review Commission (http://www.hscrc.state.md.us/)
**Expected, i.e., anticipated, but unconfirmed payer
***Workers' Compensation, Title V, Other government programs.

Table 9 below is best reviewed by comparing it to Table 3 (the Medicaid data). Such a comparison reveals that the *primary* diagnostic markers for opioid dependence are evident in hospital admissions, but far less evident in the MMIS2 records. Accordingly, it seems that for many hospital-based transactions, an OUD is noted as a secondary rather than as a primary concern of the treating venue. The primary diagnoses on these claims must therefore be other diagnoses such as those related to mental illness or an acute (e.g., trauma) or chronic condition (e.g., infectious disease, cardiovascular) that brought the subject to the hospital. By comparison in the MMIS2 records, OUD is more frequently the focus of at least one medical transaction that is presumed to be a community-based service in an ASAM IOP or Level I clinic especially dedicated to amelioration of OUD-specific morbidity. Further evidence that the HSCRC data are mainly sensitive to ancillary and crisis opioid morbidity is the fact that the last row of the table shows that only 21 to 26 percent of the persons identified receive non-emergent outpatient therapy.

Table 9. Hospital Rate Setting (HSCRC*) Data on Service Use Associated with Opioid Use Disorders

	FY 2013					FY 2014				
Measure	**yes/no flag**	**days of service among users**				**yes/no flag**	**days of service among users**			
	n (%)	**mean**	**st. dev.**	**min.**	**max.**	**n (%)**	**mean**	**st. dev.**	**min.**	**max.**
Primary dx (PDX) abuse (all)	225 (1.68)	1.54	0.82	1	6	272 (1.97)	1.53	0.73	1	5
PDX abuse (w/o dependence)	205 (1.53)	1.57	0.81	1	6	245 (1.77)	1.54	0.73	1	5
PDX dependence (all)	1,869 (13.98)	12.32	17.46	1	126	1,817 (13.14)	12.8	16.94	1	122
Secondary dx (Dx2) abuse (all)	4,377 (32.75)	2.46	2.51	1	52	4,775 (34.53)	3.06	2.95	1	51
Dx2 abuse (w/o dependence)	3,547 (26.54)	2.34	2.18	1	35	3,840 (27.77)	2.91	2.56	1	51
Dx2 dependence (all)	7,849 (58.72)	2.76	3.73	1	96	8,022 (58.01)	3.61	4.3	1	81
heroin overdose	352 (2.63)	1.86	1.26	1	9	400 (2.89)	2.43	2.26	1	19
opioid overdose	922 (6.9)	2.09	1.8	1	21	928 (6.71)	2.77	2.46	1	25
Inpatient	688 (5.15)	1.05	0.22	1	3	1,198 (8.66)	1.13	0.39	1	4
Emergent-to-inpatient	3,169 (23.71)	1.33	0.7	1	9	5,844 (42.26)	1.46	0.98	1	13
Emergent, ambulatory	2,111 (15.79)	1.8	1.47	1	33	2,604 (18.83)	1.83	1.46	1	28
Intensive outpatient (IOP)	232 (1.74)	21.23	23.64	1	117	224 (1.62)	17.83	16.92	1	112
Other outpatient opioid	1,157 (8.66)	57.83	64.94	1	365	1,154 (8.35)	58.87	64.77	1	359
Other SUD treatment	2,402 (17.97)	12.19	23.07	1	364	1,909 (13.81)	15.45	27.42	1	288
OMT (methadone)	829 (6.2)	19.33	17.25	1	52	778 (5.63)	20.05	17.02	1	52
Outpatient or medication assistance treatment*	3,520 (26.34)	n/a	n/a	n/a	n/a	3,019 (21.83)	n/a	n/a	n/a	n/a

*Buprenorphine, OMT, or outpatient treatment that is not emergent.
Dx= diagnosis

Because Hilltop did not have access to unique person HSCRC IDs for this investigation, it was not possible to directly connect those data to the other data sources. However, expected payment source information in the HSCRC data does allow us to, in the aggregate, consider whether those data agree with the Medicaid data reviewed. Specifically, the overdose counts are roughly comparable between the two systems with these two clarifications: 1) heroin overdose events are almost double in the HSCRC system, suggesting higher reporting in hospitals than in non-hospital clinics, and 2) other opioid overdose rates are vastly similar between the two systems, suggesting that such events are evenly spread between private and publicly insured clients with opioid issues.

The ED rates observed in the HSCRC data can be compared to a previous analysis conducted by the City of Baltimore using the same data source for earlier years. That analysis found approximately 2,946 ED visits tied to OUDs in Baltimore City in calendar year 2013 (personal communication, Aruna Chandry, 12/18/2014). That number is comparable to, albeit lower than, those shown in Table 9 in FY 2013 (n=2,111 persons*1.8 visits/person=3,800) and FY 2014 (n=2,604*1.83=4,765). The discrepancy between those estimates and the ones in Table 9 is likely related to the increased sensitivity of the data pull methods used here—which included overdose, OMT codes, and diagnoses codes in the primary *or secondary* positions. It is worth noting that the ambulatory ED rates observed in this population of persons with OUDs (15 to 19 percent) is well below calculations made across all behavioral health disorders (i.e., major and other mental illness such as bipolar and schizophrenia, as well as substance use disorders). Specifically, previous Hilltop analyses using the HSCRC data found that, among hospital users with such broad spectrum of behavioral health illness, 58 percent had at least one ambulatory ED visit in FY 2012 (data not shown[4]). Accordingly, it can be argued that the ambulatory ED use is far less prevalent among those with OUDs than among people with broad spectrum behavioral health issues.

Finally, careful review of Table 9 shows that the between-year service use rates (percentages) were similar, with a single notable exception: ED-to-inpatient events were far more prevalent in FY 2014 than in the previous year (42 vs. 24 percent). The reason for the marked climb in such specific events is presently unknown. Moreover, this increase from FY 2013 to FY 2014 is not consistent with increased inpatient or residential treatment in either the SMART or MMIS2 data, which suggests that it may be the result of some year-specific HSCRC data recording change. Whatever the case, future study of this change is necessary to consider what underlies the observed increase.

[4] See: Abrams et al., Memorandum to the Coordination of Care Advisory Committee (DHMH Division of Behavioral Health and Disabilities), "All-payer service use among those with behavioral health treatment records," 12/13/13.

Combination of All Data Sources

This final portion of the results section presents combined rates of OUDs across all three databases using the following strategies to de-duplicate and combine observations between these separate systems. First, Hilltop merged the Medicaid and SMART data using SSNs, which were available in both data systems. Second, Hilltop reduced the HSCRC data to only those observations that were not paid for by Medicaid, assuming that all Medicaid hospital transactions would be captured in the MMIS2 data. Remaining in the HSCRC system, then, would be Medicare, private pay, self-pay, and other government payment such as workman's compensation and block grant dollars. Accordingly, there is the possibility that the HSCRC and SMART data jointly double-count some persons in both systems who are covered by Medicare, private insurance, self-payment (uninsured), or state or federal block grant funds. The maximum scope of this possible over-count is on the order of 1,799 persons in FY 2013 and 1,529 persons in FY 2014 (see the "opioid treatment payer" section of Table 4; difference between Total and Medicaid), amounts that are less that 10 percent of the total populations presented here (see below).

Tables 10 and 11 present rates of OUDs across each of the three databases utilized and, in the shaded final rows, a combined estimate across all these sources. The combined estimate is a robust accounting of all illicit opioid abuse and treatment in Baltimore City for the two study years. Overall, the data review described here found 24,714 (FY 2013) and 24,887 (FY 2014) persons with some indication of an OUDs in Baltimore City. Moreover, the right side of these tables shows that just over 59 percent of those persons received some form of ASAM Level I maintenance treatment, and that 11 to 15 percent experienced an ED-to-inpatient or an ambulatory ED in a given year. These aggregate rates suggest that ED visit rates are lower for persons with OUDs than for people with other forms of serious behavioral health disorders (e.g., schizophrenia, bipolar disorder, major depression),[5] and that treatment rates are higher than those seen in New York City (McNeely et al., 2012) and nationally (Saloner & Karthikeyan, 2015).

[5] Ibid.

Table 10. Diagnostic and Service Use Prevalence for All Persons with Opioid Use Disorders in Their Medical Record, FY 2013

	Diagnostic or use indicators (unique persons)					Treatment Prevalence, person-count (percentage of those with any opioid problem)							
Data source	Abuse[a]	Depen-dence[a]	heroin label[a,b]	Opioid Poisoning[a]	Any Opioid Problem[c]	OMT[a]	Bupre-norphine[a]	Level I[a]	Level II[a]	Level I-II Treat-ment[d]	Level III or other in-patient[a,e]	ED to Inpatient	ED ambula-tory
MMIS2	783	15,688	184	997	16,650	8,587 (34.8)	3,810 (15.4)	750 (3.0)	601 (2.4)	12,109 (49.0)	390 (1.6)	1,871 (7.5)	1,612 (6.5)
SMART	n/a	4,116	3,523	n/a	4,116	1,153 (4.7)	1,373 (5.6)	882 (3.6)	1,869 (7.56)	3,547 (14.4)	1,360 (5.5)	n/a	n/a
HSCRC	3,645	9,301	352	922	13,348	829 (3.4)	n/a	1,157 (4.7)	232 (0.9)	1,342 (5.43)	688 (2.8)	3,169 (12.8)	2,111 (8.5)
Combined	2,601	20,040	3882	1481	24,714	9,506 (38.5)	4,544 (18.4)	2,343 (9.5)	2,587 (10.5)	14,623 (59.2)	2,245 (9.1)	2,726 (11.0)	3,308 (13.4)

Table 11. Diagnostic and Service Use Prevalence for All Persons with Opioid Use Disorders in Their Medical Record, FY 2014

	Diagnostic or use indicators (unique persons)					Treatment Prevalence, person-count (percentage of those with any opioid problem)							
Data source	Abuse[a]	Depen-dence[a]	heroin label[a,b]	Opioid Poisoning[a]	Any Opioid Problem[c]	OMT[a]	Bupre-norphine[a]	Level I[a]	Level II[a]	Level I-II Treat-ment[d]	Level III or other in-patient[a, e]	ED to Inpatient	ED ambula-tory
MMIS2	790	16,249	245	1,100	17,309	8,854 (35.6)	3,860 (15.51)	851 (3.4)	747 (3.00)	12,379 (49.74)	534 (2.15)	2,153 (8.65)	1,622 (6.52)
SMART	n/a	3,451	3,047	n/a	3,451	934 (3.75)	1,190 (4.78)	699 (2.8)	1,628 (6.54)	3,021 (12.14)	1,206 (4.85)	n/a	n/a
HSCRC	3,979	9,425	400	928	13,819	778 (3.13)	n/a	1,154 (4.6)	224 (0.90)	1,294 (5.20)	1,198 (4.81)	5,844 (23.48)	2,604 (10.46)
Combined	2,718	20,190	3,487	1,564	24,887	9,708 (39.0)	4,573 (18.38)	2,291 (9.2)	2,486 (9.99)	14,703 (59.08)	2,509 (10.08)	3,424 (13.76)	3,714 (14.92)

[a] At least one uniquely dated transaction with such a flag, and abuse and dependence are mutually exclusive of one another
[b] Heroin, and not just opioid used, is indicated in the medical record
[c] Abuse or dependence or poisoning event
[d] OMT or Buprenorphine or Levels I-II
[e] Other inpatient means those not associated with an ED admission

Logistic Regression Models

The following logistic models were run, by fiscal year:

Pr(Outpatient Substance Use Treatment) =

> *function of* (gender, race, agegrp, inpt_opioid, ed_opt_opioid, ed_inpt_opioid, OD_any, mcaid_pay, mcare_pay, private_pay, other_pay)

where the following definitions apply:

Pr=probability in terms of odds that the event occurred

Race: B=Black, W=White, O=Other

Agegrp: Age groups as follows: 12-17 years old, 18-26 years old, and >26 years old

ED_opt_opioid: code=1 if the individual had at least one ambulatory ED visit in the year, else code=0

ED_inpt_opioid=1 if the individual had at least one ED-to-inpatient transition event in the year, else code=0

Any_OD_flag=1 if there was an codes indicated an opiate overdose in the year, else code=0

Payment flags: **mcaid**=Medicaid, **mcare**=Medicare, **private**=Private insurance, **other**= other payment including block grant funding to BHA. Note that a person could have multiple flags in a given year.

Figure 1 below provides a graphic representation of the logistic regressions by fiscal year. Specifically, it provides adjusted odds ratio point estimates for each explanatory variable, and a 95 percent confidence interval surrounding that point estimate. Statistically significant effects to the $p<0.05$ level can thus be discerned observing confidence intervals that do not touch the line where the odds ratio = 1 (i.e., even odds). Accordingly, most but not all effects are significant as each year has over 24,000 observations. Because the overall fits of the regression model underlying these results are adequate per some statistical tests (i.e., ROC and r-square tests) but suspicious per the Hosmer-Lemeshow test, these results should be considered as suggestive rather than definitive.

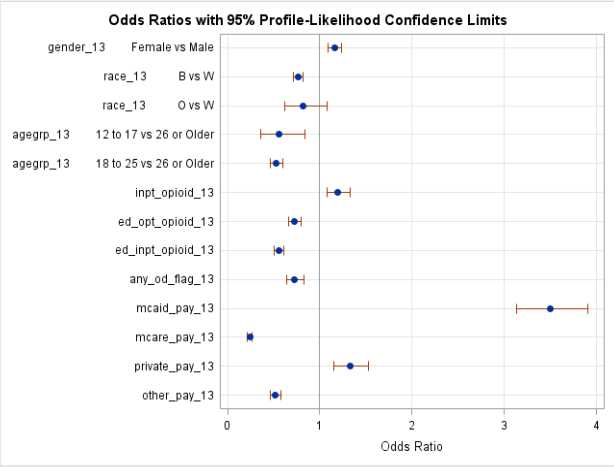
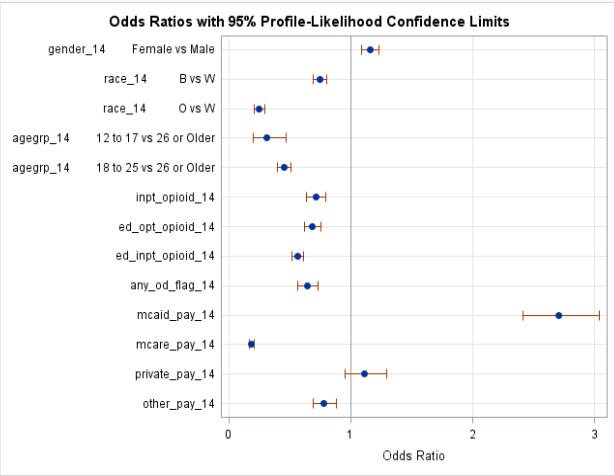
Significant effects evident in both years show that the following variables correlated with *increased* odds of outpatient treatment: female gender and Medicaid coverage, with the Medicaid coverage effect being especially strong.

Significant effects evident in both years that correlate with *decreased* odds of outpatient treatment were Black vs. White race, younger age (<26), ambulatory ED and ED-to-inpatient events, overdose events, and Medicare or other (e.g., block grant) payment for services.

Effects that differed between years were that the Other race vs. White comparison was only significant in FY 2014 (the year in which the Other category was used much more frequently), and the private insurance coverage (versus its absence) was only significant in FY 2014; however, the direction and magnitude of these effects were similar between years, especially for the private pay variable, which overall appears to correlate with increased odds of outpatient services use.

The singular result that conflicted between years was that inpatient events (events not from the ED) were correlated with increased outpatient use in FY 2013 but decreased outpatient use in FY 2014. This inconsistent finding is likely in part related to the fact that such non-emergent (i.e., "planned," or at least unrelated emergency service use) inpatient admissions are relatively rare, and this variable includes Level III admission, both of which are a step down from full hospital-based transactions (see the last three columns of Tables 10 and 11).

Figure 1. Logistic Regression Results
(dependent variable is within FY engagement in an outpatient substance abuse treatment service Level I, II, OMT, buprenorphine, or disulfiram)

FY 2013	FY 2014
	

Conclusion

Main Findings

This study used three state-maintained health care databases to estimate the prevalence of opioid abuse/dependence and treatment in Baltimore City for two recent years. The three data sets jointly reveal that, as of June 30, 2014, there were 24,887 persons in Baltimore City with some record of opioid-related pathology or treatment. Because of limits on the information entered in these databases, only 3,487 of these individuals were specifically identified as heroin users, even as the actual rates of heroin are known to be higher than the 14 percent this number implies. Within the SMART data reporting system, which has fields capturing the specific substance of abuse, 85 to 88 percent of those with apparent OUDs had been using heroin at the time of program admission (Table 5). Applying the 85 percent figure to our calculated OUD population (0.85*24,887) yields an estimate of 21,153 heroin users in Baltimore City, a figure slightly above the number (18,916) that the data group estimated for the Baltimore mayor's Heroin Treatment and Prevention Task Force report. Moreover, reducing the estimate proffered here to account for possible overlaps between the HSCRC and SMART systems (Table 4 on page 12 for non-Medicaid counts in FY 2014) yields a Baltimore City estimate of 19,624 (21,153 – 1,529), which is even closer to the Task Force estimates.

This study further found that 59 percent of the population identified as having OUD was engaged in at least one form of desirable (i.e., non-ED and non-inpatient) community-based treatment at least once during the year. Such treatment ranged from medication-assisted therapy (mainly buprenorphine or methadone) to intensive outpatient program (IOP) placement. While this treatment rate demonstrates the likely existence of a considerable treatment gap of 41 percent, it is further reflective of high treatment rates in Baltimore City compared to other regions. One recent study, for example, reviewed national survey data and observed treatment rates of only 21 percent (Saloner & Karthikeyan, 2015), and the New York City based study that partly inspired this work reported treatment rates of only 23 to 33 percent (McNeely et al., 2012). The definition of treatment in both of these other studies is comparable to the one employed here, but the population (i.e., the denominator of the treatment prevalence calculation) of those studies is certainly broader because they were population surveys, whereas the current study uses treatment databases exclusively. Finally, the 59 percent treatment rate proffered here is a rate in which the numerator is a low threshold of just one day of treatment even if the need for treatment was much greater than that single day. The distributions in Tables 3 and 5 show that treatment durations were typically well below 365 days of coverage despite the fact that OUDs are known to be chronic conditions that require months to years of maintenance care (Lin et al., 2015).

Regarding correlates to treatment, the multiple regression models presented here reveal associations that may be of importance to policymakers trying to increase the engagement of maintenance-level opioid abuse/dependence treatment. Specifically, these regressions show that females, Whites, adults >26, Medicaid enrollees, and persons without same-year crisis (ED or inpatient) services use who have OUDs are generally more likely to engage in outpatient

maintenance services than other OUD subgroups. These finding are limited by marginal statistical fits and by the potential for biased results secondary to the omission of variables that are correlated both to our covariates and our outcome measure (treatment duration, illness severity, living situation, education, income, etc.).

Limitations

The main limitation of this study is that it is based on *treatment* databases rather than a more inclusive population survey. This means that any persons with OUDs (including any heroin users) not overlapping with the Medicaid, SMART, or HSCRC treatment systems would not be captured by Hilltop's review. The Medicaid database is limited to persons who are among the neediest members of the U.S. citizenry or legal immigrants. Similarly, the HSCRC database captures users of any health care services (substance use or otherwise), but it is more inclusive than the Medicaid data in one way and less so in another. The HSCRC database is more inclusive than the Medicaid database because it includes data on persons with all types of medical insurance coverage, not just Medicaid. So, this would include Medicare, private pay, other forms of coverage, or the absence of any health insurance. The HSCRC data, however, are less inclusive than the Medicaid data because they are constrained to regulated hospital-based services (i.e., inpatient, ED, and outpatient service clinics at hospitals). Because much medical care is delivered in free-standing venues not affiliated with a regulated hospital, the HSCRC database thus misses much substance use care, including outpatient buprenorphine prescriptions and methadone clinic visits. Finally, the SMART data is an all-payer record of transactions are like the HSCRC, although the SMART data are greatly limited to only those providers who accept at least some public support for their addiction-specific treatment efforts.

Accordingly, because there are members of the population who have an opioid problem but are not seeking treatment for that problem and are not disclosing that issue to the medical care providers they do see, Hilltop's analysis is not sensitive to those hidden cases. These errors of omission might occur for homeless persons, among persons who are institutionalized or incarcerated, or among persons whose singular medical care venue is in the Veterans Administration (VA) system. The magnitude of these omissions has yet to be considered in conjunction with this work. Data from New York and Baltimore indicate that including homeless persons adds about 5 percent to the prevalence estimator (City of Baltimore, Baltimore City Health Department, & BHSB, 2015), while including incarcerated populations adds about 15 percent (McNeely et al., 2012).

A second limitation to this work is that the HSCRC IDs do not include SSN and are only unique within each hospital year. As such, our aggregate estimates may double-count persons who use multiple hospitals or who use HSCRC and SMART or MMIS2 recorded services. We have made adjustments for this limitation by discarding from the aggregate tally all HSCRC records in which Medicaid is the payer. However, redundant counts may yet result if the HSCRC payer entry is inaccurate, or in a maximum of 10 percent of the cases in which Medicare, privately insured, and uninsured persons may be entered in both the SMART and HSCRC systems. Future

work in this area will likely benefit from a standardized ID for each patient that is applicable to both the HSCRC and the public treatment databases referred to here, perhaps using the Chesapeake Regional Information System (CRISP) identifier (see https://crisphealth.org/).

A third limitation to this work pertains to the payer information from the SMART and HSCRC databases which, unlike the MMIS data, reflect expected—rather than adjudicated—payer. For this report, we have not estimated the accuracy of those payer fields because a claim-by-claim review would be required to obtain such an estimate.

Future Directions

This technical report commissioned by BHSB is designed to give policymakers in Baltimore City, and researchers interested in opioid treatment, baseline information about the magnitude of the OUDs and related treatment in the city. The work demonstrates that treatment databases generally agree with the survey estimates of approximately 24 to 25 thousand persons with opioid use disorders in Baltimore City as of June 2014. Additionally, the tabulations presented indicate that standard-level-of-care penetration is on the order of 59 percent of that population, though treatment day counts are well below full (i.e., 365 days per year) coverage. Finally, multiple regression modeling faintly (i.e., with cross-sectional models) indicates that the following factors increase one's risk of not obtaining standard opioid treatment: 12-26 years old, Black, neither Medicaid nor private insurance, ED admission for an OUD, and an opioid overdose event. These sub-populations should accordingly be of special interest for surveillance and intervention activities moving forward as Baltimore works to address a drug overdose death "epidemic" that is now on par with the height of the AIDS epidemic of the late 1980s (Park & Block, 2016).

References

Abrams, M. T., Kim, S. O., & Miller, J. M. (2012). *Subgroups of Medicaid clients with substance use disorders*. Retrieved from http://www.hilltopinstitute.org/publication_view.cfm?pubID=96&st=tbl_Presentations

Center for Behavioral Health Statistics and Quality. (2015). *Behavioral health trends in the United States: Results from the 2014 National Survey on Drug Use and Health*. (HHS Publication No. SMA 15-4927, NSDUH Series H-50). Retrieved from http://www.samhsa.gov/data/

City of Baltimore, Baltimore City Health Department, & Behavioral Health System Baltimore. (2015, July). *Baltimore mayor's Heroin Treatment & Prevention Task Force report*. Retrieved from http://health.baltimorecity.gov/sites/default/files/Task%20force%20report_071015_Full.pdf

Hermann, P. (2015, May 18). After Baltimore riots, killings pile up largely under the radar. *The Washington Post*.

Hosmer, D. W., & Lemeshow, S. (1989). *Applied logistic regression*. New York: Wiley.

Jones, C. M., Logan, J., Gladden, M., & Bohm, M. K. (2015). Vital signs: Demographic and substance use trends among heroin users — United States, 2002–2013. *Morbidity and Mortality Weekly Report, 64*(26), 719-725.

Kristof, N. (2015, June 7). Heroin doesn't have to be a killer: Commentary. *New York Times*.

Lipari, R. N., & Hughes, A. (2015). *The NSDUH report: Trends in heroin use in the United States: 2002 to 2013*. Rockville, MD: Substance Abuse and Mental Health Services Administration, Center for Behavioral Health Statistics and Quality.

Lin, C. K., Hung, C. C., Peng, C. Y., Chao, E., & Lee, T. S. (2015). Factors associated with methadone treatment duration: a Cox regression analysis. *PLoS One, 10*(4), e0123687.

Maryland Behavioral Health Administration. (2015). *The spreading use of heroin in Maryland* (Data Short Volume 4, Issue 2).

Maryland Behavioral Health Administration Department of Health and Mental Hygiene. (2014). *Outlook and outcomes in substance-related disorder treatment FY 14*. Retrieved from http://bha.dhmh.maryland.gov/Documents/Publications/FY14OandO_6edited2.pdf

Maryland Department of Health and Mental Hygiene. (2011). *Billing procedures for the following community-based substance abuse services: Substance abuse assessment, individual outpatient therapy, group outpatient therapy, intensive outpatient and methadone maintenance*. Retrieved from

https://mmcp.dhmh.maryland.gov/healthchoice/Documents/SA%20CMS%201500%20Billing%20Instructions%202.15.12.pdf

Maryland Health Services Cost Review Commission. (2016). *HSCRC overview*. Retrieved from http://www.hscrc.state.md.us/aboutHSCRC.cfm

McNeely, J., Gourevitch, M. N., Paone, D., Shah, S., Wright, S., & Heller, D. (2012). Estimating the prevalence of illicit opioid use in New York City using multiple data sources. *BMC Public Health, 12*, 443.

Office of the Assistant Secretary for Planning and Evaluation in the Department of Health and Human Services. (2015, March 26). *Issue brief: Opioid abuse in the U.S. and HHS actions to address opioid-drug related overdoses and deaths*. Retrieved from https://aspe.hhs.gov/sites/default/files/pdf/107956/ib_OpioidInitiative.pdf

Oppel, R. A. (2015, June 13). Looking for gains in policing, Baltimore finds fewer police. *New York Times*.

Park, H., & Block, M. (2016, January 16). How the epidemic of drug overdose deaths ripples across America. *New York Times*.

Saloner, B., & Karthikeyan, S. (2015). Changes in substance abuse treatment use among individuals with opioid use disorders in the United States, 2004-2013. *JAMA, 314*(14), 1515-1517.

Schwartz, R. P., Gryczynski, J., O'Grady, K. E., Sharfstein, J. M., Warren, G., Olsen, Y., et al. (2013, May). Opioid agonist treatments and heroin overdose deaths in Baltimore, Maryland, 1995–2009. *Am J Public Health, 103*(5), 917-922.

Studenmund, A. H. (2006). *Using econometrics: A practical guide* (Fifth ed.). Boston: Pearson Addison Wesley.

Substance Abuse and Mental Health Services Administration. (2014). *Results from the 2013 National Survey on Drug Use and Health: Summary of national findings*. NSDUH series H-48, HHS Publication No. (SMA) 14-4863. Rockville, MD.

Tarter, R. E. (2002). Etiology of adolescent substance abuse: A developmental perspective. *Am J Addict, 11*(3), 171-191. doi: 10.1080/10550490290087965

Tucker, S. J. (2014). *Substance use disorder transmittal no. 9: Medicaid billing and enrollment for provider type 32*. Retrieved from http://maryland.valueoptions.com/provider/alerts/2014/121914-Medicaid-Billing-Enrollment-Provider-Type32.pdf

University of Maryland Institute for Government Service and Research. (2016). *About SMART*. Retrieved from http://www.igsr.umd.edu/SMART/about.php

Appendix A. ICD-9 Codes Related to Opioid Use, Abuse, and Dependence

ICD-9 Code	Diagnosis
304.00	Opioid type dependence
304.01	Opioid type dependence, continuous
304.02	Opioid type dependence, episodic
304.03	Opioid type dependence, in remission
304.70	Combinations of opioid type drug with any other drug dependence
304.71	Combinations of opioid type drug with any other drug dependence, continuous
304.72	Combinations of opioid type drug with any other drug dependence, episodic
304.73	Combinations of opioid type drug with any other drug dependence, in remission
305.50	Nondependent opioid abuse
305.51	Opioid abuse, continuous
305.52	Opioid abuse, episodic
305.53	Opioid abuse, in remission
965.00	Poisoning by opiates and related narcotics
965.01	Poisoning by heroin
965.02	Poisoning by methadone
965.09	Poisoning--other opiates and related narcotics
970.1	Poisoning by opiate antagonists
IDC-9 E-Code	
E850.0	Accidental poisoning by heroin
E850.1	Accidental poisoning by methadone
E850.2	Accidental poisoning by other opiates and related narcotics
CPT or HCPCS code	**Service**
H0020	Alcohol and/or drug services; methadone administration or service

Appendix B. Revenue and Procedure Codes Related to Substance Abuse Treatment

	Revenue Codes	Procedure Codes	Definition(s)
Inpatient			
	0116		Detoxification (private bed)
	0126		Detoxification (semi-private bed)
	0136		Detoxification (3-4 beds)
	0156		Detoxification/ward
	0944		Drug Rehabilitation
IOP	0905		Intensive Outpatient Psychiatric
	0906		Intensive Outpatient Services (Chemical Dependency)
	0912		Partial Hospitalization (Less Intensive)
	0913		Partial Hospitalization (Intensive)
		H0015	Alcohol and/or drug services (intensive outpatient)
		G0411	Interactive group psychotherapy in a partial hospitalization setting
		H0035	Mental health partial hospitalization
		H2001	Rehabilitation program
		H2012	Behavioral health day treatment
		H0037	Community psychiatric supportive treatment program
		H0039	Assertive community treatment (per 15 minutes)
		H0040	Assertive community treatment (per diem)
Other Outpatient	0900		General behavioral health treatments
	0911		Behavioral health rehabilitation
	0914		Behavioral health (individual)
	0915		Behavioral health (group)
	0916		Behavioral health (family therapy)
	0918		Behavioral health testing
	0919		Other behavioral health
	0944		Drug rehabilitation
		H0001	Alcohol/drug assessment
		H0004	Behavioral health counseling and therapy
		H0005	Alcohol/drug group counseling
		H0014	Alcohol and/or drug services; ambulatory detoxification
ED	0450		ED (General classification)
	0451		EMTALA
	0452		ER beyond EMTALA
	0456		Urgent Care
	0459		Other ED

The Hilltop Institute

University of Maryland, Baltimore County
Sondheim Hall, 3rd Floor
1000 Hilltop Circle
Baltimore, MD 21250
410-455-6854
www.hilltopinstitute.org