

Opioid Exposure in Maryland Hospitals

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Acknowledgments

This report is the third in a series exploring whether the expansion of buprenorphine is a cost-effective strategy for battling opioid addiction. This report was prepared by the Center for Health Program Development and Management (Center) at the University of Maryland, Baltimore County (www.chpdm.org) under the sponsorship of the Annie E. Casey Foundation and the Baltimore City Health Department. The data utilized in this report was made available with the permission and cooperation of the Maryland Department of Health and Mental Hygiene and the Maryland Health Services Cost Review Commission.



Introduction

This report is an extension of two recent reports about the costs and benefits associated with expanding buprenorphine treatment as an alternative therapy for heroin addiction. The first report in this series was a simple case-control study. It revealed that opioid addicts on methadone consume far fewer Medicaid resources than addicts who go untreated (Center for Health Program Development and Management, 2007a). The implication of this finding is that treatment works and is cost-effective because downstream medical expenditures such as emergency room (ER) visits and inpatient stays are substantially reduced. The second report was a literature review of the individual and relative cost-effectiveness of methadone and buprenorphine as treatments for heroin addiction (Center for Health Program Development and Management, 2007b). That literature review found that methadone is generally more cost-effective, but that buprenorphine shows considerable and economically viable promise as an alternative for those who are not benefiting from methadone treatment due to limitations in the distribution system.

This report extends the empirical work completed earlier by identifying data outside of the Medicaid system. This extension is important because Medicaid accounts for only about 20 percent of all national methadone funding (Stoller & Bigelow, 2006). In fact, the vast majority of methadone funding comes from local, state, and federal grants or earmarks; and from consumers themselves who pay out-of-pocket for 17 percent of all methadone services used in the United States (Stoller & Bigelow, 2006). Because of these various payment sources for treatment related to heroin addiction, a thorough review of public costs and benefits associated with a heroin treatment program expansion should consider all payer data, especially that which pertains to publicly financed programs serving Medicaid populations or those who are under- or un-insured. One source of such data is the Maryland Health Services Cost Review Commission (HSCRC), which compiles data for all payers for hospital-based services.

For over 30 years, the HSCRC has set payment rates for Maryland hospitals. As part of this state-mandated activity, Maryland hospitals report extensive information on all services, regardless of the patient's source of payment. The HSCRC databases from calendar year (CY) 2005 alone correspond to more than 3.5 million ambulatory or inpatient transactions that tally to expenditures greater than \$9 billion.

HSCRC data contains both inpatient and outpatient transactional information that is similar, albeit not identical to, Medicaid claims data. One substantial component of the Medicaid data that is not present in the HSCRC data are medical transactions that occur outside of the hospital, such as in stand-alone physician or other practitioner offices. Despite that limitation, HSCRC data may be used to review cost and other utilization data associated with specific diagnostic and procedure codes. However, with regard to studying opioid-addicted populations, the HSCRC data has two limitations when compared to Medicaid data.

First, HSCRC data does not include any unique patient ID number. This means that if the same person is hospitalized or visits the ER more than once in the same year, it is not possible to



match these separate care transactions under a single patient record.¹ As such, and for simplicity, the numbers reported here correspond to cases (events) rather than individual people, and it is likely that in some instances, multiple cases correspond to the same person—especially for those with chronic illness, which includes heroin addiction (Amato et al., 2005). Second, the HSCRC data, unlike Medicaid data, does not include many outpatient encounters such as methadone clinic transactions (visits). As a result, the site of a great deal of treatment for heroin dependence is totally omitted from the HSCRC data, especially these unique clinics that are idiosyncratic and central to the methadone delivery system in the United States (Saxon & McCarty, 2005). Accordingly, it is not possible to carry out a case-control study such as the earlier Medicaid analysis (Center for Health Program Development and Management, 2007a). In that previous Medicaid report, the case-definition (those being treated) was tied directly to methadone clinic billing. The HSCRC data contains no such billing records. Therefore, this HSCRC report defines cases simply as those with opioid diagnoses, without the ability to flag treated versus untreated cases.

Prevalence of Opioid-Associated Diagnoses in the HSCRC Data

Table 1 on the next page is a test of the completeness of the opioid diagnoses in the HSCRC data using Medicaid payments as a control. Because the Medicaid payment data is generally accepted to be complete, comparing Medicaid-paid hospital transactions (from the Medicaid data) against these reported transactions (from the HSCRC data) is a test of the reliability of the HSCRC data. Should the HSCRC data prove to be reasonably complete for Medicaid transactions, it is reasonable to assume the HSCRC data is similarly complete for non-Medicaid payment sources.

Therefore, **Table 1** compares the aggregate count of Medicaid transactions (for the entire state of Maryland) against the analogous HSCRC transaction counts where Medicaid was the primary payer. It furthermore divides opioid-associated transactions into: 1) all opioid use including dependence, abuse, remission, and associated conditions, and 2) opioid dependence (OD) only. The latter category is a subset of the former, and ODs are individuals with the most severe disease. **Table 1** reflects reasonable correspondence between Medicaid data obtained from the Medicaid Management Information System (MMIS) and HSCRC data, despite the fact that they are coalesced and maintained by separate entities for different purposes,² and the fact that collection and processing procedures for these two systems diverge from the point of the actual medical encounter between patient and care provider. Because the correspondence is always 78 percent or higher, we are confident that the HSCRC is reasonably complete for capturing opioid-treatment based hospital transactions.

¹ One can approximate a unique ID with variables such as date of birth plus race, etc., but these make-shift IDs pose considerable risk of collapsing two different people with the same birth date together as one.

² Medicaid agency using MMIS data to track all medical managed care claims for the purposes of capitated rate-setting, and all fee-for-service claims for the purposes billing and reimbursement; whereas the HSCRC tracks claims for rate-setting and only as it pertains to hospital-based medical transactions.



Table 1. Maryland hospital transactions involving opioid diagnoses where Medicaid is the primary payer. Constrained to individuals aged 13-60.

Data Source/ Region	CY 2003		CY 2004		CY 2005	
	All Opioid Diagnoses ^c	Opioid Dependence Only	All Opioid Diagnoses ^c	Opioid Dependence Only	All Opioid Diagnoses ^c	Opioid Dependence Only
MMIS ^a	9,443	5,942	10,424	6,500	13,132	8,855
HSCRC ^b	11,923	6,310	13,349	7,254	13,866	7,656
Percent difference	21%	6%	22%	10%	5%	-16%

^a Medicaid administrative data

^b Maryland Health Services Cost Review Commission (HSCRC).

^c Includes: dependents, those in remission, and those treated for opioid-induced illness (e.g., intoxication, psychoses).

Purpose

Ultimately, this work aims to offer information to assist Baltimore City with developing cost-benefit or cost-effectiveness analyses regarding the potential expansion of buprenorphine treatment for heroin addicts in their region. As noted in the introduction, HSCRC data complements and expands Medicaid data by adding data from other payers, as well as the uninsured who utilize hospital services that fall within the ambit of HSCRC's oversight. Additionally, other diagnoses or co-morbid diagnoses (Fingerhood, 2006) will be reviewed in this report to offer epidemiologic insight into the increased costs that are associated with opioid abuse, and to consider these diagnostic labels as markers for untreated opioid addicts.

Methods

HSCRC inpatient, outpatient, and outpatient surgical procedure files were reviewed for CYs 2003, 2004, and 2005. Transaction level data was divided into two groups: opioid users and all other patients. This review includes all opioid users, rather than only the sub-population of opioid dependents, in order to broadly consider all hospital costs that may be associated with inappropriate opiate use.

Cross-tabulations by group, year, and geographic region (Baltimore City and the rest of the state) were created to summarize basic demographic information and insurance status. Additionally, similar cross-tabulations were created to summarize the following service utilization variables:

%ERInpt: Percent of ER visits leading to an inpatient admission.

%ERout: Percent of ambulatory ER visits.

%Inpt: Percent of Inpatient stays.

InptLOS: Length of those inpatient stays (mean number of days).



Charge: Charge for claims (mean dollars).

Percent of the following 10 diagnoses: 1) Abscesses, 2) Hepatitis B or C, 3) HIV, 4) Respiratory problems³, 5) Tuberculosis, 6) Consciousness (e.g., coma), 7) Cardiac problems, 8) Endocarditis, 9) Depression, and 10) Psychosis.

The above listed 10 diagnoses were selected for review based on references in the literature (Fingerhood, 2006) and on the previous Medicaid study that enumerated the most frequent comorbidities observed in both the treated and untreated opioid dependent population (Center for Health Program Development and Management, 2007a).

Findings/Brief Comments

Table 2 presents basic demographic data corresponding to “all opioid” and to all other users of Maryland hospitals in the age range of 13 to 60 years, and without respect to payer. The number of opioid user transactions in Baltimore City and the rest of the state were 19,067 and 16,664, respectively, meaning Baltimore City had 50 percent more than all of Maryland’s opioid user transactions. This contrasts with Baltimore City’s lower rate of overall hospital events, in which the number of other uses (i.e., treatments not associated with opioid diagnoses) of hospitals in Baltimore City was over 500,000, and in the rest of the state it exceeded 1.7 million. Clearly these numbers demonstrate that the problem of opioid-associated hospital use is concentrated in Baltimore City. The demographic categories summarized are gender (i.e., percent of females) and race (percent of Blacks and Caucasians).

Table 2. CY 2005 Demographic summary information based on HSCRC^a data. Constrained to individuals aged 13-60. Percentiles reported.

	Baltimore City		Rest of State	
	All Opioid Diagnoses (n=19,067)	Other HSCRC ^b (n=505,187)	All Opioid Diagnoses (n=16,664)	Other HSCRC ^b (n=1,712,440)
%Females	43	58	42	59
%Black	75	76	23	31
%Caucasian	24	21	75	61

^a Maryland Health Services Cost Review Commission (HSCRC).

^b All hospital claims in Maryland without any diagnoses suggesting opiate use.

Table 2 demonstrates that the opioid transactions are skewed toward males whereas the other HSCRC population is skewed toward females. It is not immediately clear why this is the case, but it may be related to relative pregnancy rates, an inference that could be confirmed with future analyses.

³ E.g., pneumonia, bronchitis, asthma, acute respiratory failure, apnea, and shortness of breath.



Table 3 provides a breakdown of the primary payment source for each hospital transaction. The percentiles listed aim to encapsulate nearly all of the public and private revenue streams germane to methadone treatment.

Table 3. CY 2005 Primary payment source of all Maryland Hospital Claims based on HSCRC^a data. Constrained to individuals aged 13-60. Percentiles reported.

Primary Payer	Baltimore City		Rest of State	
	All Opioid Diagnoses (n=19,067)	Other HSCRC ^b (n=505,187)	All Opioid Diagnoses (n=16,664)	Other HSCRC ^b (n=1,712,440)
%Medicaid	48	32	28	13
%Medicare	10	9	9	5
%Private	6	33	23	61
%Uninsured	35	26	38	18
%Unknown	1	0	2	3

^a Maryland Health Services Cost Review Commission (HSCRC).

^b All hospital claims in Maryland without any diagnoses suggesting opiate use.

Data in **Table 3** demonstrate that the opioid claims are, as expected, tied proportionally to individuals who are either uninsured or on Medicaid (Stoller & Bigelow, 2006). These figures, however, also demonstrate that private coverage is quite high in the rest of the state compared to Baltimore City, for opioid-associated claims and otherwise. Specifically, the private payment rate in the rest of the state is nearly double (61 percent) that of Baltimore City (33 percent). Overall, these figures show that public payers shoulder a much higher burden for opioid use in Baltimore City than elsewhere in the state.

Table 4 provides a summary of utilization variables including rates of ER use, inpatient length of stays, and mean costs for each transaction. The first three rows are percentiles, whereas the mean length of stay (LOS) is in days, and mean charges are in dollars. It is important to note that inpatient cases are broken into admissions via the ER (ERinpt), and those where the admission was by some other route. The ER admission path may well represent either avoidable inpatient admissions or more severe medical incidents, whereas the latter is more likely to be related to planned medical procedures.



Table 4. CY 2005 Utilization variables based on HSCRC^a data. Constrained to individuals aged 13-60. Numbers are percentiles, mean days, or dollars.

	Baltimore City		Rest of State	
	All Opioid Diagnoses (n=19,067)	Other HSCRC ^b (n=505,187)	All Opioid Diagnoses (n=16,664)	Other HSCRC ^b (n=1,712,440)
%ERinpt ^c	48	8	44	9
%ERout ^d	23	57	37	60
%Inpatient ^e	24	4	20	7
LOS ^f (mean days)	4.4	4.0	4.4	3.5
Charge ^g (mean±SD \$)	6,706±12,520	1,830±7,243	5,521±13,288	2,078±7,481
Total charges (\$)	61,138,602	924,492,210	27,952,823	3,558,450,320

^a Maryland Health Services Cost Review Commission (HSCRC).

^b All hospital claims in Maryland without any diagnoses suggesting opiate use.

^c ER visits leading directly to inpatient admissions.

^d Ambulatory ER visits.

^e Percentage with inpatient claims where the admission was *not* through the ER.

^f Mean length of stay per inpatient claim.

^g Total mean charge per claim (transaction).

Table 4 demonstrates a clear diagnostic correlate by showing that inpatient and ER rates are markedly higher in the opioid-using group compared to the general population. Similarly, inpatient rates (regardless of the mode of admission), and total case-based charges (for any service: inpatient, ER, or otherwise) were both markedly higher in the opioid groups. Previous Medicaid analysis identified much larger annual expenditures for opioid dependents ranging from \$15,000 to \$21,000 per year (Center for Health Program Development and Management, 2007a). The opioid charges presented in **Table 4** are likely well below those Medicaid figures for at least the following two reasons: one, because the data here represents claims and not individual person-level costs aggregated for the entire year; and two, because the current data also excludes all non-hospital clinical transactions and professional fees. Still, despite these differences, **Table 4** presents evidence that supports the general hypothesis that illicit opioid use is associated with far higher medical costs than those experienced by the general population.

Table 4 also dramatically reinforces that the financial impact of opioid use is much higher in Baltimore City than in the rest of the state. The total charges associated with opioid diagnoses in Baltimore City exceed \$61 million, which is more than twice the amount in the rest of the state combined (just under \$28 million). This is not true of all other diagnoses combined, where the total charges in Baltimore City (about \$925 million) are 26 percent of the rest of the state combined (about \$3.56 billion).

There are two final points about the above table. First, ambulatory ER percentiles (%ERout) actually are lower in the opioid-using group, indicating that ER visits tied to heroin use typically result in an inpatient admission. And second, lengths of stay are all comparable across the four columns of **Table 4**, indicating that the charge differences are tied to treatment intensity rather than treatment duration issues.



Table 5 below provides frequencies of diagnoses that are typical co-morbidities to heroin addiction. Rates presented can be thought of as representing the proportion of Maryland hospital claims that are associated with each indicated diagnosis cluster.

Table 5. CY 2005 Co-morbidities corresponding to of all Maryland Hospital Claims based on HSCRC^a data. Constrained to individuals aged 13-60. Numbers are percentiles.

	Baltimore City		Rest of State	
	All Opioid Diagnoses (n=19,067)	Other HSCRC ^b (n=505,187)	All Opioid Diagnoses (n=16,664)	Other HSCRC ^b (n=1,712,440)
%Abscess	10	3.1	8.0	2.1
%Viral Hep	28	2.0	17	1.0
%HIV	11	3.0	2.8	0.42
%Respiratory	23	11	16	8.9
%Tuberculosis	0.03	2x10 ⁻³	0.000	10 ⁻³
%Consciousness ^c	1.5	0.65	1.7	0.91
%Cardiac	1.2	0.30	0.56	0.20
%Endocarditis	1.2	0.04	0.56	0.02
%Depress	14	2.6	15	3
%Psychosis	16	2.1	23	2.1

^a Maryland Health Services Cost Review Commission (HSCRC).

^b All hospital claims in Maryland without any diagnoses suggesting opiate use.

^c E.g., coma, vegetative state, etc.

As predicted, **Table 5** shows that opioid users often have higher proportions of the listed co-morbidities. Given these results, it may not be necessary to use such diagnostic flags to find otherwise undiagnosed addiction cases because it seems that these data already are flagged with opioid diagnostic labels, and fairly robustly so. It is not, for example, the case that there are huge rates of infections in the “Other HSCRC” population. Still, sensitivity analyses of cost-benefit calculations will consider the possibility that a proportion of the abscess or HIV cases in the “Other HSCRC” columns are at high risk for addiction. After all, the 3.1 percent of claims labeled with abscesses in the city corresponds to $0.031 \times 505,187 = 15,661$ transactions. Additionally, the rates of these co-morbidities, and the individuals that they flag, could point to those who are experiencing “unmet need” for drug treatment.

Finally, careful review of data from CYs 2003 and 2004 reveals very similar patterns across all three years reviewed, and across all demographic, insurance coverage, utilization, and co-morbidity variables.



Conclusions

The information presented here extends previous efforts using Medicaid data by analyzing all payer hospital claims and expenditures for those who abuse opioids. These numbers demonstrate that the social burden of opioid use is far higher in Baltimore City than the rest of the state, both in terms of the use of hospitals related to opioid-associated conditions, and in the absence of private financing for those hospital stays. These numbers can help us advance our cost-benefit analysis with empirical data regarding the burden of opioid addiction in the full populations of Baltimore City and across Maryland. Caution, however, must be used when considering the opioid versus non-opioid utilization data presented in this report because it combines information from those receiving drug treatment with those who are not. Therefore, the numbers presented will naturally underestimate any true differences between those in the general population and those who are active, untreated substance abusers.

The co-morbidity frequencies presented in **Figure 5** must be considered cautiously as they represent counts which are case- rather than person-based. Still, if taken at face value, they clearly demonstrate that a disproportionate level of disease burden falls on populations with diagnostic indicators in the opioid dependence and illicit use domains. For example, in the conjunction with an opioid-associated diagnosis, the risk of viral hepatitis or endocarditis is 14 to 30 times higher than in the general population.

The dollar amounts reported in the final row of **Table 4** are more straight-forward to interpret as they represent unique enumeration of medical utilization. These data indicate that eradication of the morbidity associated with opioid diagnoses has the potential to save nearly \$100 million statewide (>\$60 million in Baltimore City) in hospital-based charges alone. This inference is, on one hand, an overestimate because it targets the lofty goal of complete eradication of all morbidity associated to opioid abuse. On the other hand, it represents an underestimate because it assumes that all opioid addiction and abuse is actually reflected in the HSCRC medical records—an assumption that is likely incorrect because of social stigma that may inhibit such reporting, and because the HSCRC does not track all non-hospital based outpatient services, such as the treatment delivered by methadone clinics.



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