An Evaluation of Whether Medical Savings are Associated with Expanding Opioid Maintenance Therapy for Heroin Addiction in Baltimore City

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This is the final report in a series exploring whether the expansion of buprenorphine as a strategy for battling opioid addiction is cost-effective. It was prepared by the Center for Health Program Development and Management (www.chpdm.org) with sponsorship from the Annie E. Casey Foundation under a grant to the Baltimore City Health Department.

Introduction/Background

This report is a summary and synthesis of four previous reports regarding methadone and buprenorphine treatments for opioid (*e.g.*, heroin) dependence (Center for Health Program Development and Management, 2007a, 2007b, 2007c, 2007d). These are principally based on administrative data collected by the state of Maryland to manage and inform its Medicaid and all-payer hospital rate-setting systems. The ultimate question addressed in these reports is simple: is the treatment of heroin addiction associated with reductions in other medical utilization and costs?

The burden of heroin addiction has been described previously by many authors. The lifetime prevalence is on the order of 1 percent of the United States population (Crum, 2006), and each year more than one million individuals experience the serious and typically chronic problems associated with such addiction (Stoller & Bigelow, 2006). The clinical definition for drug dependence is characterized by 1) significant impairment involving the need for ever-increasing amounts of a drug, 2) detrimental physiologic effects if those escalating amounts are not consumed, 3) a persistent desire to quit coupled with the inability to do so, and 4) serious damage to physical and behavioral functioning resulting from drug use (American Psychiatric Association, 2000). The National Institute on Drug Abuse describes heroin abuse specifically in the following way:

> Once they are addicted, the heroin abuser's primary purpose in life becomes seeking and using drugs. The drugs literally change their brains and their behavior (National Institute on Drug Abuse, 2005).

Heroin addiction is furthermore correlated with intravenous drug use, which places one at substantially increased risk for infectious diseases (*e.g.*, HIV and hepatitis), increased levels of criminal behavior (Healey *et al.*, 2003), and decreased levels of legal employment. In total, such negative effects were estimated to cost the United States economy more than $20 billion annually, and this estimate reflects 1996 expenditures (Mark *et al.*, 2001). Personal costs are also high and they impact youths as well as adults. Recent Congressional Testimony included a first-person account of the downward cycle of heroin dependence that transformed a 15-year-old girl from being a straight-A student athlete to stealing from her family and eventually living on the streets (United States Congress, Senate Caucus on International Narcotics Control, 2000).

Fortunately, there are effective treatments for heroin addiction. Principal among them is the opioid agonist methadone. Validated in the 1960s as a therapy for heroin addiction, there has long since been a broad consensus in the addiction field that methadone is a cost-effective treatment for heroin dependence, and one that furthermore eases much human suffering surrounding the use and trade of illicit opiates. A National Institutes of Health (NIH) Consensus Development Panel (arguably the nation's "supreme court" for pressing biomedical issues) wrote this in its 1997 decision regarding the problem of heroin use in our society:

> Opiate dependence is a brain-related medical disorder that can be effectively treated with significant benefits for the patient and society, and society must make a commitment to offer effective treatment for opiate dependence to all who need it….The unnecessary regulations of methadone maintenance therapy and other long-acting opiate agonist treatment programs should be reduced, and coverage for these programs should be a required benefit in public and private insurance programs.[1]

Despite the fact that this statement was issued more than ten years ago and methadone treatment remains a gold standard of care that provides substantial harm reduction to addicts and to society at large, surveillance data yet indicates that less than 25 percent of those who need such therapy actually receive it (Saxon & McCarty, 2005). Data from Baltimore City is demonstrative in that regard.

Phone-based survey estimates from the mid-1990s indicate that well over 30,000 Baltimore City residents need treatment for heroin addiction (Drug Strategies, 2000; Reuter *et al.*, 1998) while municipal documents from as recent as 2005 report there were only about 4,200 public methadone slots spread across 14 sites (Baltimore Substance Abuse Systems & Baltimore City Health Department, 2006)[2]. Other data collected annually by Baltimore City conservatively reported that average waiting time for a methadone treatment slot is 18 days, and it has been at or above that level for many years previously (Baltimore City Health Department, 2006). The consequences of such treatment availability gaps can be quite severe. Recent clinical trials data from Baltimore, for example, found that of 120 individuals placed on waiting lists, only 27.5 percent enrolled in methadone treatment programs over the subsequent ten months (Schwartz *et al.*, 2006; Schwartz *et al.*, 2007). Equally telling, a calendar year 2000 phone survey of ten of the city's methadone clinics[3] found that these facilities received approximately 500 calls per week for only 50 available slots. A separate survey of 236 addicts (identified in Baltimore's most intensive drug market locations) who subsequently tried to get treatment showed that only 84 of them (36 percent) were able to find treatment slots (Drug Strategies, 2000). Overall, these numbers indicate that Baltimore City treatment rates for heroin abuse range from 10 to 36—a range that overlaps with and exceeds national estimates (Drug Strategies, 2000; Saxon & McCarty, 2005).

One solution to this problem would be to expand treatment by increasing the size of—or building more—methadone clinics. For a variety of reasons, this solution is not easy to achieve. (Bailes & Lowery, 2006; Saxon & McCarty, 2005; Janis, 2004). Accordingly, alternative approaches also should be considered, and high among them is the delivery of buprenorphine: a drug with less

[1] consensus.nih.gov/1997/1998TreatOpiateAddiction108html.htm., accessed 8/24/07.
[2] Personal communication with Vanessa Kuhn, Baltimore Substance Abuse Systems, Inc. Beyond those 14, the Substance Abuse and Mental Health Services Administration reveals only 7 private methadone clinics within a 5 mile radius of downtown Baltimore, and 5 of those clinics do not have a sliding fee payment scale (dasis3.samhsa.gov, accessed 8/17/07). The capacity of these private clinics was not quantified.
[3] As of early May 2007 there were 19-24 opioid maintenance clinics in the City of Baltimore per: www.bsasinc.org and http://maryland-adaa.org/resource/; accessed 5/1/07 and 5/2/07, respectively.

potency than methadone, but a potentially easier distribution mechanism. Accompanying the lower potency is lower abuse and overdose potential. Reducing such risk means buprenorphine can be prescribed and monitored by a physician in an outpatient setting, and subsequently self-administered using take-home doses instead of daily clinic visits requiring observed medication dispensing procedures (Fiellin & Strain, 2006; Sung & Conry, 2006).

The Baltimore City Health Department has worked to expand buprenorphine maintenance therapy in Baltimore City as one arm of its strategy to deal with the problem of heroin addiction (Baltimore City Health Department *et al.*, 2007). In 2004, the city installed a buprenorphine coordinator to help educate and train physicians interested in prescribing the drug, which was available at 16 programs citywide (Michalik, 2004). Still, because of physician knowledge and capacity restrictions and also because buprenorphine is approximately ten-fold more expensive per equivalent dose than methadone,[4] diffusion of the therapy is not as widespread as it could be, as indicated by the treatment gaps described above for opioid maintenance therapy (OMT). The expense of buprenorphine remains a concern for many policy makers, and this concern prompted the series of reports in this study.

This summary, along with the four studies leading up to it, considers the medical expenditures correlated to heroin treatment in Baltimore City so that such estimates may be used to consider the impact of expanding buprenorphine. Buprenorphine was not studied directly, except via a secondary source literature review, because the therapy is not yet widely prescribed in Medicaid (the principal data source for our work) (Center for Health Program Development and Management, 2007a, 2007b). All-payer hospital rate-setting data has also been utilized in this study, but that data did not include information about methadone clinics, nor about pharmaceutical use (Center for Health Program Development and Management, 2007c). As such, it also yielded no specific information regarding buprenorphine use; however, the all-payer data was used to consider the correlation between opioid addiction diagnoses and overall hospital costs.

Methods

This summary focuses on Baltimore City and aims to coalesce information about medical costs associated with heroin addiction and treatment. The data utilized in this study come from Medicaid and all hospital data in Baltimore, and from international data on the cost-effectiveness of such treatment in other venues.

Four studies were conducted to establish point estimates for Baltimore City. The first is a review of Medicaid data corresponding to all individuals demonstrating opioid dependence (ICD-9 code =304.xx) and then stratifying individuals into those with methadone clinic exposure, and those with none. This comparison was done over three consecutive years (2003 thru 2005) (Center for

[4] Rosenheck and Kosten (2001) estimated the daily doses of buprenorphine or methadone at $4-8 per day versus $0.66 per day, respectively. Doran *et al* (2003) reported six month medication costs in Australia for these drugs to be $A37 and $A459, respectively. Finally, note that Rite Aid sells on-line 8/2mg Suboxone (buprenorphine/naloxone) at $159 for 30 tablets, a 30 day supply (www.drugstore.com, accessed 8/15/07).

Health Program Development and Management, 2007b). Second, a literature review was undertaken to consider other studies that quantified the cost-benefit or cost-effectiveness ratios corresponding to OMTs, specifically and especially for such studies that looked at methadone and buprenorphine (Center for Health Program Development and Management, 2007d). Third, a study was conducted looking at all hospital service data in Baltimore City, across payers, in order to consider per admission costs associated with any opioid misuse diagnoses (*e.g.*, dependence, abuse, overdose) and to compare those costs to admissions which did not have any opioid-linked diagnoses (Center for Health Program Development and Management, 2007c). Finally, drawing from the 2003 to 2005 Medicaid-eligible sample established in the first study, an assessment was made of the medical cost shifts that took place from pre-treatment to post-treatment for those individuals who began methadone treatment (Center for Health Program Development and Management, 2007a).

Results

The first report, hereafter referred to as the Medicaid "treated vs. untreated" study, revealed substantial fee-for-service (FFS) costs savings in Baltimore City corresponding to a treatment effect on the order of $9,000 (*i.e.*, treated individuals on average consumed $9,000 less than untreated individuals) (Center for Health Program Development and Management, 2007b). Follow-up multiple regression analysis, which adjusted for group differences in age, gender, Medicaid coverage group (TANF, SSI, or Duals), duration of methadone treatment, and number of managed care months, attenuated that FFS reduction such that, on average, treated individuals consumed $80 less for every week they stayed on methadone.[5] Similar multiple regression analyses confirmed that emergency room (ER) and inpatient utilization rates were also reduced in those individuals engaged in treatment. Specifically, fitting an analogous regression model to that described in footnote 3, each additional methadone week was significantly correlated with reductions in ER visits and inpatient days on the order of 0.030 and 0.051 per week, respectively, corresponding to potential annual reductions of 1.6 ER visits and 2.7 inpatient days (multiply by 52 weeks). Note that all of these summary and inferential statistics were conducted using data from individuals with continuous Medicaid enrollment, so there was some stability in the population under review.

The second study was a review of cost-benefit and cost-effectiveness literature on methadone and buprenorphine. No studies were found that looked at aggregate medical costs per se; instead, they reviewed estimations of total societal costs (for the cost-benefit studies) or costs associated with certain outcomes (for the cost-effectiveness studies). Across 13 studies that looked at such inputs and outcomes, 12 included buprenorphine either in comparison to, or as an equivalent alternative for, methadone. One study included data only about methadone. All 12 of the

[5] The multiple regressions had the general form: ffs dollars = *f* (gender, eligibility category, age, methadone weeks, HealthChoice months). The *adjusted*-R^2 = 0.20, and the *partial*-*t* and *p*-values for methadone weeks were highly significant (*-13, <0.0001*, respectively) as were the overall *F* and *p* (*181, <0.0001*) for the model which included 4,274 observations. Note that the regression model also excluded individuals who consumed more than $68,000 in the study year (2005) as they fell in the top 1 percent of such consumption. The SAS 9.1 for Windows *proc reg procedure* was used to carry out these calculations. No interaction effects were considered.

burprenorphine studies indicated favorable efficacy, effectiveness, or cost-effectiveness of the treatment agent, but in several cases methadone was found to be superior. This is consistent with previous comparative efficacy reviews (Strain, 2006). Select point estimates, especially those that are of use for prospective cost-estimations, are presented in **Table 1**.

Table 1. Point estimates from secondary sources regarding costs associated with opioid maintenance therapy. All estimates have been converted to US dollars (USD).

Description	**Estimate**	**Source**	**Notes**
12 month treatment costs with methadone or buprenorphine (2002 USD)	4,436 USD	Shanahan *et al.*, 2006	Australian study. Opioid treatment costs in isolation.
Six month treatment costs (1997 USD)	902 USD (methadone) 1122 USD (buprenorphine)	Doran *et al.*, 2003	Australian study. Staff time, medication, and facility expenses included in cost calculations.
Hypothetical treatment costs in initial year of that treatment (low-high estimates) (2001 USD)	3,119-5,417 USD (methadone) 2,869-6,170 USD (buprenorphine)	Rosenheck & Kosten, 2001	Assumes buprenorphine would require less intensive support therapies. Dispensing, medication, therapy, and screening costs included. Compilation of U.S. costs.

The point estimates in **Table 1** jointly indicate that a year of methadone or buprenorphine treatment ranges in mean cost from roughly $2,939 to $5,887.[6]

The all-payer hospital data, compiled by the Health Services Cost Review Commission (HSCRC), offer a limited estimate of medical expenditures associated with opioid addiction without providing any information about the impact or cost of treatment.[7] This is because the HSCRC is not responsible for oversight of methadone clinics, nor is it responsible for setting the rates and reimbursement policies for prescription drugs such as buprenorphine.

Calendar year 2005 Baltimore City data from the all-payer source indicated that a hospital admission (inpatient or outpatient, the latter including ER and clinic visits) cost an average $6,706 if an opioid diagnosis was reported, but only $1,830 otherwise (Center for Health

[6] Inflation adjustment of 5 percent applied to costs to obtain estimates in 2007 US Dollar prices. It is worthwhile to note that 2 of the 3 studies used to determine the rough range were conducted in Australia where total per capita expenditures on health were 3,123 USD in 2004 compared to US spending of $6,096 (www.who.it, accessed, 8/15/07).

[7] HSCRC data do not indicate a patient identifier, so it is not possible to definitively link records to specific individuals– thereby making it similarly uncertain to identify whether an individual is admitted more than once at different points in time, or to link the hospital records with Medicaid beneficiary information.

Program Development and Management, 2007c). These numbers suggest that opioid addiction increases the average admission charge by approximately $4,876 (the arithmetic difference). The cost differential additionally was correlated with increased rates of ER visits leading to inpatient admissions and increased inpatient rates—though the average length of stays were comparable between the opioid exposed population and all others, suggesting it is the *intensity* of the inpatient stay which matters, not the length. Opioid diagnoses in the hospital data was also correlated with increased rates of diseases associated with such dependence including infections, respiratory illness, and mental health problems. **Table 2** summarizes the utilization and co-morbidity group differences.

Table 2. Rates (percentiles) for ER and inpatient transactions, and for select diagnoses that are frequently co-morbid with opioid abuse. These rates are from Baltimore City and are based on 2005 data from the HSCRC. Enumerations correspond to hospital transactions (*e.g.*, ER visits, inpatient stays), and they are not de-duplicated to account for individuals who access services on more than on occasion. Source: Center for Health Program Development and Management, 2007c.

Indicator	**Opioid diagnosis n=19,067**	**No opioid diagnosis N=505,187**
Emergency room visits leading to an inpatient admission, rates	48%	8.0%
Inpatient rates	72%	12%
Abscess rates	10%	3.1%
Viral hepatitis rates	28%	2.0%
Respiratory difficulty rates	23%	11%
Psychosis rates	16%	2.1%

Finally, the pre/post review of Medicaid data indicated subtle group differences between six-month periods before and after methadone treatment began (Center for Health Program Development and Management, 2007a). FFS cost differences were not apparent in this short time span, largely because the majority of the Medicaid dollars were capitated payments based on a two-year look back at utilization data such that a 12 month review is too short a time period to realize shifts in those calculations. It also appears that individuals who chose treatment were already fairly low utilizers of Medicaid services (compared to all opioid dependents), an indication of an ascertainment bias impacting the treated vs. untreated analysis that began this series of reports. Still, the pre/post comparisons identified treatment effects in Baltimore City, which are summarized in **Table 3**. Two effects were in the expected direction: inpatient and respiratory illness indicators both declined with treatment. Two other effects, however, indicated increased utilization with treatment. One was ambulatory care (excluding methadone clinic visits), which can be explained by increased medical care correlated with methadone clinic enrollment—a favorable outcome. The other, however, was more confusing; general symptoms (*e.g.*convulsions, fainting, *etc.*) increased with treatment, suggesting some negative side-effects,

or drug-drug interactions associated with methadone therapy. In order to consider whether, and to what extent, these service utilization and diagnostic indicators contribute to overall medical costs, one would need to assign costs to the inpatient days and ambulatory care visits. Here, however, we will refrain from making such calculations, because hospital and outpatient rates can be quite variable across facilities in Baltimore City; these rates also vary depending upon the precise nature of the specific complaint and treatment. Thus, it suffices to say that at least slight decreases in morbidity are apparent even though corresponding decreases in short-term expenditures are masked by the capitation payment system.

Table 3. Summary of significant treatment effects (Wilcoxon $p<0.05$) in a pre- to post-methadone treatment comparison for Baltimore City residents enrolled in Medicaid (2003-2005). Pre- and post periods are each six months in duration, the aggregate change corresponds to the total reduction/increase which accrued across the population during the first six months of treatment. Source: Center for Health Program Development and Management, 2007a.

Variable	Mean Change[a]	Aggregate[b] Change
Inpatient days	-.028	-53
Ambulatory care counts	0.30	568
Respiratory illness visits	-0.078	-148
General symptom visits	0.046	87

[a] Mean within-subject (*i.e.,* pairwise) post minus pre amount.
[b] Across all subjects in the sample, n=1,893. *E.g.,* the top right-hand cell can be interpreted as follows: In the six month period after treatment began, Baltimore City methadone clinic enrollees used a total of 53 fewer inpatient days than they did in the six months prior to treatment.

Conclusions/Implied Medical Cost Savings Estimates

Overall, the four reports indicate that expanding OMT does have the potential to save the publicly financed health care system money by reducing heroin-associated morbidity in Medicaid and other insured and uninsured populations. However, precise estimates for these hypothetical savings are not easily generated and unfortunately are not discernable from the pre/post treatment review of Medicaid data because of the system's reliance on capitated payments. Cost estimates, therefore, must come from the three other studies described: 1) the treated vs. untreated review, 2) the secondary source literature review, and 3) the all-payer database review.

Table 4 below provides an estimate of the potential financial impact of increasing the number of OMT slots in Baltimore City based on the reports and needs estimates reviewed in the text above. The table assumes that *all* opioid addicts in Baltimore City enter sustained treatment (52 weeks) in a given year. Such complete coverage and compliance is obviously not realistic given the complexities of engaging any population of individuals in some form of medical intervention, but the numbers are put forth as a starting point from which one can derive certain targets. For

example, based on the total in row 4, expanding OMT to 10 percent of those currently untreated would yield $441,150 in reduced medical spending. The all-payer HSCRC data (row 2, column 3, item b) validates these numbers by suggesting that opioid diagnoses correlate to hospital-based admissions, which are $5,376 more costly than other such transactions; however, because this quantity cannot be coupled directly to OMT or to individuals, it is ignored for the purposes of calculation other than as an indicator.

Table 4. Parameter estimates regarding the cost impact of expanding opioid maintenance therapy (OMT) in Baltimore City.

Row	Variable	Quantity [8]
1	OMT costs per each new enrollee per year	-$2,939 to -$5,887 [9] per person per year **Quantity used is midpoint which = -$4,413**
2	Apparent reductions in medical costs associated with OMT or the absence of an opioid-based diagnosis	**a)** +$4,586 per person per year[10] **b)** +$5,376 per admission[11] **Quantity used is +$4,586** which represents both a conservative and liberal estimate of costs associate with treatment. Liberal because it is not based on a randomized control trial, conservative because it reflects Medicaid rates (the lowest in the marketplace) and only a portion of the total Medicaid costs (fee-for-service).
3	Number in need of treatment	25,500 persons[12]
4	Estimate of potential medical cost savings with expanded OMT to all currently untreated individuals	25,500 * ($4,586-$4,413)= +**$4,411,500**

[8] Prices adjusted to 2007 levels using a 5 percent inflation factor. "-" denotes expenditure/cost, "+" denotes apparent gain (*i.e.*, a decrease in costs).

[9] Doran *et al.*, 2003; Rosenheck & Kosten, 2001; Shanahan *et al.*, 2006

[10] 2005 Medicaid data only based on Center for Health Program Development and Management, 2007b and the multiple regression described in footnote 3 ($4,586 = $80/treatment * 52 treatments/year * 1.05^2; last term is an inflation factor to bring the value to 2007 dollars).

[11] 2005 All-payer data based on: Center for Health Program Development and Management, 2007c adjusted to 2007 prices. This indicator is likely larger than the Medicaid FFS indicator because it reflects all hospital-based services only, *i.e.*, it focuses upon a subset of the most expensive medical services (inpatient, ER, surgeries). A five percent inflation factor is applied.

[12] This is a rough estimate of need based on 2003 data on treatment capacity and need from: Baltimore City Health Department, 2006; Baltimore Substance Abuse Systems & Baltimore City Health Department, 2006; Drug Strategies, 2000; and Reuter *et al.*, 1998. The key assumptions to this estimate are that there are 30,000 persons in need and 4,500 public and private treatment slots in Baltimore City (refer to page 4 for discussion of these estimates).

Of substantial importance for any true benefit-cost analyses of OMT is that the variables presented in **Table 4** do not include benefits that almost certainly accrue outside of the medical arena. Specifically, the calculations exclude two very sizable benefits: crime reduction and productivity gains. Using 1996 data, Mark and colleagues (2001) conducted a thorough review of econometric data related to heroin dependence and determined that it cost the United States economy over $20 billion per year. Breakdowns of those costs showed that 50 percent were associated with lost workplace productivity, 25 percent were related to crime, and another 25 percent were related to medical costs associated with addiction treatment or with secondary effects of addiction (*e.g.*, hepatitis infection). French and colleague (2000) similarly found that legal/criminal cost reductions and employment earning increases represented over 90 percent of the accrued benefits in an investigation demonstrating substantial (>$10,000 in a nine-month period) and favorable drug treatment effects. These benefits would likely far surpass the rather small medical costs savings implied by **Table 4**.

A key limitation of this work is that it is not based on a randomized clinical trial. As such, it is not known whether or not those who choose treatment are somehow predisposed to respond better to that intervention than those who do not. Additionally, the point estimate used to consider costs savings was based on treated vs. untreated individuals who had stable enough profiles so that they were continuously enrolled in Maryland's Medicaid program (Center for Health Program Development and Management, 2007a, 2007d). So, generalizing to those who move in and out of Medicaid or are never engaged (uninsured) is somewhat speculative.

The other important limitation of this work is that is has mostly relied on data corresponding to methadone, not buprenorphine. Buprenorphine is not only more expensive per dose, but its clinical use will also correlate by design with a paradigm shift of sorts from the traditional and tightly controlled methadone clinic delivery system to primary care settings—a shift that poses both challenges and opportunities that have not been well studied.

Despite these limitations, the overall implication of this and the four reports leading up to it is that expansion of OMT with buprenorphine offers the promise of reducing overall health care costs elsewhere in the medical system while increasing the treatment capacity in Baltimore City, a place where substantial wait lists and constrained delivery regimens impede efforts to enroll and maintain those in need.

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