Comparing Pre-Treatment to Post-Treatment Medicaid Utilization in Individuals who Enter Methadone Therapy

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Introduction/Background

This report is a direct extension of three recent reports about the medical costs and benefits associated with expanding buprenorphine treatment as a therapy for heroin addiction. The first report in this series was a case-control, cross-sectional study that revealed that opioid dependents on methadone consume far fewer Medicaid resources than those who go untreated (Center for Health Program Development and Management, 2007a). The implication of these data 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 opioid addiction (Center for Health Program Development and Management, 2007b). The 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 the methadone distribution system. The third report reviewed correlates to opioid dependence or use in an all-payer hospital database and found that medical costs and the utilization of intensive services (ER and inpatient) was increased in hospital patients with such drug exposure. This report, the final in the series, looks at Medicaid service utilization associated with opioid dependents before and after they initiate opioid maintenance treatment (OMT)—principally methadone therapy.

This pre-/post-treatment data review is intended as a complement to the case-control study mentioned above. A pre/post study offers the advantage of tracking individual response to therapy and thus effectively uses each subject as his/her own control. Given the results of the case-control study, it is expected that the pre/post study will demonstrate that entry into OMT results in measurable health improvement that can be observed using Medicaid claims and encounter data.

Previous pre/post studies have demonstrated measurable treatment effects. Kosten and colleagues (1993) studied 79 individuals after the initiation of methadone treatment and found that their heroin use decreased by more than 50 percent within one to two months of initiating therapy. Withdrawal symptoms similarly decreased. Lavignasse *et al.* (2002), in a naturalistic (not randomized) trial in France involving nearly 700 participants, found similar reductions in heroin use. They also reported large reductions in injection drug use and abscesses, as well as arrests and court appearances—all declines being observed between baseline and six months post-treatment initiation. Doran and colleagues (2003) reported that six months of methadone treatment yielded a gain of nearly 20 additional heroin-free days per month, by the sixth month. Harris *et al.* (2005) reported that heroin-free days increased from 11.4 days at baseline to 18.3 by the sixth month of treatment; however, they did not observe analogous increases in quality-adjusted life-years. Crime reductions (contrasting prevalence rates for the three months pre- and the 9-12 months post-treatment) were also observed by Healey and colleagues (2003) with the initiation of methadone therapy. Finally, Shanahan *et al.* (2006) found that twelve months after treatment, there were 15.3 more heroin-free days than at baseline, and crime was reduced 53 percent.

The above cited reports and others indicate that methadone treatment of opioid dependence can yield positive effects that are measurable within weeks or months of initiating treatment. The experiment conducted here focuses specifically on medical treatment covered by Maryland's Medicaid program (Medical Assistance). The *a priori* hypothesis for this investigation is that favorable medical utilization patterns will occur when pre-treatment health care utilization is compared to post-treatment utilization. Such shifts may include reductions in emergency room (ER) and inpatient facility use, reductions in acute infection rates (abscesses), and even reductions in fee-for-service (FFS) medical spending. It is necessary to contrast FFS spending with capitated spending in Maryland's Medicaid program because the latter is fixed each year using risk-adjusted rate-setting procedures based on utilization two years prior, whereas the former represents payments for current services used. As such, FFS payments for a person entering treatment might directly reflect some therapeutic effect, whereas capitated payments would not reflect such impacts until two years after the fact.

Consistent with the hypothesis that Medicaid utilization and expenditure indices can be used to reflect treatment effectiveness, a previous study found substantial differences in annual ER and inpatient rates, as well as Medicaid FFS payments (and not capitated payments) when comparing groups of opioid dependents with methadone exposure to those who went untreated (Center for Health Program Development and Management, 2007a). That study, however, was limited by the fact that those who were treated may be different in critical ways from those who were untreated (more motivated, higher functioning, *etc.*). By contrast, this pre/post study adjusts for such endogenous factors because each person serves as his/her own control, and thus observed treatment effects are more likely to be real and not linked to unobserved factors related to who enters treatment and who does not.

Methods

Using as a foundation the opioid dependent Medicaid enrollees from the earlier treated vs. untreated study (Center for Health Program Development and Management, 2007a), the current study identified all individuals who met the following criteria:

- First methadone treatment date was on or after July 1, 2003
- First methadone treatment date was before December 31, 2005
- At least six months of Medicaid eligibility before first treatment
- At least six months of Medicaid eligibility after first treatment

Six month windows were deemed reasonable given previous studies of that duration which indicated fairly rapid positive effects from methadone. Individuals were included in this study based on the criterion of initiating therapy. That is, it was not necessary for an individual to remain in OMT during the entire six months to be included in this study. Accordingly, this represents an "intent-to-treat" study rather than a less rigorous investigation that might alternatively include only a select subset of individuals who comply with therapy for a specified period of time.

The three-year treatment cohort (with variable initial treatment dates) was used to build a data set for longitudinal, within-subject comparisons of pre- vs. post-treatment Medicaid utilization indicators. Specifically, the following 16 variables were considered:

1. ER visit counts
2. Inpatient days
3. Ambulatory care visit counts (excluding ER, mental health, and substance abuse visits)
4. Total Medicaid FFS dollars[1]
5. Pregnancy complication counts
6. Indicators of normal pregnancy and delivery counts
7. Abscess visit counts
8. Viral hepatitis infection visit counts
9. HIV infection visit counts
10. Respiratory illnesses visit counts
11. Tuberculosis-related visit counts
12. General symptoms[2] visit counts
13. Cardiac/circulatory disease (heart failure, hypertension) visit counts
14. Carditis (infections) visit counts
15. Depression-related visit counts
16. Psychosis-related visit counts

It should be noted that variables 5-16 were quantified based on tallying medical transactions where diagnostic codes indicated their presence. As such, they reflect only general measures of condition intensity rather than specific ones that consider functional impairment more directly. *A priori* hypotheses regarding a treatment effect on these diagnostic indicators depend in large part upon the chronicity and time of onset of many of the medical conditions listed. For example, abscesses are likely to decrease from pre-treatment to post-treatment as they are relatively acute infections caused by using contaminated needles or snorting particulates that damage the nasal passages. By comparison, HIV is a condition that needs to be managed over the long term, and thus the appearance of that diagnosis pre-treatment will likely persist into the post-treatment interval of this review such that pre/post differences are not observed.

Statistical methods used to analyze the database are straight-forward. First, summary demographic statistics are provided to characterize the sample studied, including information regarding age, gender, eligibility, and race. Then pair-wise comparisons are run to consider whether or not any of the 16 utilization variables differ significantly between the pre- and post-treatment six month intervals. Wilcoxon signed-rank tests are used to minimize the impact of extreme values and to account for the fact that most of the variables have skewed distributions

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[1] Fee-for-service principally reflects specialty mental health care services, which are carved-out of Maryland's capitation program known as HealthChoice. Also, individuals who are dually enrolled in Medicaid and Medicare are not enrolled in HealthChoice for any services they receive, so these services would be reflected in the fee-for-service data as well.

[2] General symptoms include coma, transient alterations in awareness, persistent vegetative state, hallucinations, fainting/blackouts, convulsions, dizziness, sleep disturbances, fever, fatigue, chills, and sweating.

(Pagano & Gauvreau, 1993). Data is further stratified by region so that Medicaid beneficiaries residing in Baltimore City can be considered separately from those living throughout the rest of Maryland (hereafter: "Rest of State"). These analyses were conducted using SAS PC version 9.1.

Results

Demographic Description of the Sample

Because the individuals isolated here were drawn from a sample of treated individuals used in a prior treated vs. untreated comparison (Center for Health Program Development and Management, 2007a), the demographics of this longitudinal sample look nearly identical to the treated subjects of that previous investigation. Discrepancies only occur where the treated enrollees included previously did not have six months pre- and six months post-treatment Medicaid enrollment spans necessary for inclusion in this investigation. It is also the case that this current investigation constrains the population to those 13-60 years old, whereas the previous investigation did not limit the upper end of the age range. This exclusion was made here to focus on the bulk of the opioid dependent population in Maryland's Medicaid program.[3] **Table 1** summarizes demographic information for the final cohort used.

Table 1. Sample demographics for this pre- versus post-opioid maintenance treatment (mostly methadone) investigation.

	Baltimore City	**Rest of State**
N	1893	781
Age (mean±sd)	42±8.7	35±10.9
Gender (% females)	63	70
Race		
%Black	80	22
%Caucasian	17	74
%Hispanic	0.32	0.63
%Other	2.7	3.4
Eligibility		
%TANF*	31	41
%SSI	56	42
%Dual Eligibles	8.6	7.4
%Other	4.4	9.6

*Families and Children

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[3] Previous work indicates that >95 percent of opioid dependents enrolled in Medicaid are 60 years or younger (Center for Health Program Development and Management, 2007a).

Treatment Intensity and Duration Indicators

As noted in the introduction of this report, all subjects are tracked from pre- to post-initiation of methadone treatment in what can be considered an intent-to-treat research design (*i.e.*, the presence of one or more methadone transactions is taken as a marker for treatment without consideration for how long a given individual's treatment lasts). This is a standard and well-accepted way to conduct scientific reviews as it does not bias the analyses based on whether or not individuals persist in the treatment. Instead, it focuses on whether the treatment opportunity proved helpful. The spectrum of actual treatment duration is presented in **Table 2** along with information about managed care enrollment in Maryland's HealthChoice program, as well as a frequency table indicating the proportion of individuals who began treatment in each of the three years reviewed. The managed care information is reported in order to demonstrate that the population is predominantly enrolled in capitation plans, which in Maryland are financed by risk-adjusted per member per month payments determined well before the period of coverage.

Table 2. Medicaid treatment and intensity information for individuals with opioid dependence spanning the 12 months under study (six months before and six months after the initiation of opioid maintenance treatment, mostly methadone).

	Baltimore City	**Rest of State**
N	1893	781
Year treatment began		
% in 2003	29	23
% in 2004	38	41
% in 2005	33	36
Pre-treatment managed care enrollment months (mean±sd)	4.4±2.4	4.4±2.2
Post-treatment managed care enrollment months (mean±sd)	5.3±1.7	5.5±1.4
Post-treatment number of opioid maintenance transactions (mean±sd)	18±8.8	15±9.8
Total number of methadone transactions from first treatment to June 30, 2006*	55±39	39±35

*The most recent data reviewed for this study.

The percentiles and ranges in **Table 2** demonstrate that managed care enrollment in this population is high, but not 100 percent, and that this penetration rate is fairly stable (increasing only slightly) over the course of the study. This high managed care penetration means that it is likely that most of the Medicaid dollars for these subjects will be in the form of capitated payments, *i.e.*, linked to prior utilization rather than actual expenditures. In fact, review of the actual data supports this inference as capitated payments account for over 89 percent of all of the

Medicaid dollars under consideration in this study. The majority of the 11 percent of dollars identified as FFS payments reflect two types of Medicaid expenditures: 1) specialty mental health services, which are carved-out of the capitated managed care program, and 2) all medical care for individuals dually enrolled in Medicare and Medicaid, because these individuals are not enrolled in managed care.

Post-treatment methadone clinic transactions (one per week is standard) indicate that, on average, these regimens are sustained for 18 treatments in Baltimore City and 15 treatments in the rest of the state. Accordingly, many discontinue or interrupt their treatments for one reason or another as the standard expected count of treatments is 26 over six months (one for every 7 days). Finally, **Table 2** demonstrates that despite treatment discontinuities, if one follows all continuously Medicaid-eligible subjects identified (regardless of year of treatment) until June 30, 2006 (the margin of the data reviewed for this investigation), the mean number of methadone treatments was 55 and 38 in the City and Rest of State, respectively. These numbers indicate that a substantial proportion of individuals remain in treatment for many months with longer term methadone treatment especially evident in Baltimore City.

Longitudinal Statistical Trends

For the 16 utilization variables, pair-wise statistical comparisons relied exclusively on the non-parametric signed-rank test as the variable distributions were typically skewed heavily toward zero (no or little change in indicators pre- and post-treatment), and some of the events were relatively low frequency. The Wilcoxon allows pair-wise comparisons that avoid outlier bias by relying on weighted rankings rather than real values of the data (Pagano & Gauvreau, 1993). Accordingly, these results consider both the magnitude of the difference score (the rank) and the direction (positive or negative: the sign) in each pre/post calculation, but magnitude outliers will not drive the resulting statistic.

Table 3 presents all of the statistical results and corresponding mean values associated with the outcome comparisons described above.

Table 3. Pair-wise statistical results comparing pre- to post-opioid maintenance treatment (mostly methadone) in the context of Maryland's Medicaid program spanning the years 2003-2005. All comparisons based on six month prevalence or cumulative data before, and six month data after the initiation of therapy. Analyses were conducted separately for Baltimore City and for all other regions in the state ("Rest of State"). Significant pre/post change statistics ($p<0.05$) are indicated with an "*" adjacent to the reported Wilcoxon p-value.

Variable	Baltimore City (n=1,893)				Rest of State (n=781)			
	Mean change[a] (sd)	Pre mean (sd)	Post mean (sd)	Wilcoxon signed rank p-value	Mean change[a] (sd)	Pre mean (sd)	Post mean (sd)	Wilcoxon signed rank p-value
1. ER visit counts[b]	0.043 (1.9)	0.88 (2.1)	0.93 (2.2)	0.16	-0.20 (2.5)	1.4 (3.2)	1.2 (2.4)	0.047*
2. Inpatient days	-0.028 (0.57)	0.035 (0.56)	0.0074 (0.17)	0.029*	0.0064 (0.90)	0.028 (0.41)	0.035 (0.78)	0.67
3. Ambulatory care visit counts[c]	0.29 (3.6)	2.1 (3.2)	2.3 (3.6)	<0.0001*	0.22 (4.5)	3.1 (4.4)	3.3 (4.2)	0.014*
4. Total Medicaid fee-for-service (FFS) dollars	-49 (1681)	497 (1625)	448 (1505)	0.3	-132 (970)	513 (1173)	381 (847)	0.0018*
5. Pregnancy complication counts[d]	-2.6 (13)	2.9 (13)	0.26 (2.3)	<0.0001*	-3.0 (14)	3.5 (14)	0.55 (2.6)	<0.0001*
6. Indicators of normal pregnancy counts[e]	-0.0005 (0.023)	0.00053 (0.023)	0 (0)	1.0	0 (0)	0 (0)	0 (0)	na
7. Abscess visit counts	-0.00053 (1.2)	0.15 (0.79)	0.15 (0.95)	0.17	-0.088 (1.0)	0.16 (1.1)	0.070 (0.34)	0.011*
8. Viral hepatitis visit counts	0.0 (1.2)	0.25 (0.90)	0.25 (1.1)	0.54	0.017 (0.77)	0.15 (0.63)	0.17 (0.62)	0.24
9. HIV visit counts	0.13 (3.9)	0.54 (2.0)	0.68 (4.2)	0.98	0.085 (1.7)	0.073 (0.51)	0.16 (1.8)	0.41
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Variable	Baltimore City (n=1,893)				Rest of State (n=781)			
	Mean change[a] (sd)	Pre mean (sd)	Post mean (sd)	Wilcoxon signed rank *p*-value	Mean change[a] (sd)	Pre mean (sd)	Post mean (sd)	Wilcoxon signed rank *p*-value
10. Respiratory illnesses visit counts	-0.078 (1.5)	0.35 (1.4)	0.28 (1.2)	0.02*	-0.12 (2.1)	0.30 (1.8)	0.18 (1.2)	0.024*
11. Tuberculosis-related visit counts	-0.0095 (0.29)	0.011 (0.28)	0.0011 (0.046)	0.13	-0.0090 (0.11)	0.0090 (0.11)	0 (0)	0.031*
12. General sympts. (alts. in consc., fatigue, sweats) visit counts	0.046 (0.74)	0.050 (0.32)	0.096 (0.68)	0.0096*	0.041 (0.79)	0.079 (0.51)	0.12 (0.67)	0.18
13.Cardiac/circulatory disease (e.g., hypert.) visit counts	0.0095 (0.34)	0.017 (0.33)	0.027 (0.28)	0.12	-0.020 (0.51)	0.023 (0.51)	0.0026 (0.051)	0.25
14. Carditis (infections) visit counts	-0.013 (0.35)	0.017 (0.38)	0.0048 (0.076)	0.18	-0.0013 (0.18)	0.0077 (0.10)	0.0064 (0.15)	0.59
15. Depression-related visit counts	-0.080 (3.2)	0.46 (3.0)	0.38 (1.8)	0.74	-0.11 (2.5)	0.72 (2.5)	0.61 (2.4)	0.28
16. Psychosis-related visit counts	-0.36 (6.9)	1.9 (8.2)	1.5 (5.8)	0.17	-0.076 (6.3)	2.6 (7.6)	2.5 (6.8)	0.94

[a] Mean within-subject (pair-wise) post minus pre amount.
[b] Includes a very low frequency of "urgent care" visits, i.e., not emergency rooms, but facilities designed to deliver immediate acute care which may require referral to an emergency room.
[c] Ambulatory visits *exclude* mental health, substance abuse, and emergency room visits. "Urgent care" visits were also explicitly excluded from this category.
[d] In Baltimore City there were 357 individuals who had some diagnosis associated with pregnancy complications, in the rest of the state there were a total of 193 such individuals. Exclusion of these 550 individuals did not appreciably alter the findings reported in the table with the exception of increasing the ambulatory visit pre/post differences by 2-3 times (data not shown). This increase is likely associated with Medicaid enrollment rules that facilitate care access for pregnant women. Pregnancy complications may include the presence of opioid use.
[e] Only a single instance of a "normal pregnancy" diagnostic label was identified across the entire population. This indicates that essentially all pregnancy diagnosis indicators identified here were those labeled clinically as "complications".

The results in **Table 3** demonstrate several subtle but statistically significant treatment effects. **Table 4** summarizes those significant results and also lists the calculated aggregate change in the number of days or visits for each variable.

Table 4. Summary of significant treatment effects in a pre- to post-opioid maintenance treatment (mostly methadone) comparison in the context of Maryland Medicaid (2003-2005). Data presented come directly from Table 3. Significant pre/post change statistics ($p<0.05$) are indicated with an "*". Pre- and post periods are six months in duration each, such that the aggregate change corresponds to total reduction/increase which accrued during the first six months of treatment.

	Mean Change[a]		Aggregate[b] Change	
Variable	*Baltimore City* *n=1,893*	*Rest of State* *N=781*	*Baltimore City* *n=1,893*	*Rest of State* *N=781*
ER visit counts	0.043	-0.20*	-	-156
Inpatient days	-.028*	0.0064	-53	-
Ambulatory care counts	0.30*	0.20*	568	156
Total Medicaid fee-for-service (FFS) dollars	-49	-132*	-	-103,092
Pregnancy complications	-2.6*	-3.0*	-4,921	-2,343
Abscess visits	-0.00053	-0.088*	-	-69
Respiratory illness visits	-0.078*	-0.12*	-148	-94
Tuberculosis visits	-0.0095	-0.0090*	-	-7
General symptom visits	0.046*	0.041	87	-

[a] Mean within-subject (i.e., pair-wise) post minus pre amount.
[b] Across all subjects in the sample, 1,893 and 791 for City and Rest of state respectively (this is a simple multiplication calculation for mean estimates tied to statistically significant results).

Most of the significant findings support this study's hypothesis, although significant results are not always apparent across the state. Specifically, post-treatment ER counts and abscesses declined significantly in the rest of the state only, whereas inpatient day declines were apparent only in Baltimore City. These inpatient declines were very slight, the result of only 13 enrollees having fewer inpatient days after treatment began compared to only three enrollees with more. Declines in pregnancy complications are consistent and robust across the state and likely reflect resolution of pregnancy rather than real decreases in morbidity given the 12 month duration of this study and given that maternal and fetal care are Medicaid priorities. Tuberculosis visit counts declined significantly post-treatment in the rest of the state, but since this decline was tied to only six total cases, it may not be a reliable finding. Respiratory illness visits were consistently and significantly reduced across the state. Ambulatory care visits demonstrate statewide and significant increases in the use of non-emergent and preventive services.

One significant result occurred in an unexpected direction. In Baltimore City, general symptoms (e.g., alternations of consciousness, convulsions, sweating, chills, fatigue[4]) appeared to significantly increase after treatment began. It is unclear why this shift, which affected a total of 81 individuals, might have occurred. It is reasonable to speculate that some of these symptoms reflect physiologic withdrawal that is common as one reduces her/his use of opiates, although the majority (alterations in consciousness) may be tied to some sustained heroin use or methadone overuse.

Finally, FFS dollars dropped very slightly, but significantly in the rest of the state population. Similar non-significant declines were observed in Baltimore City. Declines in FFS dollars across time may be the result of individuals transitioning from fully FFS coverage into the HealthChoice managed care program, or they could be connected to a slight decrease in FFS utilization that is linked to a treatment effect—perhaps tied to a decreased use of specialty mental health services which are carved-out of Maryland's Medicaid managed care program. Whatever the case, the data presented here indicate that FFS dollars either remain stable or decline slightly with OMT treatment, both in the face of steady medical inflation. However, it is important to keep in mind that these FFS dollars account for only a small fraction of all Medicaid costs and services tied to each individual as most expenditures and services are covered under capitated arrangements.

The right two columns of **Table 4** offer simple calculations of the total change in days or visits for each variable where the statistical comparisons were significant. For example, for ambulatory care, the total number of visits across the study population increased from pre- to post- by 568 and 156 visits in Baltimore City and the rest of the state, respectively. As another example, the statistically significant results indicate that the total number of inpatient days in Baltimore City declined by 53.

For most of the variables studied, the direction, magnitude, and statistical significance of pre- to post- comparison was comparable between Baltimore City and Rest of State. Three notable exceptions, however, were observed. First, ER visit declines were only observed in the smaller Rest of State population, while such rates were flat for the Baltimore City population. Second, significant declines in inpatient days were only observed in Baltimore City. Third, abscesses demonstrated a decline in Rest of State only. The inpatient days result may be an issue of statistical power because the Rest of State mean change value was essentially zero— non-significant and very small. The ER result, however, suggests that for this population, methadone clinic treatment is more likely to divert individuals from ER use in the Rest of State compared to Baltimore City. The source of this discrepancy is not deducible from the data reviewed here, but one can speculate that it is tied to factors including: density of ERs in Baltimore City and/or urban-rural differences in the structure, delivery, and consumption of medical services. It is also worth considering that social/ethnic forces may have an impact here as the proportion of African Americans in Baltimore City is far higher than in the Rest of State (see **Table 1**). The abscess rate result is perhaps most puzzling, but it suggests that jurisdictions outside of Baltimore City

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[4] A review of the full (5 digit) diagnostic codes revealed that 76 of 78 individuals with post-treatment symptoms in this domain suffered from transient alternations in conscious ranging from drowsiness to blackouts/fainting.

are more successful at coupling methadone treatment with strategies that actually abate intravenous drug use compared to Baltimore City. As with the ER rates, the precise reason for this difference is not deducible from the data studied here.

Discussion/Conclusion

The results from this longitudinal, pre/post-treatment investigation of Medicaid utilization in individuals with opioid dependence provide several significant, albeit subtle, indications of favorable methadone treatment effects. Those effects are manifested in terms of decreased direct or indirect indicators of morbidity. Both the subtlety and the significance of these effects can be appreciated graphically by reviewing **Figure 1** below, which plots the change score distribution of respiratory illness counts in the Baltimore City population. The significant result for this variable is driven by the fact that the left side of the distribution (reflecting decreases in respiratory illness counts) is greater in area than the right.
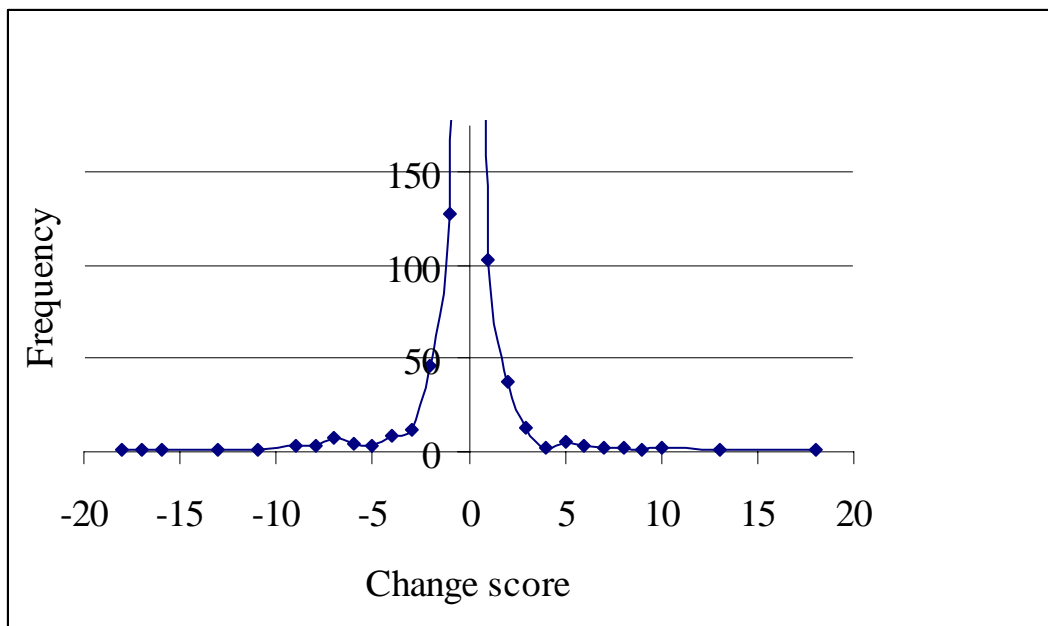

Figure 1. Frequency distribution of respiratory illness visit count change (post *minus* pre) scores for opioid dependent individuals in Maryland's Medicaid program before and after they began opioid maintenance treatment (mostly methadone) sometime during the years 2003 to 2005. The peak of this distribution (not shown due to scale) is at 0 (no change between pre and post conditions) and contains 1500 individuals. The visible portions of the graph show that the left-hand area (negative values) of the curve is larger than the right-side, an asymmetry that is correspondent with a significant Wilcoxon signed-rank test supporting a treatment effect that is associated with decreases in respiratory illness counts.

Direct and significant decreases in morbidity are evident in the respiratory illness (across the state) and abscess (Rest of State only) disease categories. Respiratory illnesses exclude tuberculosis (a separate category), and are composed of more than 23 unique disease

classifications ranging from Kaposi's sarcoma of the lung to chronic bronchitis and apnea. As such, the category is a broad indicator of general pulmonary health.

Indirect morbidity indicators of treatment effectiveness are declines in inpatient days (Baltimore City only), and increases in ambulatory care counts across the state. The former variable suggests a desired treatment effect because it is presumably correlated with declines in the severe forms of illness that require hospitalization. The latter variable likely indicates increases in preventive and maintenance care and, as such, is also a favorable treatment correlate. It should further be noted that the increase in ambulatory visits does explicitly exclude methadone clinic and other addiction visits, so these increases reflect "walk-in" medical care outside of those that directly addresses addiction.

ER visit counts declined only in the Rest of State population. This result is surprising given that a previous study showed a substantive difference in ER rates between many of the individuals included in this investigation and other Maryland Medicaid enrollees who did not enter OMT (Center for Health Program Development and Management, 2007a). The suggestion of this finding is that ER utilization shifts in this population of opioid dependents (a population that eventually enters treatment) are only marginally impacted during the first six months post-treatment. These results also suggest that endogenous mediators are associated with the differences between the group under review and other Medicaid enrollees who did not enroll in treatment.

Similarly, FFS Medicaid dollars declined slightly but significantly (average: $132 over six months) for the Rest of State group, a finding that indicates non-capitated payments decrease far less in this experiment than in previous work comparing this group to an untreated group (Center for Health Program Development and Management, 2007a). Once again, endogenous factors are likely involved—an inference that is supported by the fact that the pre-treatment six month expenditure data presented here is comparable to the treated population means of the previous study. In other words, the baseline for the experimental group was already well below the expenditure rate of the untreated subjects in the cross-sectional study so that there was little room for improvement.

With regard to the implied cost-benefit ratio for methadone treatment, one might be tempted to consider this study as neutral because it seems the therapy neither increases nor decreases (except slightly in Rest of State) FFS Medicaid costs. This assessment, however, is likely too pessimistic for at least two reasons. First, medical costs represent only part of the total societal cost-benefit equation—other beneficial effects of treatment, as noted in the earlier summary of the literature, also support the efficacy of treatment (Center for Health Program Development and Management, 2007b). Absent from this investigation, for example, are any quantification of quality of life or crime costs, both of which represent large impacts that often offset any added treatment costs (Center for Health Program Development and Management, 2007b; Strain, 2006). French *et al.* (2000), for example, found that legal 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.

Second, this study likely underestimates the financial impact of methadone therapy because the majority (> 89 percent) of all Medicaid dollars tied to the subjects of this investigation are fixed as annual capitation rates determined by a two-year look back, or based on standardized demographic information when previous Medicaid is not available. As such, if methadone treatment yields any true reduction in overall medical expenditures, much of it will not be realized in a review of Medicaid capitated payments until two years after the fact.

Overall then, the results in this study generally support the value and effectiveness of methadone treatment. They indicate that methadone treatment is associated with subtle enhancements in direct and indirect clinical indicators (derived from Medicaid data) within six months of treatment initiation. The implications of this study and the previous study comparing those who were treated to those who were not (Center for Health Program Development and Management, 2007a), suggest that expanding treatment access has the potential to reduce both individual suffering and overall societal burden associated with opioid dependence without increasing the cost of medical care. More study would be needed to clarify if methadone treatment is truly cost-beneficial or at least cost-neutral with respect to medical expenditures alone. We could not reach a finding on this issue due to the volume of services delivered in capitated arrangements. Finally, it should be noted that while this analysis indicates OMT is generally desirable, we could not study buprenorphine because that drug's penetration in the Medicaid system is very low. Accordingly, validating buprenorphine's impact on health care costs would also require further study.

References

Center for Health Program Development and Management. (2007a). *Heroin addiction correlates in Maryland*. Baltimore, Maryland: University of Maryland, Baltimore County.

Center for Health Program Development and Management. (2007b). *Review of cost-benefit and cost-effectiveness literature for methadone or buprenorphine as a treatment for opiate addiction*. Baltimore, Maryland: University of Maryland, Baltimore County.

Doran, C. M., Shanahan, M., Mattick, R. P., Ali, R., White, J., & Bell, J. (2003). Buprenorphine versus methadone maintenance: A cost-effectiveness analysis. *Drug Alcohol Depend, 71*(3), 295-302.

French, M. T., Salome, H. J., Krupski, A., McKay, J. R., Donovan, D. M., McLellan, A. T., et al. (2000). Benefit-cost analysis of residential and outpatient addiction treatment in the state of Washington. *Eval Res, 24*, 609-634.

Harris, A. H., Gospodarevskaya, E., & Ritter, A. J. (2005). A randomised trial of the cost effectiveness of buprenorphine as an alternative to methadone maintenance treatment for heroin dependence in a primary care setting. *Pharmacoeconomics, 23*(1), 77-91.

Healey, A., Knapp, M., Marsden, J., Gossop, M., & Stewart, D. (2003). Criminal outcomes and costs of treatment services for injecting and non-injecting heroin users: Evidence from a national prospective cohort survey. *J Health Serv Res Policy, 8*(3), 134-141.

Kosten, T. R., Schottenfeld, R., Ziedonis, D., & Falcioni, J. (1993). Buprenorphine versus methadone maintenance for opioid dependence. *J Nerv Ment Dis, 181*(6), 358-364.

Lavignasse, P., Lowenstein, W., Batel, P., Constant, M. V., Jourdain, J. J., Kopp, P., et al. (2002). Economic and social effects of high-dose buprenorphine substitution therapy. Six-month results. *Ann Med Interne (Paris), 153*(3 Suppl), 1S20-26.

Pagano, M., & Gauvreau, K. (1993). *Principles of biostatistics*. Belmont, CA: Duxbury Press.

Shanahan, M., Havard, A., Leesson, M., Mills, K., Williamson, A., & Ross, J. (2006). Patterns and costs of treatment for heroin dependence over 12 months: Findings from the Australian treatment outcome study. *Australian & New Zealand Journal of Public Health, 30*(4), 305.

Strain, E. C. (2006). Chapter 6: Methadone dose during maintenance treatment. In E. C. Strain & M. L. Stitzer (Eds.), *The treatment of opioid dependence* (pp. 89-118). Baltimore: Johns Hopkins University Press.