Pursuing Cost-Effectiveness in Mental Health Service Delivery for Youth with Complex Needs

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Abstract

Background: Mental health advocates seek to expand children's services, noting widespread failure to meet the needs of public sector youth suffering from serious emotional disturbance (SED). However, state and national budgets face deepening cuts, with rising health care costs taking the blame. As the gap between needs and finances widens, identification of cost-effective treatments that will benefit children with SED and their families is of increasing importance. Community-based interventions for this population, such as the wraparound approach and systems-of-care, are being disseminated but literature is scant regarding effects on expense. The Mental Health Services Program for Youth (MHSPY) model is aligned philosophically with wraparound and systems-of-care but unique in blending public agency dollars to deliver integrated medical, mental health and social services. MHSPY's linked clinical and expense data is useful to study community-based treatment cost-effectiveness.

Aims of Study: To examine the cost-effectiveness of an intensively integrated, family and community-based clinical intervention for youth with mental health needs in comparison to ''usual care.''

Methods: Study and reference populations were matched on age, gender, community, psychiatric diagnosis, morbidity and insurance type. Claims analyses included patterns of service utilization and medical expense for both groups. Using propensity score matching, results for study youth are compared with results for the population receiving ''usual care.'' Clinical functioning was measured for the intervention group at baseline and 12 months.

Results: The intervention group used lower intensity services and had substantially lower claims expense (e.g. 32% lower for emergency room, 74% lower for inpatient psychiatry) than their matched counterparts in the ''usual care'' group. Intervention youth were consistently maintained in least restrictive settings, with over 88% of days spent at home and showed improved clinical functioning on standard measures.

Discussion: The intensive MHSPY model of service delivery offers potential as a cost-effective intervention for complex youth. Its integrated approach, recognizing needs across multiple life domains, appears to enhance engagement and the effectiveness of mental health treatment, resulting in statistically significant clinical improvements. Functional measures are not collected in ''usual care,'' limiting comparisons. However, claims expense for intervention youth was substantially lower than claims expense for Medicaid comparison youth, suggesting clinical needs for intervention youth post-enrollment were lower than for those receiving ''usual care.''

Implications for Health Care Provision and Use: The MHSPY model, which intentionally engages families in ''clustered'' traditional and non-traditional services, represents a replicable strategy for enhancing the impact of clinical interventions, thereby reducing medical expense.

Implications for Health Policies: Blending categorical state agency dollars and insurance funds creates flexibility to support community-based care, including individualized services for high-risk youth. Resulting expenses total no more, and are often less, than ''treatment as usual'' but yield greater clinical benefits.

Implications for Further Research: Further research is needed regarding which intervention elements contribute the most towards improved clinical functioning, as well as which patients are most likely to benefit. A randomized trial of MHSPY vs. ''usual care,'' including examination of the sustainability of effects post-disenrollment, would provide a chance to further test this innovative model.

Background

In the U.S., 9-13% of children and adolescents are estimated to have serious emotional disturbance (SED),[1,2] roughly twice as many youth as those with asthma, the most common chronic pediatric condition.[3] Yet health services researchers estimate that only 1 in 5 children with diagnosable mental illness receive any mental health treatment.[4,5] Instead, vulnerable youth, with complex needs and non-specific symptoms, often present first in schools, courts and other settings not designed to address them. Fragmented delivery systems and other barriers to care lead such youth to get too little, too late. Mental health advocates argue for service

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expansion for children, noting the failure of current resources to meet the needs of youth suffering from SED.

The challenge to providers to improve treatment access for child mental health conditions has been broadly communicated through such vehicles as the Surgeon General's Report[6] on children's mental health, published in 2000 and the 2004 New Freedom Commission report,[7] which calls for a public health model to ''transform'' the children's mental health service delivery system. Researchers and policy makers argue that ''categorical funding,'' or the arbitrary separation of resources for youth in the mental health system from those for youth receiving other types of services (special education, child welfare, juvenile justice and/or medical care), makes little clinical sense.[8,9] Meanwhile, burdened Medicaid officials and state agency budget managers, struggling with rising costs, cost-shifting and budget cuts, are learning that reliance on traditional services for complex youth may also not make sense financially.[10]

Additionally, a second Surgeon General's report, this one on culture, race and ethnicity, has clearly delineated how health disparities for fragile youth, based on poverty, race and class, further magnify the gap between resources and need. The report indicates these children are ''less likely to have access to available mental health services, less likely to receive needed mental health care, often receive poorer quality care, and are significantly under-represented'' in mental health treatment settings.[11]

As the gap between needs and finances widens, identification of cost-effective treatments that will benefit children with SED and their families is of increasing importance. At the same time, advocates seek to address access barriers and expand availability of care in ''least restrictive settings'' for service delivery to children and families struggling with complex mental health needs.[12] Previous reports have described improvements for SED youth whose families participated in innovative home and community-based programs.[13,14] Additionally, the specific contributions of a ''wraparound'' approach[15] to the care of children with complex mental health needs have been noted in programs such as those in Indiana[16] and Milwaukee,[17] while the nationwide dissemination of wraparound[18,19] and of systems-of-care[20] has also been well-documented.

While positive results in care experience and service use have been reported from the wraparound approach, and large amounts of federal dollars have been dedicated to promulgating systems of care, the children's mental health literature is scant regarding investigations related either to expense or to individual clinical improvement.[21,22]

The delivery system model underlying the Mental Health Services Program for Youth (MHSPY), a demonstration project in Massachusetts,[23] draws on the wraparound approach and incorporates systems of care principles, such as family driven treatment in least restrictive settings and the use of a ''child and family team'' to guide creation of a plan of care. This shared foundation would be expected to produce similar positive findings in previously documented areas of success, such as family engagement.

There are also some differences between MHSPY and the wraparound approach. MHSPY is a clinical care management entity, working to ensure ''continuity of intent'' or shared purpose among state agency staff and service providers toward measurable goals, while holding the authority to pay directly for mental health and other services. Intensive clinical oversight takes place within the program, influencing the process of care; and child and family services may be directly delivered by the Clinical Care Manager, who has a more active role than either a case manager or a care coordinator. MHSPY is also unique in that it blends public agency dollars to support integrated delivery of medical, mental health and social services. Another difference is that the MHSPY clinical care management is guided by a system that recurrently measures individual clinical outcomes, modeling new ''real world'' ways to approach evaluation of the cost-effectiveness of care.

A target population of Medicaid youth was determined to be eligible for MHSPY based on consensus driven clinical criteria. These criteria were developed by the participating state agencies and included: presence of SED and expectations of either frequent psychiatric hospitalization and/or long-term out-of-home placement. In the MHSPY model, each family is provided an experienced Clinical Care Manager, who reviews the child and family's needs and strengths with them across eight Life Domains, regardless of whether the child is at home, in the hospital or in placement at the time of enrollment. The Clinical Care Manager then works with the family to create a Care Planning Team, including a parent/guardian; school and health professionals; mental health and state agency service providers, if any; as well as individuals the family or youth identify as natural social supports. The Care Planning Team establishes specific, measurable goals to address each of the prioritized needs, creating a single, individualized care plan for all pediatric, mental health, substance abuse, educational and social services. These services are provided in an actively coordinated fashion, with frequent communication among team members emphasizing shared direction toward goal achievement.

MHSPY services are funded by intentionally blended public agency dollars drawn from the distinct budgets of multiple state agency stakeholders. Services may be delivered directly by the Care Manager or purchased fee-for-service under a case-rate administered by a private, not-for-profit, managed care organization. This unique collaborative model, which makes extensive use of natural supports for both youth and families to facilitate delivery of intensive, individualized clinical care, has received international recognition.[24] Initial findings suggest improved access to care for typically hard-to-engage families[25] with improved clinical effectiveness in supporting fragile children to be able to live at home and go to school in their communities.[26]

The philosophy underlying the MHSPY intervention is that strength-based, contextually informed mental health treatment for children, focused by a clear clinical formulation, enhances the ability of families to care for children with SED. If the intervention is successful, decreased clinical need should correspond to maintaining children at home and, thereby, decreased expense.

Study Aims

Aim I of this study was to compare outcomes including expense for the intervention vs. ''usual care'' youth with SED. This aim was supported by analyzing trends in service utilization, which yielded information about both morbidity and expense, for MHSPY study subjects vs. those in the comparison group. Aim II was to compare clinical functioning for study youth at baseline and follow-up, in association with restrictiveness of care, to assess effectiveness and potential cost-effectiveness of the intervention.

Methods

Study and reference populations were matched on age, gender, psychiatric diagnosis, morbidity, community and insurance type (Medicaid). Using claims data, annualized, age-adjusted service utilization and expense trends for youth receiving the integrated MHSPY intervention were contrasted with trends for the reference population who received ''usual care.'' Additional comparisons include clinical functioning based on medical record review for enrollees in the MHSPY intervention group at baseline and 12 months; and service utilization patterns for both ''usual care'' and intervention groups in the periods 12 months prior and 12 months post-intervention.

Study Population

The intervention group (N=100) was made up of a convenience sample of Medicaid youth, ages 3-18 years old, residing in five urban communities in the Boston area, who were diagnosed with psychiatric illness for at least 12 months prior to enrollment and received MHSPY services between July 2003 and December 2007. To meet criteria for MHSPY enrollment, participants were required to have documented mental health needs, including at least six months of significant clinical impairment as measured by the Child and Adolescent Functional Assessment Scale or CAFAS[27]; current out-of-home placement, such as hospital/residential treatment or foster care, or imminent risk of out-of-home placement or psychiatric hospitalization. MHSPY enrollees also needed to be eligible for Medicaid, as well as at least one other state child serving agency, such as special education, child welfare, state mental health or juvenile justice. Additional requirements included parent/guardian consent and an IQ ≥ 70 (consistent with state service agreements). Information regarding demographics, psychiatric diagnosis and previous service use was collected upon study enrollment.

Comparison Population

The reference population (N = 20,183) corresponds to the MHSPY study group with regard to age, gender, community, psychiatric diagnosis, morbidity and insurance type (Medicaid). A minimum of 12 months continuous Medicaid enrollment, with 6 or more months falling within the study period, was required for inclusion in both study and reference population samples. The first step in creating the reference population was to identify all children insured by the Medicaid managed care organization (MCO) who were three to nineteen years of age between July 1, 2003 and December 2007 (**Figure 1**). From this group, children with a mental health claim were identified. Total medical and mental health claims were extracted for the children within this group who were continuously enrolled in the MCO for twelve months between July 1, 2003 and June 30, 2007. Claims data for the reference population children were then divided into two groups: ''Group A'' consisted of children who had no inpatient psychiatry claims; ''Group B'' consisted of children whose total mental health claims included at least one inpatient psychiatry admission.

Claims Analysis of Study Youth vs. Reference Population

Medicaid claims were used to compare total service utilization by the MHSPY intervention group to that for the comparison population of children receiving ''usual care.'' A minimum of six and a maximum of twelve months' worth of claims for each subject were aggregated to produce a mean monthly per child expense comparison. MCO claims expense for the ''usual care'' comparison groups was broken down into the following service types: inpatient pediatrics, outpatient pediatrics, ER, pharmacy, inpatient psychiatry, outpatient psychiatry and acute residential treatment (ART). Age-adjusted mean monthly per person clinical expenses for the period of the study were calculated for the MHSPY intervention group, and for the inpatient and outpatient ''usual care'' comparison groups across the seven service categories. Age adjusted rates were created via the direct method[28] with the intervention sample as the standard.

In a separate analysis, claims data for the 12 months prior to enrollment in the study was compared to that for the 12 months after enrollment to examine combined inpatient psychiatry and ART readmission rates for the ''usual care'' vs. the MHSPY intervention populations. Admission rates per 1000 were calculated by age for the baseline year, for both the intervention and comparison groups, and then compared to rates per 1000 for each group in the second year. Ratios of these rates, constructed by dividing the rate of hospitalizations or out-of-home placements after enrollment by the rate of hospitalizations or out-of-home placements before enrollment, were used to compare readmission trends for ''usual care'' vs. MHSPY enrollees, controlling for age.

Chart Review Analyses for Study Youth

In addition to the claims-based comparisons performed between the intervention group and the ''usual care'' group, chart review analyses were done for the MHSPY group. Medical record and claims data for the 100 MHSPY study subjects were combined to examine intervention effects on
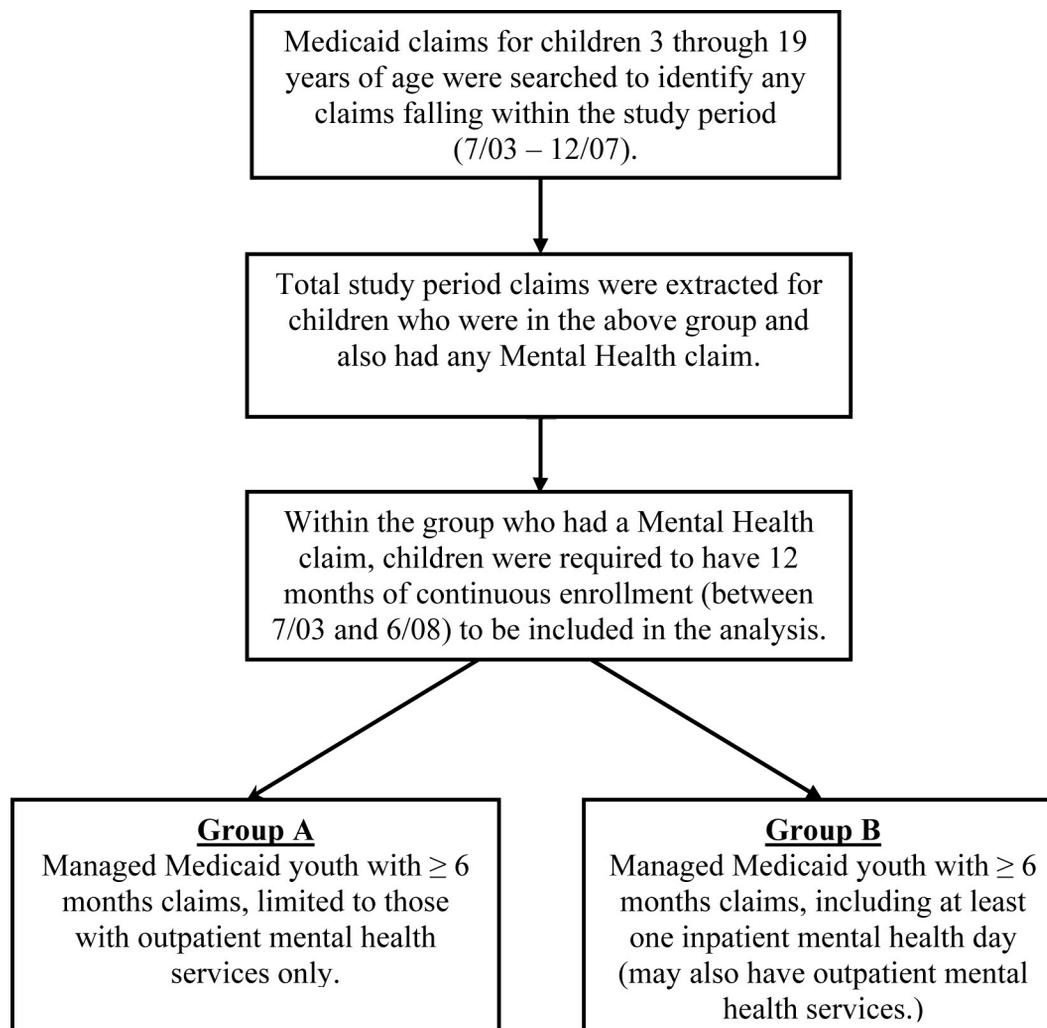
Figure 1. Process Flow for Comparison Group Data

restrictiveness of treatment setting and on level of clinical functioning.

Restrictiveness of Setting

Annualized distribution of the total number of days spent at home (the least restrictive setting) vs. those spent in psychiatric hospitals, detention centers or other out-of-home placements (most restrictive), was examined for the MHSPY intervention group, yielding the overall average percentage of ''days at home'' vs. total program days for the study period. In addition, to investigate intervention effect on use of restrictive treatment setting, differences in relative risk for use of hospital or out-of-home placements were compared pre and post study enrollment, on an individual study subject basis, with significance testing.

Level of Functioning

Clinical functioning is reported on standardized measures at baseline and twelve months for MHSPY study subjects in order to assess whether patterns of service use corresponded to changes in clinical status. Measures included the CAFAS, which rates level of functioning across eight domains (School/Work, Home, Community, Behavior Toward Others, Moods/Emotions, Self-Harm, Substance Use and Thinking), the Child Behavior Checklist (CBCL), the Youth Self Report (YSR)[29] and the Child Global Assessment Scale (CGAS).[30]

Statistical Analysis

Summary statistics were obtained for all variables of interest available in the medical record for the MHSPY group, including number and type of prior treatments, baseline and follow-up measures of clinical functioning and tallies of service settings by level of restrictiveness. Comparative analyses across the intervention and matched reference populations included frequency distributions and trends in service utilization and medical expense based on Medicaid claims.

The assignment of an individual subject to MHSPY was not made randomly. Thus, to validate the results and reduce the potential for bias and confounding by latent variables that may occur in assigning individuals to receive MHSPY

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Table 1. Distribution of MHSPY Study Sample by Age, Gender, and Race/Ethnicity

Age	Black/African-American F	Black/African-American M	Latino/Hispanic F	Latino/Hispanic M	White F	White M	Other F	Other M	Totals by age
3-7	1	3	1	4	3	5	0	0	17
8-12	2	5	0	8	5	10	2	7	39
13-15	4	4	1	6	8	9	0	1	33
16-18	1	1	1	0	3	4	1	0	11
Totals by gender and race/ethnicity	8	13	3	18	19	28	3	8	**N = 100**

services or not, a propensity score matching scheme was utilized in the analyses. This is based on the hypothesis that individuals with more severe mental health services needs would be more likely to be assigned to MHSPY. The propensity score analysis helps to alleviate some of the inherent discrepancies between the MHSPY and control populations by adjusting for the likelihood of being assigned to the intervention. This approach allows us to reduce the bias and focus on the results of the intervention.

The propensity score logistic regression model included terms representing the demographic variables age, gender, community, psychiatric diagnosis and insurance; as well as clinical morbidity indicated by having a prior mental health acute residential treatment or inpatient psychiatric hospital admission; and indicator variables for the following diagnoses: Post-Traumatic Stress Disorder, Mood Disorders, ADHD, Conduct and Oppositional Disorders, Anxiety Disorders, Developmental Disorders, Psychosis and Substance Abuse. Propensity score, or predicted probabilities of being enrolled in MHSPY, were obtained for each subject. Individuals were then stratified by propensity score and an analysis of visits and costs was performed for each stratum.

Next, the propensity scores were used to aid in the assessment of medical expense for each of the populations evaluated. MHSPY subjects with a hospitalization or ART admission were compared to ''usual care'' Group B subjects for the 12 months prior to study enrollment. Using nearest-neighbor matching (NNM), multiple individuals from the comparison group were selected as matching partners for each treated individual based on propensity score without replacement. We then compared the means of the comparison group with the means of the MHSPY group in two ways: using their actual group status, and matched on propensity scores using NNM. T-tests were used to examine these means and demonstrate the change in bias when using NNM procedures.[31] Lastly, to adjust for covariates, weighted linear regression was utilized to evaluate differences between the MHSPY and comparison groups, controlling for key demographic characteristics including psychiatric diagnosis. The weights for the linear regression were based on the mean of the response variable for each regression model to reduce the effect of positive outliers, given that the distribution of expenses is somewhat right-skewed.

Paired t-tests were used to compare functional measure scores on CAFAS, CBCL, YSR, or CGAS for MHSPY participants before and after one year of enrollment in the study. Microsoft Excel and SPSS version 18.0 (Chicago, IL) were used for all statistical analysis and graphical presentations.

Results

Demographics

The average age for MHSPY study participants was 11 years old with a 2:1 ratio of males to females overall. The range for percentage of females varies with age: from 15% in the 3-7 years age group, to close to 40% among 13-15 year olds. The majority of study participants (53%) were children of color: 21% self-identified as Black/African-American, 21% identified as Latino/Hispanic and 11% identified as immigrants (**Table 1**).

For the clinically complex youth in the MHSPY intervention group, co-morbidities are common (75%). Distribution frequencies for primary diagnosis are displayed in **Table 2**; Post-Traumatic Stress Disorder (PTSD) being the

Table 2. Distribution of Primary Psychiatric Diagnoses for MHSPY Study Sample

Primary Diagnosis	N
Post Traumatic Stress Disorder	43
Mood Disorders	32
Attention Deficit/Hyperactivity Disorder	9
Conduct and Oppositional Disorders	6
Anxiety Disorders	4
Developmental Disorders	3
Psychosis	2
Substance Abuse	1
Total	100

Note:
(i) Primary diagnoses from July 2003 to December 2007, based on record review.
(ii) N=100. Study subjects chosen for the presence of psychiatric diagnosis for $\geq$ 12 months prior to intervention.

Table 3. Descriptive Statistics for Control and Intervention Populations Based on As-treated vs. Propensity Score Group Allocation

	Test	Control Mean (SD) or %	Intervention Mean (SD) or %	Test statistic(p-value)	Bias
Gender (% female)	χ^2				
As treated		45.8%	32.0%	7.6 (< 0.001)	13.8 pct pts
NN Matched		44.5%	33.3%	7.1 (< 0.001)	9.2 pct pts
Age	t				
As treated		11.2 (3.7)	12.4 (3.5)	−3.2 (0.001)	1.2
NN Matched		11.5 (3.7)	12.1 (3.6)	−1.7 (0.089)	0.6
Mental Health ART visits in prior year	W				
As treated		0.01 (0.12)	0.11 (0.40)	−12.1 (< 0.001)	0.10
NN Matched		0.04 (0.21)	0.07 (0.29)	−3.4 (< 0.001)	0.03
Mental Health inpatient visits in prior year	W				
As treated		0.03 (0.22)	0.66 (1.05)	−20.1 (< 0.001)	0.63
NN Matched		0.24 (0.49)	0.34 (0.66)	−7.7 (< 0.001)	0.10
Individual diagnoses	χ^2				
Psychosis					
As treated		3.3%	18.0%	63.7 (< 0.001)	14.7 pct pts
NN Matched		10.0%	16.4%	2.9 (0.088)	6.4 pct points
Mood disorders					
As treated		38.6%	48.0%	3.7 (0.056)	9.4 pct pts
NN Matched		44.5%	47.8%	2.5 (0.114)	3.3 pct pts
Post-traumatic stress					
As treated		6.4%	28.0%	73.7 (< 0.001)	21.6 pct points
NN Matched		21.4%	32.8%	5.0 (0.025)	11.4 pct points
Anxiety					
As treated		15.7%	10.0%	6.3 (< 0.001)	−5.7 pct pts
NN Matched		13.8%	7.3%	10.1 (< 0.001)	−6.5 pct pts
ADHD					
As treated		16.0%	9.0%	10.5 (< 0.001)	−7.0 pct pts
NN Matched		16.2%	7.6%	9.3 (< 0.001)	−8.6 pct pts
Conduct					
As treated		18.1%	6.0%	12.0 (< 0.001)	−12.1 pct pts
NN Matched		17.3%	9.5%	7.9 (< 0.001)	−7.8 pct pts
Substance abuse					
As treated		0.4%	1.0%	0.43 (0.512)	0.6 pct pts
NN Matched		0.4%	1.0%	0.45 (0.500)	−0.4 pct pts
Develop. disorders					
As treated		0.5%	3.0%	0.51 (0.273)	2.5 pct pts
NN Matched		0.5%	1.0%	0.37 (0.543)	0.5 pct pts

Notes:
(i) χ^2: Chi square test for categorical variables
(ii) t: Two sample t-test for approximately normally distributed variables
(iii) W: Wilcoxon rank sum test for skewed, discrete variables
(iv) ART = Acute Residential Treatment

most frequent diagnosis, at 43%. Mood Disorders make up the next most frequent primary diagnosis category for study enrollees, at 32%. Both Attention Deficit Hyperactivity Disorder and Conduct/Oppositional Disorders are frequently present as co-morbid diagnoses to PTSD or Mood Disorders but drop to the third and fourth category (9% and 6%), respectively, when ranked as a primary diagnosis. Substance Abuse is listed as a primary diagnosis only 1% of the time, although it is listed 48% of the time as a co-morbid diagnosis for study participants who are age 13 or older.

Descriptive Statistics for Propensity Score Analysis of Study and Comparison Populations

To assess to what degree the NNM propensity score results accounted for differences in the propensity of service utilization, the outcomes of treated individuals were compared to the outcomes of control group members prior to group assignment (**Table 3**). We assessed the bias in each of five predictor variables used in the propensity score analysis

Table 4. MHSPY vs. Comparison Group Claims Expense

| | MHSPY | Comparison Groups | | | |
| | | (A) | | (B) | |
		Crude	Age Adjusted	Crude	Age Adjusted
Member Months	1247.7	176531.6		7104.6	
Distinct Persons	100	19214		969	
$ PMPM					
Inpatient PEDS	3.57	15.00	15.46	57.87	60.14
Outpatient PEDS	140.77	92.56	119.79	231.65	234.61
ER	31.56	11.49	12.80	45.48	46.01
Pharmacy	151.37	28.84	30.99	131.17	132.04
Inpatient Psych	270.10	–	–	988.85	1010.77
Outpatient Psych	146.13	68.76	71.60	83.88	99.72
Acute Residential	15.96	1.06	1.12	36.55	50.03
Total $ PMPM	$761.69	$217.71	$236.30	$1517.58	$1573.18

Notes:
(i)   Standard population is MHSPY; all claims correspond to the period 7/1/05-6/30/06.
(ii) Comparison group (A); all claims for subjects with no inpatient psychiatry services.
(iii) Comparison group (B); all claims for subjects with at least one inpatient psychiatry day.

and showed how balanced groups were before and after NNM. The findings suggest that the NNM procedure did reduce some of the inherent biases between the control and MHSPY groups. There were large relative biases initially with respect to age, gender, number of admissions to either inpatient psychiatry or ART and psychiatric diagnosis. Although the NNM scheme reduced the bias for all variables, the matching scheme was not sufficient to reduce all of the bias to non-statistically significant levels, except for age. Even after matching, the MHSPY (as treated) population retains markers of greater psychiatric severity, as indicated by a higher likelihood of previous hospitalizations and the presence of youth with diagnoses of psychosis, mood disorders, post-traumatic stress, conduct disorder and substance abuse. These results bias our findings toward the null.

Trends for Service Utilization for MHSPY vs. Comparison Groups by Claims Expense

Total per member per month (PMPM) claims expense for the MHSPY intervention group, whose eligibility criteria place them at the high-end of child mental health morbidity, is higher than the total PMPM claims expense for the outpatient only ''usual care'' sample Group A as shown in **Table 4**. However, the total PMPM claims expense (includes pediatric inpatient, ambulatory pediatrics, ER, pharmacy, inpatient and outpatient mental health) for the intervention group represents less than half ($761 PMPM vs. $1573 PMPM) that for the age-matched, psychiatrically ill youth in ''usual care'' Group B.

There is variability in rank order of expense across the three groups by service type. Some results may be related to increased treatment adherence, such as the finding that outpatient mental health claims expense was twice as much for the intervention group as for ''usual care'' Group A, and 46% higher in the intervention group than that for Group B. Similarly, MHSPY participants received 15% more outpatient pediatric services than Group A, but about 40% fewer outpatient pediatric services than Group B. For more intensive services, MHSPY youth required 23% fewer inpatient pediatric admissions than Group A, and 94% fewer inpatient pediatric admissions than Group B. ER use is often correlated with hospital admission, so these findings are consistent with the fact that the MHSPY group had 2.5 times the amount of ER expense as those in Group A (usual care youth without psychiatric hospitalizations), but 32% less than their counterparts in Group B. For acute residential treatment, MHSPY youth incurred $15.96 PMPM vs. $50.03 PMPM for youth in comparison Group B.

Inpatient psychiatry and pharmacy were the two most expensive services PMPM for MHSPY youth, consistent with national healthcare expense trends. Total pharmacy claims expense was nearly 5 times larger for the intervention group than for Medicaid youth with outpatient mental health claims only (Group A) and still 15% higher than for comparison youth with inpatient psychiatry claims (Group B). But inpatient psychiatry claims expense for MHSPY study group enrollees was 73% lower ($270 PMPM vs. $1010 PMPM) than inpatient psychiatry expense for youth in Group B, resulting in a net differences of $721.34 PMPM fewer dollars spent on MHSPY youth than comparison youth in ''usual care.''

The MHSPY study sample is a more psychiatrically impaired population than the usual care group, despite being matched by diagnosis and prior hospital use. One of the
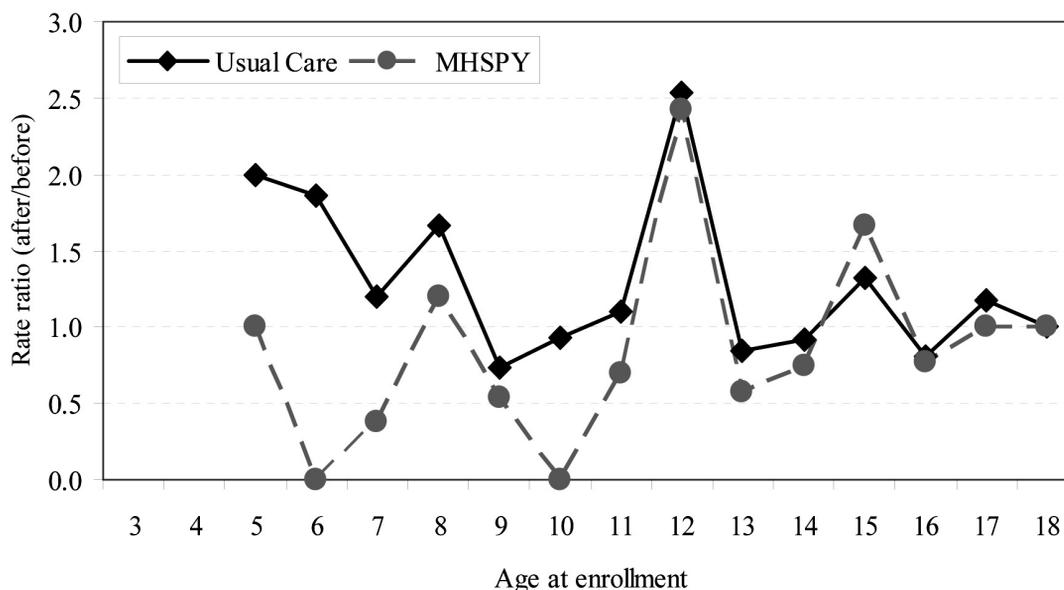
Figure 2. Hospital and ART Re-admission Rate for MHSPY Intervention Group vs. ''Usual Care'' Group at 12 Month Follow-up

Notes:
(i) Psychiatric hospitalization and ART admission rates were analyzed for the 12 months prior to enrollment for MHSPY intervention group and compared to admission rates for the same youth 12 months after enrollment.
(ii) Psychiatric hospitalization and ART admission trends from the ''usual care'' comparison group matched on age, gender, psychiatric diagnosis, morbidity, community and insurance type (Medicaid) were also analyzed for two consecutive 12 month periods, like the MHSPY group.
(iii) The rate/ratio compares the likelihood that a MHSPY vs. a comparison group child would be admitted in the second 12 months, if they were admitted in the first 12 months.
(iv) Results are biased towards the null, since lower intensity ART admissions are counted equally with psychiatric hospital admissions.

Table 5. Differences in Annualized Health Care Expense for MHSPY vs. Comparison Youth ($)

Expense type	Unadjusted $ Per Person/Year	$ Adjusted for gender and age only	$ Adjusted for all covariates
Inpatient PEDS	-224.9 $(-582.5, 132.9)$	-210.6 $(-581.8, 160.6)$	-445.1 $(-877.8, -12.4)$*
Pharmacy	638.5 $(-170.8, 1447.8)$	471.3 $(-351.0, 1293.6)$	-100.8 $(-1061.6, 860.0)$
Inpatient Psych	-688.7 $(-2712.4, 1335.0)$	-1059.0 $(-3137.4, 1019.4)$	-332.6 $(-3097.7, 2432.6)$
Outpatient Psych	1269.2 $(-508.5, 3046.8)$	1252.0 $(-552.3, 3056.3)$	267.8 $(-1734.1, 2269.6)$

Notes:
(i) MHSPY person-year expense is compared to person-year expense for ''usual care'' comparison group with at least one hospital admission (Group B)
(ii) Regression analysis showing total differences in four selected health care expenditures in the 12 months study period; adjusting for age and gender and for propensity scores ($).
(iii) Negative values indicate that expenditures were lower in MHSPY youth than in the comparison group.
(iv) Positive values indicate that expenditures were higher in MHSPY youth than in the comparison group.
* $p < 0.05$

indicators of this is the MHSPY rate of 14.1 admissions per thousand for combined psychiatric hospital and acute residential treatment (ART) in the twelve months prior to intervention. The comparable rate for the usual care sample is 11.3 admissions per thousand. In the twelve months post intervention, the MHSPY study sample admissions/thousand rate fell to 11.1, while the usual care sample's admissions/thousand rate rose to 15.3. Most significantly, when age-matched hospital or ART readmission rates for both intervention and comparison group youth were mapped for the twelve months after the study began vs. the twelve months before the study, the likelihood of readmission proved substantially lower for MHSPY intervention youth,

especially for those whose initial admission occurred under age 13 (**Figure 2**).

The next step was to observe the differences more closely using multivariable regression models to compare MHSPY youth with the comparison Group B, who had at least one inpatient psychiatry claim. Three models were examined – an unadjusted model comparing MHSPY to non-MHSPY individuals directly, a second model including terms for age at enrollment and gender, and a third model including a term for all covariates, including age, gender, community, psychiatric diagnosis, morbidity and insurance type to determine if there were statistically significant differences between the MHSPY and comparison Group B (**Table 5**).
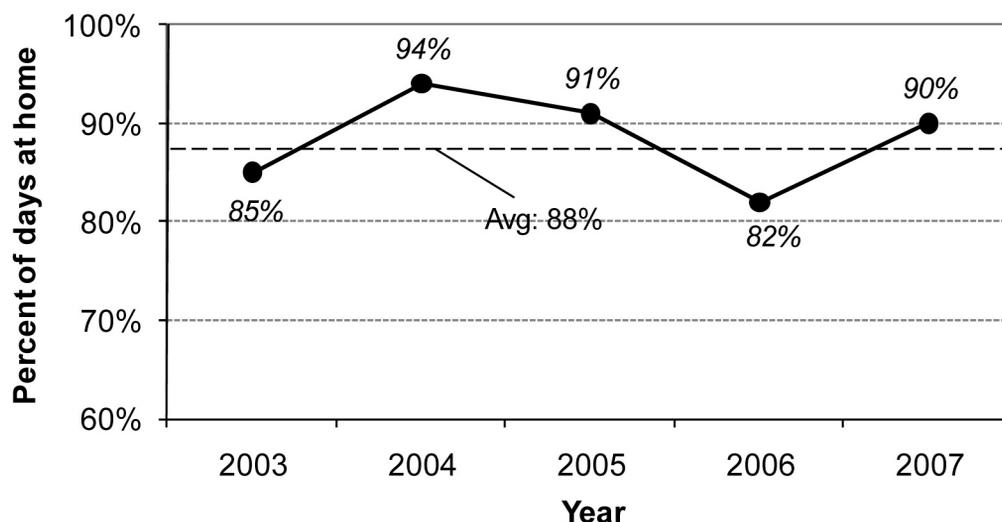
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Figure 3: Percentage of MHSPY Study Subject Days Spent at Home

Notes:

(i)   Home is considered to be the least restrictive treatment setting, in contrast to psychiatric hospitals or locked detention centers, which are defined as highly restrictive treatment settings.

(ii) Over the five years of data reviewed, and regardless of prior residential setting use, an average of 88% of total study subject days during the MHSPY intervention were spent at home.

As displayed in **Table 5**, annualized individual expense for inpatient pediatrics, pharmacy and inpatient psychiatry were all lower for MHSPY youth than for the comparison group youth. Adjusted inpatient pediatric expense, was significantly lower in MHSPY youth than in the comparison group (p = 0.037). Unadjusted pharmacy claims appear higher in the MHSPY group than in the comparison group ($638 higher), but after propensity score adjustment, MHSPY pharmacy expense is shown to be $101 lower per person-year than that for the comparison group. Inpatient psychiatry expense was also consistently lower in the MHSPY group than in the comparison group. Although the results were not statistically significant, these trends suggest that when comparable morbidity is involved, pharmacy and inpatient psychiatry expense may be lower, rather than higher, in the intervention group. Expenditures for outpatient mental health rose for the intervention group, possibly consistent with increased treatment engagement, with adjusted expense only about a third as much as would be indicated by the non-propensity matched findings.

Study Group Hospitalizations and Placements

Level of Restrictiveness

System of care principles include maintaining youth with serious emotional disturbance in least restrictive settings. Home is considered to be the least restrictive treatment setting, in contrast to psychiatric hospitals or locked detention centers, which are defined as most restrictive treatment settings. Contrary to clinical prediction, the percentage of days spent at home for the sample of high-risk youth enrolled in the intervention group averaged over 88% each year for the period from July 2003- December 2007 (see **Figure 3**).

Patterns of Utilization Pre and Post Study Enrollment

Rates for MHSPY study subject admissions to psychiatric hospital or out-of-home residential placement, for the 12 months prior to enrollment, were compared to readmission rates during the 12 months of the study (**Table 6**). Only 55% of study participants with a hospitalization in the 12 months prior to the study required readmission during the study. In addition to fewer children requiring hospital level of care, the total number of admissions also dropped by 70% (from 66 hospitalizations to 20) since many children had had more than one admission in the prior 12 months. Further utilization pattern changes were observed in the number of children requiring out-of-home placements, including a drop in long-term residential care, which declined 82%, acute residential treatment, which declined 44% and foster care, which fell by 83%. In the 12 months prior to enrollment, MHSPY study subjects averaged 1.5 out-of-home placement events per child. In the 12 months post-enrollment, the number of out-of-home placements was reduced 68%, to 1.2 events per child.

Study Group Clinical Improvement

Functional Measures

MHSPY study subjects demonstrated statistically significant improvement on all standard measures of clinical functioning: the CAFAS, the CBCL, the YSR and the CGAS. Scores on all instruments at baseline and after 12 months of study enrollment are presented in **Table 7**. The YSR can only be collected for youth eleven years or older; findings on improvement in T-scores from baseline to 12 months are somewhat less significant, possibly due to the small sample size.

Table 6. Total MHSPY Intervention Group Hospital and/or Placement Use: 12 Months Pre and Post Study Enrollment July 2003 - December 2007

Hospital/ Placement (24 hour service types)	Total Hospital/ Placement Events 12 mos. Prior to Study Enrollment	N	Average Events per Child	Total Hospital/ Placement Events after 12 mos. of Study Enrollment	N	Avg. Events per Child	Percent Reduction in Events	Percent Reduction in Children
Inpatient Psych	66	38	1.7	20	17	1.2	70%	55%
Long-term Residential Care	11	11	1	2	2	1	82%	82%
Acute Residential	11	9	1.2	6	5	1.2	45%	44%
Foster Care	6	6	1	2	1	2	67%	83%
Totals	94	64	1.5	30	25	1.2	68%	61%

Notes:
(i)   Total N=100; of the total children in the study, 64 had a qualifying out-of-home event prior to study enrollment.
(ii) 61% fewer children overall required hospital or out of home placement in the 12 months after enrollment than in the 12 months before enrollment.

Table 7. Change in Clinical Functioning for MHSPY Study Population: Baseline vs. 12 Months Post-Enrollment

	Baseline Score Mean (SD)	12 Month Score(SD)	N	Point Change	Percentage Improvement	p-value
CAFAS	111.9 (38.0)	89.0 (31.8)	89	22.9	−20%	< 0.001
CBCL	69.4 (7.3)	63.1 (9.6)	77	6.3	−9%	< 0.001
YSR	58.9 (11.0)	55.1 (12.4)	33	3.8	−6%	0.035
CGAS	54.3 (9.9)	60.6 (11.8)	100	6.3	+12%	< 0.001

Notes:
(i)   Measurements across all instruments demonstrate improvement in clinical functioning, with statistically significant change in scores for all four instruments.
(ii) For CAFAS, CBCL, YSR instruments, reduction in score indicates clinical improvement.
(iii) For CGAS, increase in score indicates clinical improvement.

Significant Clinical Change

Results from a measure of clinically significant change specifically designed for the CAFAS instrument are displayed in **Figure 4.** The MHSPY study group showed an average 22 point improvement in total CAFAS scores, from an average baseline score of 111 at the time of enrollment in the intervention, down to an average score of 89 at 12-months follow-up. This total improvement includes a 60% decrease in *Risk of Self-Harm*.

Discussion

A myriad of societal factors have dramatically altered the landscape of mental health service delivery in the last two decades. These include the more limited role of providers under managed care, the emergence of behavioral health carve-outs, the turnover in insurance status, and the increased numbers of under-insured or uninsured families, particularly children. Together, these factors have contributed to fragmented care; with a weakening of delivery system supports for clinical ''ownership'' at the case level. This, in turn, appears to have increased the degree of risk for the most vulnerable of patients. Children and adolescents are moved from one care delivery setting to another with little or no clinical history or formulation accompanying them. They, and their families, experience frequent provider turnover, frequent changes in insurance driven by where they are placed, and an absence of any locus of accountability for outcomes.

Linking clinical, social, forensic and educational outcomes is one way to diminish the risk of fragmented care. Assigning accountability for both financial and health status outcomes to the same entity shortens the distance between managing expense and managing quality (including consumer experience) and creates one clear chain of responsibility for results. The MHSPY model draws heavily on the systems-of-care principles, but adds an integrated care management infrastructure design that assumes broad responsibility for cost and clinical outcome measures. Unlike typical systems-
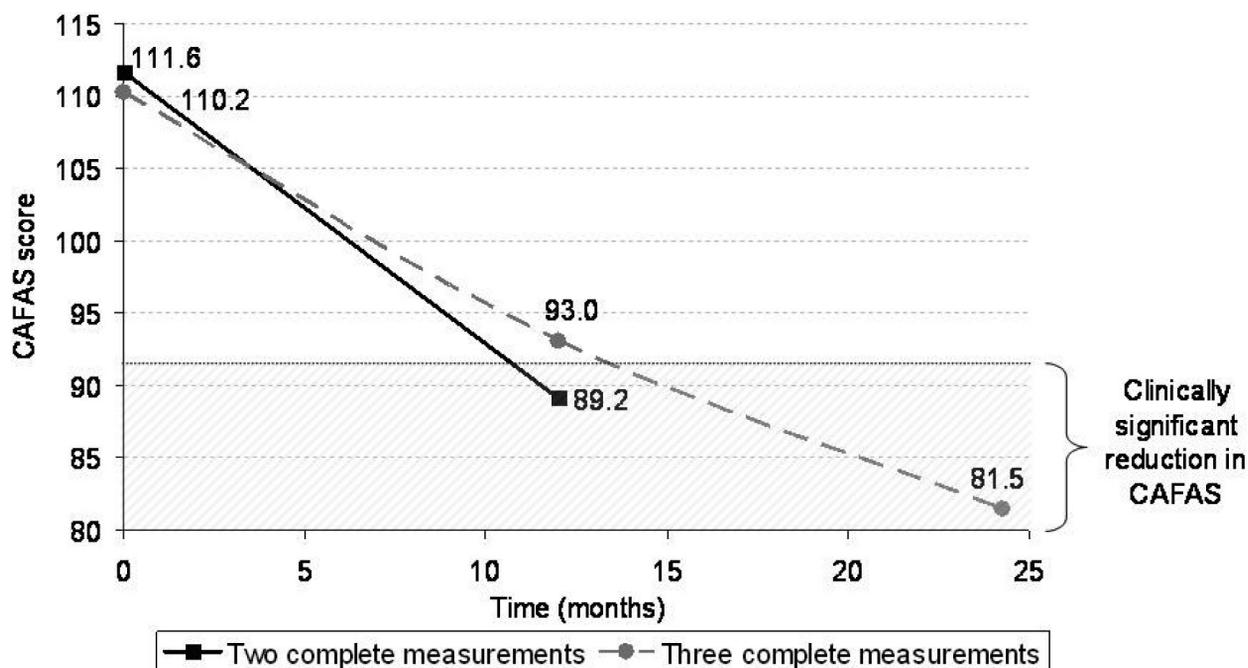
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Figure 4: Clinical Improvement on CAFAS Scores for MHSPY Intervention Group: Baseline vs. 12 and 24 Month Follow-up

Notes:
(i) Improvement on Child and Adolescent Functional Assessment Scale is indicated by a decrease in score; ≥20 point drop is clinically significant, associated with a decreased need for intensive services (Hodges, 2004).
(ii) N = 89 for study subjects with CAFAS baseline and 12 months scores (solid black line). N = 47 for study subjects with CAFAS baseline and 24 months scores (dotted line).

of-care designs, MHSPY locates intensive clinical services at the heart of each family-based team, focusing on accuracy in diagnosis and specific, measurable treatment goals.

Many MHSPY features are consistent with a list identified by Burns and Hoagwood of shared characteristics of evidence-based interventions for community based treatments. These characteristics include: ''function as service components within systems of care,'' ''provided in the home and community,'' ''involve natural supports and parents/youth consumers as partners,'' ''operate under the auspices of all child-serving systems, not just mental health,'' ''were studied in the field with 'real world' children and families,'' ''are less expensive than institutional care (when a continuum is in place).''[13] While not yet tested, it is possible that combining these features in an integrated intervention may have contributed to the positive results.

The morbidity level of the MHSPY population is underscored by the frequency rate for the diagnosis of post-traumatic stress disorder, carried by 43% of the study participants. This a noticeably higher rate than the 7% found in the general population of children in mental health treatment,[2] and higher than the recorded prevalence of PTSD among adolescents with SED involved in multiple service systems (28%).[32] A possible explanation may be that one of the largest referring sources for the MHSPY intervention was the state child protection agency.[26] Despite the clinical complexity of youth being served, there appear to have been positive effects of the model on treatment adherence, as evidenced by the increased use of outpatient services (and possibly increased compliance with medication) and the

decreased use of ER, hospital and other 24-hour care settings with a corresponding reduction in expense.

Consistent with the Burns review of evidence-based interventions noted above, the MHSPY model's integrated approach, recognizing needs identified within the family, school and community, appears to impact engagement and thereby increase the effectiveness of mental health treatment, resulting in improved clinical functioning. At-risk, impoverished youth and families with past histories of difficulty connecting with treatment appear to have benefitted from the unique community-based outreach strategies and flexible service array. Those with previous hospital use or out-of-home placement showed improvement following exposure to clinically intensive, home-based, integrated care. The intervention sample had a foster care placement rate at enrollment that was three times higher than the published rate for Massachusetts Medicaid overall.[33] During the study period, the rate of foster care placement for MHSPY youth fell to half that for Massachusetts Medicaid. Hospital and acute residential treatment admissions within the study group dropped significantly (70%) and study subjects spent close to 90% of their days at home. This is contrary to conventional wisdom, which holds that the best predictor of hospitalization is prior hospitalization.[34]

Measures of level of functioning are not collected in ''usual care,'' which limits clinical trend comparison. However, in the MHSPY group, the 22 point drop in CAFAS total score is consistent with earlier validity studies showing that a change in total CAFAS score by ≥ 20 points indicates ''reliable clinical change.''[35] Additionally, since overall

claims expense for the "usual care" youth was substantially higher than those for intervention youth, it appears that clinical needs for those receiving "usual care" remained high while MHSPY youth improved during the study period.

In addition to demonstrable clinical impact, the intensively integrated services delivery model appears to have potential as a cost effective intervention, as demonstrated in age-adjusted comparisons with "usual care" recipients, applying techniques of propensity score matching. Total emergency room claims expense was 31% lower than that for the reference population of equivalent morbidity, and inpatient psychiatry claims expense was 73% lower. Total medical expense from July 2003 – December 2007 for youth receiving the intervention was substantially lower than that for Medicaid managed care enrollees receiving "usual care," suggesting that clinical needs for the comparison group remained high while those for study participants dropped.

Pharmacy expense was higher for intervention youth, although overall medical expense was lower. Since, the average number of medications prescribed to MHSPY youth has been found to be fewer than that for Medicaid youth in "usual care," the expense differential suggests that different medications may be being prescribed and/or that MHSPY youth are more likely to comply with medication use. Further evidence of the effectiveness of the intervention comes from the propensity score analysis, which reveals a residual bias for the MHSPY (as treated) population toward greater psychiatric severity than the comparison group. Therefore, our estimates may underrepresent the potential intervention effect size.

Lowered expense and reduced hospitalizations can also occur when necessary care is withheld. In such an instance, deterioration of clinical status would be expected. However, the level-of-care decision-making appears to have been clinically appropriate based on the finding that functional status in the intervention group improved across all measures.

These findings suggest that there may also be enhanced clinical effectiveness that is obtained at equal or reduced cost compared to that for "usual care."

Limitations

The absence of a body of child mental health cost-effectiveness literature limits our ability to provide context for our study and comparison groups findings. Also, although the comparison group sample size is robust, the intervention study sample size was restricted, due to state Medicaid constraints, thus we were unable to perform significance testing on some measures. The restrictions on the size of the pilot program mean the time interval necessary to gather outcome data was long, which introduces possible alternative sources of variation due to both case level and system-level changes. Additional limitations include the fact that prior service use data for each of the 100 MHSPY subjects is taken from chart review, unlike the claims data collected during program enrollment, so that numbers of prior placement and hospitalization are likely to under represent actual pre-enrollment hospital utilization. Further,

there is an eligibility requirement of IQ ≥ 70 for MHSPY participants and no IQ information available for the reference population. This could potentially interfere with extrapolation of results for a broader population. Additionally, a potential limitation to this study was the "real world" context in which the work takes place which did not provide clinical measures for subjects in "usual care," nor allow random assignment into the MHSPY group vs. "usual care" group.

Propensity score matching was used to mitigate the absence of random assignment and make the groups more comparable by reducing potential bias and confounding. Propensity score matching is one of the most widely-used and powerful tools available to the health researcher to estimate treatment impact for large populations with comparatively small experimental groups and to be able to better compare a control to an experimental group, in the absence of a true control group.[36] However, propensity score matching itself has limitations, including the fact that despite reducing some potential biases, residual biases and confounding may still remain. Propensity score analyses are also limited in other respects, above and beyond the issue of bias. This approach allows the researcher to account only for observed variables; there may be other, latent and unobserved variables that contribute to potential differentials in the propensity for treatment that cannot be included in such models. Also, the longer the time period of study, the more potential bias will be introduced in the propensity score analysis.

Implications for Health Care Provision and Use

Health care access barriers multiply disparities in health status and reduce effectiveness of treatment. At the same time, policy makers worry that "appropriate" access will lead to unsupportable increases in cost. This investigation offers evidence that intensive home-based programs can reduce barriers to care and improve outcomes, particularly when provided earlier in the treatment process. Research findings reported by the Surgeon General indicate that racial and ethnic minorities face increased barriers in accessing mental health care in traditional settings, as compared to whites.[11] The percentage of MHSPY enrollees who are children of color is more than double the general population rate in their communities, suggesting that that this intervention may offer increased accessibility of mental health services to minority youth. The MHSPY model, which intentionally engages families via "clustered" traditional and non-traditional services, represents a replicable strategy for enhancing clinical impact, thereby improving quality of care.

Implications for Health Care Policies

The MHSPY model, with its expanded insurance benefit purchased under a case rate, offers substantial promise as a cost-effective means to improve mental health outcomes in underserved populations. Blending categorical state and federal dollars across child serving agencies allows flexible support for community-based outreach and engagement

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practices, including highly individualized clinical services for high-risk youth. Resulting expenses total no more than ''treatment as usual'' but yield greater benefits. This clinical risk reduction should, theoretically, also lower future expense for involved youth. The shared ownership experienced within the MHSPY governance model contributes to system change consistent with system-of-care principles, producing sustainable collaboration among family members, providers, community-based system partners and state agency stakeholders. The layered infrastructure facilitates efficient policy and clinical decision-making with associated economies of resource allocation. All these delivery system differences between the intervention model and usual care suggest that improving delivery system design can directly enhance outcomes without increasing expense.

Implications for Further Research

Given the current recognition of unmet mental health needs for large numbers of youth, strategies that can successfully engage family and community members to serve as natural supports, improving access and adherence to health care, are of great potential value. Additionally, the emergence of data demonstrating the added medical vulnerability for youth with mental health conditions makes interventions that address both types of health needs highly relevant. Further research, ideally a randomized trial of the intervention vs. ''usual care,'' should be done. This would help test which elements of the clustered clinical intervention have the largest effect and which patients are most likely to benefit. Follow-up studies of post-intervention patterns of service use for study subjects vs. youth treated in ''usual care,'' would also help determine which results are most likely to endure, and the meaning of those results in terms of both clinical effectiveness and expense.

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