Weight Calculation

Confounders

Observed time-invariant confounders included: i) baseline age, ii) sex, iii) race/ethnicity, iv) mental illness diagnosis, and v) the PRP patient population size where the individual received the plurality of PRP services. Observed time-varying variables included: i) eligibility for Medicaid via disability, ii) SUD diagnosis, iii) co-morbidity (measured via Charlson index) iv) region of residence, v) number of PRP services received, vi) past inpatient utilization, vii) past ED utilization, viii) past primary care use and ix) indicator for enrollment in one of 9 possible Medicaid managed care organizations. Time-varying variables were measured in the preintervention period (October 2012 -September 2013) and during each one-year period throughout the study. To ensure these variables were measured prior to the outcomes and exposure of a given time period they were lagged by one time-period.

Mental Health Diagnosis was defined as having at least two uniquely dated claims with one of the following diagnosis codes: Schizophrenia: ICD-9 295.0-295.X, ICD-10 F20.x, F25.x; Bipolar Disorder: ICD-9 296.0x-296.1x, 296.4x-296.8x, ICD-10 F30.x-F31.x; Major Depressive Disorder: ICD-9 296.2x-296.3x; ICD-10 F32.x-F33.x; Anxiety/PTSD: ICD-9 300.x, 309.81, ICD-10 F40.x, F41.x, F42.x F44.x, F45.0x, F45.1x, F45.2x, F48.x, F43.1x; Other Serious Psychiatric Condition: ICD-9 296.82, 296.90, 296.99, 298.0-298.x, 297.0-297.x, 301.22, 301.83 ICD-10 F32.8, F33.8, F34.8, F23.x, F22.x, F24.x, F21.x, F60.3. These categories are not mutually exclusive.

Treatment Weights

At each person 3-month observation, the estimated treatment weight was calculated as such: Let A_{ij} denote an individual i's treatment assignment (BHH enrollment) at time period j *($A_{ij}=1$ indicates individual i is enrolled at time j, and $A_{ij}=0$ otherwise)*. Let L_{ij} denote the vector of time-invariant and time-varying confounders observed for subject i at time period j. Let $\acute{L}_{ij}$ and $\overline{A}_{ij}$ represent the ith individual's observed covariate and treatment history up through time j. The weight for each person 3-month observation was defined as:

$$\text{TW}_i(t) = \frac{\Pi^t_{j=1} P_j(A_{ij} \vee \overline{A}_{i,j-1})}{\Pi^t_{j=1} P_j(A_{ij} \vee \overline{A}_{i,j-1}, \overline{L}_{ij})}$$

Each term in the numerator was the conditional probability of the ith individual receiving their assigned treatment (BHH enrollment or not), given past treatment assignment. Each term in the denominator was the conditional probability of the ith individual receiving their assigned treatment, given past treatment assignment and the observed time-invariant and time-varying covariates up until time j.

Censoring Weights

At each person 3-month observation, the estimated censoring weight was calculated as such: Let C_{ij} denote if individual i is censored in time period j+1 *($C_{ij}=1$ indicates individual i is not censored in time period j+1, and $C_{ij}=0$ otherwise)*. Let L_{ij} denote the vector of time-invariant and time-varying confounders observed for subject i at time period j. Let $\acute{L}_{ij}$ and $\overline{A}_{ij}$ represent the ith

individual's observed covariate and censoring history up through time j. The weight for each person 3-month observation was defined as:

$$\text{CW}_i(t) = \frac{\Pi^t_{j=1} P_j\left(C_{ij} \vee \overline{C}_{i,j-1}\right)}{\Pi^t_{j=1} P_j\left(C_{ij} \vee \overline{C}_{i,j-1}, \overline{L}_{ij}\right)}$$

Each term in the numerator was the conditional probability of the ith individual receiving their assigned censoring status, given past censoring. Each term in the denominator was the conditional probability of the ith individual receiving their assigned censoring status given past censoring and the observed time-invariant and time-varying covariates up until time j.

Final Weights
The final weight for any given person year observation was the product of the censoring and treatment weight. To control for high variability, weights were truncated to the value of the 1st percentile and at the value of the 99th percentile of the weight distribution.

Weight estimation was conducted with adaptations to Stata code developed by Fewell and colleagues.

Weighted Regression Model
We fit the following weighted negative binomial regression to estimate the results: Number of Outcome Events= B_0 + B_1(HealthHome$_{ij}$) + B_2(Time), where HealthHome$_{ij}$ represents any enrollment in a given person-3 month period.

This marginal structural model approach makes the following assumptions: health homes enrollment does not affect the number of other PRP services received, no unobserved confounders, anyone in the reference population is eligible to enroll in BHH, dropout is independent of the outcome conditioned on the observed history, and our regression models are correct.

Appendix Table 1. Weighted Characteristics of the Study Sample at Baseline (October 1, 2012 – September 30, 2013)

Weighted Characteristic	Total Sample (N=12,232)		Health Home Enrollees (N=3,319)		Never Enrolled in Health Home (N=8,913)	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**
Age	42.2	11.3	44.6	11.2	41.3	11.2
Charlson Index	0.84	1.5	0.9	1.5	0.82	1.5
	%	**N**	**%**	**N**	**%**	**N**
Female	56.4	6,896	44.65	1,482	60.7	5,414
Race						
Black	56.3	6,886	46.1	1,530	60.1	5,356
White	38.3	4,684	47	1,560	35.1	3,125
Other Race	5.4	662	6.9	229	4.9	433
Geographic Region						
Northwest Region	8.1	986	10.0	331	7.4	655
Baltimore City	36.4	4,457	21	697	42.2	3,760
Baltimore Surrounding	25.6	3,126	31.2	1,035	23.5	2,091
National Capital Region	16.7	2,039	18.1	600	16.1	1,439
Southern Region	4.9	604	<1	*	6.7	601
Eastern Shore	8.3	1,013	19.6	652	4.1	361
Other Region	<1	*	<1	*	<1	*
Disability Qualification	61.6	7,536	83.6	2,776	53.4	4,760
Dual Eligibility for Medicare	32.3	3,958	47.9	1,588	26.6	2,370
Managed Care Organization (MCO)						
MCO 1	43.7	5,345	53.4	1,738	40.5	3,607
MCO 2	14.7	1,794	10	331	16.4	1,463
MCO 3	1.4	166	<1	*	1.7	149
MCO 4	<1	*	<1	*	<1	*
MCO 5	10.4	1,276	7.6	252	11.5	1,024
MCO 6	3	364	1.4	45	3.6	319
MCO 7	10.6	1,293	10.0	332	10.8	961
MCO 8	2.1	253	1.5	50	2.3	203
MCO 9	14.1	1,729	16.5	549	13.2	1,180
Psychiatric Diagnosis						
Schizophrenia	43.2	5,289	63.3	2,100	35.8	3,189
Bipolar Disorder	33.1	4,043	24	797	36.4	3,246
Major Depressive Disorder	22.7	2,776	11.9	396	26.7	2,380
Other Mental Health Disorder	1.0	124	0.8	26	1.1	98
Baseline Health Care Utilization						
Inpatient Days	1.8	7.3	2.3	8.0	1.6	7.0
Emergency Department Visits	1.9	4.7	1.6	3.9	2.0	4.9
Outpatient Behavioral Health Service Days	23.3	27.9	26.5	26.8	22.2	28.2
Outpatient Medical Service Days	10.4	9.6	13.2	9.4	9.4	9.4

Asterisk (*) indicated values blinded if N<20

Appendix Figure 1. Standardized Mean Differences of Baseline Measures Pre- and Post-Weighting