

Appendix Part 1 (A1)

Table 1. Core components of Behavioral Health Home (BHH) intervention

	Component (And definition – adapted for Behavioral Health Home setting)	Details of BHH program implemented september 2015
1	<b>Integrated Organizational Culture</b> (Integration is a shared vision of the organization and leadership.)	<ul style="list-style-type: none"> <li>• First in system to integrate primary care into specialty behavioral health care for patients with Serious Mental Illness</li> <li>• Local champions identified (Clinical Director, Program Manager),</li> </ul>
2	<b>Population Health Management</b> (Program tracks patients by prevalent comorbidities; Health IT is used to manage outcomes.)	<ul style="list-style-type: none"> <li>• <u>EHR/IT tools</u>: Population registry, Admission / Discharge / Transfer alerts, Hospital discharge follow-up reports</li> <li>• Proactive use of registry for direct patient outreach</li> <li>• Health plan based care management</li> </ul>
3	<b>Structured Use of a Team Approach</b> (Co-located primary care into specialty behavioral health; shared, team-based workflow.)	<ul style="list-style-type: none"> <li>• Integrated Nurse Practitioner (NP) providing primary care</li> <li>• Integrated Care Manager</li> <li>• All-team meetings</li> </ul>
4	<b>Integrated Behavioral Health Staff Competencies</b> (Providers engage patients and coordinate care with other providers, including primary care, social services, and specialists.)	<ul style="list-style-type: none"> <li>• Coordination with community-based services: structured approach facilitated by full time Integrated Care Manager</li> <li>• Partners the BHH with on-site primary care</li> <li>• Connections to off-site practices</li> <li>• Transition support to facilitate discharge planning from hospitalizations</li> </ul>
5	<b>Universal Screening: Health Conditions</b> (Screenings for common and costly physical health conditions)	<ul style="list-style-type: none"> <li>• Routine metabolic monitoring</li> </ul>
6	<b>Integrated, Person-Centered Treatment Planning</b> (Documented person-centered treatment plans unifying behavioral and physical health.)	<ul style="list-style-type: none"> <li>• Patient-centered care plans documented in the EHR and available for all of the patient’s providers to see across primary and specialty behavioral health care</li> </ul>
7	<b>Systematic Use of Evidence-Based Clinical Models</b> (Evidence-based and guideline-concordant interventions for behavioral/physical health conditions; evidence-based health and wellness programming)	<ul style="list-style-type: none"> <li>• Evidence-based counseling or therapy (Cognitive Behavioral Therapy, family-based therapy, group therapy)</li> <li>• Medication management</li> <li>• Health Promotion:                             <ul style="list-style-type: none"> <li>○ Groups: nutrition and weight management programs, exercise, smoking cessation</li> <li>○ Behavioral incentives</li> <li>○ Wellness tools</li> </ul> </li> </ul>
8	<b>Social Connection*</b> (Opportunities for patients to connect socially to other patients, providers, and staff.)	<ul style="list-style-type: none"> <li>• Patient, Provider, &amp; Staff Community events</li> <li>• Group-based wellness activities and therapy</li> </ul>
9	<b>Patient Voice*</b> (Soliciting patients’ experiences, views, values, and priorities for the program.)	<ul style="list-style-type: none"> <li>• Patient Advisory Council (PAC)</li> </ul>

**Notes:** Adapted from “Best Practices in Integrated Behavioral Health: Identifying and Implementing Core Components” Zahniser et al. 2016. Components **8 and 9** are components of *this* BHH but are not typically included as “Core Components” in existing BHH models.

## Appendix Part 2 (A2)

In a sensitivity analysis for our ITSA, we included not just those who enrolled in BHH before the end of October 2015 but all those who ever enrolled in BHH (a total of 717 BHH patients). Because an intervention start date of September 2015 would be inappropriate for individuals who enrolled in BHH beginning after October 2015 (at least two months later), we adjusted the time-series of the analysis to reflect not calendar months but the number of months elapsed since individual enrollment in BHH (“T-0 analysis”); the intervention start date of September 2015 was maintained for the control sample.

Even with this new sample and adjusted design, most of our primary findings held (Table A2). Among findings which remained statistically significant, there was a qualitative decrease in the DID level shift for primary care (0.184 to 0.118) and DID trend shift for BH Outpatient Care (-0.0155 to -0.0505). With the T-0 analysis, BHH enrollment is no longer associated with a DID trend shift for inpatient care but is now associated with a DID trend shift of -0.00377 ( $p < 0.05$ ) for emergency department visits.

These minor changes may be due to the addition of a more heterogenous sample of BHH participants (potentially consisting of those who were not already receiving care at the clinic sites), slight modifications in the delivery of the intervention over time, or changing environmental conditions which may have altered the efficacy of the intervention at later dates. It is nevertheless the case that this sensitivity analysis reinforces the results of our main analysis that enrollment in a BHH is associated with an increase in the utilization of primary care services and a decrease in the amount of outpatient BH visits over time, among other utilization shifts.

<b>Table A2: Main ITSA Shifts Due to BHH for Main Analysis versus T-0 Analysis</b>				
Visit Type	<i>Difference-in-Difference Shifts</i>			
	<i>T-0 Analysis</i>		<i>Main Analysis</i>	
	Level Shift (SE)	Trend Shift (SE)	Level Shift (SE)	Trend Shift (SE)
Primary Care	0.1179*** (0.03462)	0.00076 (0.0026146)	0.184*** (-0.036)	0.00572 (-0.00371)
Emergency Department	-0.0353*** (0.0126581)	-0.00377** (0.001532)	-0.0307** (-0.0117)	-0.000229 (-0.00167)
Inpatient	-0.00338 (0.0048788)	-0.0002653 (-0.0008233)	0.00216 (-0.00331)	0.000736*** (-0.000244)
Outpatient	0.0426*** (0.0152)	0.00319** (0.0016)	0.0548*** (-0.0149)	0.00436*** (-0.00139)
Behavioral Health Inpatient	0.0138*** (0.0042478)	0.0000365 (0.0004418)	0.0177** (-0.00783)	0.00098 (-0.000795)
Behavioral Health Outpatient	-0.120657 (0.07737)	-0.0505*** (0.011758)	0.0722 (-0.0537)	-0.0155*** (-0.00446)

\*\*\* $p < 0.01$ , \*\*  $p < 0.05$

### Appendix Part 3 (A3)

**Table A3: Covariate Balance Shift after SMR Weighting**

Variable	Unmatched Matched	Mean		%bias	%reduct  bias	t-test	
		Treated	Control			t	p> t
Age	U	50.748	50.031	4.6		0.80	0.424
	M	50.748	51.238	-3.2	31.7	-0.54	0.589
English	U	.90557	.80197	29.6		5.00	0.000
	M	.90557	.89857	2.0	93.2	0.43	0.668
Female	U	.45036	.53707	-17.4		-3.21	0.001
	M	.45036	.47306	-4.6	73.8	-0.84	0.402
Diabetes	U	.18886	.17833	2.7		0.51	0.613
	M	.18886	.19531	-1.7	38.8	-0.30	0.764
Schizophrenia	U	.85956	.50752	81.7		13.62	0.000
	M	.85956	.85177	1.8	97.8	0.41	0.685
Bipolar	U	.30993	.61275	-63.7		-11.56	0.000
	M	.30993	.32137	-2.4	96.2	-0.45	0.651
Race_NonHispanicBlack	U	.23002	.15656	18.7		3.62	0.000
	M	.23002	.23922	-2.3	87.5	-0.40	0.690
Race_NonHispanicWhite	U	.63438	.61327	4.4		0.80	0.423
	M	.63438	.61378	4.2	2.4	0.78	0.435
Race_Asian	U	.04358	.03629	3.7		0.71	0.479
	M	.04358	.0453	-0.9	76.4	-0.15	0.878
Race_Hispanic	U	.01937	.08709	-30.5		-4.76	0.000
	M	.01937	.01828	0.5	98.4	0.15	0.881
MaritalStatus_Married	U	.08959	.14982	-18.6		-3.21	0.001
	M	.08959	.09795	-2.6	86.1	-0.52	0.602
MaritalStatus_Single	U	.79661	.65474	32.2		5.64	0.000
	M	.79661	.76962	6.1	81.0	1.19	0.234
MaritalStatus_Divorced	U	.0799	.11198	-10.9		-1.92	0.055
	M	.0799	.09386	-4.7	56.5	-0.89	0.372
MaritalStatus_Widowed	U	.02179	.04044	-10.7		-1.82	0.069
	M	.02179	.02732	-3.2	70.3	-0.64	0.525
Insurance_Private	U	.05569	.08087	-10.0		-1.75	0.081
	M	.05569	.05368	0.8	92.0	0.16	0.870
Insurance_Medicaid	U	.43826	.5324	-18.9		-3.48	0.001
	M	.43826	.44922	-2.2	88.4	-0.41	0.685
Insurance_Medicare	U	.50605	.38206	25.1		4.68	0.000
	M	.50605	.4971	1.8	92.8	0.33	0.742
MaritalStatus_Legally	U	.01211	.03473	-15.0		-2.42	0.016
	M	.01211	.01124	0.6	96.2	0.15	0.881
perfemaleHH_blockgroup	U	14.856	14.616	3.0		0.53	0.596
	M	14.856	14.977	-1.5	49.7	-0.27	0.789
perlessHS_blockgroup	U	10.211	13.752	-40.8		-7.08	0.000
	M	10.211	10.522	-3.6	91.2	-0.73	0.463
perforeignborn_tract	U	27.972	30.658	-24.5		-4.36	0.000
	M	27.972	28.277	-2.8	88.6	-0.52	0.600
perpoverty_tract	U	13.436	13.869	-6.7		-1.21	0.225
	M	13.436	13.539	-1.6	76.2	-0.28	0.777

### Appendix Part 4 (A4)

<b>Table A4: Time Series Level and Trends Values during Pre-Intervention Period</b>						
Visit Type	BHH Level (SE)	BHH Trend (SE)	Control Level (SE)	Control Trend (SE)	Difference in Level (SE)	Difference in Trend (SE)
Primary Care	0.36*** (-0.03)	-0.0057 (-0.005)	0.29*** (-0.02)	-0.0022 (-0.003)	0.067*** (-0.02)	-0.0019 (-0.003)
Emergency Department	0.15*** (-0.02)	0.0004 (-0.002)	0.13*** (-0.009)	-0.0014 (-0.001)	0.013 (-0.01)	0.0015 (-0.0016)
Inpatient	0.032*** (-0.003)	-0.0008 (-0.0006)	0.033*** (-0.002)	-0.00035 (-0.0003)	-0.0021 (-0.002)	-0.00048** (-0.0002)
Outpatient	0.24*** (-0.01)	-0.0063*** (-0.001)	0.21*** (-0.01)	-0.000098 (-0.001)	0.04*** (-0.009)	-0.0045*** (-0.001)
Behavioral Health Inpatient	0.029*** (-0.003)	0.00027 (-0.0009)	0.045*** (-0.03)	0.00094** (-0.0005)	-0.016*** (-0.003)	-0.00061 (-0.0008)
Behavioral Health Outpatient	1.55*** (-0.04)	0.0091* (-0.005)	0.74*** (-0.02)	0.0032 (-0.003)	0.81*** (-0.02)	0.0052 (-0.004)

\*\*\* p<0.01, \*\* p<0.05

\*All trends and levels are expressed in the average amount of visits per month (level) or the rate at which that average monthly amount changes (trend)

\*Pre-intervention differences assume the control sample to be the referent case (i.e. BHH value – control value)

**Appendix Part 5 (A5)**

**ITSA difference-in-difference (DID) results across all racial and linguistic sub-group analyses**

Results for sub-group analyses *strictly among BHH enrollees*, restricted to racial or linguistic sub-groups

White BHH Enrollees vs Non-White BHH Enrollees				
Visit Type	Difference-in-Difference Shifts			
	DID level shift		DID slope shift	
	Value	Standard	Value	Standard
Non-White BHH Enrollees vs Non-White Controls				
Primary Care	0.0574	-0.0509	0.00417	-0.00427
Physical Health Inpatient	-0.00464	-0.00345	0.000564	-0.00035
Emergency Department	-0.0388	-0.0258	0.00799	-0.00304
Behavioral Health Inpatient	-0.00119	-0.0156	0.000865	-0.0017
Behavioral Health Outpatient	0.297***	-0.0538	-0.0344***	-0.00932
Physical Health Outpatient	0.0505	-0.0321	-4.20E-03	-0.00328
Physical Health Inpatient	0.00631*	-0.00363	0.000468	-0.000466
Emergency Department	-0.00109	-0.0292	-0.000724	-0.00349
Behavioral Health Inpatient	0.00863	-0.0147	-0.000898	-0.00168
Behavioral Health Outpatient	-0.119	-0.0922	0.00349	-0.00548
Physical Health Outpatient	0.0407	-0.0294	0.00933**	-0.00378

Native English-Speaking BHH Enrollees vs non-Native English-Speaking BHH Enrollees				
Visit Type	Difference-in-Difference Shifts			
	DID level shift		DID slope shift	
	Value	Standard	Value	Standard
Native English-Speaking BHH Enrollees vs Non-Native English-Speaking Controls				
Primary Care	0.135**	0.0604	0.00925	0.00717
Physical Health Inpatient	-0.00544	-0.0101	0.000735	-0.00163
Emergency Department	0.0519***	0.0201	0.0102***	0.00281
Behavioral Health Inpatient	-0.00477	-0.0126	-0.000999	-0.00192
Behavioral Health Outpatient	-0.102	-0.109	0.0102	-0.00695
Physical Health Outpatient	0.0441	-0.0694	3.13E-03	-0.00608
Physical Health Inpatient	-0.00559	-0.0108	0.000824	-0.00173
Emergency Department	-0.0196	-0.0258	0.0109***	-0.00273
Behavioral Health Inpatient	-0.00875	-0.0137	0.000731	-0.00204
Behavioral Health Outpatient	0.045	-0.107	-0.0204**	-0.00787
Physical Health Outpatient	0.0307	-0.0664	-6.96E-05	-0.0062

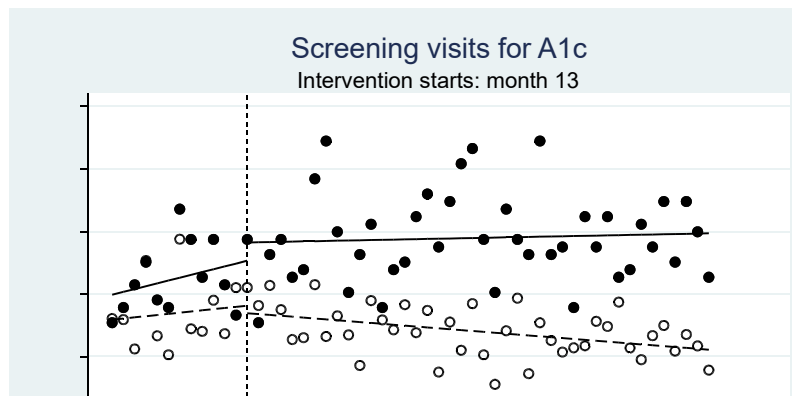
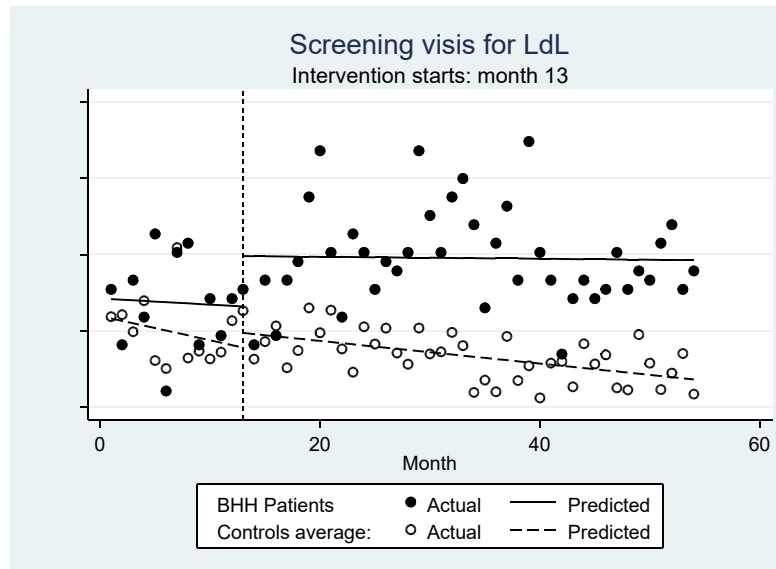
Results for sub-group analyses for BHH enrollees *and* controls, restricted to racial or linguistic sub-groups

\*\*\* p<0.01, \*\* p<0.05

\*\*\* p<0.01, \*\* p<0.05

## Appendix Part 6 (A6)

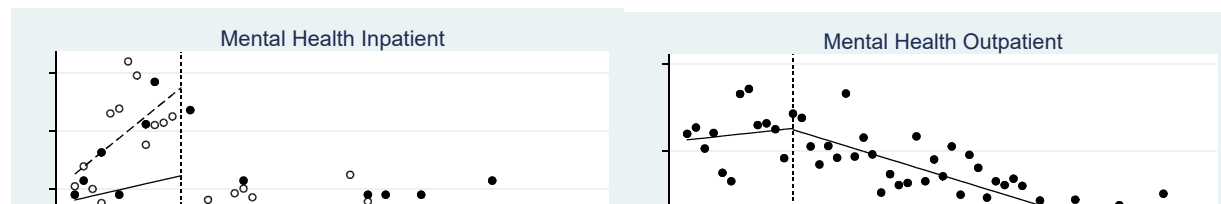
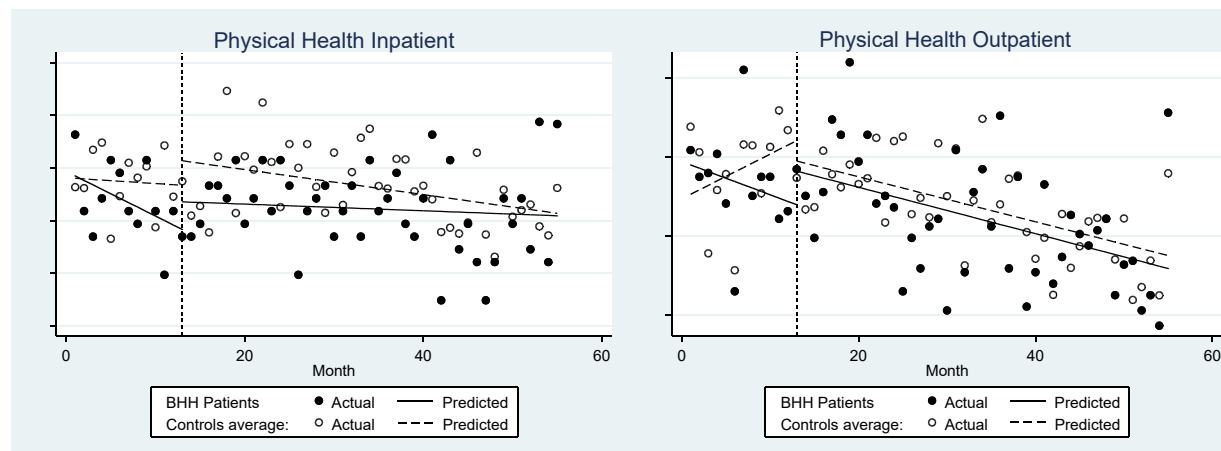
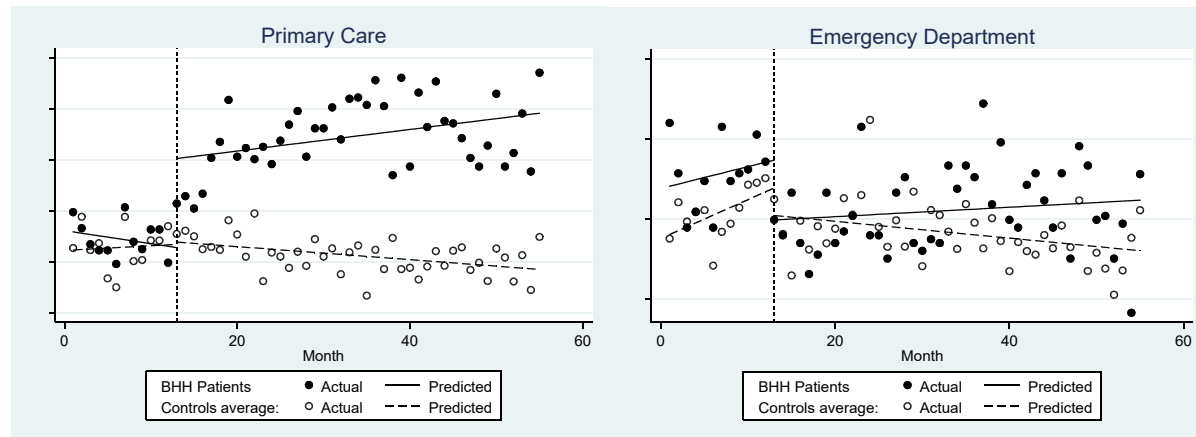
As an exploratory analysis, we qualitatively verified the amount of screening of cardiometabolic measures (LdL and A1c) received by either the control or BHH patient population. To create the following graphs, the same analytic techniques were applied as those used to create figure 2 in the main manuscript (that is, the amount of monthly visits for individuals in the control population were weighted using propensity-score based SMR weights before averaging across the sample of all controls). Qualitatively, the amount of visits was higher for both LdL and A1c screening for BHH patients compared to controls in both the pre and post periods (before and after “month 13” on the graphs).



# Online Supplement

## Appendix Part 7 (A7)

As a qualitative sensitivity analyses, we conducted our main ITSA analyses while further restricting our control sample to those who had at least one encounter in each of the three different years in the post period. This was done to verify that decreasing number of visits witnessed over time (especially for encounter types such as Physical Health Outpatient and Behavioral Health Outpatient) were not due to individuals leaving the health system soon after the intervention began. As is evident from the figures below, we still witness a secular decline in the amount of visits over time for these two service types, even when restricting the control sample to those who were present in the health system throughout the entire duration of the post period.



## Online Supplement