

# Evaluation of Bridges to Moms (2019)

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**PREPARED FOR:**



Health Care Without Walls  
Compassionate care for women and families in need

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## Background

Bridges to Moms, a program of Health Care Without Walls, began in January 2016 and provides intensive case management, medical referral, and social support for homeless and housing insecure pregnant women and new mothers. Patients of the obstetrical service at Brigham and Women's Hospital (BWH), a high-risk referral hospital in Boston, are referred to Bridges to Moms, a targeted outreach program that works as a collaboration between BWH Obstetrics and Health Care Without Walls, a local 501(c)(3) non-profit.

Bridges to Moms participants are demographically diverse, united by a common experience of homelessness or housing instability during pregnancy and the postpartum period. Bridges to Moms seeks to meet the unaddressed needs of homeless women and their families and promote improved birth outcomes, consistent access to routine medical care, and stable housing.

Referrals from BWH are assigned to an outpatient community-based field team managed by a nurse coordinator. The field team, employed and operated by Health Care Without Walls, provides support to women in the prenatal, perinatal, and postpartum periods. Bridges to Moms services address complex needs related to social determinants of health: transportation assistance, food security, housing advocacy, and personal safety. Community health workers communicate with enrolled women regularly and connect them to services. A nurse practitioner and nurse midwife conduct prenatal and postpartum wellness checks, alerting BWH Obstetrics staff of clinical issues that they discover during home visits.

## Evaluation Methods

The Institute for Community Health (ICH) is the external evaluator for the Bridges to Moms program. In 2019-2020, ICH conducted a quantitative program evaluation, which included two key components:

1. A process evaluation to understand program implementation, which included analysis of program records to quantify support received by clients.
2. An outcome evaluation to quantify the impact of Bridges to Moms participation on maternal and child health outcomes. This included analysis of outcomes for Bridges to Moms clients and a comparison group of homeless women who received care at BWH.

## Intervention and Comparison Groups

The intervention group for this evaluation included all Bridges to Moms clients who were enrolled in Bridges to Moms in January 2017 or later and delivered prior to October 1, 2019. The intervention group included 134 women in total. For a subset of analyses, we limited the intervention group to women who enrolled in Bridges to Moms in the advanced prenatal period (30 days or more before delivery, N=92).

We identified the comparison group by searching the electronic medical record (EMR) at Brigham and Women's Hospital for references to homelessness. Hospital registration did not capture housing status so a word search software program, QPID, was utilized to identify charts where relevant words

were embedded in the clinical notes. Examples of search terms included "homeless", "homelessness", "couch surfing", "doubled up", "evicted", "shelter", and "housing insecure." A research assistant reviewed identified records for documentation of homelessness or housing instability and extracted data from the charts of women who met the established inclusion criteria: documented homelessness in the medical record, prenatal care received at Brigham and Women's Hospital, and a delivery occurring at Brigham and Women's Hospital between January 2017 and October 1, 2019. In total, 133 comparison patients were identified.

For both the intervention and comparison groups, the data extracted for the evaluation went through December 2019.

## Process Evaluation

Bridges to Moms collects program data on services provided to program participants. For women in the intervention group, ICH quantified program participation and the support received by clients using the following metrics:

- Participant demographics
- Time of enrollment in Bridges to Moms\*
- Number of taxi/transportation vouchers distributed and used
- Number of meal vouchers distributed

\*Women join Bridges to Moms at different times in their pregnancy or in the postpartum period. We defined the time of enrollment in Bridges to Moms as advanced prenatal (more than 30 days before delivery), prenatal (less than 30 days before delivery), and postpartum (at or following delivery).

## Outcome Evaluation

To determine the impact of Bridges to Moms participation, we compared outcomes for the intervention group to those for the comparison group. In a previous evaluation, we determined that the impact of the Bridges to Moms program on prenatal and birth outcomes varied based on when clients began receiving services, with more pronounced outcomes for clients who had been enrolled longer. Therefore, for prenatal and birth outcomes, we restricted our analysis to the subset of the intervention group that enrolled in Bridges to Moms in the advanced prenatal period. The outcomes we assessed are summarized in Table 1.

<b>Table 1. Summary of outcome evaluation analyses</b>		
<b>Category</b>	<b>Outcomes</b>	<b>Groups analyzed</b>
Access to care	Number and percentage of prenatal appointments attended	Advanced prenatal intervention group vs. comparison
	Number and percentage of postpartum appointments attended	Full intervention group vs. comparison
	Pediatrician identified, primary care doctor for mother identified	Full intervention group only
Maternal health (exploratory analysis)	Prenatal maternal hypertension, gestational diabetes	Advanced prenatal intervention group vs. comparison
	Postpartum maternal hypertension, gestational diabetes	Full intervention group only
Newborn health	Gestational age, birth weight, APGAR score at 1 minute, APGAR score at 5 minutes, if neonatal intensive care unit (NICU) attention was required, number of days in the NICU (if NICU stay was required),	Advanced prenatal intervention group vs. comparison
Maternal engagement in the NICU	Percentage of days with a maternal visit, percentage of days with a maternal call	Advanced prenatal intervention group vs. comparison (only for mothers with newborns that required a NICU stay)

We used an independent t-test for continuous variables and chi-squared test of association for binary variables to determine if outcomes were significantly different for Bridges to Moms participants vs. comparison women or infants. We used linear regression models to assess the impact of Bridges to Moms participation on gestational age, birthweight, and length of stay in the NICU. We also used a linear regression model to look at the relationship between taxi voucher usage and NICU visitation in the Bridges to Moms group. We used a logistic regression to assess the impact of Bridges to Moms participation on gestational age at 37 weeks and odds of low birth weight. Potential confounders were chosen based on demographic variables and comorbidities that were

imbalanced between the two groups and associated with poorer health outcomes (age, race, housing status, and depression). We tested models to determine if they satisfied model assumptions.

## Results

### Process Evaluation

Bridges to Moms supported 134 women who met the criteria for the intervention group, of which 120 were homeless or housing insecure at the time of program referral and 14 had stable housing. Of the 134 women in the intervention group, 24 were enrolled in Bridges to Moms for less than 30 days before delivery (prenatal), 92 were enrolled for 30 or more days before delivery (advanced prenatal), and 18 were enrolled in the program at or following delivery (postpartum).

Bridges to Moms participants had an average age of 27.7 years old and ranged in age from 17 to 44. The majority of participants were Hispanic (55.9%) and an additional 32.1% were Black, non-Hispanic. 62.7% of participants spoke English as their primary language and 32.1% spoke Spanish as their primary language. The women enrolled in Bridges to Moms have a complex medical history, many with mental illness. At program enrollment, 41% had been diagnosed with anxiety, 50% with depression, and 65.7% with a history of trauma. See Appendix 1 for summary of participant demographics.

As part of their services, the Bridges to Moms program distributes meal vouchers for use at the cafeteria at Brigham & Women's Hospital and cab vouchers for transportation to medical appointments for prenatal, postpartum, and primary care. During the study time period, Bridges to Moms distributed a total of 1422 meal vouchers and 1771 cab vouchers to the advanced prenatal group of participants. Of the cab vouchers distributed, 1207 (68.2%) were used (meal voucher usage is not tracked).

### Outcome Evaluation

We determined the impact of the Bridges to Moms program on access to care, maternal and child health using a comparison group of women who delivered at Brigham and Women's Hospital but who were not enrolled in Bridges to Moms. Bridges to Moms participants were similar to women in the comparison group (See Appendix 1) in terms of some demographic characteristics (language of care, type of insurance); alcohol and drug use; and pregnancy history. However, the comparison group was younger than Bridges to Moms participants with a mean age of 25.4, compared to 27.7 among Bridges to Moms participants. Additionally, Bridges to Moms participants had a higher level of anxiety, depression, and history of trauma, but a lower level of tobacco use at enrollment.

#### Access to care

Our analysis of prenatal and postpartum visit attendance suggests that Bridges to Moms improves access to care (Table 2). Bridges to Moms participants in the advanced prenatal group attended an average of 11.4 prenatal visits, whereas women in the comparison group attended an average of 9.9 prenatal visits ( $p=0.004$ ). However, the percentage of visits attended was not significantly different between groups - Bridges to Moms participants attended an average of 82.7% of their scheduled prenatal visits and the comparison group attended an average of 83.7% of their scheduled prenatal visits ( $p=0.6528$ ).

Bridges to Moms participants had a higher mean number and percent of postpartum visits attended. On average, Bridges to Moms participants attended 56.3% of postpartum visits compared to 37.8% of visits attended by the comparison group ( $p < 0.0001$ ).

Of participants who completed the 3-month postpartum period in the Bridges to Moms program, 92 (92.9%) had a primary care provider (PCP) identified and 89 (92.7%) had a pediatrician identified for their newborn.

<b>Table 2. Access to care outcomes</b>					
	<b>Bridges to Moms</b>		<b>Comparison</b>		
	<b>Mean</b>	<b>Std</b>	<b>Mean</b>	<b>Std</b>	<b>p-value</b>
<b>Advanced prenatal intervention group</b>	<b>N=92</b>		<b>N=133</b>		
Prenatal visits	11.413	4.2353	9.8797	3.2846	0.004
Percent of prenatal visits attended	0.8267	0.1695	0.8369	0.1655	0.6528
<b>Full intervention group</b>	<b>N=134</b>		<b>N=133</b>		
Postpartum visits	1.3955	1.1373	1.0902	0.9331	0.0172
Percent of postpartum visits attended	0.5625	0.3879	0.3784	0.3318	<0.0001
<b>Participants who completed Bridges to Moms follow-up period</b>	<b>N</b>	<b>%</b>	<b>N</b>	<b>%</b>	
Pediatrician identified (N=96)	89	92.71	--	--	--
PCP identified (N=99)	92	92.93	--	--	--

### Maternal health

We conducted an exploratory analysis of two common health conditions during pregnancy – hypertension and gestational diabetes (Table 3). Because of the small sample size of women with these conditions, we did not conduct statistical analyses for some outcomes.

In the prenatal period, approximately 9.8% of women in both the advanced prenatal intervention group and comparison group were diagnosed with maternal hypertension ( $p=0.9984$ ). There was a larger proportion of women in the advanced prenatal intervention group diagnosed with gestational diabetes compared to the comparison group (12.5% vs 6.0%), but this difference was not statistically significant ( $p=0.0923$ ). Of those diagnosed, 7 (77.8%) women in the advanced prenatal intervention group were on medication for hypertension compared to 8 (61.5%) women in the comparison group. Ten (90.9%) women in the advanced prenatal intervention group were on medication for gestational diabetes compared to 8 (100%) of those in the comparison group.

For women who were on medication for each condition, we examined whether the condition was controlled (blood pressure or blood glucose in a normal range). Of those on medication for maternal hypertension, 3 (42.9%) women in the advanced prenatal intervention group had their blood pressure under control and 5 (62.5%) of the women in the comparison group had their blood pressure under control. Of those on medication for gestational diabetes, 9 (90%) of women in the

advanced prenatal intervention group had their blood sugar controlled compared to 3 (37.5%) of women in the comparison group.

In the postpartum period, 17 (12.7%) of all Bridges to Moms participants were diagnosed with maternal hypertension and 11 (8.9%) were diagnosed with gestational diabetes. Of those diagnosed, 16 (94.1%) women were on medication for hypertension and 10 (90.91%) of women were on medication for gestational diabetes. Of those on medication, 8 (50%) of the women had their blood pressure under control and 7 (70%) had their blood sugar under control. We did not examine the comparison group due to incomplete data.

<b>Table 3. Maternal health outcomes</b>						
	<b>Bridges to Moms</b>			<b>Comparison</b>		
	<b>N</b>	<b>Total N</b>	<b>%</b>	<b>N</b>	<b>Total N</b>	<b>%</b>
<b>Advanced prenatal intervention group</b>						
Maternal hypertension (prenatal)	9	92	9.78	13	133	9.77
On medication	7	9	77.78	8	13	61.54
Controlled maternal hypertension	3	7	42.86	5	8	62.5
Gestational diabetes (prenatal)	11	88	12.5	8	133	6.02
On medication	10	11	90.91	8	8	100
Controlled gestational diabetes	9	10	90	3	8	37.5
<b>Full intervention group</b>						
Maternal hypertension (postpartum)	17	134	12.69	--	--	--
On medication	16	17	94.12	--	--	--
Controlled maternal hypertension	8	16	50	--	--	--
Gestational diabetes (postpartum)	11	123	8.94	--	--	--
On medication	10	11	90.91	--	--	--
Controlled gestational diabetes	7	10	70	--	--	--

### Newborn health

We next assessed newborn health outcomes for Bridges to Moms participants in the advanced prenatal group compared to the comparison group. Results are summarized in Tables 4-6.

The mean gestational age, birthweight, and APGAR score at 5 minutes was similar between the two groups. The mean APGAR score at 1 minute was lower for the advanced prenatal intervention group compared to the comparison group (7.6 vs. 8.1,  $p=0.0391$ ); although this difference is statistically significant, it is not clinically significant, as a score of 7 or above indicates good health. Finally, a similar proportion of babies required a NICU stay in the two groups (18.9% for the advanced prenatal intervention group vs 12.2% for the comparison group,  $p=0.1713$ ).

<b>Table 4. Newborn health outcomes (advanced prenatal group)</b>					
	<b>Bridges to Moms</b>		<b>Comparison group</b>		
	<b>N=92</b>		<b>N=133</b>		<b>p-value</b>
Gestational age (days) (mean, std. dev.)	266.9	15.69	269.9	15.89	0.1533
Gestational age (weeks) (mean, std. dev.)	38.12	2.24	38.56	2.27	0.1533
Gestational age less than 37 weeks (n, %)	17	18.68	16	12.03	0.1678
Birthweight (grams) (mean, std. dev.)	3035.3	602.7	3124.2	530	0.249
Low birthweight (less than 2500 grams) (n, %)	12	13.64	14	10.52	0.4824
Apgar Score 1 minute (mean, std. dev.)	7.62	1.75	8.08	1.29	0.0391
Apgar Score 5 minutes (mean, std. dev.)	8.59	1.05	8.73	1	0.3508
NICU stay required (n, %)	17	18.89	16	12.21	0.1713
Length of stay in NICU (mean, std. dev.)	25	21.348	27.375	32.473	0.8085
Comorbidities on NICU discharge (mean, std. dev.)	7.0588	3.848	4.6	3.043	0.0563

We modeled the relationship between birthweight and enrollment in Bridges to Moms as well as the relationship between gestational age and enrollment in Bridges to Moms, adjusting for age, race, housing status, and depression (Table 5). In the model, the mean birthweight was 73.35 grams lower in the advanced prenatal intervention group, however, this result was not statistically significant ( $p=0.4005$ ). The mean gestational age was 1.71 days lower in the advanced prenatal intervention group, and this was not statistically significant ( $p=0.4886$ ).

<b>Table 5. Multiple* linear regression models for newborn health outcomes (advanced prenatal group)</b>		
	<b>Parameter Estimate</b>	<b>p-value</b>
Birthweight	-73.3536	0.4005
Gestational age	-1.7066	0.4886
Length of stay in NICU	-26.6522	0.0364

\*All estimates are adjusted for age, race, housing status, and depression

We also examined birthweight and gestational age categorically (Table 6), assessing the proportion of babies born at less than 37 weeks (preterm birth) and those born with a low birthweight (below 2500 grams). In the adjusted logistic regression models, the advanced prenatal intervention group had higher odds of both low birthweight (OR=1.44,  $p=0.4608$ ) and preterm birth (OR=1.53, 0.3441). However, these results were not statistically significant.

<b>Table 6. Multiple* logistic regression models for newborn health outcomes (advanced prenatal group)</b>		
	<b>Odds Ratio</b>	<b>p-value</b>
Low birthweight (under 2500 grams)	1.442	0.4608
Premature gestational age (less than 37 weeks)	1.529	0.3441

\*All estimates are adjusted for age, race, housing status, and depression

Next, we looked at the average number of comorbidities on NICU discharge and the average length of stay in the NICU for infants that required a NICU stay (Table 4). On average, infants born to mothers in the advanced prenatal intervention group had a higher number of comorbidities on NICU discharge compared to the comparison group (7.1 vs 4.6,  $p=0.0563$ ).

Infants born to mothers in the advanced prenatal group stayed 25 days in the NICU and those born to mothers in the comparison group stayed 27.4 days in the NICU ( $p=0.8085$ ). Using a multiple linear regression, we modeled the relationship between enrollment in Bridges to Moms and length of stay in the NICU, adjusting for age, race, housing status, and depression. We found a statistically significant difference in the mean length of stay in the NICU between those enrolled in the advanced prenatal intervention group and the comparison group (Table 5). In the model, the mean length of stay in the NICU was 26.6 days lower for the advanced prenatal intervention group than the comparison group, adjusting for age, race, housing status, and depression ( $p=0.0364$ ).

### Maternal engagement in the NICU

We assessed maternal engagement, measured by visits and phone calls made by mothers while their infants were in the NICU, in the full Bridges to Moms intervention group compared to the comparison group.

There were 35 (26.5%) infants that required a NICU stay in the Bridges to Moms group and 16 (12.2%) infants in the comparison group. On average, Bridges to Moms participants visited their infants in the NICU 85.6% of hospitalization days, while mothers in the comparison group visited 78.7% of the hospitalization days. Mothers in both groups called the NICU an average 7% of hospitalization days. There were no significant differences in maternal engagement between groups.

<b>Table 7. Maternal engagement in the NICU (full intervention group)</b>					
	<b>Bridges to Moms</b>		<b>Comparison</b>		
	<b>N=35</b>		<b>N=16</b>		
	<b>Mean</b>	<b>Std</b>	<b>Mean</b>	<b>Std</b>	<b>p-value</b>
Proportion of days mother visited NICU	0.8559	0.1479	0.7866	0.2726	0.3523
Proportion of days mother called NICU	0.0713	0.0886	0.0669	0.084	0.868

For Bridges to Moms women with infants in the NICU, there was a statistically significant association between the number of taxi vouchers used while the infant was in the NICU and the number of visits the mother made to the NICU ( $p<0.0001$ ).

<b>Table 8. Association between number of taxi vouchers used while infant in the NICU and number of visits mother made to NICU (full intervention group)</b>		
	<b>Parameter Estimate</b>	<b>p-value</b>
Taxi vouchers used	0.3101	<0.0001

Note for all NICU outcomes: there was a small sample size of babies that required a NICU stay, so results should be interpreted with caution.

## Conclusions

Bridges to Moms provides needed social and medical support services to a racially and linguistically diverse population of vulnerable pregnant women and new mothers, many of whom have co-occurring behavioral health conditions.

Our findings suggest that enrollment in Bridges to Moms impacts access to care and newborn health outcomes. We found higher prenatal visits among women who were involved with Bridges to Moms at least 30 days before delivery. Additionally, we found a significantly shorter NICU hospital stay, and thus estimated lower total hospital costs, among infants born to women in the advanced prenatal intervention group relative to infants born to women in the comparison group, despite the infants in the intervention group having a significantly higher mean number of comorbidities. We also found that those enrolled in Bridges to Moms at any point during their pregnancy had a higher number of postpartum visits and a higher proportion of postpartum visits attended.

It is important to note that some of the analyses conducted for this evaluation are limited by small sample sizes and that postpartum outcome analyses are limited by potential missing information for the comparison group. Nevertheless, the results of our evaluation highlight the importance of the Bridges to Moms program in improving access to care and health outcomes for this vulnerable population of women during pregnancy and the postpartum period.

<b>Appendix 1. Demographic and clinical characteristics for Bridges to Moms participants and comparison group</b>					
	<b>Bridges to Moms N=134</b>		<b>Comparison Group N=133</b>		
	<b>N</b>	<b>%</b>	<b>N</b>	<b>%</b>	<b>p-value</b>
<b>Race/Ethnicity</b>					0.0105*
Black, non-Hispanic	43	32.09	33	25	
Hispanic	75	55.97	86	65.15	
White, non-Hispanic	8	5.97	13	9.85	
Other	8	5.97	0	0	
Unknown race	0	0	1	0.75	
<b>Language of care</b>					0.0544
English	84	62.69	99	75	
Spanish	43	32.09	32	24.24	
English and Spanish	3	2.24	0	0	
Other	4	2.99	1	0.76	
Unknown language	0	0	1	0.75	
<b>Insurance</b>					0.556
Private Insurance	3	2.24	4	3.01	
Public Insurance	131	97.76	128	96.24	
Medicare	12	9.3	4	3.2	
Medicaid	116	89.92	116	92.8	
Health Safety Net	1	0.78	5	4	
No insurance	0	0	1	0.75	
<b>Housing status at time of referral</b>					<0.0021*
Unstable (homeless, couch surfing, being evicted, shelter, hotel, doubled up)	120	89.55	131	98.5	
Stable (apartment, subsidized housing, section 8, scattered site)	14	10.45	2	1.5	
<b>Age</b>					
Age (mean, std. dev.)	27.73	5.86	25.39	5.39	0.0009*
Unknown age	3	2.24	1	0.75	
<b>Pre-pregnancy BMI</b>					
BMI (mean, std. dev.)	29.72	8.3	29.24	7.37	0.7088
Unknown pre-pregnancy BMI	46	34.33%	69	51.88%	
<b>Parity and gravidity (Mean, std. dev.)</b>					
Previous pregnancies	2.76	1.92	2.98	1.71	0.333
Term pregnancies	0.9701	1.23	1.03	1.13	0.6789
Pre-term pregnancies	0.194	0.4824	0.1504	0.4999	0.4685
Abortions or miscarriages	0.806	1.39	0.7744	1.08	0.8364

Living children	1.17	1.22	1.19	1.3	0.9086
<b>Substance use</b>					
Alcohol use at program enrollment	2	1.53	2	1.5	0.9878
Drug use at program enrollment	8	6.11	15	11.28	0.1363
Smoking at program enrollment	3	2.29	11	8.27	0.0302*
Unknown alcohol, drug, smoking status	3	2.24%	0	0	NA
<b>Comorbidities</b>					
Anxiety	55	41.04	24	18.32	<.0001*
Cancer	2	1.49	0	0	NA
Depression	67	50	48	36.64	0.0283*
Postpartum Depression	14	10.45	14	10.69	0.9495
PTSD	15	11.19	11	8.4	0.4441
Trauma	88	65.67	64	50	0.0102*