

Assessing the impact of text messaging support on postpartum transitions of care for patients diagnosed with impaired glucose tolerance during pregnancy: a pilot study

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Assessing the impact of text messaging support on postpartum transitions of care for patients diagnosed with impaired glucose tolerance during pregnancy: a pilot study

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Abstract

Background: Universal hemoglobin A1c (HbA1c) screening in pregnancy leads to increased identification of impaired glucose tolerance (IGT). If patients with IGT never develop gestational diabetes, they may not receive nutritional support, counseling regarding long-term metabolic risks after pregnancy, or formal transition of care to primary care providers (PCPs).

Objective: This pilot study reports the design process and initial program evaluation for the Better followup of Impaired Glucose tolerance (BRIDGE) program, a 12-week text-based postpartum support program promoting lab completion and PCP visit scheduling for patients diagnosed with IGT at the start of pregnancy. The 19-month program was divided into two arms lasting 9.5 months each, BRIDGE- (text messaging support alone, October 2021-July 2022) and BRIDGE+ (text messaging and wraparound postpartum visit focused on IGT, July 2022-April 2023).

Methods: Patients were eligible for BRIDGE if they received prenatal care at the pilot study site, were diagnosed with IGT in early pregnancy and never developed GDM and could receive English text-messages. We performed a comparative analysis between the BRIDGE cohort and a 19-month historical cohort. Primary outcomes were (1) completion of hemoglobin A1C (HbA1C) by 1 year postpartum and (2) PCP visit scheduling by 12 weeks postpartum. Analysis was stratified by in-network vs out-of-network PCP. We also performed a comparative effectiveness analysis between BRIDGE- and BRIDGE+.

Results: BRIDGE participants had increased odds of HbA1C completion by 1 year postpartum (39.8% vs 12.5%, aOR 4.28, 95% CI 2.71-6.78) and PCP visit scheduling (31.0% vs 12.0%, aOR 9.58, 95% CI 4.39-20.9) compared to the historical cohort. There were high levels of visit attendance among those who scheduled PCP visits in both the historical and BRIDGE cohorts (92.7 vs 96% of scheduled visits). However, rates of IGT counseling at PCP visits were relatively low in both cohorts (39.5% vs 54.2% of visits). There were no differences in HbA1C completion or PCP visit scheduling between the BRIDGE and BRIDGE+ cohorts.

Conclusions: Text messaging support with educational and behavioral prompts tripled completion rates of HbA1C screening within 1 year postpartum and doubled the scheduling rate for PCP visits by 12 weeks postpartum. While attendance at scheduled PCP visits was very high, <60% of PCP visits included IGT-focused counseling, highlighting key areas for improvement in the quality of postpartum transitions to primary care.

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Conclusions: Text messaging support with educational and behavioral prompts tripled completion rates of HbA1C screening within 1 year postpartum and doubled the scheduling rate for PCP visits by 12 weeks postpartum. While attendance at scheduled PCP visits was very high, <60% of PCP visits included IGT-focused counseling, highlighting key areas for improvement in the quality of postpartum transitions to primary care.

KEYWORDS: postpartum transitions of care, impaired glucose tolerance, obstetrics, quality improvement

INTRODUCTION

According to the 2020 National Diabetes Statistics Report, approximately 1 in 3 American adults have impaired glucose tolerance (IGT) or prediabetes, defined as hemoglobin A1C (HbA1C) of 5.7-6.4 [1]. IGT is often considered an intermediate state of abnormal glucose metabolism that exists between normal glucose homeostasis and diabetes. The natural history of IGT is variable and may include normalization, persistence of impaired tolerance or progression to diabetes [2-4]. Up to 70% of patients with IGT may ultimately develop diabetes without intervention [5]. Given the variable natural history and the ability to alter disease trajectory with behavioral modifications, individuals with IGT are ideal candidates for diabetes prevention efforts [6, 7]. Pregnancy is a time in which individuals enter the health care system and may be motivated to focus on their health. As a result, obstetricians can play a role in promoting overall health, impacting both future pregnancy and long-term health outcomes.

As the prevalence of pre-existing and gestational diabetes (GDM) among pregnant people have increased in recent years [8, 9], universal HbA1C screening in early pregnancy has been proposed to identify undiagnosed pre-existing diabetes as well as to screen for early-onset GDM [10, 11]. In a retrospective cohort at a single institution, 12% of pregnant patients had impaired glucose tolerance in early pregnancy but never developed GDM [12]. Patients with IGT in pregnancy are at risk for both adverse pregnancy outcomes and long-term health outcomes, even if they never develop GDM. Although there are relatively few studies of pregnant patients with IGT and without GDM, several studies have demonstrated an increased risk of spontaneous preterm birth <37 weeks [13, 14]. A singular cohort study has also shown a potentially increased risk of hypertensive disorders of pregnancy (HDP), major congenital anomalies, shoulder dystocia, large for gestational age births, and perinatal death in this population [14]. The American Diabetes Association recommends patients with IGT complete HbA1C screening for development of diabetes every 1-2 years [15]. Pregnant patients diagnosed with GDM receive counseling on dietary and physical

activity recommendations, antenatal glucose monitoring, counseling on long-term metabolic risks, and postpartum glucose testing. In contrast, there are no established guidelines for the prenatal or postpartum management of pregnant patients with IGT and without GDM. They may not receive dietary and exercise counseling, counseling on long-term metabolic risks, postpartum glucose testing, or a formal transition of care to a primary care physician or endocrinologist. This can create gaps in care with implications for future pregnancy and future health outcomes. In previously unpublished data from our institution, an exploratory analysis of long-term outcomes for 100 patients with IGT in pregnancy at a single institution demonstrated that 71% of patients did not have a visit with a primary care provider (PCP) in the 1-3 years after delivery. Of the 29 patients with PCP visits, nearly half (48.3%) did not obtain repeat HbA1c values to determine if there was persistence of IGT. In half of cases, this was due to lack of ordering by the PCP. Of the 15 patients who completed repeat HbA1c testing, 93.3% remained $>5.7\%$ 1-3 years after delivery. There were also 14 repeat pregnancies in this cohort; 78.6% of which continued to demonstrated IGT during early pregnancy screening.

Text messaging support programs have been utilized effectively in the postpartum period to support transitions of care. A randomized controlled trial of a text message support program prompting primary care transitions demonstrated significant improvement in primary care visit completion as well as fewer postpartum readmissions and increased receipt of services such as blood pressure assessment and screening for mood symptoms [16]. Other text messaging support programs have focused on completion of recommended clinical assessments postpartum for patients with pregnancy complications such as hypertensive disorders of pregnancy or gestational diabetes, with many programs reporting improved engagement with text messaging support [17-21].

Based on our institutional data demonstrating clinical need, our team developed a program called Better Followup of Impaired Glucose Tolerance (BRIDGE) to address postpartum transitions of care for patients diagnosed with IGT in pregnancy. Here, we present a single institution pilot

study, including (1) the design process for BRIDGE, (2) a retrospective analysis comparing clinical outcomes for BRIDGE patients to a historical cohort, and (3) a comparative effectiveness analysis comparing two programmatic strategies utilized within BRIDGE.

METHODS

This is a pilot study of Better Followup of Impaired Glucose Tolerance (BRIDGE), a program to support postpartum transitions of care for patients with impaired glucose tolerance in pregnancy. BRIDGE was implemented at a single tertiary care institution, with approximately 4000 deliveries per year, in the northeastern United States. The program ran for 19 months between October 2021 and April 2023.

Patients were eligible for the program if they had an HgA1C value of 5.7-6.4 prior to 20 weeks gestation, completed third trimester glucose testing and did not receive a diagnosis of GDM, had a singleton pregnancy, delivered at our hospital, and were English-speaking. We include more details regarding program implementation, including recruitment, data collection, and analytic plan for our program evaluation, in subsections below.

The project was designated a quality improvement project and deemed exempt from review by our Institutional Review Board. For this nonrandomized pilot study, we utilized a combination of the CONSORT 2010 guidelines on pilot and feasibility trials as well as the STROBE guidelines on observational studies to report our findings [22-24].

PROGRAM DESIGN

Overview

Our team developed a program called Better Followup of Impaired Glucose Tolerance (BRIDGE) to address postpartum transitions of care for patients diagnosed with IGT in pregnancy. The first half of BRIDGE (BRIDGE-) enrolled participants in biweekly text messages between 0-12

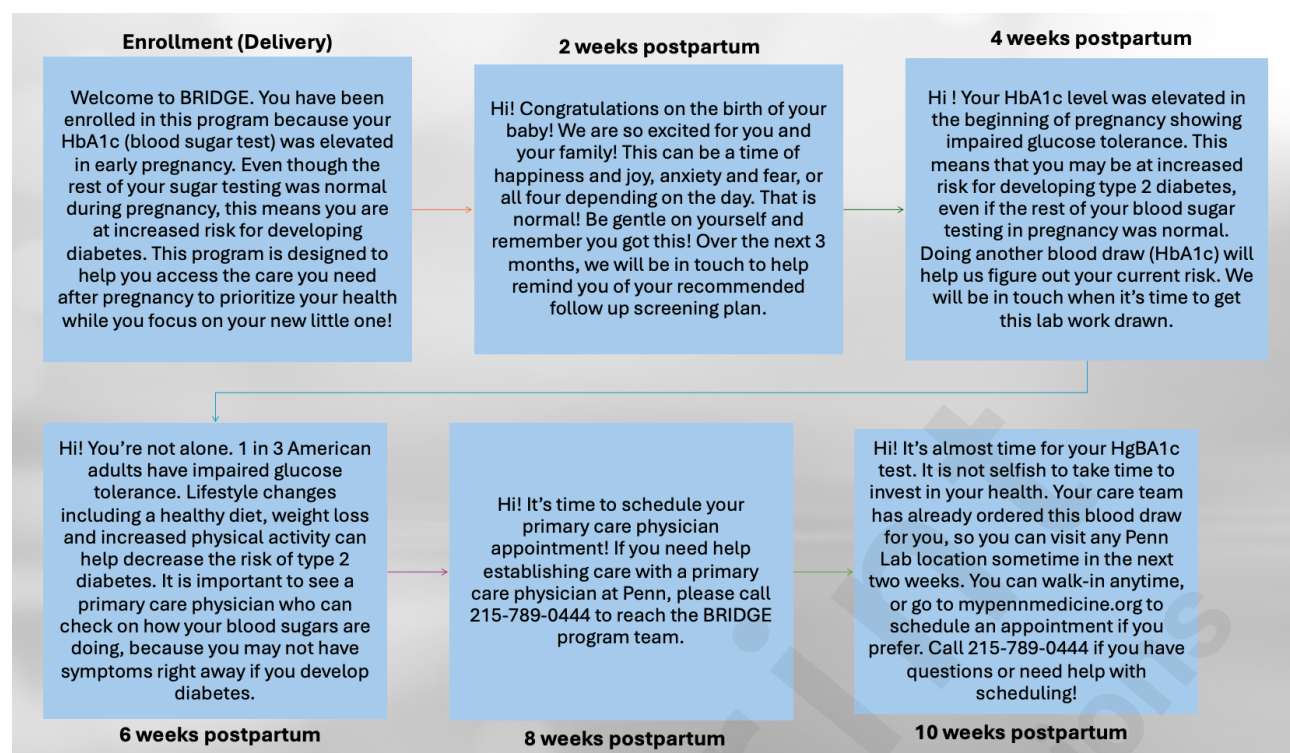
weeks postpartum including educational content and reminders to complete desired postpartum transition milestones, namely (1) completing HgA1C assessment and (2) scheduling a visit with a PCP. During the last half of the program (BRIDGE+, July 2022-April 2023), participants were offered an additional postpartum visit for standardized IGT education in addition to the text messaging support.

Text Message Design and Content

The BRIDGE text messaging program was designed in collaboration with multiple expert groups within our healthcare institution as well as lived-experience experts. First, we partnered with Way2Health (W2H), a Web-based platform providing technology infrastructure for sustainable behavior change interventions to build the text messaging support program.[25-27] W2H infrastructure is integrated into the electronic medical record (EMR) system at our institution, which allows providers to confirm enrollment in BRIDGE and to review text message content if desired. To optimize the frequency and content of messaging in the program, we collaborated with the Nudge Unit, which is a behavioral design team embedded within our institution's healthcare system (Figure 1). Finally, we reviewed the planned messages with a lived experience expert to confirm the language and content of the messaging was appropriate and affirming.

Opt-out enrollment of eligible patients was performed manually by the study team at time of their delivery. Patients received a text message with a description of the program, recommended milestones and the option to decline to participate.

Figure 1: Overview of BRIDGE text message content and timing



Primary Care Physician Scheduling and Follow-up

Our study team held pre-implementation planning meetings both with our prenatal care provider teams as well as the primary care teams to optimize workflows for patient enrollment and engagement with the program.

To facilitate participants' success with expected milestones, we developed an expedited pathway for PCP referral through the BRIDGE program within our healthcare system. We utilized a referral order with a specific indication related to BRIDGE within our EMR. These BRIDGE referrals to primary care were reviewed by the administrative team for our primary care offices on a bimonthly or monthly basis to expedite scheduling.

Programmatic outcomes were reviewed by our study team in monthly implementation meetings. Certain implementation strategies were added or removed to address specific barriers communicated by our prenatal care providers or PCPs as well as patients. For example, we integrated referrals to a virtual social work support program offered by our institution to address patients' reports regarding social drivers of health limiting their engagement with care.

Importantly, our ongoing implementation meetings led to a significant strategic shift at the

midway point of our program where we added a specific postpartum visit where prenatal care providers offered IGT counseling (IGT-focused postpartum visit, iPPV), reiterating the importance of HgbA1C completion and PCP visit scheduling. The addition of iPPV was based on feedback from both patients, who desired to continue care in settings where they had established trust during pregnancy, as well as our primary care team, who reported workforce capacity and insurance challenges. This marked the transition from BRIDGE- to BRIDGE+.

PROGRAM EVALUATION WITH HISTORICAL COHORT AND COMPARATIVE EFFECTIVENESS ANALYSIS

Initially, our program evaluation aimed to compare outcomes among BRIDGE participants to a historical cohort of similar duration at our institution. For our historical cohort, we selected all patients who met identical eligibility criteria to BRIDGE participants and delivered between June 2018 and December 2019. We picked a continuous 19-month time period (identical to BRIDGE program duration) that preceded the COVID pandemic in March 2020 (given disruptions of typical care during that time).

Following the strategic transition to include an iPPV as part of BRIDGE, we also planned to perform an additional comparative effectiveness analysis assessing outcomes among participants in the first half of the program (BRIDGE-), which did not include an additional IGT-focused postpartum visit, to participants in the second half of the program (BRIDGE+), which included iPPV.

The two primary outcomes for the BRIDGE program were (1) completion of a hemoglobin A1c and (2) scheduling of a visit with PCP by 12 weeks postpartum. Given the paucity of national recommendations regarding follow-up for IGT identified in early pregnancy, these postpartum transition milestones were determined based on expert opinion from our maternal fetal medicine, primary care, and endocrinology teams. When completing our comparative analysis with the historical cohort, we assessed hemoglobin A1c completion by 1 year postpartum rather than by 12

weeks postpartum, to provide an appropriate comparison with the standard of care during the historical period. For our comparative effectiveness analysis, we assessed hemoglobin A1C completion by 12 weeks postpartum, which is the programmatic goal, as well as by 1 year postpartum, which is aligned with national recommendations by some organizations such as the ADA [28].

Secondary outcomes included other process outcomes such as PCP visit attendance and the inclusion of IGT counseling during PCP visit (for in-network patients where this data was available in our EMR). We also reported descriptive data regarding iPPV scheduling and attendance for BRIDGE+ participants only. We stratified all outcomes related to PCP visit scheduling and attendance by patients who had in-network PCPs vs all patients due to the insurance and workforce capacity challenges faced by patients who did not have established PCPs within our healthcare system.

Data was collected by study team on participant demographics and clinical characteristics as well as primary and secondary outcomes through EMR review. Race and ethnicity were self-reported. For our primary analysis comparing the BRIDGE population to a historical cohort, we performed bivariate analyses comparing clinical and demographic characteristics between our BRIDGE-/BRIDGE+ and historical cohorts using t-tests for continuous variables and chi-squared tests for categorical variables. Multivariable logistic regressions comparing the odds of all assessed outcomes in the BRIDGE vs historical cohort included all variables with $p < 0.20$ in the bivariate analyses. Backwards stepwise regression was used to create parsimonious models using $p > 0.20$ for elimination. Covariates initially evaluated in the multivariable models included age (continuous variable), insurance status, Black race, family history of diabetes, history of IGT prior to current pregnancy, history of metformin use, history of PCOS, history of macrosomia in prior pregnancy, and late initiation of prenatal care (> 16 weeks gestation). After stepwise backwards regression, only history of IGT prior to current pregnancy remained in the models.

For our comparative effectiveness analysis, we similarly performed bivariate analysis comparing demographic and clinical characteristics between our BRIDGE- and BRIDGE+ cohorts, including all variables with $p < 0.20$ in our multivariable logistic regressions comparing the odds of all assessed outcomes and utilizing backwards stepwise regression (with $p > 0.20$ for elimination) to create parsimonious models. Covariates initially evaluated in the multivariable models included Black race, scant prenatal care (defined as < 5 prenatal visits in pregnancy), history of IGT prior to pregnancy, and history of GDM in prior pregnancy. Following stepwise regression, only history of IGT prior to pregnancy remained significant.

With a sample size of 150 patients, we would be powered to detect an improvement in PCP visit scheduling from an assumed baseline of 15% based on existing literature [29] to 35% with 80% power and alpha of 0.05.

All analysis was performed using Stata v 17.0 (StataCorp LLC, College Station, TX)

RESULTS

Demographic and clinical characteristics of the cohorts

In total, 161 participants were enrolled in BRIDGE program and compared to 342 participants in the historical cohort (Table 1). A higher proportion of participants in the BRIDGE cohort self-identified as Black or initiated prenatal care after 16 weeks. A higher proportion of the BRIDGE cohort had a family history of diabetes, personal history of IGT, PCOS, or metformin use prior to their current pregnancy, or history of macrosomia in a prior pregnancy.

There were 82 participants in the BRIDGE- arm and 79 participants in the BRIDGE+ arm (Table 2). A higher proportion of the BRIDGE- cohort self-identified as Black. A higher proportion of the BRIDGE+ cohort had scant prenatal care, a history of IGT prior to pregnancy and history of GDM in prior pregnancy.

Table 1: Demographic and clinical characteristics of patients with IGT in a historical cohort (June

2018-December 2019) vs enrolled in text messaging support program (BRIDGE, October 2021-April 2023)

<u>Demographics^a</u>	<u>Historical cohort</u> <u>(n=342)</u>	<u>BRIDGE^b</u> <u>(n=161)</u>
Age (median, IQR ^b)	31 (27, 35)	32 (28, 36)
Insurance		
Private	159 (46.5%)	65 (40.4%)
Public	179 (52.3%)	96 (59.6%)
None	4 (1.2%)	
Race		
White	36 (10.5%)	11 (6.8%)
Black	256 (74.9%)	131 (81.4%)
Asian	20 (5.8%)	10 (6.2%)
Other / Unknown	30 (8.8%)	9 (5.6%)
Hispanic ethnicity	16 (4.7%)	7 (4.3%)
Scant prenatal care (<5 visits)	6 (1.8%)	2 (1.3%)
Late prenatal care initiation (>16 weeks)	9 (2.6%)	8 (5.0%)
Nulliparous	107 (31.3%)	44 (27.3%)
Primary care (PCP)		
In network	118 (34.5%)	54 (33.5%)
Out of network	118 (34.5%)	46 (28.6%)
None	106 (31.0%)	61 (37.9%)
<u>Clinical Characteristics</u>	<u>Historical cohort</u>	
History of prior IGT	35 (10.2%)	40 (24.8%)
History of GDM in prior pregnancy	5 (1.5%)	2 (1.3%)
History of macrosomia in prior pregnancy	3 (0.8%)	4 (2.5%)
History of IUFD >20 weeks gestation	1 (0.3%)	0 (0%)
Family history of diabetes	83 (24.3%)	49 (30.4%)
History of PCOS	4 (1.2%)	11 (6.8%)
History of metformin use	7 (2.0%)	7 (4.3%)

^aData is listed as n(%) unless otherwise specified.

^bMissing values: scant prenatal care (n=1 in BRIDGE cohort); late prenatal care (n=1 in BRIDGE cohort); GDM in prior pregnancy (n=1 in BRIDGE cohort)

^cAbbreviations: IQR, interquartile range; PCP, primary care physician; IGT, impaired glucose tolerance; GDM, gestational diabetes; IUFD, intrauterine fetal death; PCOS, polycystic ovarian syndrome

Table 2: Demographic and clinical characteristics of patients with IGT enrolled in text messaging support (BRIDGE-, October 2021-July 2022) vs text messaging support + wraparound postpartum visit (BRIDGE+, July 2022-April 2023)

<u>Demographics^a</u>	<u>BRIDGE-^b (n=82)</u>	<u>BRIDGE+ (n=79)</u>
Age (median, IQR ^b)	32 (28, 36)	33 (29, 36)
Insurance		
Private	32 (39.0%)	33 (41.8%)
Public	50 (61.0%)	46 (58.2%)
None		
Race		
White	3 (3.7%)	8 (10.1%)
Black	72 (87.8%)	59 (74.7%)

Asian	4 (4.9%)	6 (7.6%)
Other / Unknown	3 (3.7%)	6 (7.6%)
Hispanic ethnicity	2 (2.4%)	5 (6.3%)
Scant prenatal care (<5 visits)	0 (0%)	2 (2.5%)
Late prenatal care initiation (>16 weeks)	4 (4.9%)	4 (5.1%)
Nulliparous	21 (25.6%)	23 (29.1%)
Primary care (PCP)		
In network	24 (29.3%)	30 (38.0%)
Out of network	22 (26.8%)	24 (30.4%)
None	36 (43.9%)	25 (31.6%)
<u>Clinical Characteristics</u>	<u>BRIDGE</u>	<u>BRIDGE+</u>
History of prior IGT	16 (19.5%)	24 (30.3%)
History of GDM in prior pregnancy	0 (0%)	2 (2.5%)
History of macrosomia in prior pregnancy	3 (3.7%)	1 (1.3%)
History of IUFD >20 weeks gestation	0 (0%)	0 (0%)
Family history of diabetes	23 (28.0%)	26 (32.9%)
History of PCOS	5 (6.1%)	6 (7.6%)
History of metformin use	5 (6.1%)	2 (2.5%)

^aData is listed as n(%) unless otherwise specified.

^bMissing values: scant prenatal care (n=1 in BRIDGE- cohort); late prenatal care (n=1 in BRIDGE- cohort); GDM in prior pregnancy (n=1 in BRIDGE- cohort)

^cAbbreviations: IQR, interquartile range; PCP, primary care physician; IGT, impaired glucose tolerance; GDM, gestational diabetes; IUFD, intrauterine fetal death; PCOS, polycystic ovarian syndrome

Program evaluation of BRIDGE utilizing historical cohort

BRIDGE participants had increased odds of A1C completion by 1 year postpartum (39.8% vs 12.5%, aOR 4.28, 95% CI 2.71-6.78) and PCP visit scheduling (31.0% vs 12.0%, aOR 9.58, 95% CI 4.39-20.9) compared to the historical cohort (Table 3). This was true among the subgroup of patients with in-network PCPs as well (27.3% vs 12.0%, aOR 8.30, 95% CI 3.77-18.2). Importantly, in the historical cohort, every patient who scheduled a PCP visit had an established in-network PCP in pregnancy; in contrast, in the BRIDGE cohort, 6 out of the 50 patients who scheduled a PCP visit (12%) did not already have an established in-network PCP.

There were remarkably high levels of attendance of PCP visits among those who scheduled PCP visits, across both the historical and BRIDGE cohorts (92.7-96% of scheduled visits). However, rates of IGT counseling at PCP visits were relatively low in both the historical and BRIDGE cohorts (39.5%-54.2% of visits). With both outcomes, there were no significant differences between the

historical and BRIDGE cohorts.

Table 3: Comparing postpartum transitions of care for patients with IGT in a historical cohort (June 2018-December 2019) vs text messaging support (BRIDGE) cohort (October 2021-April 2023)

Postpartum Transitions	Historical cohort (n=342)	BRIDGE cohort (n=161)	aOR (95% CI)^d
A1C completion (1 year postpartum) ^a	43 (12.5%)	64 (39.8%)	4.28 (2.71-6.78)
PCP visit scheduling (n,%)			
In network PCPs ^b	41 (12.0%)	44 (27.3%)	8.30 (3.77-18.2)
All patients ^c	41 (12.0%)	50 (31.0%)	9.58 (4.39-20.9)
PCP visit attendance			
In network PCPs	38 (92.7%)	42 (95.4%)	1.81 (0.28-11.7)
All patients	38 (92.7%)	48 (96%)	2.11 (0.33-13.6)
PCP visits with IGT counseling			
In network PCPs	15 (39.5%)	21 (50.0%)	1.45 (0.59-3.56)
All PCPs	15 (39.5%)	26 (54.2%)	1.65 (0.68-3.98)

^aAbbreviations: A1C, hemoglobin A1C; PCP, primary care physician

^bA limited number of patients had in-network PCPs (n=119 for patients in historical cohort, n=24 for patients in BRIDGE, n=30 for patients in BRIDGE+).

^cThe data on PCP visit scheduling and attendance for patients with out-of-network PCPs was obtained via EMR review (of postpartum notes) for both historical and BRIDGE cohort patients. Phone interviews were also attempted for BRIDGE cohort patients to obtain self-reported data, which was limited by low response rate (n=10 interviews total).

^dOdds ratios adjusted for history of prior IGT.

Comparative effectiveness analysis between BRIDGE and BRIDGE+ arms

In comparing the BRIDGE- to BRIDGE+ arms of the program, the BRIDGE+ cohort had slightly improved odds of hemoglobin A1C completion by 12 weeks postpartum (36.7% vs 19.5%, aOR 2.31, 95% CI 1.12-4.74), though this positive effect utilizing the BRIDGE+ strategy did not persist by 1 year postpartum (48.1% vs 31.7%, aOR 1.88, 95% CI 0.98-3.61, Table 4). There was no difference in PCP visit scheduling between the BRIDGE- and BRIDGE+ program strategies (32.9% vs 29.3%, aOR 0.46, 95% CI 0.11-2.00). This was similar when looking at PCP scheduling among patients with established in-network PCPs (29.1% vs 25.6%, aOR 0.47, 95% CI 0.11-2.09). A similar proportion of patients who did not have established in-network PCPs were able to schedule a PCP visit in both the BRIDGE- and BRIDGE+ cohorts.

Once again, there were remarkably high attendance rates for scheduled PCP visits (91.6%-100%). There were relatively low levels of IGT counseling during PCP visits (53.8%-54.5%). In the BRIDGE+ cohort, a larger proportion of patients scheduled a postpartum visit exclusively focused on IGT counseling (iPPV) than a PCP visit (59.5% vs 29.1%), but attendance rates at scheduled iPPV visits were much lower than PCP visits (48.9% vs 100%).

Table 4: Comparing the effectiveness of text messaging support (BRIDGE-) vs text messaging support + wraparound postpartum visit (BRIDGE+) in completing postpartum transitions of care for patients with IGT

^aAbbreviations: A1C, hemoglobin A1C; PCP, primary care physician

^bA limited number of patients had in-network PCPs (n=119 for patients in historical cohort, n=24 for patients in BRIDGE, n=30 for patients in BRIDGE+).

^cThe data on PCP visit scheduling and attendance for patients with out-of-network PCPs was obtained via EMR review (of postpartum notes) for both historical and BRIDGE cohort patients. Phone interviews were also attempted for BRIDGE cohort patients to obtain self-reported data, which was limited by low response rate (n=10 interviews total).

^dOnly BRIDGE+ participants were eligible for this visit (n=79).

^eOdds ratios adjusted for history of prior IGT.

<u>Postpartum Transitions</u>	<u>BRIDGE- (n=82)</u>	<u>BRIDGE+ (n=79)</u>	<u>aOR (95% CI)^e</u>
A1C completion (12 weeks postpartum) ^a	16 (19.5%)	29 (36.7%)	2.31 (1.12-4.74)
A1C completion (1 year postpartum)	26 (31.7%)	38 (48.1%)	1.88 (0.98-3.61)
PCP visit scheduling (n,%)			
In network PCPs ^b	21 (25.6%)	23 (29.1%)	0.47 (0.11-2.09)
All patients ^c	24 (29.3%)	26 (32.9%)	0.46 (0.11-2.00)
PCP visit attendance			
In network PCPs	19 (90.4%)	23 (100%)	---
All patients	22 (91.6%)	26 (100%)	---
PCP visits with IGT counseling			
In network PCPs	10 (52.6%)	11 (47.8%)	0.70 (0.23-2.73)
All PCPs	12 (54.5%)	14 (53.8%)	0.98 (0.30-3.20)
IGT-focused postpartum visit ^d			
Appt scheduled		47 (59.5%)	
Appt attended		23 (48.9%)	

DISCUSSION

Principal results

Implementing BRIDGE, a text message support program with educational and behavioral prompts focusing on postpartum transitions for patients with impaired glucose tolerance in pregnancy, resulted in increased completion of a hemoglobin A1C within 1 year postpartum and increased scheduling of a PCP visit by 12 weeks postpartum. Adding a wraparound IGT-focused postpartum visit (iPPV) to the text messaging support improved completion of hemoglobin A1C by 6 weeks postpartum but this effect did not persist at 1 year postpartum. Addition of a wraparound IGT-focused postpartum visit also did not impact PCP visit scheduling. Across both the historical and BRIDGE cohorts, attendance at scheduled PCP visits was very high, but fewer than 60% of PCP visits included IGT-focused counseling.

Limitations and Strengths

Our study had several key limitations. As a retrospective observational study, our analysis cannot account for unmeasured confounders. The historical cohort in this study was not subject to the systemic changes in healthcare post-COVID, such as the rising utilization of telemedicine, which may have improved access to care. There are also some scalability concerns with the BRIDGE program. Specifically, the iteration of the BRIDGE program utilized in this pilot study was resource intensive, involving manual enrollment of participants by study staff using EMR review; however, if proven effective, these resource intensive steps could be automated. In addition, other institutions may not have access to the staffing capacity required to support other aspects of the program, such as social work support or wraparound IGT-focused postpartum visits. Finally, our study enrolled only English-speaking patients at a single tertiary care institution in the northeastern United States. Due to limitations with our IRB exemption, we were unable to collect demographic or clinical data on participants who opted out of program enrollment. For patients with out of network PCPs, we had

extremely limited data on PCP visit scheduling and attendance for patients with out-of-network PCPs via EMR abstraction. We attempted phone interviews for BRIDGE cohort patients to obtain self-reported data but had a low response rate (n=10). We deferred phone interviews for the historical cohort because of concern for recall bias.

Our study also had many strengths. First, the development of the BRIDGE program utilized robust input from interdisciplinary teams spanning behavioral health, digital health and communications expertise. In addition, the pre-implementation and ongoing implementation work with prenatal care sites during the pilot allowed us to optimize the effectiveness of the program using flexible and varied implementation strategies, based in an expansive understanding of the barriers faced by patients and providers attempting to achieve a successful postpartum transition. Finally, our population was racially and socioeconomically diverse with varied experiences with PCP care entering pregnancy, which may make their experiences more generalizable to other populations.

Comparison with Prior Work

To our knowledge, this is the first study examining the impact of an intervention on postpartum transition milestones for patients diagnosed with impaired glucose tolerance in pregnancy, who often do not receive tailored support during pregnancy and the immediate postpartum period through specialized programming given to patients with HDP or GDM (e.g. transition clinics, remote BP monitoring programs, Diabetes in Pregnancy programs). This is an important population to target as these patients experience higher rates of negative interpregnancy and long-term health outcomes [30-32].

While there is a paucity of literature focusing on patients with IGT, postpartum transitions for patients with GDM have been well studied. Postpartum glucose screening rates within 12 weeks postpartum for patients with GDM (primarily assessed via completion of a 2 hour glucose tolerance test rather than hemoglobin A1C completion by 6 weeks postpartum, based on guidelines) range

from 7% to 59% in the literature, which are similar to our 6-week hemoglobin A1C completion rate in historical and BRIDGE cohorts (12.5% and 39.8%, respectively) [33-36]. Our PCP visit attendance rates for both the historical cohort (11.1%) and BRIDGE cohort (29.8%) were similar to published rates, which range from 22% to 60% [16, 37]. Multiple systematic reviews assessing the impact of reminder interventions (e.g. emails, phone calls, mail) on postpartum glucose screening rates for patients with GDM have shown potential benefit [38-40]. A randomized controlled trial of a text message intervention targeting primary care transitions for patients with GDM and HDP improved PCP visit completion by 18.7%, which is similar to the difference in PCP visit attendance between the historical and BRIDGE cohorts (11.1% vs 29.8%) [16]. Overall, this consistency with existing literature provides reassurance that BRIDGE intervention may be generalizable to other settings.

This program evaluation highlights areas for improvement in the quality of the postpartum transition for patients with complications of pregnancy, as a large proportion of PCP visits in both the historical and BRIDGE cohorts did not include counseling regarding IGT. Per existing literature, potential contributing factors to this gap in primary care transitions may be related to communication breakdown between the OB and primary care teams regarding pregnancy complications that may influence long-term counseling or management, awareness and knowledge of GDM guidelines among PCPs, and patients' recall of providers' counseling regarding long-term risks, among other factors [41, 42].

Our efforts to effectively implement BRIDGE highlighted many deep-rooted challenges with primary care transition for pregnant patients. From a healthcare system standpoint, PCP access was limited by both health insurance specifications and reduced capacity in the primary care workforce. This limited the ability to successfully schedule PCP visits for postpartum patients without targeted efforts in this area. In addition, patients reported negative social drivers of health (e.g. lack of childcare support, transportation support, or challenges with newborn care such as a city-wide

formula shortage) as well as physical or mental health challenges which served as barriers or competing priorities for patients attempting to complete postpartum transition milestones. These challenges have been well characterized in both quantitative and qualitative analyses within the literature and highlight the need for a multi-level approach to optimizing postpartum transitions of care, addressing individual, healthcare system, and societal barriers [43-47].

Conclusions

For patients with IGT in pregnancy, text messaging support with educational and behavioral prompts tripled completion rates of hemoglobin A1C screening within 1 year postpartum and doubled the scheduling rate for PCP visits by 12 weeks postpartum. While attendance at scheduled PCP visits was very high, <60% of PCP visits included IGT-focused counseling, highlighting key areas for improvement in the quality of postpartum transitions to primary care for this population. The implementation of BRIDGE also highlighted a complex array of individual, systemic, and societal barriers to achieving desired postpartum milestones. Text messaging support may be an effective tool to incorporate into multi-level approaches to optimizing postpartum transitions of care.

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CONFLICTS OF INTEREST

The authors have no conflict of interest to declare.

ABBREVIATIONS

IGT; impaired glucose tolerance

PCP; primary care provider

BRIDGE; Better Followup of Impaired Glucose Tolerance

HbA1C; hemoglobin A1C

HDP; hypertensive disorders of pregnancy

GDM; gestational diabetes

DATA AVAILABILITY

Data is available upon request from authors.

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