Gestational Diabetes: Addressing the Barriers to Care in the Postpartum Period

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Abstract

Gestational diabetes mellitus (GDM) is closely linked to the development of type 2 diabetes mellitus (T2DM) and other metabolic and cardiovascular complications after pregnancy. Despite these associated risks and published guidelines for follow-up, postpartum follow-up remains suboptimal, and resources remain underutilized. A Federally Qualified Health Center reported no current standardized practice of postpartum care for women with GDM-affected pregnancies and poor adherence to recommended guidelines. A GDM best practice flowchart, was implemented over 12 weeks as a universal practice change to increase postpartum glucose tolerance test (GTT) screening and referrals to family practice/internal medicine for ongoing care. A total of 135 participants were de-identified and a retrospective chart audit and data collection were completed for descriptive statistics. After implementation, postpartum GTT ordering increased to 61% (n = 82) and there was a 25% (n = 34) postpartum GTT completion rate. 79% (n = 107) had a history of GDM added to their medical record, 29% (n = 39) had a referral to family practice/internal medicine, and 24% (n = 33) had a scheduled appointment. The results were clinically significant, as there was an increase in postpartum GTT orders and screening rates. The impact of a provider flowchart shows enhanced continuity of care and a standardized process. There were limitations including compliance. Postpartum follow-up for GDM-affected pregnancies is crucial, as this can lead to long-term risk reduction.

Keywords: gestational diabetes mellitus, postpartum, Chronic Care Model, metabolic, cardiovascular

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There is an overwhelming rise in gestational diabetes mellitus (GDM) that has sparked concern among experts and healthcare providers nationwide. A GDM-affected pregnancy bears many risks to the mother and their unborn babies. Though the condition is deemed gestational, these risks remain in the postpartum period and beyond with any GDM diagnosis.

Background and Significance

GDM is identified as one of the most common pregnancy-related complications in the United States, affecting 5-10% of pregnancies, and nearly 250,000 new cases are reported annually (Martinez et al., 2017). A GDM-affected pregnancy involves the onset of glucose intolerance and poses risks to the mother and her child even after birth (Martinez et al., 2017; Vounzoulaki et al., 2022). GDM-affected pregnancy individuals have a 40-70% risk of developing type 2 diabetes mellitus (T2DM) in their lifetime (Bauer et al., 2022).

Current literature provides insight into the burden of GDM during pregnancy and postpartum. There are significant gaps in postpartum care, and this can be a precursor for disease progression. Priority effort is placed on managing GDM in pregnancy; however, the postpartum period is just as crucial as it provides a critical window of opportunity for the prevention of known risks (Jones et al., 2019; Li et al., 2020; Vounzoulaki et al., 2022). Obstetrical providers tend to focus more on the pregnancy state and fail to acknowledge the associated risks between GDM and the development of T2DM, hypertension, and other metabolic and cardiovascular diseases following pregnancy (Daly et al., 2018; Li et al., 2020).

Problem Statement and Population Affected

Women with GDM-affected pregnancies undergo intensive monitoring and follow-up during pregnancy, and, in many cases, follow-up diminishes during the postpartum period

despite recommendations for ongoing care (Mielke et al., 2013). Individuals with GDM-affected pregnancies perceive that GDM concerns dissipate after childbirth (Bauer et al., 2022; Mielke et al., 2013). This mistaken perception stems from several barriers. Patient barriers include low health literacy, lack of awareness, anxiety or fear of diagnosis, inconvenience of testing, schedule conflicts, lack of insurance, and coordinating childcare (Bauer et al., 2022; Martinez et al., 2017). Healthcare provider barriers to promoting appropriate follow-up also exist, including a lack of knowledge about the importance of follow-up testing in the postpartum period (Bauer et al., 2022). These barriers have generated gaps in the quality of postpartum care, thus contributing to a further disease burden and decreased quality of life.

Epidemiologic Data

Globally, GDM affects approximately one in six births (Vounzoulaki et al., 2022). Of those screened postpartum, one in three individuals has an impaired glucose result (Bauer et al., 2022). The increasing incidence of GDM is directly related to contributing factors of advanced maternal age, obesity, and a lack of physical activity (Martinez et al., 2017; Sahin & Madendag, 2020). Pregnancies affected by GDM elicit a continuous long-term risk for metabolic and cardiovascular disease (Jones et al., 2019). There is a tenfold higher risk of developing T2DM in this population (Vounzoulaki et al., 2020; Vounzoulaki et al., 2022). An even greater risk is associated with African Americans, Native Americans, Hispanics, and low-income women. (Jones et al., 2019).

Purpose and Rationale

Given the rapidly increasing prevalence of GDM, its associated risks, and barriers to poor follow-up in the postpartum period, healthcare providers must implement strategies to improve the post-delivery transition of care. While many identifiable barriers are acknowledged,

awareness allows for strategic interventions to change practice. This project aims to address obstacles by emphasizing the importance of the postpartum 2-hour glucose tolerance test (GTT) and primary care referral as part of a routine follow-up to delay the progression of disease processes and reduce the risk of severe health complications.

Current Practice and National Guidelines

Postpartum glucose screening rates for women with GDM-affected pregnancies remain suboptimal despite the magnitude of known risks (Jones et al., 2019). Current guidelines from the American Diabetes Association (ADA) and the American College of Obstetricians and Gynecologists (ACOG) recommend a 2-hour GTT at 4-12 weeks postpartum for any individual with a GDM diagnosis and referral to primary care (ACOG, 2018; American Diabetes Association Professional Practice Committee, 2022; Bauer et al., 2022; Bernstein et al., 2017; 2022; Hylton-McGuire, 2020; Paul & Fitzpatrick, 2020; Sahin & Madendag, 2020). This postpartum screening aims to identify persistent issues with glucose metabolism beyond gestation to allow for prompt intervention. Given risks remain despite follow-up screening results, referral to a primary care provider ensures continuity of care. While these recommendations have been implemented for several years, numerous individuals with GDM are not being screened during their postpartum period. Recent studies reveal that screening rates are less than 50% (Bauer et al., 2022).

Internal Evidence

A nonprofit, Federally Qualified Health Center (FQHC) in the Southwestern United States is devoted to serving underserved communities by improving and sustaining health and providing quality, affordable care. They offer healthcare to all ages, including pediatric care,

women's health/pregnancy care, family medicine, dental care, integrated services, and on-site pharmacy services.

This organization has reported identifiable gaps in the continuity of care for women with GDM-affected pregnancies in the postpartum period. Specifically, they have identified missed opportunities to complete the recommended postpartum 2-hour GTT for this population. They have also reported inconsistencies with adhering to recommended guidelines for ordering the postpartum GTT and routine follow-ups beyond the postpartum period. A retrospective chart audit from June 2022 to June 2023 revealed only 56% of patients with GDM had a postpartum 2-hour GTT ordered, and 21% of patients completed this screening.

PICO Question

A review of the literature led to the clinically relevant PICO question: "In women with Gestational diabetes mellitus receiving care in a community health center (P), how does a streamlined workflow (I) as compared to no workflow (C) affect the completion of a postpartum 2-hour glucose tolerance test postpartum and referral to primary care (O)?"

Evidence Synthesis

The literature searches yielded a great deal of promising data that was narrowed down to ten studies. Integrating qualitative and quantitative studies and various study methods allowed for a complex yet comprehensive literature review. The quantitative studies added some strength to the topic by providing hard numerical data and more precise analysis.

Search Strategy

The exhaustive literature search was completed using three different electronic databases including PubMed, Cumulated Index to Nursing and Allied Health Literature (CINAHL), and ProQuest. These databases were chosen to yield a variety of literature that would provide

healthcare relevancy and applicability to the PICO question. The initial keyword selection was focused on the population or problem, *gestational diabetes* and the outcomes, *postpartum follow-up,* and *primary care*. The searches were further expanded to focus more on the intervention piece and included *program, compliance*, and *handoff*.

Literature Review and Synthesis of Evidence

All ten chosen studies were carefully evaluated and analyzed for validity and reliability (see Appendix A, Table A1, and Table A2). Melynk & Fineout-Overholt's (2019) rapid critical appraisal tools facilitated this process. Initial evaluations examined the relevancy of each study to see if the purpose aligned with the topic and would be helpful in practice. Fine details were then reviewed to identify the study design, implications, subjects, variables, data collection, methods, and results depending on the type of study.

For the studies that included actual subjects, the sample sizes ranged from 10-246, with ages ranging from 18-32 years (see Appendix A, Table A1, and Table A2). The differences were that the studies incorporated various interventions and methods; however, all revealed promising results that influenced outcomes in some manner (see Appendix A, Table A3). Only one of the ten studies did not yield any favorable results (Soffer et al., 2021). However, the patient scheduling component of this study had a significant impact on patient reach and was like other appointment scheduling interventions. Commonalities included eight studies that were GDM-specific, further strengthening the evidence related to the topic.

Overall, these studies support interventions for implementing a workflow process for follow-up care on GDM-affected pregnancies. The process could consist of various aspects addressing several barriers altogether. An algorithm, patient reminder, provider toolkit, patient toolkit, and warm handoff process can all be incorporated into one workflow (Crowley et al.,

2020; Domingo et al., 2022; Nedergaard et al., 2022; Rotem et al., 2019; Shellhass et al., 2016; Sanderson et al., 2021).

Synthesis and Influence on the DNP Project

GDM care in the postpartum period is lacking, and current interventions and guidelines can guide change. The literature reveals numerous barriers to the current gaps in postpartum care for patients with GDM-affected pregnancies, often occurring simultaneously. Healthcare provider, patient, and system-level barriers exist, making it challenging to overcome current deficits with simple interventions. Common barriers include unawareness of care needed in the postpartum period, patient non-compliance, appointment no-shows, inconsistencies in test ordering or postpartum scheduling, lack of transportation, lack of childcare, ambiguous roles, and communication difficulties (Bauer et al., 2022; Jones et al., 2019; Li et al., 2020; Martinez et al., 2017; Mielke et al., 2013; Vounzoulaki et al., 2022). The evidence demonstrated heterogeneity of interventions ranging from appointment reminders to clinical system changes (see Appendix A, Table A3).

While most interventions are promising, methods have identifiable weaknesses that allow alternate barriers to interfere while others are being addressed. Therefore, a comprehensive intervention that addresses multiple barriers simultaneously would strengthen postpartum care for GDM-affected pregnancies. Addressing barriers concurrently will help enhance services, improve best care practices, and ultimately improve patient outcomes. Shellhaas et al.'s (2016) study, the Ohio Gestational Diabetes Postpartum Care Learning Collaborative, strongly influenced the design and concept of the intervention. This study incorporated a multifaceted approach at a system level with a patient toolkit, provider toolkit, and healthcare provider workflow. This multidimensional system improvement yielded promising results.

Conceptual Framework and Implementation Framework

Due to the risks associated with GDM, long-term implications, and the increased need for surveillance, it is addressed comparably to a chronic condition. Therefore, implementing a framework with a chronic care methodology is ideal. The Chronic Care Model (CCM) is an evidence-based conceptual framework that allows for a cohesive approach, particularly for patients with chronic health conditions (Wagner, 1998). This framework incorporates elements conducive to improving healthcare systems at the community, organization, practice, and patient levels, and it has been widely used in various settings, populations, and conditions (Bose-Brill et al., 2020).

The CCM closely aligns as it provides the necessary infrastructure for a systematic, patient-centered approach to managing GDM in the prenatal period and beyond (Bose-Brill et al., 2020). The identifiable patient, healthcare provider, and system-level barriers associated with GDM follow-up care coincide with the six interventional components of the CCM. These components include sustaining community resources and policies, health systems and the organization of health care, self-management support and skills, delivery system design and coordinating care, decision support by providing guidance and evidence-based care, and utilizing clinical information systems (see Appendix B, Figure B1). Incorporating the CCM can help improve GDM care delivery (Bose-Brill et al., 2020). Brown et al. (2022) incorporated the CCM in their GDM pilot study, facilitating a seamless transition to primary care and increasing patient receptivity (see Appendix A, Table A1).

The Plan-Do-Study-Act (PDSA) is the quality improvement model that will be used to guide the intervention process (Deming, 1994). PDSA is a four-step problem-solving model specific to improving processes and implementing change (AHRQ, 2020). The four steps include

planning what will be done, then doing it, studying the results, and acting on those findings (Deming, 1994). This method allows for quick evaluation of interventions, thus allowing for timely adjustments and improvements to help achieve desired outcomes. It is a straightforward process yet includes the necessary components to be effective and can be repeated as necessary (see Appendix B, Figure B2).

Methods

The project was implemented within six women's health departments in a FQHC in the Southwestern United States. Participants included females, 18 years old and older, who had a diagnosis of GDM in pregnancy, up to 12 weeks postpartum, and were seen in the women's health department. Women's healthcare providers and clinical support staff were the key drivers of the project.

Intervention

A standardized practice change occurred, incorporating a workflow that reinforces current practices within the project site and new implementations that align with current practice guidelines. Human subjects protection was obtained by Arizona State University's institutional review board (IRB) and expedited approval was obtained on November 21, 2023. The Diabetes in Pregnancy Best Practice Flowchart was launched within the project site's women's health department on November 21, 2023, as a standardized practice change during an all-provider healthcare meeting (see Appendix C, Figure 1). The flowchart reinforces current practices within the project site, including the pre-ordering of the postpartum 2 HR GTT during the 2-week postpartum visit and patient reminders (see Appendix C, Figure 1). New workflows introduced included adding the ICD-10 code: "History of gestational diabetes Z86.32" into the patient's

electronic health record (EHR) and initiating an internal handoff process to family practice/internal medicine via a telephone encounter in the EHR (see Appendix C, Figure 2).

Data Collection and Analysis

A chart audit was conducted of retrospective data over a 12-week time period from November 22, 2023 to February 14, 2023. Chart audit inclusion criteria included females, 18 years old and older, who had a diagnosis of GDM in pregnancy, up to 12 weeks postpartum, and who were seen in the women's health department. Individuals meeting the inclusion criteria for the chart audit were provided by an individual at the project site's informatics team. The chart audit took place at the project site, and no identifiable data left the project site. A subject ID key was utilized (see Appendix C, Figure 3). This subject ID matched the key on the chart audit form. De-identified data collected on the chart audit form included age, gender, ethnicity, insurance status, postpartum glucose tolerance test order status, glucose tolerance test completion status, ICD-10 code of history of gestational diabetes added to the right-sided chart problem list, telephone encounter created for referral to family practice/internal medicine, and appointment scheduled in family practice/internal medicine (see Appendix C, Figure 4). The subject ID was kept in a secure filing cabinet at the project site, and all forms were shredded at the end of data analysis in May 2024 and were not banked for future use.

After the completion of the chart audit, a statistical analysis was performed on the data for descriptive statistics using Intellectus™ software (Intellectus Statistics™, 2023). No funding was received for the implementation of this project.

Results

Descriptive Statistics

Introduction

Summary statistics were calculated for each interval and ratio variable, and frequencies and percentages were calculated for each nominal and ordinal variable.

Frequencies and Percentages

Summary of the demographic data includes the female population, average age of 30 years old, of Hispanic ethnicity, and having Medicaid insurance. All frequencies and percentages are presented in Table D1 and Table D2 (see Appendix D, Table D1, and Table D2).

Of the total number of participants (n = 135), 61% (n = 82) had a postpartum GTT ordered, and 25% (n = 34) completed the postpartum GTT screening. Ordering and completion of the postpartum GTT increased from baseline data. It was observed that 79% (n = 107) had a "History of GDM" added to the EHR, 29% (n = 39) had a warm handoff documented/referral to family practice/internal medication, and 24% (n = 33) had a scheduled appointment. All frequencies and percentages are presented in Table D3 (see Appendix D, Table D3).

Discussion

The ordering and completion of postpartum GTT screening increased from baseline data. Prior to implementation, the project site had a 56% postpartum GTT ordering rate and a 21% completion rate, and it rose to a 61% ordering rate and a 25% completion rate. The GDM Best Practice Flowchart had a positive impact on postpartum care for patients with GDM-affected pregnancies. Barriers included provider inconsistencies with flowchart components, patient compliance with follow-up recommendations, no baseline data on history of GDM in the EHR, hand-offs, and appointments, and the limitation of a 12-week retrospective data analysis timeframe.

The impact of this project on the patient is improved quality of patient care, improved outcomes, and enhanced continuity of care. The impact on healthcare providers is streamlined

care provided to patients with GDM-affected pregnancies. The system now has a standardized process, operational efficiency, and efficient use of resources. The effectiveness of this workflow in improving patient outcomes can strongly influence policy. Policymakers may be inclined to implement similar practices on a larger scale. This intervention was a system-wide change that incorporates current organizational practices, allowing it to be easily sustainable.

A major strength of this project includes strong project site support and healthcare provider receptiveness. This project also maintains a patient-centered medical home model, which the project site utilizes and reinforces current national practice guidelines. Limitations include healthcare provider inconsistencies with flowchart components and patient compliance with follow-up recommendations. It is recommended to explore an alternative process for a warm handout/referral to family practice/internal medicine as it was noted that only 29% completed this recommendation.

Conclusion

Gaps in GDM postpartum care have been identified since 1998, with little to no improvement in the continuity of care (Bernstein et al., 2017). GDM is becoming more prevalent, thus increasing the likelihood of its associated health risks and complications. Caring for women with GDM-affected pregnancies offers a unique opportunity for health promotion through thorough education and completing the targeted postpartum 2-hour GTT and hand-off to primary care. Improving postpartum follow-up and GTT screenings allows for the early detection of increased risk for T2DM. Preventive care can delay and possibly prevent progression to T2DM, thus reducing morbidity and improving one’s quality of life.

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Appendix A

Evaluation and Synthesis Tables

Table A1

Evaluation Table for Qualitative Studies

Citation	Theory/ Conceptual Framework	Design/ Method/ Sampling	Sample/ Setting	Major Themes Studied/ Definitions	Measurement/ Instrumentation	Data Analysis	Findings/ Themes	Level/ Quality of Evidence; Decision for/ Application to practice; Generalization
McCloskey et al., (2019), Navigating A Perfect Storm on the Path to Prevention of Type 2 Diabetes Mellitus After Gestational Diabetes: Lessons from Patient and Provider Narratives **Country:** U.S. **Funding:** Supported in part by NICHD R21-HD75640 **Bias:** None listed	**Glasser and Strauss (1967)** Grounded Theory	**Design:** Thematic analysis **Method:** Recruitment, Study samples **Purpose:** (1) to explain how experiences reported by providers and patients converge to facilitate or impede follow-up care after GDM, (2) to elicit recommendations for system-level changes to enhance prevention across key care transitions	**Sample:** Two samples, (1) GDM affected patients (n=30) (2) Clinicians responsible for GDM management during and/or a GDM affected pregnancy (n=29) **Demographics:** (1) Females, ages 18-44, 1/2 unemployed, Medicaid insured, 8 Latina, 7 Haitian, 5 African, 2 African American, 3 Asian, 2 White, 3 unknown (2) 6 OBGYNs, 5 FM, 8 CNM, 2	(1) How do women experience GDM from the time of diagnosis through postpartum care and beyond and what challenges do they encounter? (2) How do providers experience caring for patients with GDM and what challenges do they face? **Definitions:**	Semi-structured interview in person or phone, open-ended questions **Data Dependability:** All interviews were audiotaped with consent and transcribed verbatim	A coding scheme was developed from transcripts to identify key themes within each stage of care. Codes were then applied. **Dedoose –** a cloud-based qualitative data analysis software was utilized to apply codes.	(1) Patient experiences • Fears, overwhelmed and confusion about GDM • Unclear guidance and awareness of GDM impact • Busy schedule • Too demanding (2) Provider experiences • Poor communication dynamic with patient • Communication obstacles with GDM team • Pattern of patient-provider-system level barriers • Need for fundamental shift in our	**Level of Evidence:** III **Strengths:** Strong qualitative design, diversity of women interviewed is important for minority communities, direct patient accounts, direct provider accounts **Weakness:** Sample of patients and provers is only from two practice settings, themes are drawn from personal experiences, and only a small number of PCP's included **Feasibility:** Relevant data that can be implemented into practice interventions and utilized for further research **Application:** Identified several gaps and specific areas for improvement. Identified

Key: **CHW** Community Health Worker, **CPG** Clinical Practice Guideline, **EHR** Electronic Health Record, **FQHC** Federally Qualified Health Center, **GDM** Gestational Diabetes Mellitus, **GTT** Glucose Tolerance Test, **PC** Primary Care, **PCP** Primary Care Provider, **QI** Quality Improvement, **T2DM** Type 2 Diabetes Mellitus, **VA** Veteran's Affairs

Citation	Theory/ Conceptual Framework	Design/ Method/ Sampling	Sample/ Setting	Major Themes Studied/ Definitions	Measurement/ Instrumentation	Data Analysis	Findings/ Themes	Level/ Quality of Evidence; Decision for/ Application to practice; Generalization
			Endocrinologists, and 3 IM or PCP. **Setting:** Boston Medical Center **Attrition:** 1 (clinician unable to complete interview)				model of care for women • Patient centered medical home to facilitate collaboration.	strategies/recommendations to overcome barriers.
Brown et al., (2022), Mothers' Perspectives on a Mother/Infant Dyad Postpartum Primary Care Program Following Gestational Diabetes Mellitus: A Qualitative Pilot Study **Country:** U.S. **Funding:** Ohio Department of Health, Ohio Department of Medicaid	**American College of Physicians (1998)** The Chronic Care Model	**Design:** Descriptive, pilot study **Method:** Recruitment, Convenience sampling via referrals, Study sample **Purpose:** To describe the experiences of postpartum women enrolled in a Dyad program following a GDM diagnosis to identify barriers and facilitators.	**Sample:** (n=10) postpartum women who participated in Dyad program **Demographics:** Females, average age 31, 70% identified as non-white **Setting:** Primary care practice at a large, urban academic medical center **Attrition:** 1	In women with a GDM affected pregnancy, what are their experiences being enrollment in a Dyad program and how did it influence their beliefs and behaviors?	Semi-structured interviews, narrative based **Data Dependability:** All interviews were recorded, transcribed verbatim and deidentified for analysis	A detailed codebook was constructed with a brief description. Transcripts were analyzed using **NVivo 12 Plus**.	Program allowed for seamless transition to PC Eliminated the need for multiple appointments. Reinforced health information Influenced behavior changes Integration of inclusive, patient-centered strategies into care models for GDM is necessary for patient engagement in postpartum care.	**Level of Evidence:** III **Strengths:** direct patient accounts of experience with a care model/GDM program, patient perspectives on the importance of postpartum screenings and GDM future implications **Weaknesses:** small sample size, limited to one medical center **Feasibility:** Dyad model is relevant. This intervention is sustainable and can be applied to current and future practice and research. **Application:** Benefits of implementing a care model that is patient centered is

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Bias: None listed								key to improving patient compliance and adherence
Nedergaard et al., (2022), A kind reminder – A qualitative process evaluation of women's perspectives on receiving a reminder of type 2 diabetes follow-up screening after gestational diabetes **Country:** Denmark **Funding:** None listed **Bias:** None listed	**Logic Model** **Theory of Change**	**Design:** Reflexive thematic analysis **Method:** realist sampling **Purpose:** To explore women's perspectives on receiving an electronic reminder and the role of the reminder in decision-making and informed choice on participation in follow-up screening	**Sample:** 20 women with previous GDM who received the reminder **Demographics:** Danish women of various ages, education levels, occupation, and civil status **Setting:** Dept. of OBGYN at Aalborg University Hospital **Attrition:**	In women with a history of GDM, how does an electronic reminder influence their follow up rates and their decision to follow-up after pregnancy and how do they feel about receiving these reminders?	Data collection for 4 months after reminders were sent followed by face-to-face semi-structured interviews with participants **Data Dependability:** Each interview was audio recorded and transcribed verbatim; Follow-up appointments and screenings were extracted from hospital system	Interview data was analyzed using Braun and Clarke's reflexive thematic analysis Analysis of all data was supported by **NVivo 12**	Reminders offer a range of resources Reminders support women's decisions for f/u screening Helpful tool to assess the recommended f/u screening Electronic reminders were well received Allows for co-responsibility to help bridge gaps between healthcare sectors Increased participation rates	**Level of Evidence:** III **Strengths:** Varied sample of participants, examined different perspectives of reminders **Weaknesses:** Small sample size, limitation of qualitative data, limitations of telephone/video interviews vs. face to face, all participants were ethically Danish **Feasibility:** An electronic reminder is a sustainable and can be applied to current and future practices **Application:** Findings support the uses of an electronic reminder; Can be adapted to other settings as part of long-term, routine care after a pregnancy complicated by GDM
Shellhaas et al., (2016), The Ohio gestational diabetes postpartum care	**The Model of Improvement** (Langley, 2009) by the Institute for	**Design:** Quality improvement initiative, Pilot study	**Sample:** (n=15) clinical sites **Demographics:** Sites with at least	Do provider and patient toolkits with educational and clinical practice	Monthly chart reviews were conducted to collect data on quality	Data was entered into a secure database excluding PHI; **SAS 9.3**	Resources in the provider toolkit (flowchart) were helpful, valuable,	**Level of Evidence:** III **Strengths:** Provider and patient toolkits improved prenatal education quality,

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learning collaborative: Development of a Quality Improvement Initiative to Improve Systems of Care for Women **Country:** U.S. **Funding:** None listed **Bias:** None listed	Healthcare Improvement	**Method**: Recruited by public health department or subject matter experts **Purpose:** To improve clinical practice and increase postpartum visit T2DM screening rates in women with a history of GDM	half of pregnant patient population are enrolled in Medicaid; Team of one physician, one nurse and one administrative staff member **Setting:** Various clinical sites that provide prenatal services Attrition: 3 sites (inability to commit)	resources improve clinical practice and increase postpartum visits and screenings for T2DM in women with a history of GDM? Key drivers: standardization of clinical guidelines in GDM management, increased access to services, increased awareness of risk reduction	improvement measures; 20 chart reviews per month per site; Sites submitted data from patient chart reviews; Enabled rapid-cycle feedback Survey at completion for providers to evaluate toolkit usefulness	Enterprise business platform	and educational for pts and easy to use Additional instruction needed on each tool or handout (according to weeks' gestation) More emphasis needed on glucose testing postpartum More guidance needed on resources to facilitate care coordination with PCP	tools were supported by literature and state-specific data; Flowchart for care is easy to follow **Weaknesses:** Inability to capture baseline data on PP care, missing PP data **Feasibility:** Toolkits can be customized and implemented for any setting as an educative resource **Application:** Patient and provider toolkits have demonstrated improvements in prenatal education and high acceptance of provider and patient toolkit resources; Can be implemented in any setting to support clinicians in providing consistent care for GDM PP
Korvesi et al., (2020), Implementation of the Endocrine Society clinical practice guidelines for gestational diabetes	Theory not clearly defined	**Design:** Literature review **Method:** Literature search of clinical practice guidelines (CPG)	**Sample:** 32 CPGs reviewed **Demographics:** Diabetes guidelines **Setting:** N/A	Due to insufficient adherence to CPGs, would creating a knowledge tool based on CPGs improve	Collection and comparison of CPGs for GDM; required criteria for inclusion – European or American published, systematic	Writing team assessed algorithm for consecutiveness and relevance of instructions;	Endocrine society CPG for GDM allowed for a clinical algorithm design. Developing a clinical algorithm is complex.	**Level of Evidence:** II **Strengths:** Patient focused, efficient and safe treatment pathway, novel therapeutic approach, supported by a CPG

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mellitus to a knowledge tool **Country:** Greece **Funding:** None listed **Bias:** None listed		**Purpose:** To develop a clinical algorithm (in the form of a flowchart) in the field of GDM based on CPGs	**Attrition:** N/A	healthcare provider compliance to the CPG?	development, and having statements of "level of evidence" and "strength of recommendation"	no gaps identified. CPG was appraised with GLIA tool	Sample algorithms were provided.	**Weaknesses:** Complexity in the entire process, no appropriate tool to assess the content completeness, number of recommendations incorporated **Feasibility:** Creating a knowledge tool/algorithm based on a CPG could be implemented as the criteria is already set forth **Application:** Algorithm is supported by clinical practice guidelines. Can be applied in any setting.
Charns et al., (2022), A Multi-site Case study of Care Coordination Between Primary Care and Specialty Care **Country:** U.S. **Funding:** None listed **Bias:** None	Primary Care Mental Health Integration Model	**Design:** Mix Methods Study **Method:** Non-random purposeful sampling **Purpose:** To fill the gaps in care by examining how VA providers manage the care coordination of	**Sample: (**n=102) Physicians, Nurses and other clinicians in PC, Cardiology, and Mental health **Demographics:** Medical centers with high and low care coordination **Setting:** 8 VA Medical Centers **Attrition:** N/A	What are the barriers and facilitators to care coordination for complex patients?	Semi-structured interviews on care processes for pts with Diabetes, mental health, or cardiovascular comorbidities. Questions aimed to learn about organization structures and processes that were facilitators or barriers in the flow of information for	Content analysis was used to determine major themes. Independent coding was performed.	Care coordination facilitators are warm handoffs, professional relationships, and physical proximity. Barriers are service agreements, reporting relationships, and staffing. Professional relationships affect care coordination and clinical outcomes	**Level of Evidence:** II **Strengths:** Direct accounts from health care professional **Weaknesses:** Conducted entirely within the VA, nonrandom sample, as a qualitative study, it does not permit claims of causality **Feasibility:** Warm handoffs provide a venue

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		Pts with chronic conditions			providers caring for the same patient **Data Dependability:** Interviews were audio recorded and professionally transcribed			for interaction between PC and specialties **Application:** This model could be similar value to a private-sector organization serving a population with patients with co-occurring medical conditions
Sanderson et al., (2021), Increasing warm handoffs: Optimizing community-based referrals in primary care using QI methodology **Country:** U.S. **Funding:** None **Bias:** None listed	Plan, Do, Study, Act (PDSA) cycles, QI model	**Design:** QI intervention **Method:** Direct intervention; program **Purpose:** Aim was to increase the warm handoff rate using QI methods and the development of a warm handoff program to improve social needs and referral programs	**Sample:** Single site FQHC **Demographics:** N/A **Setting:** Academic affiliated FQHC in South Bronx, NY **Attrition:** N/A	Do warm handoffs play a key factor in assuring that social needs of families are effectively addressed?	Community Linkage to Care program – 10 question social needs screening questionnaire. Referrals were placed in the EHR and outreach was conducted by the CHW. Warm handoffs were completed if CHW available and present **Data Dependability:** Nursing leadership oversaw program and performed continuous	Screenings were input into EHR in real time. A monthly report was distributed by the health systems information team. Outcome measure was the CHW warm handoff rate per month.	Warm handoffs between families and CHW more than doubled over the intervention period; Creating designated warm handoff blocks in the CHW schedule helped to formalize and systematize warm handoffs	**Level of Evidence:** II **Strengths:** A crucial component of performance improvement was workflow enhancement, ease of access to CHW, enhanced communication between team members **Weaknesses:** Warm handoffs were conducted at about 25% and did not reach aim of 50%, Barriers with warm handoffs still exist **Feasibility:** Warm handoffs have been used in many settings and domains of patient care **Application:** QI methods can be used to optimize workflows to increase

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					performance improvement initiatives			warm handoffs with CHW; This can be important for health centers looking to expand referral programs

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Table A2

Evaluation Table for Quantitative Studies

Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence; Application to practice; Generalization
Soffer et al., (2021), Improving postpartum attendance among women with gestational diabetes using the medical home model of care **Country:** U.S. **Funding:** None listed **Bias:** None	The Medical Home Model	**Design:** Prospective Cohort Study **Purpose:** To improve PP attendance among women with GDM through implantation of the medical home model	**N=** 74 **Demographics:** GDM Diagnosis, received care at a NYC based hospital, Mean age 31.6 years **Setting:** Hospital based clinic for OBGYN and Pediatric care **Exclusion:** Prenatal or pediatric care outside of the clinic **Attrition:** N/A	**IV1:** Joint appointment scheduling **DV1:** PP appointments **DV2:** GTT **Definitions:**	**Tools:** Historical controls, chart reviews **Validity/ Reliability:** Data extracted directly from EMR database	**Statistical Tests Used:** SAS version 9/4	**DV1:** PP appt attendance 68.9% The PP attendance rate was not significantly different than prior (p = 0.84) **DV2:** PP GTT Test ordered 76.5%, 43.6% completed	**Level of Evidence:** III **Strengths:** scheduling component had significant impact on reach, though unsuccessful the work done underscores the issues faced by providers caring for women with GDM **Weaknesses:** Difficulties with scheduling, difficulties encountered with workflow change, making changes in two clinic departments, significant amount of rescheduling, attending PP visit with infant **Feasibility:**

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Citation	Theoretical/ Conceptual Framework	Design/ Method/ Purpose	Sample/Setting	Variables	Measurement/ Instrumentation	Data Analysis	Results/ Findings	Level of Evidence; Application to practice; Generalization
								Application: The medical home model has eliminated barriers to care in various healthcare settings.
Domingo et al., (2022), Implementation of a Postpartum Note Reminder and factors associated with Postpartum glucose tolerance screening **Country:** U.S. **Funding:** None listed **Bias:** None	Theory not clearly defined	**Design:** Retrospective Study **Purpose:** To evaluate real-time reminder systems for provider adherence to PP GTT	**N= 246** **Demographics:** Mean age > 32 years, GDM diagnosis, completed prenatal care and delivered at a suburban public safety-net hospital **Setting:** Suburban public safety-net hospital Women's Health outpatient clinic **Exclusion:** History of pregestational DM **Attrition:** N/A	**IV:** Electronic reminders **DV1:** PP GTT screening **IV2:** Pt variables **DV2 :** PP visit attendance **Definitions:**	**Tools:** Chart review, EHR data collection **Validity/ Reliability:** Data obtained directly from HER	**Statistical Tests Used:** Pearson X test Univariate logistic regression	**DV1:** Increased 58.1% to 75% (P = 0.01) **DV2:** Delivery complications increased odds, CI 1.63-8.86, (P < 0.01) Increased gestational age at first visit, decreased odds CI. 0.87-0.99, (P< 0.05) Spanish speaking increased odds, CI 1.24-6.70, (P = 0.01)	**Level of Evidence:** III **Strengths:** Large sample size, Implementation of reminder in EHR **Weaknesses:** Limited information in EHR, Lack of info on transportation or proximity to hospital, unable to study women who delivered at the hospital but did not obtain prenatal or PP care in the Women's Health clinic, diminished health literacy in population **Feasibility:** EHR systems have the capability to

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								implement alerts for specific criteria **Application:** Providers play a key role in ensuring pts with GDM are properly educated, counseled, and screened in the PP period. Implementing reminders will improve adherence to current guidelines.
Rotem et al., (2020), Adherence to postpartum diabetes mellitus screening, do associated pregnancy complications make a difference? **Country:** Israel **Funding:** None listed **Bias:** None	Theory not clearly defined	**Design:** Retrospective Study **Purpose:** Is there associations between GDM complications and compliance with PP GDM screening.	**N=** 164 **Demographics:** Women with GDM associated complications **Setting:** Soroka University Medical Center **Exclusion:** Multiple gestation, GDM in past pregnancies or pregestational DM **Attrition:** N/A	**IV:** GDM complications **DV1:** PP GTT screening **Definitions:**	**Tools:** Birth registry data **Validity/ Reliability:** Data obtained directly from HER	**Statistical Tests Used:** Chi-square, Fisher exact	**DV1:** 24.4% as compared to 14.6%, though the rate almost doubled, it did not reach statistical significance (P=0.17)	**Level of Evidence:** III **Strengths:** Large sample size, access to EHR, first study to address impact of GDM complications **Weaknesses:** population with poor prenatal care, no uniformity in screening, inconsistent recommendations **Feasibility:** Study design can be implemented into

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								other healthcare organizations to include additional variables to identify barriers/facilitators to compliance **Application:** Women with complications are more likely to follow up

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Table A3

Synthesis Table

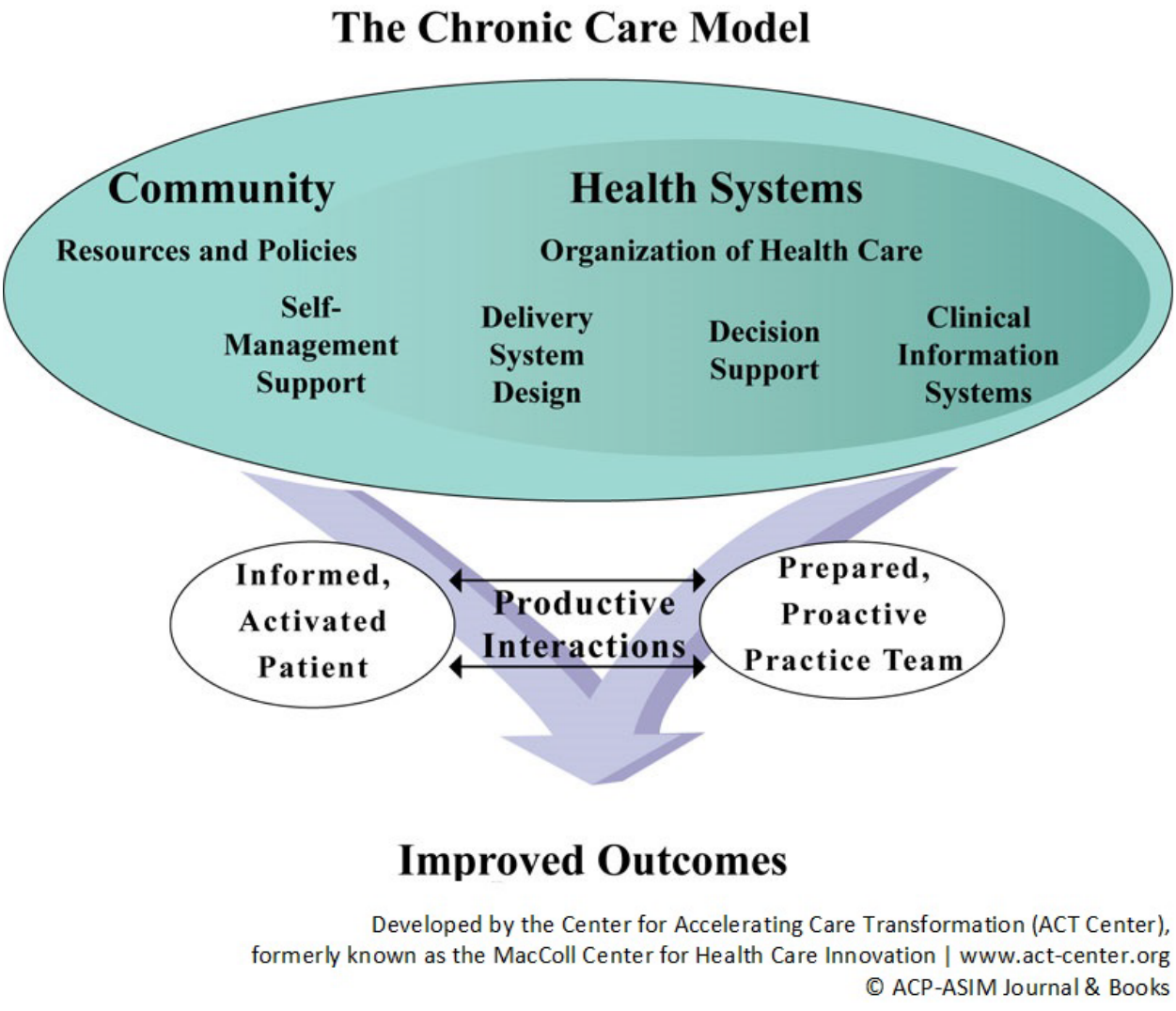
Study (Author, year)	McCloskey et al., 2019	Brown et al., 2022	Nedergaard et al., 2022	Shellhaas et al., 2016	Korvesi et al., 2020	Charns et al., 2022	Sanderson et al., 2021	Rotem et al., (2020),	Soffer et al., 2021	Domingo et al., 2022
Design	Thematic Analysis	Pilot Study	Thematic Analysis	Pilot Study	Literature Review	Mixed Methods	Quality Improvement	Retrospective Study	Prospective Cohort Study	Retrospective Study
LOE	III	III	III	III	II	II	II	III	III	III
Sample										
n subjects	30, 29	10	20	15		102		164	74	246
M-Age (years)	>18	31							31.6	> 32
GDM affected pregnancy	+	+	+	+	+	–	–	+	+	+
Setting										
Hospital	✓		✓					✓	✓	✓
Outpatient clinic		✓		✓						
FQHC Site				✓			✓			
Interventions										
Electronic reminder			✓							✓
Algorithm					✓					
Pt. Experience eval	✓	✓		✓						
Clinician experience eval	✓									
Pre-scheduled f/u								✓	✓	
QI method				✓			✓			
Warm-Hand off				✓		✓	✓			
Parent/Child Dyad		✓							✓	
Outcomes/ Themes										
PP visit attendance			↑	↑				↑		↑
PP Screening rates			↑	↑				↑	∅	↑
Pt. receptivity		↑↑	↑	↑↑						↑
Clinician receptivity				↑↑			↑			
Referral/handoff		↑↑		↑↑			↑			

Key: **LOE** Level of Evidence **M-Age** Mean Age **PP** Postpartum

Appendix B

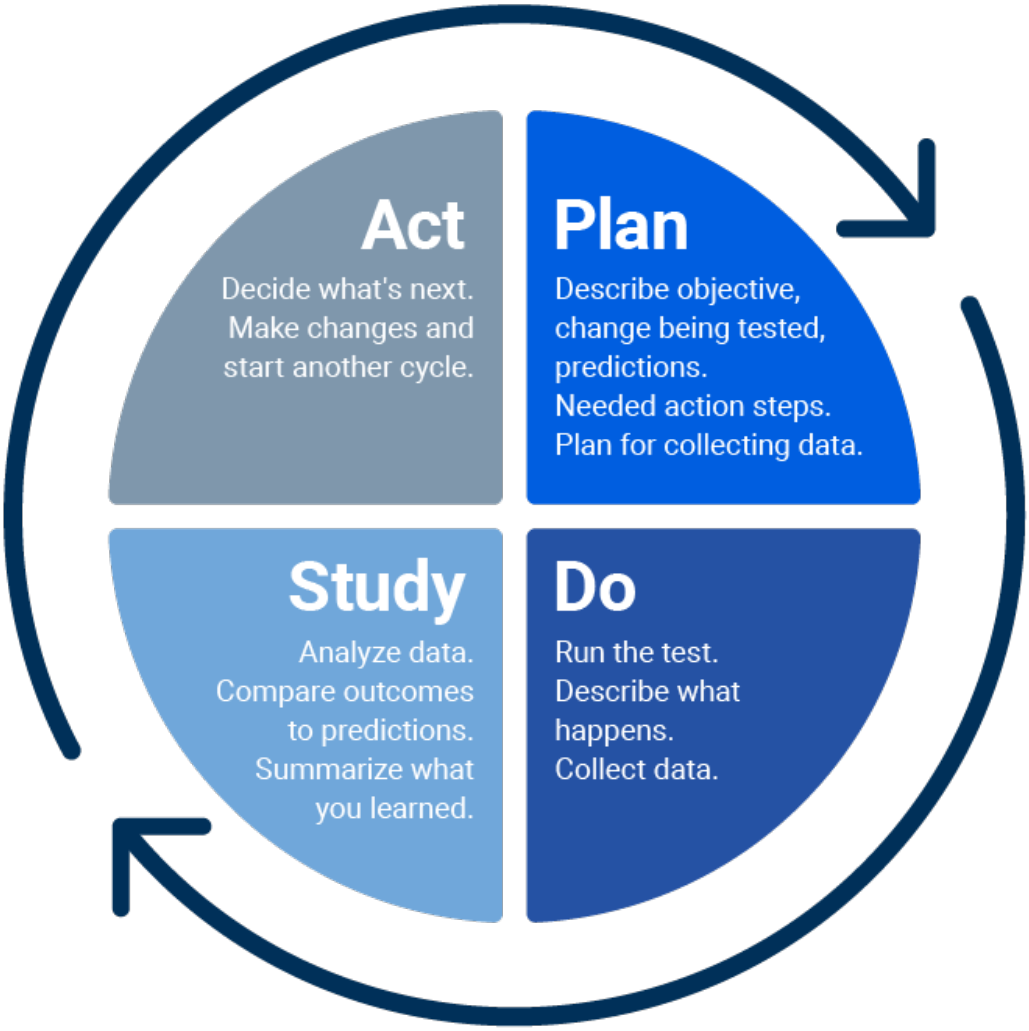
Models and Frameworks

Figure B1
Chronic Care Model



(Wagner, 1998)

Figure B2
Plan-Do-Study-Act (PDSA)



(Deming, 1994)

Appendix C

Project Components

Figure 1
GDM Best Practice Flowchart

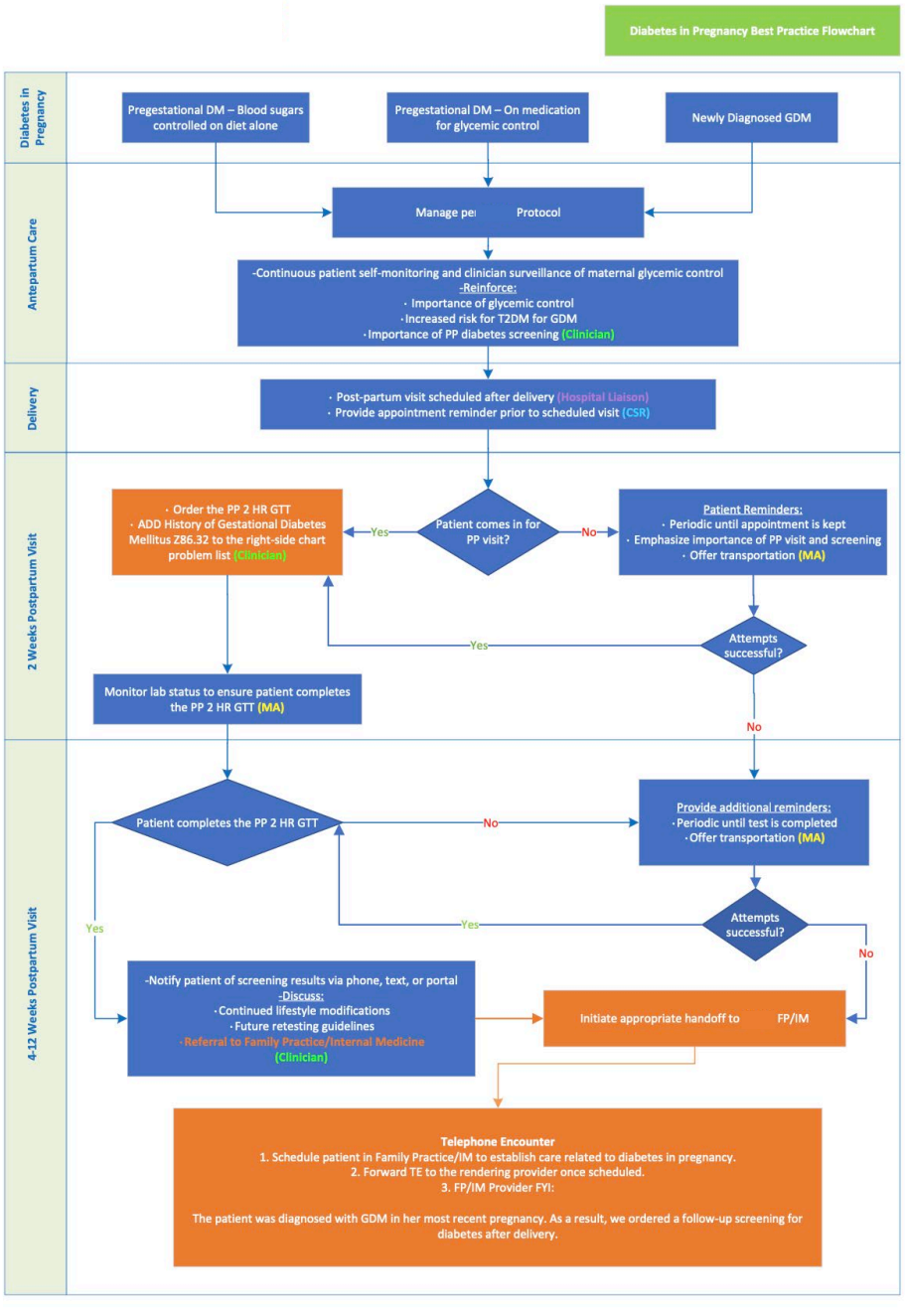


Figure 2
EHR Telephone Encounter for Warm Hand-off

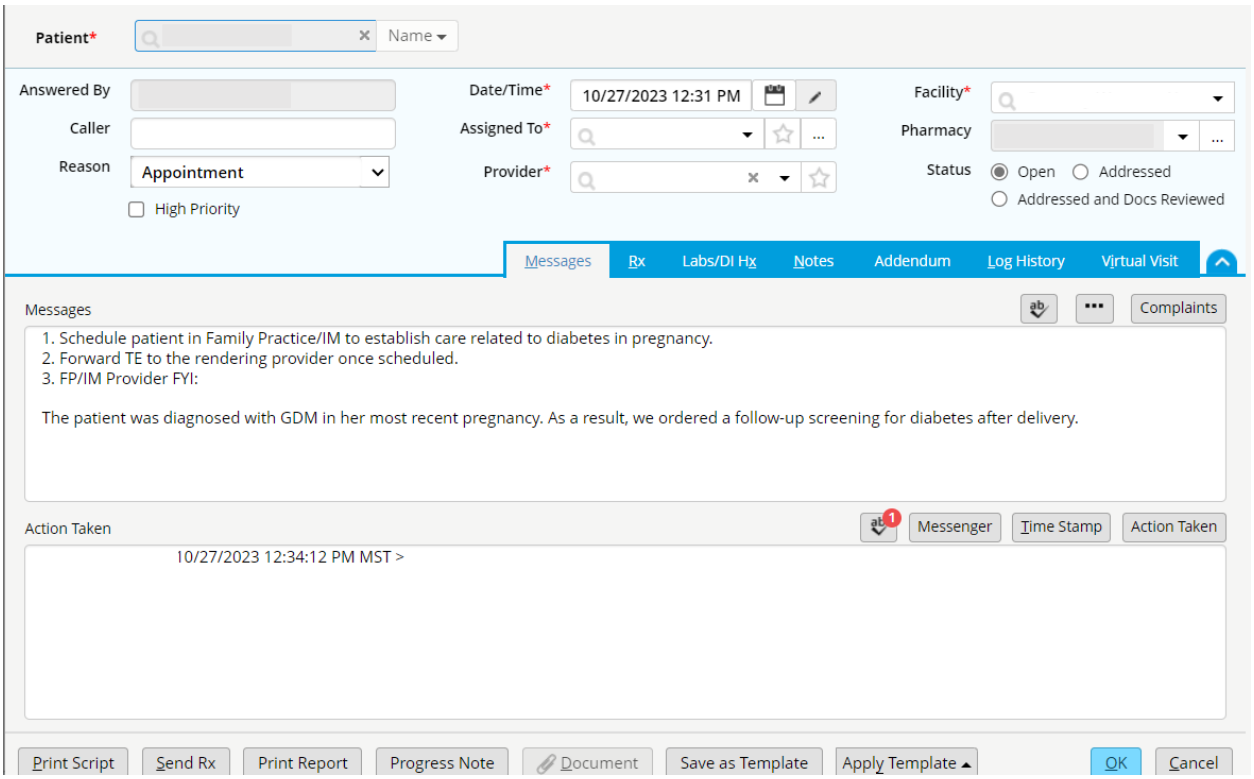


Figure 3
Subject ID Key

Identity Key

Account Number/Patient First and Last Initial	Subject ID
	100
	101
	102
	103

Figure 4
Chart Audit Form

Improving Gestational Diabetes Care in the Postpartum Period

Chart Audit Form

Date _____

Subject ID	Age (yrs.)	Gender	Race	Ethnicity	Insurance Status (Insured, No Insurance, AHCCCS)	Glucose Tolerance Test Ordered Postpartum (Y/N)	Glucose Tolerance Test Completed between 4-12 weeks after delivery (Y/N)	History of Gestational Diabetes Z86.32 is added to the right-sided chart problem list (Y/N)	Telephone Encounter Created for Referral to Family Practice/ Internal Evidence (Y/N)	Appointment Scheduled in Family Practice/ Internal Medicine (Y/N)

KEY: AI = American Indian, A = Asian, B = Black/African American, F = Female, H = Hispanic/Latino, N = No, NH = Non-Hispanic/Latino, PI = Pacific Islander/ Native Hawaiian, O = Other, Y = Yes, W = White

IRB Approval # _____ Data Entry_____ Data Validation_____

Appendix D

Descriptive Statistics

Table D1
Frequency Table for Nominal and Ordinal Variables

Variable	*n*	*%*
Gender		
F	135	100.00
Race		
W	69	51.11
A	1	0.74
U	2	1.48
O	38	28.15
D	12	8.89
B	11	8.15
M	2	1.48
Ethnicity		
H	105	77.78
NH	23	17.04
D	7	5.19
Insurance Status		
Private Insurance	23	17.04
AHCCCS	88	65.19
No Insurance	24	17.78

Note. Due to rounding errors, percentages may not equal 100%.

Table D2
Summary Statistics Table for Interval and Ratio Variables

Variable	*M*	*SD*	*n*	Min	Max
Age	30.28	6.09	135	18.00	44.00

Note. '-' indicates the statistic is undefined due to constant data or an insufficient sample size.

Table D3
Frequency Table for Nominal Variables

Variable	*n*	*%*
Post Glucose Test Ordered		
Y	82	60.74
N	53	39.26
Post Glucose Test Completed		
Y	34	25.19
N	101	74.81
Post History of Gestational Diabetes added to Problem List		
Y	107	79.26
N	28	20.74
Post Telephone Encounter for Referral		
Y	39	28.89
N	96	71.11
Post Appointment Scheduled in Family Practice IM		
Y	33	24.44
N	102	75.56

Note. Due to rounding errors, percentages may not equal 100%.