

Rural maternal health interventions: A scoping review and implications for best practices

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Abstract

Purpose: Maternal health outcomes in rural areas of the United States are persistently poor, with pregnant individuals in rural areas facing complex health care obstacles. Interventions adapted to the needs of rural patients are critical to mitigate worsening health disparities. To inform future efforts in this field, we conducted a scoping review, given the complex and diverse nature of existing interventions, to synthesize the literature on rural maternal health interventions, analyze mechanisms to improve care, and identify barriers and facilitators to intervention implementation.

Methods: We conducted a scoping review of peer-reviewed literature across six databases for maternal health interventions in rural populations. Relevant studies were analyzed for study setting, intervention type, impact on maternal health outcomes, and facilitation and barriers of intervention implementation mapped to the Consolidated Framework for Implementation Research.

Findings: We identified 64 studies published between 2010 and 2024 through comprehensive database searches relevant to our review. We determined six proposed mechanisms of action via thematic analysis across the pregnancy continuum: increased care connection, social support, care frequency, education, self-efficacy, and positive

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reinforcement. While the facilitators and barriers to implementation varied across the six themes, common facilitators included state-level buy in, integration of community partnerships, cultural humility in study design, and dedicated interdisciplinary teams. Common barriers included lapses in insurance, transportation difficulties, and communication challenges.

Conclusions: Our review shares lessons that future interventions and policies can build upon to improve peripartum care for individuals living in rural communities. Further work is needed to address intersectional disparities in rural maternal health and ensure equitable implementation.

KEYWORDS

community partnerships, maternal health, postpartum, rural health disparities

INTRODUCTION

In the United States, expectant and new birthing parents living in rural areas are nearly two times more likely to die than those living in urban areas,¹ and widening rural-urban maternal health disparities are particularly concerning as the US maternal health crisis worsens.^{1,2} Poor maternal health in rural areas is apparent across several key parameters reflective of overall maternal-infant health, including rates of pregnancy affected by diabetes or hypertensive disorders, preterm birth, and infant mortality.³⁻⁹ Such data highlight the wide implications of poor rural maternal health and the need to promptly address the causes underlying this disparity. Urban-rural health disparities are likely multifactorial and due to an interplay of decreased health care access and increased individual risk factors,¹⁰ adverse social determinants of health,¹¹ and chronic disease.¹² Health care provider shortages, rural hospital closures, and fragmented transportation and support systems make access to perinatal care increasingly challenging.^{1,13} In 2014, over half of rural US counties were classified as maternity care deserts, defined as any county without a hospital or birth center offering obstetric care and without any obstetric providers.^{14,15} Rural hospital closures, which were already occurring at concerning high rates,¹⁶ increased dramatically in 2020 during the COVID-19 pandemic.¹⁷ Consequentially, over 10% of rural pregnant individuals live more than 100 miles away from the nearest obstetric hospital¹⁸ and pregnant individuals in rural communities are less likely to access prenatal care in the first trimester than urban individuals.¹⁹ In addition, they are more likely to experience adverse social determinants of health, including poverty, food or housing insecurity, and insurance lapses, making it more difficult to engage in health-promoting behaviors²⁰ and contributing to a higher prevalence of chronic health conditions that can perpetuate poor health across generations.²¹

In response to the rural maternal health crisis, the US Department of Health and Human Services has made recommendations to provide whole-person care and expand maternal health services in rural practices.²² Systemic interventions aimed at improving rural maternal

health have focused on a variety of targets including access to prenatal and postpartum care,²³ local workforce development and training,²⁴ government funding for health care facilities,²⁵ increased telehealth access,²⁶ and development of community resource networks.²⁷ The complexity of intervention goals, designs, and delivery methods has created a patchwork of approaches that can make evidence synthesis challenging. While system-level policies and regulations are necessary for intervention support and ongoing change, individual-level interventions that directly target individual risk factors via screening and/or treatment are crucial to connect patients with critical resources that address both health care barriers and social determinants of health. Additionally, implementation in rural populations must be studied in detail, as it can be hindered by decreased infrastructure access and must be responsive to the unique needs of rural parents. Little evidence exists on best practices for implementing interventions to benefit rural birthing people.

In this scoping review, we summarize existing interventions to improve rural maternal health in the United States, with particular emphasis on facilitators and barriers to program implementation. This review had three aims: (1) synthesize and summarize interventions on rural maternal health; (2) characterize the mechanisms used for improving care; and (3) identify barriers and facilitators to implementation of these interventions. We categorize the barriers and facilitators of intervention implementation as features of the intervention, practitioners, inner organization context, and external environment that can shape implementation success consistent with the major domains of the Consolidated Framework for Implementation Research (CFIR).²⁸

METHODS

We conducted our scoping review in accordance with the Joanna Briggs Institute methodology.^{29,30} The Preferred Reporting Items for Scoping Review (PRISMA-ScR) guided the reporting of this scoping review.³¹ This review aimed to summarize maternal health interventions implemented in rural areas and identify facilitators and barriers

TABLE 1 Inclusion and exclusion criteria used to select studies for review and data abstraction.

Criteria	Include	Exclude
Date	Studies published between 2010 and 2024	Studies published before 2010
Intervention	Studies related to a maternal–child health program	Studies without a maternal–child health program
Location	United States or Canada	Other foreign country
Population	Rural	Nonrural (e.g., urban or suburban)
	Pregnant or postpartum women (delivered within the last two years of original study)	Nulliparous women with no history of pregnancy
Publication	Peer reviewed journal articles	Gray literature, reports, conference proceedings
	Primary empirical quantitative and qualitative studies	Literature reviews, other syntheses
Language	English	Non-English

influencing the success of maternal health interventions. We were particularly interested in elucidating the mechanisms of interventions to better understand the implementation of successful interventions.

Search strategy

We used a three-step search strategy to identify all relevant articles.²⁹ First, we initiated a limited search on relevant articles on PubMed and Cumulative Index to Nursing and Allied Health (CINAHL) databases to identify key words included in the title, abstract, and index terms and to formulate our search terms. The Medical Subject Headings (MeSH) terms identified by our initial search were used to create our final search term list, which included keywords “perinatal care,” “maternal-child health services,” and “rural population” (Table S1). We then implemented our search strategy across six databases: PubMed, CINAHL, SCOPUS, Web of Science, Social Work Abstracts, and SocINDEX. Initial searches were conducted during June 2021 and finalized searches in June 2022 and April 2024. Finally, all included reports were hand-searched to identify additional articles.

Inclusion criteria is listed in Table 1. Studies that described novel interventions with a stated focus on addressing rural maternal health outcomes were included; we included descriptive studies that outlined implementation activities as well as studies that reported intervention outcomes. We used the US Census Bureau definition of rural, of all populations not included within an urban area.³² These studies included participants of any age who were pregnant or delivered within the past two years and received health care services in a rural area. We did not search gray literature, defined as text not published in manuscripts (e.g., conference abstracts, reports, unpublished trials),³³

given the already large scope of literature being included to ensure adequate analysis of all included studies.

Study selection

Following the search, all citations were uploaded to Covidence³⁴ for review and duplicates were removed. Two reviewers screened titles and abstracts of 5% of manuscripts. Interrater reliability was established by comparing the results of the two reviewers for a percentage of agreement of at least 80%. Any conflicts were resolved through discussion between the two reviewers until a consensus was reached and/or review by a third reviewer. Once interrater reliability was achieved, remaining titles and abstracts were evenly split between the reviewers and single reviewed. For full-text review, the reviewers screened 10% of manuscripts to guarantee interrater reliability with a percentage of agreement of at least 80% before evenly splitting the remaining manuscripts. Reasons for exclusion at full text were recorded (Figure 1).

Data extraction

The following information was extracted from each study: authors; year of publication; city, state, and country of origin; study setting; description of the intervention; intervention effects on maternal health outcomes in the service area, and facilitators and barriers to intervention implementation.³⁵ Facilitators and barriers were identified as strengths or weaknesses of the intervention stated by the study authors, and then mapped to the CFIR.²⁸ CFIR is used to explain the relationship of programmatic effectiveness to barriers and facilitators of implementation within five potential domains: individual intervention users, intervention components, process of implementation, inner setting of intervention implementation, and outer setting.

Data analysis

Abstracted data from all included studies were synthesized and summarized in Table 2. Studies were analyzed by two authors using thematic analysis³⁶ for recurrent patterns in proposed mechanism of action, or how the intervention was proposed to affect change in outcomes or behaviors either explicitly stated or gathered based on the study's theoretical framework. Six themes inductively emerged from thematic analysis of studies: clinical service connection, social support, care frequency, education, self-efficacy, and positive reinforcement. While some studies utilized multiple mechanisms, each study was only discussed under the predominant mechanism to ensure equal representation of included studies reflecting the program's primary intent and emphasis.

RESULTS

The database search yielded a total of 5082 unique citations (Figure 1); the title and abstract screening process excluded 4787 articles (94.2%).

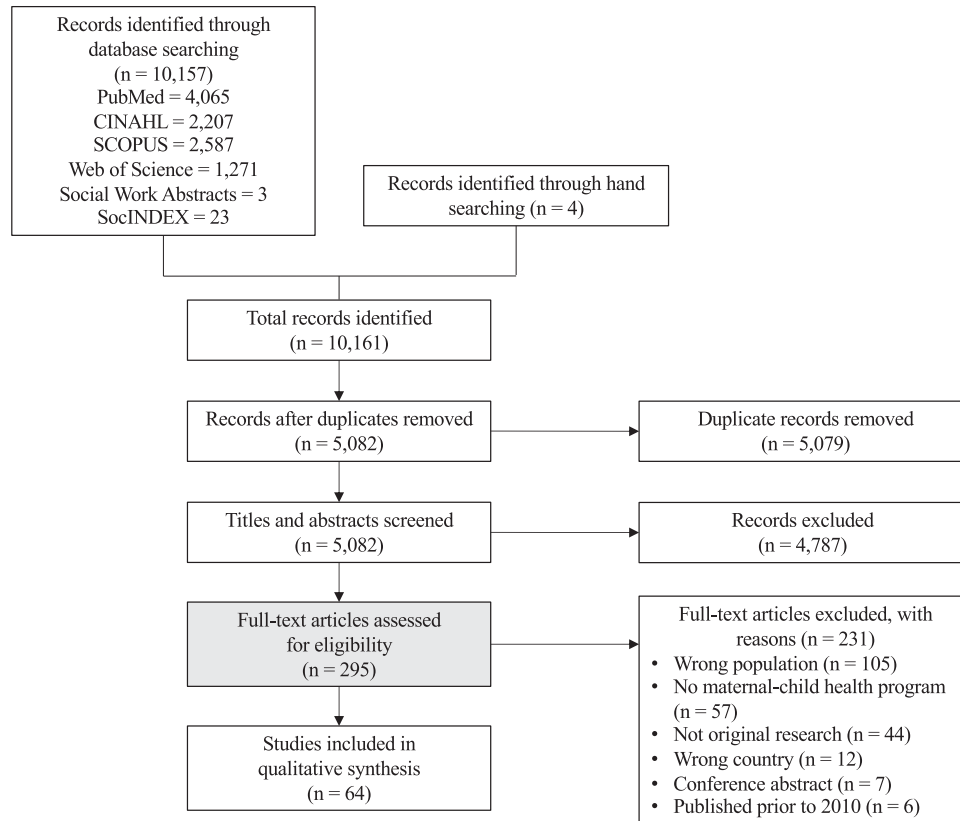


FIGURE 1 PRISMA Flow Chart.

We conducted full text assessment of the remaining 295 articles, with an additional 231 articles removed for reasons detailed in Figure 1. Therefore, a total of 64 articles (1.3%) were included. Description of individual intervention form and function¹⁰¹ is included in Table 2. The studies focused on one of the following mechanisms to improve care across the pregnancy continuum: clinical service connection (n = 16, 25%);³⁷⁻⁵² social support (n = 15; 23.4%);⁵³⁻⁶⁷ increased care frequency (n = 11; 17.2%);⁶⁸⁻⁷⁸ education (n = 11; 17.2%);⁷⁹⁻⁸⁹ self-efficacy (n = 10; 15.6%);⁹⁰⁻⁹⁹ and positive reinforcement (n = 1; 1.6%).¹⁰⁰ This review identified several maternal health interventions aimed at patients with specific comorbidities. For example, seven interventions targeted pregnant women with substance use disorders, while four interventions targeted pregnant women with obesity. Implementation occurred in a variety of locations and often in multiple settings within one study; this included obstetric care settings (n = 16), primary care clinics (n = 2), inpatient units (n = 4), pediatric offices (n = 2), community sites (n = 9), local public health department sites (n = 7), mobile care units (n = 2), and at patients' personal residences (n = 23).

Clinical service connection

Sixteen studies focused on increasing patients' connection with clinical services, including obstetrics, mental health services and breastfeeding specialists, guided by the premise that rural health disparities result from a lack of access to peripartum-specific care. Studies had a wide

variety of intervention forms used to increase clinical service connections and often involved accessing clinical services via telehealth interventions, collaborative care, or connecting patients with postpartum care while admitted for delivery. Two studies reported a large proportion of Hispanic/Latinx participants;^{37,39} however, most studies did not report the patients' racial/ethnic identity or the majority were identified as non-Hispanic White.

Intervention form and function

Increased access to high-risk obstetric care,^{40,43,49} breastfeeding support,⁵¹ and depression treatment⁵⁰ was facilitated through telehealth intervention delivery. All studies reported that the interventions were acceptable to both providers and patients; one study found lower rates of preterm labor and Neonatal Intensive Care Unit (NICU) admissions,⁴³ and another found significantly decreased depressive symptoms following intervention activities.⁵⁰ Interventions with depression and opioid use disorder (OUD) treatment that were delivered via collaborative care were associated with significant improvement in depressive symptoms,³⁹ increased treatment positions for medication assisted treatment of OUD,⁴⁴ and higher average neonatal birth weight.⁴⁸ Three studies utilized the delivery admission to connect patients with traditionally outpatient clinical services, including human papillomavirus (HPV) vaccination and long-acting reversible contraceptives (LARCs);^{37,38} an inpatient vaccination program was found to

TABLE 2 Characteristics of included studies.

Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal-child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
<i>Clinical service connection (n = 16)</i>						
Berenson et al., 2021 ³⁷	University of Texas Medical Branch (UTMB) delivery hospital and postpartum/well-child visits supported by the Cancer Prevention and Research Institute of Texas; Texas, USA	HPV vaccination program that offers vaccine to eligible new mothers while inpatient after delivery with follow up doses at postpartum or well-child visits. Additionally, provides vaccination education.	Over 4 years and 36 counties, HPV vaccine uptake rates increased from 20.5% at admission to 81.1% of eligible postpartum patients. Staff reported benefits for the clinics from the vaccination program were increased patient education and freed up provider time.	Vaccine education was available in English and Spanish and vaccine administration was conveniently offered during mother's inpatient stay and scheduled postpartum/well-child visits. Program used multiple forms of contact to reach mothers about upcoming and missed appointments. The program was funded by the Cancer Prevention and Research Institute of Texas. Providers were supportive of HPV vaccine.	The program was costly to implement and was time-intensive to educate patients and frequently remind them about appointments. Staff needed to be better educated about the vaccination schedule. Difficulties coordinating well-baby visits with vaccination schedule and financing with Medicaid coverage that expired 8 weeks postpartum.	
Gross et al., 2016 ³⁸						
Bhat et al., 2018 ³⁹	Obstetric clinic, home visiting, and telemedicine; Washington, USA	Depression Attention for Women Now (DAWN) used care managers to address patient's practical, psychological, and cultural barriers to care for six to eight weeks. Between sessions, care managers communicated with patients via text messaging to execute personalized psychiatric care needs related to diagnosis and medication management.	PHQ-9 scores declined significantly over average treatment time of 14.4 weeks. 83% of providers felt that the program had improved clinical outcomes and was most helpful in treatment and progress follow-up. All participants said they would recommend the intervention.	Case managers being a part of the local community allowed patients to feel more comfortable and understand the importance of addressing mental health concerns. Case manager visits were scheduled immediately before and obstetric visit.	There were low rates of screening and program was only able to reach English-speaking women in a community of migrant farmworkers with mobile phone access. The case managers were not direct employees of the clinic which made integration more difficult.	

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TABLE 2 (Continued)

Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal–child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
Brill et al., 2023 ⁴⁰	Mobile telehealth clinic in partnership with local and academic medical centers; Ohio, USA	The Ohio Better Starts for All (BFSA) pilot program provides mobile perinatal and telehealth services in rural Ohio. Services included pregnancy testing, prenatal and postpartum care, patient education, STI screening, birth control counseling, well-woman visits, and screening for depression and hypertension.	63% (54/86) of patients scheduled for the pilot's mobile health unit were seen by the BFSA care team.	The community–clinical partnership facilitated mobile unit housing and clinic hosting. Extramural funding and the creation of referral and scheduling networks support the maintenance and expansion of the program. Team leaders hold quarterly steering committee meetings with community stakeholder to identify strategies for continued BFSA programming.	Limited deployment of mobile unit to community sites, regional newness of telehealth services, delivery of services only within standard business hours, and complexity of interinstitutional handoffs required for telehealth scheduling hindered BFSA implementation. Clinic cancellations due to inclement weather, mobile unit breakdown, and provider COVID-19 infection.	92% of program participants were White and 61% were publicly insured.
Dumphy et al., 2016 ⁴¹	Pediatric primary care clinic; Georgia, USA	Using the Academy of Breastfeeding Medicine's (ABM) evidence-based Clinical Protocol #14, women are introduced to a team of providers, medical staff, and community members that provide individualized primary care services and education targeting increased breastfeeding.	The ABM's Clinical Protocol #14 is feasible to establish breastfeeding-friendly physician offices and effective in improving breastfeeding rates as far as the 4-month well-child visit.	Providers and medical staff receive training on implementation of breastfeeding-friendly practices from local breastfeeding experts [i.e., individuals that are certified by the International Board of Lactation Consultant Examiners (IBCLC)]. The protocol is customizable to office settings and has low cost of implementation. Protocol adherence was facilitated by selected "office champions."	Limited availability of IBCLC breastfeeding experts in local areas resulted in additional responsibilities for providers and medical staff to troubleshoot breastfeeding issues. Low attendance at breastfeeding classes combined with breastfeeding-friendly providers only being affiliated with one of the local hospitals restricted the ability to affect breastfeeding rates prenatally.	
Hoffler et al., 2017 ⁴²	Hospitals with obstetric capacity; Georgia, USA	Hospitals participating in the Georgia Perinatal Quality Collaborative's Long-Acting Reversible Contraceptive (LARC) Initiative aimed to increase LARC placement in the immediate postpartum period.	At study completion, 7 of 10 participating hospitals had LARCs available for placement.	The program had state partnerships to facilitate appropriate reimbursement. Successful teams had clinical, pharmacy, and billing perspectives involved.	The program often faced competing clinical and administrative priorities, such as needing to create charge codes for LARCs and delaying discharge for LARC placement.	

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TABLE 2 (Continued)

Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal-child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
Leighton et al., 2019 ⁴³	Telemedicine and University of Pittsburgh Medical Center; Pennsylvania, USA	Established an MFM telemedicine program through teleconsult centers where MFM physicians evaluate patients comprehensively. They use tele-ultrasound services by performing ultrasounds at local facility and sharing results electronically.	Reported lower rates of preterm delivery and NICU use but similar rates of Cesarean delivery and fetal death among program participants than women with in-person consult. Program participants reported high levels of satisfaction with care. 11% of patients reported that they would have forgone MFM care without the telehealth consult. Estimated patient savings of \$90 per telehealth consult.	The participants were able to stay at their usual place of care as the program had large health system support and created an extension of an MFM care network into underserved communities.	A relatively low number of patients actually used the telehealth MFM consultation.	Most of the participants were White and on Medicaid.
Meyer et al., 2012 ⁴⁴	Local obstetric practice, hospital-based clinic, and tertiary care center; Vermont, USA	At prenatal medical appointments, women were offered methadone or buprenorphine for substance abuse treatment options to be supplemented with addiction counseling and biweekly contact with a primary care provider.	Between 2000 and 2006, the number of women receiving medication-assisted treatment before and during pregnancy increased. Birth weight and the proportion of infants discharged to the mother improved. There was a decrease in the percent of infants requiring treatment of neonatal abstinence syndrome. There was no change in gestational age at delivery, proportion of preterm births, or developmental outcomes.	Included community resources and created a state-supported multidisciplinary team to identify gaps in care and aid in transition of the family into the community after delivery. Allowed methadone and buprenorphine to be more accessible treatment options for expectant mothers.	Minimal coordination of care services and financial constraints resulted in creation of multidisciplinary team. Major challenges in the treatment of opioid use disorder in rural areas included limited transportation and access to medication providers and stigma related to receiving treatment.	

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Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal-child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
Morgan et al., 2020 ⁴⁵	Community academic partnership between North Carolina Division of Public Health, University of North Carolina at Chapel Hill, and local health departments; North Carolina, USA	The Improving Community Outcomes for Maternal and Child Health (ICO4MCH) program aimed to improve birth outcomes, reduce infant mortality, and improve the health of children from birth to 5 years by allowing grantees to select specific evidence-based strategies (increasing contraceptive access, tobacco cessation/prevention, positive parenting, breastfeeding, preventing secondhand smoke exposure).	Direct program impact on MCH not discussed.	Combined partnership between North Carolina Department of Public Health, University of North Carolina Chapel Hill, and local health departments. North Carolina General Assembly had legislated recurring funding for evidence-based infant mortality reduction programs. Funding agreement required local health department to receive implementation support and coaching.	It was difficult to recruit and sustain diverse and committed members of the community action team and engage health care providers in participating in the team.	
Naliboff et al., 2023 ⁴⁶	Rural hospital; Maine, USA	A universal education initiative about opioid overdose recognition and treatment administered by the hospital nurses to postpartum patients before discharge. All postpartum patients were offered a take-home first aid kit with naloxone. Providers and nursing staff completed educational modules on implicit bias, harm reduction, and opioid overdose recognition and naloxone administration.	A majority of obstetrical health providers and birthing unit staff completed implicit bias and harm reduction education. 97% (192/197) of postpartum patients received education from staff on opioid overdose recognition and treatment. 94% (186/197) of postpartum patients accepted first aid kits and 76% (150/197) also accepted naloxone.	The project workgroup included perinatal quality collaborative members, an individual from the recovery community, providers, and staff from the hospital-affiliated community action agency. The project team met monthly to problem-solve, present data, and support the work of providers and staff. State law and local hospital policy allowed for anonymous and free distribution of naloxone.	Initial negative perceptions of the project from the hospital and community needed to be addressed with media and education campaigns.	A majority of participants were White.
Orrantia et al., 2010 ⁴⁷	Community obstetric practice; Ontario, CA	A new model of obstetric practice in which obstetric providers were on-call 1 month of the year in rotation. Any woman enrolled in the practice who became pregnant was assigned to the physician on-call for the month of her due date and followed with them through their pregnancy.	All patients were satisfied with their obstetric experience and 90% stated they would choose to deliver with the practice again.	Providers felt the new model of obstetric practice caused less disruption of their family practice, increased level of satisfaction, and resulted in less clinic cancellations due to deliveries.	The 1 month on-call was physically challenging for one provider.	

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TABLE 2 (Continued)

Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal–child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
Paterno et al., 2019 ⁴⁸	Maternity care clinic in collaboration between local community agencies, nurses, and obstetricians; Massachusetts, USA	Engaging Mothers for Positive Outcomes with Early Referrals (EMPOWER) program provided individualized, coordinated community care services to build a network of addiction and mental health support for women with perinatal opioid use disorder.	EMPOWER may contribute to improved neonatal birth weight and increased referrals to community resources for mothers and newborns affected by opioid use disorder. However, 50% of women post-intervention continued to use illicit drugs during pregnancy.	A premier component of the intervention were the supportive relationships developed between mothers and health care providers to address pregnancy, mental health, and addiction-related health concerns. Collaboration between local community and health providers devoted to perinatal health.	Unable to reach other vulnerable rural subpopulations with racial and ethnic diversity. Missing data and documentation possibly due to women missing postpartum checkups or late transfer to prenatal care.	Most participants were White.
Rhoads et al., 2021 ⁴⁹	Obstetrical call center - supported by Arkansas Public Health Department and University of Arkansas Medical Center; Arkansas, USA	High-risk obstetrical call center model in which call center nurses provided triage using evidence-based guidelines to pregnant and postpartum patients across the state.	The call center model decreased inappropriate ED use among pregnant and postpartum women.	The call center had interpreters available and several private physician groups contracted for nights and weekends. Housed within the Arkansas Public Health Department and University of Arkansas Medical Center.	There was very low call volume at intervention initiation.	75% of women were on an antidepressant during study
Solness et al., 2021 ⁵⁰	Telemedicine; Iowa, USA	MomMoodBooster is an internet-delivered cognitive based therapy program for the treatment of maternal depression in veteran women. Personal coaches support participants through six modules tailored to address the postpartum period.	Program participants had increased behavioral activation and decreased depressive symptoms and dysfunctional autonomic thoughts. There were no differences in response to the program between rural and urban dwelling veteran women.	The personal coach served as a nontherapeutic point of personal contact, supporting participants, encouraging engagement, and clarifying content and use of the program.	Difficult to make phone contact with some women, possibly due to reluctance to answer a call from an unfamiliar number. Noted cultural barriers to veterans receiving mental health care.	(Continues)

TABLE 2 (Continued)

Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal–child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
Uscher-Pines et al., 2020 ⁵¹ Kapinos et al., 2019 ⁵²	Telemedicine in partnership with a rural county hospital; Pennsylvania, USA	Participants in the Telehealth for Mothers to Improve Lactation Confidence (Tele-MILC) trial were provided the Pacify Health's telelactation application where they could receive unlimited, on-demand video calls with lactation consultants.	Half of the intervention participants reported using the video visit, and 87% of those who received telelactation felt it was useful. Most calls occurred in the first month of life. Although not statistically significant, a higher percentage of women offered telelactation were breastfeeding and were breastfeeding exclusively at 12 weeks, when compared to control participants.	Facilitators to program implementation were not discussed.	Telelactation participants wanted options for text or audio only and experienced technical difficulties with connecting to internet, resulting in lower satisfaction with the application. In addition, not all women reported experiencing breastfeeding challenges.	Most participants were White and almost half of participants were first-time parents or on public health insurance.
<i>Social support (n = 15)</i>						
Bailey et al., 2015 ⁵³	Prenatal care clinic; Tennessee, USA	The Tennessee Intervention for Pregnant Smokers (TIPS) was designed to help pregnant women quit smoking by the end of their second trimester, and to remain smoke free to delivery and beyond. Health educators implemented the ACOG 5A's (Ask, Advise, Assess, Assist, Arrange) model to address smoking during pregnancy.	28.1% of participants quit smoking by the end of second trimester and remained smoke free to delivery. 63.9% reported 50% or more reduction in daily smoking. Program participants had increased prenatal care utilization and were significantly less likely to experience fetal/neonatal death, low birth weight, and NICU admission.	Program assessed social determinants of health and provided practical assistance related to housing, food, and transportation. Encouraged all women who were smoking to participate even if no intention of quitting.	Very costly to implement and required start-up grant funding.	A majority of participants were White and on Medicaid.
Barrera et al., 2018 ⁵⁴	Church halls, hospitals, and other popular community sites supported by the Alabama Department of Public Health, the Alabama Breastfeeding Committee, and Centers for Disease Control (CDC)	First, Best Fed Beginnings (BFB) is a nationwide quality improvement initiative funded by the CDC to increase the number of Baby-Friendly hospitals in the United States. Second, Enhancing Maternity Practices (EMPower) supported maternity care expansion efforts through technical assistance and staff training. Third, Baby Café trained some community members to become certified lactation consultants and eventually deliver breastfeeding care services.	Alabama's efforts illustrate how efforts across the state can be coordinated to improve breastfeeding rates. The state has increased in Baby-Friendly hospital designations and has increased scores in the CDC's national survey of Maternity Practices in Infant Nutrition and Care and the CDC's National Immunization Survey for breastfeeding support.	All three interventions required local and state partnerships to supplement the roles of providers and lactation experts to disseminate breastfeeding support and lactation education across Alabama. Technical assistance and funding support was from the CDC and its partners.	The Alabama Breastfeeding Committee is composed solely of volunteers and may benefit by having a more permanent director to provide consistent leadership to run the coalition.	

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TABLE 2 (Continued)

Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal-child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
Elkins et al., 2013 ⁵⁵ Lutenbacher et al., 2023 ⁵⁶	Home visitation (CHWs) supported by community agencies and Vanderbilt University Medical Center; Tennessee, Kentucky, West Virginia, Mississippi, and Louisiana, USA	Vanderbilt University Medical Center's Maternal Infant Health Outreach Worker (MIHOW) program was a community-based intervention dedicated to enhancing birth outcomes and early child development. Trained neighborhood women provide home and group services to underserved families.	In a sample of Hispanic participants who received MIHOW, significant positive effects were observed on breastfeeding duration, safe sleep practices, stress levels, depressive symptoms, emotional support, referral follow through, parental confidence, and infant stimulation in the home.	Community agencies had positive reputations and served as respected anchor for recruitment. Outreach workers are trained community members who are the same race, culture, and language of families they serve. Accreditation system monitored program fidelity across sites.	Program organizers oversee the activities of outreach workers, and they are solely responsible for patient recruitment and financing intervention activities.	
Evans et al., 2017 ⁵⁷	Telemedicine; USA	As part of the Baby Behavioral Education Enhancement of Pregnancy (Baby BEEP) program, patients at high risk of depression received consistent telephone support from nurses to alleviate depressive symptoms, incorporate coping strategies, and develop a network of support.	The telephone support intervention has the potential to treat or offset antepartum depression, with average improvement of Mental Health Index-5 scores from 45 to 66 by the end of pregnancy. Women at highest risk of depression had increased use of nurses, indicating that the nurses may also serve as a support system.	The structure of the intervention allowed nurses to establish rapport with their patients early in their pregnancies and addressed many of the barriers to receiving adequate care that the women faced when depressed (i.e., access to health care providers, lack of on-site counseling, and transportation).	In some cases, despite nurses' best efforts, patients did not want to fully participate and demonstrated no evidence of mutual work toward health-related goals.	Targeted low-income populations.
Goodman et al., 2022 ⁵⁸	Home visitation (nurses); North Carolina, USA	Family Connects is a short-term nurse home visiting approach designed to deliver brief education and intervention, assess family needs, and connect families to community resources for ongoing support.	Effective in improving family connections to community resources and resource utilization, safe sleep knowledge, paternal involvement with childcare, and parent social support. Resulted in less infant utilization of emergency medical care.	Program elements that supported high uptake included delivery of home services at a time where families have near universal needs for support, staffing by local community members, matching families with desired community resources, and local advisory boards to support ongoing community voice in the program.	Limited access to mental health services and primary care providers in these communities.	Participants were primarily low-income and on Medicaid.

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TABLE 2 (Continued)

Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal-child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
Interrante et al., 2024 ⁵⁹	Local WIC agencies; Minnesota, USA	Breastfeeding Peer Counseling Programs (BFPCs) employ local staff with breastfeeding experience to provide in-person, text-, and/or phone-based counseling to help WIC participants meet their breastfeeding goals.	Availability of BFPCs resulted in a 4.1 to 5.2 percentage-point increase in breastfeeding duration rates among WIC-participants in rural counties. Counties that bordered and those that did not border those with WIC BFPCs also experienced positive impacts on breastfeeding rates.	Local WIC agencies were funded by The Healthy, Hunger-Free Kids Act of 2010 to implement BFPCs. County WIC officials meet at regional and statewide meetings where information about program implementation and success are shared. Peer counselors are commonly current or former WIC participants.	Current federal funding is not adequate to provide peer program services to all Minnesota WIC agencies. Local WIC agency characteristics and implementation likely modulated individual program effectiveness.	A majority of the women were White and about half were insured by Medicaid.
Jesse et al., 2015 ⁶⁰	Local health department and prenatal care clinics; Southeastern USA	Insight-Plus provided a tailored and technology enhanced cognitive-behavioral intervention for low-income African American, Caucasian, and Hispanic rural women at risk for antepartum depression.	54% of participants completed all sessions. Depression scores decreased more for high-risk women in intervention than control. Low-moderate risk African American women had significantly greater improvement than control at 1-month postintervention. 100% of intervention participants were satisfied with help received and would recommend.	Eliminated some barriers to accessing intervention activities as materials were culturally tailored for each ethnic group at a fourth grade reading level. Participants reported liking the support they received from other women in the group sessions.	Despite transportation and childcare services being provided, working women and students were more likely to drop out of the program due to the sessions being 2 h long and limited phone service. 35% of women allocated to the intervention did not receive it.	Targeted Medicaid/WIC enrolled women. Most participants were African American.
Jones et al., 2023 ⁶¹	Rural hospital; USA	Monthly group prenatal care consisting of nutritional counseling, education, health check-up, and open discussion with other pregnant people.	Group care patients had more prenatal visits and were more likely to initiate breastfeeding and less likely to report smoking at the time of delivery than traditional prenatal care patients. There was no significant difference in preterm deliveries, APGAR scores, low birth weights, total NICU admissions, gestational age at delivery, induction, augmentation, type of birth, or method of anesthesia between the two groups.	Participants were grouped by gestational age regardless of parity to foster group diversity and encourage more mentorship and exchange of knowledge.	Recruitment of participants was dependent on manual delivery book entries made by a single labor and delivery clerk.	The patient population was noted to have very little diversity.

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TABLE 2 (Continued)

Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal–child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
Lilly et al., 2019 ⁶²	Obstetric–gynecology clinics, behavioral health unit of delivery hospital; West Virginia, USA	The Drug Free Moms and Babies Project integrated maternity and behavioral health care to provide prevention, treatment, and recovery services for pregnant and postpartum women with substance use disorders. Included a multidisciplinary team, peer coaching, social service programs, and integration with local and statewide initiatives.	Program completers (71.5%) had positive urine drug screen (UDS) decline steadily from 81% positive in the first trimester to 22% at delivery. There was a statistically significant increase in negative UDS for all participants.	Program sites differed to best integrate local resources and support their communities. Referral to treatment was tailored to each patient based on individual needs and included access to other state and community-based services. Regular treatment team meetings allowed frequent monitoring of program participants.	Establishing the program required more time than anticipated and dedicated staff positions. Those who did not complete the program were more likely to have entered in the second trimester, have lower education, or be on Medicaid. Other barriers to treatment included transportation, childcare, and communication difficulties.	Participants were primarily White, low-income, with limited education, and Medicaid insured. 76% reported using more than one substance during pregnancy.
Morton et al., 2015 ⁶³	Various community sites (partnership between state agencies, community agencies, tribal communities, families, and providers); Maine, USA	The Community Caring Collaborative was a grassroots organization of agencies that designed a strengths-based system of care grounded in best practices. It focused on providing training, supervision, and direct services to families.	Program resulted in shorter lengths of stay for infants in NICU and fewer readmissions to hospitals or other emergency care settings. Participants reported the program provided needed supports, helped keep families together, and offered relevant services.	Bridged relationships between families and services through the integration of community-based activities and primary care resources. Utilized an ecological framework that addressed health on four interacting and integrated levels: individual, relational, community, and societal.	Stigma attached to poverty, substance abuse, domestic violence, and health disparities. Transportation and employment concerns prevented patients from accessing community services and resources in a timely manner. Lack of training for providers working with these populations resulted in them interpreting missed visits as noncompliance.	Included families with high-risk infants.
Tanner-Smith et al., 2013 ⁶⁴	Urban faith-based community health center; Rural birthing center; Ob/Gyn department at a large metro hospital; community health center affiliated with a large metro hospital; Tennessee, USA	CenteringPregnancy is a patient-centered group model of prenatal care that encourages open discussion and information sharing of breastfeeding advice, and the opportunity to social network among a small group of new mothers.	Rural women in CenteringPregnancy group care were significantly more likely to report breastfeeding on discharge compared to individually delivered care. However, there was no significant difference in odds of breastfeeding at postpartum follow up or of exclusive breastfeeding at discharge or postpartum follow up.	Group prenatal care provided peer discussion about breastfeeding and an outlet to women who may lack social and emotional support during their pregnancy.	Unable to reach populations with a high risk for an adverse health outcome and lack of consistent breastfeeding recommendations from providers following hospital discharge.	Majority of participants at rural birthing center were White, Medicaid-insured; only enrolled pregnancies that were not deemed high risk.

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TABLE 2 (Continued)

Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal-child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
Van de Griend et al., 2020 ⁶⁵	Hospitals and clinics supported by the South Carolina Department of Health and Human Services; South Carolina, USA	State-wide, interagency collaborative that expanded CenteringPregnancy group prenatal care to multiple health care practices, incorporates health care checkups, facilitative groups, and health education.	Direct program impact on MCH not discussed. Reports important considerations for successful implementation of group prenatal care at the organizational and statewide levels.	Strong political advocacy, interdisciplinary collaboration, state-level financial support for group prenatal care made it possible for clinics to provide CenteringPregnancy.	There is resistance to policy changes within complex health systems and competition for state leaders' limited resources and attention.	
Whittaker et al., 2021 ⁶⁶	Home visitation - supported by the Maternal Infant and Early Childhood Home Visitation (MIECHV) program; Pennsylvania, USA	Focused on programs that use the Community Capitals Framework, which focuses on tight community ties and looser ties between communities and organizations, to provide prenatal and postpartum support, including NFPs, Parents as Teachers, Healthy Families America, and Early Head Start.	Direct program impact on MCH not discussed.	Investment in social and cultural aspects of rural lifestyles through the integration of provider-patient-community relationships with health care services encouraged participation in intervention activities. Parent Policy Councils helped promote parent voices in local programs.	Social isolation is a major aspect of rural lifestyles, and it is further compounded by personal transportation, financial, social and cultural issues that prevent timely receipt of social and health care services.	
Williams et al., 2017 ⁶⁷	Home visitation (community health workers, nurses, social workers) - statewide program; Kentucky, USA	The Kentucky Health Access Nurturing Development Services program is a home visitation program for new and expectant at-risk first-time parents through the second year of life. Professionals and paraprofessionals provide information, problem solving, facilitate parent skill development, and assist with meeting basic needs. These visits are supplemented with visits from a registered nurse or social worker.	Program resulted in lower rates of preterm delivery and low birth weight infants, increase in prenatal care, and decrease in pregnancy complications. Participants were more likely to receive WIC during their pregnancies. There was no difference in breastfeeding initiation.	The program used small home visitor caseloads and a combination of paraprofessional and professional home visitors, which balanced the need for professional supervision with maintaining low program costs. The program was funded by the state and Medicaid reimbursements.	Eligible participants (not previously parented a child and at least two risk factors) needed to undergo a two-step screening and assessment process for enrollment. Challenges with recruitment as only half of all initial referrals received one or more home visits.	Most of the participants were White and on Medicaid.

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Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal-child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
<i>Increased care frequency (n = 11)</i>						
Campbell et al, 2019 ⁴⁸	Home visitation (public health nurses); British Columbia, CA	The Nurse Family Partnership (NFP) is an early intervention program that provides first-time mothers experiencing social and economic disadvantaged with connections to community and health care resources via home visits with public health nurses up until their child's second birthday.	Direct program impact on MCH not discussed. Reports public health nurses and NFP supervisors are well-positioned to identify the modifications require to support program delivery in rural communities.	Public health nurses were able to form strong bonds and relationships with their clients as a result of their dual role as a community member and a medical professional. In addition, frequently cited barriers to accessing health care services (e.g., isolation and transportation) were addressed within the structure of the intervention. Supervisors understood the unique demands on rural public health nurses and were flexible with accommodating their schedules.	As the only health care provider in the area, nurses reported feeling isolated while being expected to deliver high quality health care services to their community. They addressed varied social and medical concerns with limited access to services and barriers to communicating with patients, especially during extreme weather conditions. Some felt frustrated with having to complete administrative tasks for the program.	Socio-economic disadvantaged criteria were used at intake resulting in a majority of participants being low-income, first-time mothers.
Chernoff et al, 2017 ⁴⁹	Patient's homes; Alaskan hub fishing communities; and birthing/medical facilities; Alaska, USA	In the Alaska Community Health Aid Program, primary care is provided by community health aids and practitioners (CHA/Ps) who were connected to senior medical providers at regional hospitals through telephone, computer, and radio.	CHA/Ps describe how the program allows families to stay together instead of being sent to regional hubs for care. CHA/Ps report providing a wide range of services including prenatal and postpartum care, emergency deliveries, well-child visits, social support, and referrals to additional services.	CHA/Ps are recruited from the communities they serve and are respected sources of information which allowed the development of strong patient relationships and incorporation of Alaska Native traditions into care. CHA/Ps received standing orders from physicians that allowed them to continually increase their scope of practice in line with their skills.	CHA/Ps struggle with work-life balance as they are available for health-related questions 24/7 to support comprehensive health care services to their patients.	

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Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal–child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
Cramer et al., 2018 ⁷⁰	Telemedicine; Nebraska, USA	The intervention group received usual prenatal care plus a smartphone preloaded with a tailored prenatal platform with automated texting, chat function, hyperlinks, and weekly contact from a CHW.	Direct program impact on MCH not discussed. Participants reported satisfaction with the intervention.	The project used community-based participatory research and formed a rural community advisory board. Data were collected to understand enrollment and attrition barriers. Board meetings were used to discuss problems and solutions.	Recruitment and enrollment were slower than anticipated due to lag times between referrals and home visits, especially for Spanish speakers and teens. Many patients already had a phone and did not want to carry 2 phones. Difficulty achieving provider buy-in to recruit patients.	Nearly half of participants were Hispanic/Latinx.
Hussaini et al., 2011 ⁷¹	Home visitation (CHWs) supported by Bureau of Women's and Children's Health at the Arizona Department of Health Services; Arizona, USA	The Health Start Program utilizes CHWs who live in and reflect the ethnic, cultural and socioeconomic characteristics of the communities they serve. They provide prenatal care education, support, advocacy and referral services, and home visits for the first 2 years of the child's life.	Health Start mothers had twice as better odds of having a normal birth weight than non-Health Start mothers. Women in urban settings had better birth outcomes than those in rural settings, especially among Hispanic women.	CHWs who live in and represent the racial, ethnic, and cultural diversity of their respective neighborhood encouraged engagement in intervention activities. The program is state-supported and funded with both general fund and lottery dollars.	Requirement of a referral from a health care provider may prevent women from accessing social and medical services due to large geographic distances to prenatal and pediatric clinic. Poorer outcomes in rural areas may be attributed to lack of access to care, adequate nutrition, social support, and transportation.	Approximately 78% of the sample was Hispanic.
Kellom et al., 2018 ⁷²	Home visitation supported by the Maternal Infant and Early Childhood Home Visitation (MIECHV) program; Pennsylvania, USA	Four evidence-based models—NFPs, Parents As Teachers, Early Head Start, and Healthy Families America—colocated sites to fill service gaps based upon population needs.	Direct program impact on MCH not discussed.	Integrated and expanded upon well-regarded aspects of evidence-based models to create more personalized care plans for a greater number of patients.	Only able to reach patients who met the eligibility criteria of one of four programs. Difficulties handling needs of multiple populations and competition between programs.	

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Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal–child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
Kornelsen et al., 2014 ⁷³	Midwifery practice; British Columbia, CA	Rural midwifery-led primary prenatal care service.	71.9% of population giving birth was cared for at the midwifery practice. Reported lower rates of Cesarean deliveries, inductions, episiotomies, and postpartum hemorrhage among women cared for at midwifery practice compared to provincial averages. Similar admission rates to primary care-led prenatal care practices.	Midwives had good relationships with obstetric providers. Second attendants were registered nurses who would accompany patients requiring hospital transfer, ensuring continuity of care.	Barriers to program implementation not discussed.	
Parasuraman et al., 2019 ⁷⁴	Home visitation operated through community-based organizations, community health centers, or local health departments; Nationwide, USA	Healthy Start Program focuses on improving maternal and perinatal outcomes in communities with high rates of infant mortality for the first 2 years of life by improving women's health, promoting quality services, strengthening family resilience, achieving collective impact, and increasing accountability through quality improvement, performance monitoring, and evaluation.	Program grantees reported providing direct services to 44,219 women during the grant year, which includes women who are pregnant, preconceptual, or interconceptual. The program served 24,706 children up to the age of two. Grantees reported a core set of services to participants, including case management, health education, and referrals to community providers. However, referral services may not have been universally offered across all sites.	Use of diverse staff to best serve the needs of target populations. Coordinated primary care services through partnerships with community providers and assistance with insurance applications.	Participants were referred at low rates to ancillary support services (e.g., employment or child care). The breadth of services offered were affected by availability within each community.	Targeted high-risk women and children in communities with rates of infant mortality at least 1.5× US national average and high rates of other adverse perinatal outcomes. Participants were primarily underserved racial/ethnic minorities who had limited education, low-income, and were unmarried.
Runkle et al., 2021 ⁷⁵	Home monitoring in partnership with rural health clinic; North Carolina, USA	Self-monitoring blood pressure protocol added to the Centering Pregnancy group prenatal care model. Portable blood pressure monitor and smartphone app is provided to pregnant women to remotely monitor vitals and connect patient to a physician.	Women reported high satisfaction with prenatal care and high participation in the home blood pressure monitoring. Home blood pressure readings varied slightly from clinic readings, but can detect elevated blood pressure earlier than in routine clinic visits.	High health-related internet use and e-health literacy among patient sample. All women reported having access to the internet.	The participant group missed 5 out of 13 clinic visits during the third trimester. Some women reported the blood pressure cuff was uncomfortable.	A majority of the women were White.

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Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal-child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
Taboada et al., 2021 ⁷⁶	Mobile health technology and home visitation (public health nurse from Nurse-Family partnership sites); Nationwide, USA	The Goal Mama mobile health technology platform allows patients to set and track personal goals and interact with home visits with a public health nurse.	Public health nurses reported high feasibility and acceptability scores for the Goal Mama platform, indicating uptake and buy-in even after 6 months of use.	Technology helped to meet clients where they are and provided new insights for PHNs with real-time data. The goal setting feature of the platform provided skill-building and social support.	Barriers included: (1) designing the platform for mobile needs vs. desktop function, (2) need for additional support for PHNs using technology, (3) client reluctance about goal setting, and (4) issues with PHN capacity and workflow integration. Additionally, some PHNs were reticent about clients with basic survival needs.	
Walton et al., 2021 ⁷⁷	Federally Qualified Health Centers (FQHCs); North Carolina, USA	CenteringPregnancy is a patient-centered group prenatal care model that encourages open discussion and information sharing of prenatal health advice, and the opportunity to social network among a group of 8–12 pregnant women.	Participants were more likely to achieve adequate prenatal care but had slightly higher incidence of low birth weight, preterm birth and NICU admissions. Participants reported no barriers to prenatal care.	Group prenatal care provided an outlet to women who may lack social and emotional support during their pregnancy. Patients reported feeling more trust with providers due to increased face time with them.	Previous negative interactions between patients and providers in addition to issues related transportation prevented some women from program engagement. There were no on-site translators and thus could not reach over 50% of practice population comprised of non-English speaking Hispanic women.	Women were not randomly assigned to intervention but could choose whether they wanted group prenatal care or traditional prenatal care.
Wood et al., 2021 ⁷⁸	Telemedicine (founded by Regional Obstetrics Consultants); Tennessee, USA	Solutions to Obstetrics in Rural Counties (STORC) sends both a sonographer and an advanced practice nurse to the remote site who checks vital signs, reinforces signs of complications, and when to contact the regular OB provider.	77% of participants delivered in their home community and only 8% of deliveries resulted in NICU stays. Patients reported satisfaction with remote visit and quality of care received. Estimated savings of \$43.44 per visit based on travel time and mileage.	The program allowed real-time transmittal of images from the portable ultrasound for the physician and other specialists at the hub; The nurse at the remote site assisted with diagnostic acumen.	The newness of the program has slowed insurance reimbursements for telemedicine, but some have started to understand the benefits.	

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<i>Education (n = 11)</i>						
Bush et al., 2017 ⁷⁹	Telemedicine; Wyoming, USA	The Wyhealth Due Date Plus application includes information on over 70 health risk factors in pregnancy to identify high-risk clients needing more intensive care management. The application offers women pregnancy timeline tools, information on factors that influence their health, and resources like a click-to-call nurse.	Intervention significantly increased prenatal visit utilization and approached significance for decreasing low birth weight. No significant effect on C-section or NICU admission rates.	Technology was used to engage and identify women with pregnancy risk factors early in their pregnancies and to connect them to evidence-based interventions and support services.	Difficult to sustain interest in the application without continued marketing campaigns. Program can cost at least \$100–150K per year to ensure successful adoption. Challenging to link Medicaid claims to the application.	
Jacobson et al., 2020 ⁸⁰ Jacobson et al., 2023 ⁸¹	Telemedicine and rural and urban obstetric clinics; Kansas, USA	Combined breastfeeding and diabetes prevention program-based intervention consisting of weekly counseling sessions and online peer support groups that also focuses on nutrition and physical activity.	Direct program impact on MCH not discussed. 74% completion rate among those randomized to intervention.	Used online groups to facilitate shared problem-solving. Focused on education and behavioral skills that help participants identify and implement goals. A majority of providers reported willingness to participate, believed the intervention aligned with their organization's mission, and were satisfied with the use of iPads for screening and recruitment.	Eligible women were required to understand English and have access to a cell phone and internet. 12-month time commitment may have deterred women from participating. Program completers were more likely to reside in urban locations compared to noncompleters likely due to more active recruitment and closer distance from site.	Excluded women with high likelihood or pregnancy complications.
McCabe et al., 2012 ⁸²	Home visitation administered through the Department of Health; Tennessee, USA	Help Us Grow Successfully (HUGS), a home visiting program, is open to all Tennessee families, and provides home-based prevention and intervention to pregnant women, postpartum women, children through their 6th birthdays, and their families.	Direct program impact on MCH not discussed.	No income eligibility criteria and referrals from local health departments, hospitals, and clinic offices granted all Tennessee families to be connected to health care and social services. Used existing state patient tracking system to link family members and record family-specific information.	All Tennessee families are eligible for home visits, but some families lack the motivation to enroll or drop out of the program early.	Most of the participants were White.

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Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal–child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
Menser et al., 2020 ⁸³	Home visitation (community health workers); Ohio, USA	The Ohio Infant Mortality Reduction Initiative is a home visit program led by CHWs to reduce infant mortality among high-risk populations. It includes education, referrals, and provision of supplies and social support to expectant mothers.	Direct program impact on MCH not discussed. Recommendations for starting home visiting programs include adequately training CHWs, leveraging community resources, and maintaining open communication and a realistic workload for CHWs.	Regular staff communication and connections with other community programs allowed CHWs to act as a support system and provide social and medical services to expectant mothers.	The program faced four major operational challenges: 1) difficulty finding CHW recruits, 2) challenges meeting needs of populations served, 3) uncertain/inadequate program funding, and 4) preparing CHWs for a complicated and multifaceted role.	
Mobley et al., 2014 ⁸⁴	Home visitation (registered nurse case manager); Georgia, USA	The Enterprise Community Health Start consisted of perinatal case management from prenatal through 24 months of postpartum care by registered nurse case managers (all African-American) experienced in perinatal care.	Resulted in improvement in maternal health literacy scores among high-risk women at postpartum compared to their prenatal scores. Elevated depression scores were most frequent among women with lower maternal health literacy and associated with loss of relationship with the father of the baby and intimate partner discord.	Longer length of case management and home visiting increased maternal health literacy. Long-term stable relationships with registered nurse case managers supported women's progress.	Program attrition due to challenges in communication, tracking patients, and social circumstances. Local nonemergency mental health services were limited. Antenatal depression was noted to be a deterrent to initial maternal health literacy, but despite their depression women's maternal health literacy increased by postpartum.	Participants were primarily African-American, Medicaid beneficiaries, with limited education.
Olson et al., 2014 ⁸⁵	Primary care clinics and community sites supported by Cornell University and community partnership; New York, USA	The Healthy Start Partnership (HSP) promoted healthy weights in childbearing women and their infants using numerous interventions that targeted diet, weight gain, and breastfeeding support and education.	Although community residents were exposed to the interventions, they did not result in major differences in weight outcomes or intention to breastfeed compared to controls.	The partnership governing structure was made up of a committee composed of university partners and local representatives that regularly met and made funding decisions.	The Interventions were primarily informational and relatively low intensity; thus, they likely need to be paired with those aimed at changing community structures and individual behaviors.	

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Puma et al., 2018 ⁸⁶	WIC facilities (academic and community partnership); Colorado, USA	To augment the postpartum maternal care currently provided by the Special Supplemental Nutrition Program for Women, Infants, and Children: Implementation of an interactive electronic decision support system and training of staff in empathic counseling, reflective listening, and shared decision-making to support mental health behavior change.	The electronic decision support system showed initial high uptake, but usage declined over subsequent months. The intervention decreased participants' daily consumption of sugar-sweetened beverages and improved maternal weight status, but these results were not sustained long-term. It did not improve any other eating/physical activity behaviors.	Participants were able to access services in a relatively accessible location that could address most their social and medical needs at a single site. The Plan-Do-Study Act process was used to assess and improve the implementation of the intervention.	Many participants were reluctant to engage in intervention activities due to competing priorities, receipt of too much information at each visit, and limited health knowledge regarding the connection between their health and diet. There was a lack of staff buy-in and high turnover due to inexperience and unbalanced workloads. The program was also limited by its budget and temporary cessation of government funding.	Participants were primarily low-income and on Medicaid.
Ramsey et al., 2018 ⁸⁷	Community health program partnered with Texas Department of State Health Services and Texas Chapter of March of Dimes; Texas, USA	The Becoming a Mom program curriculum, designed by the March of Dimes, included multiple sessions led by trained medical professionals that aimed to improve pregnant women's knowledge concerning health and pregnancy.	Significant improvement seen in knowledge of postpartum health, symptoms of preterm labor, knowledge of safe sleep, and intention to breastfeed. Rates of preterm birth were lower and rates of low birth weight were slightly higher among participants when compared to others in the corresponding area but these results were not statistically significant.	Program intervention offered in English and Spanish. Incentives (diapers, blankets, toys) given for attending sessions that would prepare of aid the participant's pregnancy. Partnered with community resources and supported by State Department of Health Services and March of Dimes.	Financial constraints of program and limited health care knowledge among socially and medically vulnerable pregnant women. 10% of participants stated they had not sought out prenatal care as they had no documentation.	Participants were primarily low-income, dependent on social insurance programs, without education beyond high school.
Ravindran et al., 2020 ⁸⁸	Public health units; Ontario, CA	Public health nurses with extensive clinical expertise in preconception and interconception health assessed patients' risk for adverse pregnancy outcomes, delivered an individualized care plan, and referred patients to specialty services.	Women were satisfied with the intervention, which had high program response and retention rates. However, only 42% felt more knowledgeable about health factors affecting fertility and pregnancy post-intervention.	Relationships developed between public health nurses and patients in breastfeeding clinics, parenting classes, and home-visiting programs that encouraged program participation. Public health nurses had positive perceptions about the risk assessment tool and intervention overall.	Participants reported health information is gone through too quickly. Perceived absence of risk and lack of awareness of preconception health importance are barriers to uptake of preconception care.	Most of the participants were White, married, and had a high level of education and income.

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Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal–child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
Wiltheiss et al., 2013 ⁸⁹	Home education kits; North Carolina, USA	The intervention group received motivational counseling from a trained health coach and eight monthly educational kits via mail that focused on stress management and parenting, promoted positive healthy changes in the home, and encouraged healthy behaviors in mothers and children. Participants were invited to attend one group session led by a registered dietitian and a trained health coach to reinforce information.	There were no significant differences between intervention and control arms in change in energy intake, diet quality, or weight from baseline to follow-up. The intervention did not promote postpartum weight loss. Reducing energy intake, rather than improving diet quality, should be the focus of weight loss interventions for overweight/obese postpartum women.	Facilitators to program implementation were not discussed.	Participants may have underreported actual food consumption, especially foods high in fat and sugar that are perceived as unhealthy choices.	Most of the participants were White.
<i>Self-efficacy (n = 10)</i>						
Addicks et al., 2019 ⁹⁰	Home visitation, community locations, and university-associated clinic; Appalachian Region, USA	The intervention group received a motivational interviewing session provided by one of two therapists. Participants were provided a list of possible topics related to breastfeeding and encouraged to lead the conversation by selecting topics that interested them.	Women who received motivational interviewing were more likely to report breastfeeding at 1 month postpartum than women receiving standard education. There was no difference in changes to intended feeding method, breastfeeding exclusivity, proportion of feedings that were breastmilk, or future breastfeeding plans.	Program was noted to be resource-efficient.	Difficult to change the attitudes of multiparous women toward breastfeeding due to decrease in openness to change and high likelihood of repeating previous breastfeeding patterns. Noted a telehealth component may have helped reach women with barriers that prevented in-person participation.	Of note, participants were primarily White, well-educated, married, with higher average income.
Aguirre et al., 2018 ⁹¹	Online educational program; Nebraska, USA	The intervention group was enrolled in an interactive, bilingual, computer-based breastfeeding educational support program.	Intervention participants had a significant increase in breastfeeding knowledge at week 6 compared to controls. The control group showed a decline in self-efficacy at month 3 and 6 compared to the intervention group which had a gradual increase in self-efficacy. There was no significant change in breastfeeding attrition between groups.	A community liaison (certified translator and respected community member) was available as needed. The intervention tried to utilize Hispanic communication norms and children were welcome at all in-person meetings. Follow-up was designed to be by phone to avoid transportation issues, and the same study member kept in contact with participant to build trust.	If participants requested the team pick up the educational materials, the study team would drive (sometimes > 100 miles per trip). Unique cultural beliefs such as la cuarentena (traditional postnatal period of rest) made new mothers reluctant to leave their homes.	Targeted Hispanic women with low breastfeeding rates.

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TABLE 2 (Continued)

Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal-child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
Baffour et al., 2012 ²	Family health advocacy offices, day care center, churches, and community center; Northern Florida, USA	Conducted by paraprofessional workers, the Family Health Advocacy intervention provided weekly community-based educational resources and connections to social support tools to address rural prenatal health disparities.	Post-intervention, women significantly increased their knowledge of safer sex practices, alcohol consumption, early prenatal care, maternal infection, and nutrition. Women used more positive ways to lower stress but did not exhibit behavioral change related to nutrition or risk of maternal infection.	CHWs are trained extensively in culturally appropriate education and served as a bridge toward the acceptance of services with traditional health and social service providers. Program staff are supervised to ensure all data collection and intervention procedures are conducted in a culturally sensitive and ethical manner.	Many program participants failed to complete the program due to poor health, work demands, and new demands of motherhood. Cultural beliefs likely impeded behavioral change (e.g., douching practices). Program required significant man power and financial resources.	Majority of program participants were African-American, unemployed, low-income, and with high school or less education.
Chertok et al., 2015 ²³	Prenatal care clinics and telephone support; West Virginia, USA	The ACOG's 5A's (Ask, Advise, Assess, Assist, Arrange, smoking cessation intervention model was supplemented by midwife-based prenatal care with nurse telephone support.	Program resulted in significant change in women's confidence in cutting down and quitting smoking. Significant reduction in cigarettes smoked per day overtime.	Midwives and nurses provided personalized support and guidance, which was instrumental in supporting women that already expressed interest in quitting smoking behaviors. The 5's helped increase efficiency of counseling in the clinic setting.	Unable to reach populations that did not have significantly high prenatal smoking tests and limited funding for nicotine testing.	Excluded participants with high-risk pregnancy.
Dennis et al., 2020 ²⁴ Dennis et al., 2012 ²⁵	Telemedicine supported by public health departments; CA	Interpersonal Psychotherapy (IPT) is a psychotherapeutic approach to achieve symptomatic relief for depression by addressing current interpersonal issues. Postpartum women received 12 weekly sessions, each 50 to 60 min in duration, of telephone-based IPT from a trained nurse where they learned strategies to work through interpersonal issues to overcome depression.	Nurse-delivered IPT was effective in treating postpartum depression and anxiety among urban and rural women. These women were 4.5 times less likely to meet criteria for depression than those who received standard treatment. They also reported improved partner relationship quality and reduced attachment avoidance.	Telephone sessions were flexible, private, nonstigmatizing, and highly accessible. Nurses conveyed empathy and understanding to increase patient engagement in intervention activities. IPT adherence and treatment fidelity was enhanced using nurse checklists, digital audio recordings, and weekly group supervision.	Nurses were required to undergo extensive IPT training consisting of a 5-h didactic workshop and intensive supervision to ensure ongoing treatment fidelity. Participants reported they would have liked more sessions with "weaning."	Most participants were married with post-secondary education and had no concurrent psychiatric therapy during the study.

(Continues)

TABLE 2 (Continued)

Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal-child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
Hudgins et al., 2014 ⁹⁶	Group homes operated by local organizations; Georgia, USA	Georgia's Second Chance Home Network provides housing and support to pregnant and parenting teenagers along with intensive case management, financial education, career support, and employment.	Among intervention participants, 50% graduated high school/GED, over 25% had their own apartment, and 50% were employed at final follow-up. There was a decrease in Child Protective Services placements and only 4% had repeat pregnancy before age 20 (vs. state average of 25%). Participants had improvement in parenting education scores and 96% of children had up-to-date vaccinations at discharge.	Facilitators to program implementation were not discussed.	There were only a limited number of spots available in the program and some teen parents left the program very quickly as they did not see any benefits of program placement.	Targeted teenagers. Majority of participants were African American and in Department of Children's Services custody.
Johnston et al., 2017 ⁹⁷	Public health well child clinics; Alberta, CA	Converted one-on-one well child service delivery model into CenteringPregnancy model of group care that included group education sessions, childhood vaccinations, health screenings, and referrals to resources.	Participants reported satisfaction with the program, more confidence in their parenting skills, better stress management, and more positivity toward their roles as parents at program completion. All babies were vaccinated and 81% of mothers were still breastfeeding at 6 months postpartum in the program cohort compared to 59% reported for the province.	Able to build on the successful Albertan PHN-led well-child visit program through greater dissemination of health knowledge in a supportive group format that enabled mothers to feel welcomed, respected, and listened to.	Health care provider availability and financial constraints resulted in a reduced number of sessions.	Participants were first-time parents and more likely to have lower levels of education and lower household income than comparison group.
Samankasikorn et al., 2016 ⁹⁸	Home visitation (community health workers); Virginia, USA	The Resource Mothers Program (RMP) focuses on improving maternal child health through providing home visits by a CHW during pregnancy and postpartum. The CHWs provide social support, role modeling, screening, health education, and referrals.	Improved 3-month postpartum self-esteem with most improvement among Hispanic teen. Program resolved the preexisting disparity of increased baseline stress scores between Hispanic and non-Hispanic teens.	Majority of CHWs shared ethnicity/racial backgrounds with the population served and could provide Spanish-language care. CHWs built strong relationships with their clients to positively impact their self-esteem.	Some of the most vulnerable teens may not have been included due to failure to obtain consent. Teens also preferred texting and other social media outlets over phone correspondence, and many had sporadic telephone service.	Targeted pregnant teenagers. Most participants were Hispanic and African American.

(Continues)

TABLE 2 (Continued)

Author and year of publication	Study setting (including state/country)	Description of the intervention	Impact on maternal-child health	Facilitators to program implementation	Barriers to program implementation	Notable participant characteristics
Weisman et al., 2011 ⁹⁹	Small groups at WIC facilities, churches, and community centers; Central Pennsylvania, USA	The <i>Strong Healthy Women</i> Intervention included six sessions delivered over a 12-week period and focused on behavior modification related to key risks for adverse pregnancy outcomes, such as preterm birth and low birthweight. Strong focus on nutrition and physical activity.	Intervention participants reported significantly lower weight and BMI at 12 months and more than doubled odds of using daily folic acid. Intervention participants who became pregnant gained significantly less weight during pregnancies compared to controls but did not reduce odds of exceeding recommended weight gain. Effect on reading food labels was significant at 6 months but became nonsignificant by 12 months.	Supplemented health advice shared during prenatal medical appointments in a nontraditional community setting in a small group environment.	Unable to reach other vulnerable subpopulations in rural, low-income communities that are largely White and non-Hispanic. Physical activity increase was not sustained secondary to end of social support from group meetings after program completion. Response bias noted that women who responded to follow-up surveys were older due to more residential stability.	A majority of the participants were White.
<i>Positive reinforcement (n = 1)</i>						
Olson et al., 2019 ¹⁰⁰	Federally Qualified Health Center (FQHC); New Hampshire, USA	Smoke-Free Moms, a behavioral economics-based smoking cessation intervention, was conducted by clinical staff during routine prenatal and postpartum medical appointments. Using the 5 A's (Ask, Advise, Assess, Assist, Arrange) model, women received individualized care and monetary compensation for smoking cessation.	The addition of incentives with 5 A's counseling had similar quit rates in pregnancy to 5 A's counseling alone but resulted in more women with smoking cessation persisting 6–8 weeks postpartum. The average cost of incentives per woman who quit was similar to the cost of one clinical visit in the region.	The intervention occurred within the routine prenatal care process. Personalized plans of care and monetary reward to quit smoking encouraged program participation.	Some women with low confidence in quitting may need additional support and counseling to successfully quit smoking. No options for increased or varied incentives (e.g., diapers and baby clothing).	Only able to reach rural White populations.

be acceptable by providers³⁸ and increased HPV vaccination.³⁷ Other studies detailed the development of academic–community practice partnerships,⁴⁵ change in obstetric provider call schedules,⁴⁷ increasing access to OUD overdose recognition education,⁴⁶ and increasing breastfeeding education in primary care.⁴¹

Implementation facilitators and barriers

Common facilitators for clinical service connection interventions (Table 3) included multidisciplinary program champions who provided education and staff reminders, as well as programs being supported by large health care systems in their inner setting. State legislation supporting program development was identified as a facilitating outer setting, as evidenced by Georgia Medicaid reimbursement for LARC placement immediately postpartum⁴² and the North Carolina legislature dedicating funding for development of academic–community clinic partnerships to reduce infant mortality.⁴⁵ Overall, study staff being embedded into existing health care structures and providing the clinical service after a scheduled visit was considered acceptable to providers and patients.³⁹ Shared barriers to clinical service connection implementation included low resource utilization, such as lack of connection to supplemental nutrition programs or existing community resources; transportation and internet connectivity issues; and sustaining community partnerships throughout the implementation process. Clinical service connection interventions that spanned inpatient and outpatient settings struggled to coordinate scheduling of appointments in advance. Insurance lapses also made providing postpartum care difficult, given that multiple states' maternal Medicaid coverage expired at 8 weeks postpartum.

Social support

Fifteen studies focused on the lack of social support for pregnant individuals in rural communities and addressed connectivity with their community and/or other pregnant individuals as an intervenable mechanism. Social support for postpartum individuals was delivered via group care, home visits, and collaborative care. Four studies^{58,60,64,65} noted a diverse patient sample (>25% of participants self-identifying as racial/ethnic minorities); other studies either did not report race/ethnicity or identified most participants as non-Hispanic White. All studies documented that most participants were eligible for Medicaid.

Intervention form and function

Social support delivered through home visits focused on improving general maternal–child health outcomes^{55,58,66,67} and used a combination of licensed social workers, nurses, and community health workers

(CHWs) to complete visits. Home visits were found to improve community resource and outpatient clinic utilization, lower emergency room visits, decrease substantiated reports of child maltreatment, and lower rates of preterm birth. One study noted that the intervention effect was dose dependent, and the rate of preterm birth decreased as the number of home visits increased.⁶⁷ Social support was delivered via group care for both general maternal health as well as depression and breastfeeding.^{54,60,64,65,61} Group interventions were associated with improved breastfeeding rates and decreased depression symptoms for high-risk pregnant individuals. Two studies reported on the use of collaborative care in perinatal health with social services and community resources to provide social support to families, and showed decreased positive infant drug screens at birth⁶² and shorter NICU stays.⁶³ Over 85% of providers in one study stated the social support intervention changed the way they practice with a focus on modifiable social vulnerability risk factors.⁶³ Other studies included personalized social support provided by nurses in connection with prenatal clinics, both in-person and via telephone, for breastfeeding,⁵⁹ depression,⁵⁷ and tobacco use treatment.⁵³

Implementation facilitators and barriers

Common facilitators to increasing social support included integration with community resources within the implementation process, which met the holistic needs of families and increased participation and longitudinal rapport with study team members. One study noted that enrollment earlier in pregnancy improved the trust between patient and nurse and increased intervention efficacy.⁵⁷ Studies with diverse patient populations noted that employing community members with similar demographics as patient-facing staff and developing culturally informed interventions were crucial to programmatic success. While scheduling conflicts were noted to be a significant barrier to group interventions, participants reported the support from other participants in the sessions as one of the most beneficial aspects.⁶⁰ Social support interventions had shared barriers that included high cost of programs, setting concerns regarding scarcity of necessary additional services (such as mental health care or primary care), and balancing fidelity of intervention delivery across sites with the need for individual tailoring.

Increased care frequency

Eleven studies were designed to improve maternal health by promoting frequent contact with health care providers. Increased care frequency was primarily delivered by home visits and diversifying health care providers, but also utilized telehealth interventions and group care to increase contact. Half of the assessed studies reported a diverse patient population, with two enrolling at least half Hispanic/Latinx patients^{70,71} and one study conducted among an Alaskan Native tribal population.⁶⁹

TABLE 3 Summary of facilitators and barriers to implementation across the six identified themes using the Consolidated Framework for Implementation Research (CFIR).

	Facilitators	Intervention	Outer setting	Inner setting	Process	Individual
Clinical service connection		Multidisciplinary program staff providing education and administration. Culturally informed interventions (e.g., delivery in English and Spanish). High cost of intervention. Time-intensive interventions.	State legislation supporting program development (e.g., Medicaid reimbursement) or dedicated funding. Insurance lapses (e.g., Medicaid coverage expiration in postpartum period). Transportation and phone/internet connectivity issues. Social stigma related to intervention participation.	Large health care system support. Integration of study staff into existing clinical structures and workflow. Ensuring fidelity of intervention (e.g., staff needed to be better educated about vaccination schedules). Competing clinical and administrative priorities.	Partnered with clinical and community resources. Supportive relationships established between study staff and participant. Sustaining community partnerships throughout the implementation. Coordinating appointment scheduling between inpatient and outpatient settings.	Low resource utilization and intervention engagement.
Social support	Facilitators	Employment of community members with similar demographics to target population. Culturally informed interventions (e.g., aspects of rural lifestyles).	Political advocacy, technical support and funding at the local and state level.	Study staff from similar racial/ethnic groups and/or community as target population. Some study staff are former participants of intervention.	Integration with community partners (e.g., local advisory boards) and matching of participants with community resources. Longitudinal rapport between study team and participant.	
	Barriers	High costs of intervention. Time-intensive interventions. Administration located outside of the community or lack of consistent program leadership.	Isolation and scarcity of necessary additional services in rural setting (e.g., mental health care or primary care). Transportation, childcare, and communication issues. Stigma related to poverty and poor social standing.	Ensuring fidelity of intervention across different sites (e.g., lack of consistent recommendations from study staff to participants).	Scheduling conflicts, especially with large participant group interventions.	Low utilization and poor participation toward health-related goals. Inability to participate due to employment and childcare needs.
Care frequency	Facilitators	Culturally informed interventions. Shared administrative structures by intervention sites.	Strong informatics infrastructure (e.g., collecting data to understand enrollment and attrition).	Flexibility in staff schedules and availability of weather-related equipment for travel to remote intervention sites. Study staff are respected and from same community as participants.	Community engagement in research design and implementation (e.g., rural community advisory board). Integration with community resources. Strong bonds and relationships between study staff and participants. Good relationships between study staff and providers.	

(Continues)

TABLE 3 (Continued)

	Intervention	Outer setting	Inner setting	Process	Individual
Education	Barriers	Administration located outside of the target community resulted in difficulties providing similar breadth of services to all participants.	Isolation and scarcity of necessary additional services in rural settings. Insurance, transportation, and communication issues.	Study staff with dual roles in clinic and intervention struggled to balance both responsibilities. Difficulty maintaining provider buy-in.	Low resource utilization and intervention engagement.
	Facilitators	Interventions rooted in evidence-based guidelines.	Strong informatics infrastructure (e.g., state-based patient tracking systems). Support from local and state programs and legislation.	Positive attitudes of study staff toward intervention.	Increased length of case management and involvement and presence of paternal involvement in childcare.
	Barriers	High costs of intervention.	Scarcity of necessary additional services in rural setting. Transportation and phone/internet connectivity issues. Challenges integrating state systems with programmatic information.	High turnover and reduced study staff buy-in to the education provided.	Limited knowledge about health care and condition among participants. Low resource utilization due to competing priorities.
Self-efficacy	Facilitators	Multidisciplinary dedicated program staff. Culturally informed interventions (e.g., utilization cultural communication norms).		Study staff from same racial/ethnic background or community as participants.	Community engagement in research design and implementation. Longitudinal relationships between study staff and participants built on trust and empathy.
	Barriers	High costs of interventions. Limited availability of intervention.	Transportation and phone/internet connectivity issues. Strong cultural beliefs impeding intervention components.	Difficulty ensuring ongoing intervention fidelity. Study staff balancing clinical and intervention roles.	Low resource utilization with shorter term interventions and due to childcare, employment, or personal beliefs.
Positive reinforcement	Facilitators	Connected to evidence-based guidelines. Monetary reward to encourage participation.		Intervention embedded within routine clinical care structures.	
	Barriers	No options for increased or varied incentives.	Lack of support and additional necessary services in rural setting.		Some women with low confidence required additional support during intervention.

Intervention form and function

Three studies increased care frequency by diversifying available health care providers.^{47,69,73} Pregnant individuals assisted by CHWs had increased odds of having an infant with normal weight, with the largest improvement for Hispanic individuals.⁷¹ A rural midwifery service led to lower rates of induction and postpartum hemorrhage, as well as a lower emergency intrapartum transfer rate.⁷³ Interventions delivered by telehealth to increase contact frequency were used in four studies throughout the pregnancy continuum;^{70,75,76,78} while participation was high during pregnancy, postpartum intervention fidelity and acceptability decreased after 6 months postpartum.⁷⁶ Increased care contact via home visits were documented in two studies that implemented state-wide initiatives.^{72,74} One study found that while intervention participants were more likely to achieve adequate prenatal care and improved provider relationships, they experienced higher rates of preterm birth and low birth weight.⁷⁷

Implementation facilitators and barriers

Common facilitators to increasing care frequency included community engagement in research design and implementation, which helped to inform research strategy and increase respect of cultural values. For example, CHWs in Alaskan Native tribes were able to facilitate increased care frequency by utilizing indigenous traditions while meeting allopathic-based goals, thus improving care and retention.⁶⁹ While shared administrative structures was considered a strength of several programs, some struggled to provide a similar breadth of services to all patients and handling the needs of multiple populations if not locally based. Programs struggled to integrate increased care frequency into existing workflows and ensure adequate connection to community resources, particularly when the administration was located outside of the community, a key intervention barrier. Study team members with dual roles, for example clinical and intervention, or who were a part of the community they were working in, reported occasionally struggling to balance intervention duties with personal priorities.

Education

Eleven studies aimed to improve maternal health behaviors and knowledge by providing health education to participants. Programs attempted to deliver maternal education through telehealth interventions, home visits, individual education, public campaigns, and group education. Three studies reported a diverse participant population,^{84,86,87} while the other studies either had mostly non-Hispanic White participants or did not report their demographics. Of note, several studies had inclusion criteria of English-speaking as educational materials were only designed in English.^{80,88,89}

Intervention form and function

Telehealth delivery was used in three studies, two with a focus on providing obesity education^{80,86,81} and one on providing general preg-

nancy health education.⁷⁹ While one study found increased prenatal care utilization, there was no long-term impact of interventions in dietary habits or physical activity noted by the two studies on obesity. One study did find a short-term decrease in consumption of sugar-sweetened beverages, but it was hypothesized that ongoing systemic barriers to improved diet were the cause of this effect loss.⁸⁶ Three studies used home visits to address disparities in general maternal health literacy;⁸²⁻⁸⁴ one study reported an increase in maternal health literacy, but also noted that a personal history of depression deterred a participant's health literacy improvement.⁸⁴ Individual education sessions were used in two studies to improve education on maternal obesity⁸⁹ and birth spacing.⁸⁸ While educational sessions were acceptable to patients, these studies did not find significant changes in dietary habits or fertility, respectively. One study launched a public campaign aimed to deliver obesity education for female individuals of reproductive age,⁸⁵ while individuals were found to have been exposed to the intervention, there was no change in obesity rates. A group educational program for general pregnancy health education found significant improvements in knowledge of pregnancy health issues and intention to breastfeed, and noted a trend toward lower preterm birth rates.⁸⁷

Implementation facilitators and barriers

Common facilitators for educational programs included connection to evidence-based guidelines and integration of community resources, use of state-based patient tracking systems, and community resources. One study noted that individual participant facilitators, including length of case management involvement and presence of paternal involvement in childcare, both played important roles in participants' success.⁸⁴ Shared barriers included educational programs being economically burdensome and difficulty completing interventions that required reliable internet access. It was also noted that staff buy-in to the education provided was variable and impacted the quality of education provided. Educational interventions delivered via home visits noted that programs needed further training on home visit safety and improved data collection methods. In regards to program evaluation, informatics that could support program evaluation was a key inner setting facilitator; while one study noted that a significant strength was the existing state patient tracking system that linked family members,⁸² another study noted that integrating Medicaid data to programmatic information was challenging.⁷⁹

Self-efficacy

Ten interventions were based on the concept that self-efficacy, or belief in one's ability to succeed, was integral to improving health outcomes and focused on promoting confidence. Interventions aimed at increasing self-efficacy commonly utilized educational sessions with the stated goal to increase participant motivation and confidence, but also used delivery methods of telehealth interventions or home visits, or forms including case management and diversifying available providers. Two studies exclusively enrolled only Hispanic⁹¹ or

non-Hispanic Black⁹² individuals, two other studies had a diverse participant population,^{96,98} while the other studies either did not report their participants' demographics or enrolled primarily non-Hispanic White participants.

Intervention form and function

Three studies used educational sessions to improve self-efficacy; two used group sessions to build confidence for general maternal health^{97,99} and one used individual motivational interviewing for tobacco use disorder.⁹³ Group self-efficacy session participants reported lower gestational weight gain and higher breastfeeding rates at 6 months compared to average breastfeeding rates in the province. Individual self-efficacy sessions significantly reduced the number of cigarettes smoked per day. Telehealth intervention delivery was used to improve self-efficacy in breastfeeding⁹¹ and depression symptom management;⁹⁴ these studies reported significant improvement in self-efficacy, partner relationships, and breastfeeding knowledge, but no difference in breastfeeding attrition. Two studies used case management to improve self-efficacy^{92,96} participants showed improved knowledge but no change in behavior.⁹² However, another study documented the use of housing provision for adolescent parents with intensive case management and showed improved educational/work attainment as well as decreased rates of foster placement and repeat pregnancy.⁹⁶ One study showed that motivational interviewing provided by a clinic-integrated therapist increased breastfeeding at 1 month but no other breastfeeding related outcomes.⁹⁰ Another study delivered home visits for adolescent parents and showed the highest improvement in self-esteem and resolution of preexisting disparities of baseline stress for Hispanic participants.⁹⁸ Of note, this study provided materials in Spanish and focused on providing racial/ethnic concordant care.

Implementation facilitators and barriers

Common facilitators for self-efficacy interventions included dedicated staff and a focus on harm risk reduction. Some studies noted that phone intervention delivery was more feasible for their participants compared to internet delivery. Cultural humility was also key to the design and implementation of successful self-efficacy programs—one study had participants who were reluctant to leave their homes due to “la cuarentena,” a traditional postnatal period of rest, requiring staff to drive over 100 miles per trip to deliver resources.⁹¹ Common barriers to improved self-efficacy included lack of changed behaviors with shorter term interventions and training often being noted to be time- and resource-intensive, creating process barriers.

Positive reinforcement

One study used economic incentives to aid in smoking cessation counseling for pregnant and postpartum individuals.¹⁰⁰ While the addition

of incentives resulted in similar quit rates in pregnancy to the control group, more individuals in the intervention group maintained smoking cessation at 6–8 weeks postpartum. The intervention occurred within routine clinical care, which was identified as a strength of the program, however the staff felt there was not enough support to help those with low levels of confidence in their ability to quit smoking.

Implementation facilitators and barriers using CFIR

Implementation facilitators and barriers were identified across the five domains of CFIR within all of our identified themes and are summarized in Table 3. While there was considerable variability among the intervention goals and delivery, there were some significant commonalities in intervention form and function that affected implementation across CFIR domains (Figure 2). For example, culturally informed intervention forms improved intervention efficacy across domains by providing adaptability to cultural needs, whereas multiple intervention sites within the inner setting led to variation in the implementation climate and made determining intervention fidelity difficult.

DISCUSSION

This review summarizes existing research on interventions to improve health outcomes for pregnant and postpartum individuals living in rural communities. We have provided guidance regarding facilitators and barriers of rural maternal health interventions by mechanism of action (Table 2) in the hopes of informing future study into this critical topic. Multiple delivery mechanisms were shown to be effective for decreasing depressive symptoms, lowering rates of preterm birth/low birth weight, and increasing perinatal care utilization. Given the complex and multi-component nature of many of the interventions, several interventions had impacts that crossed multiple thematic domains which may lead to difficulty directly comparing mechanistic efficacy.

While there was a diversity of types of interventions, there were commonalities in factors that helped and hindered implementation that spanned the CFIR domains (Figure 2). Successful programs integrated community resources, such as Women, Infant, Children (WIC) supplemental nutrition programs or Help Me Grow initiatives, to meet a variety of needs of their participants, had dedicated interdisciplinary teams, and often had government buy-in to support program growth. Critical consideration of the target population and ensuring consideration of their unique strengths and needs helped promote well-utilized programs. Common barriers to implementing programs included insurance lapses, transportation difficulties for both participants and staff, and communication challenges, especially concerning internet connectivity. Some studies noted that centrally administered programs that were disseminated in rural areas, while well-resourced, often struggled to adequately address the specific needs of the population.⁸³ These lessons have implications for both future research efforts as well as practice changes to improve health care for rural birthing individuals. Our results suggest that rural communities can leverage strong

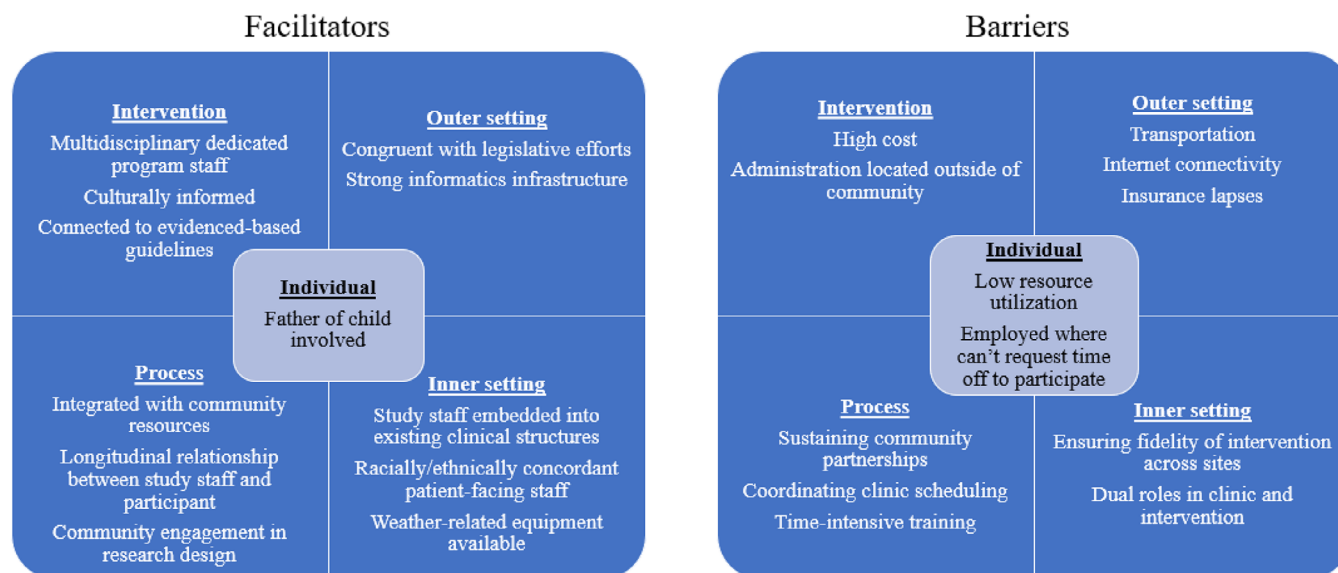


FIGURE 2 Facilitators and barriers to implementation identified by included studies mapped to the domains of Consolidated Framework for Implementation Research (CFIR).²⁵

relationships and local partners in the community to autonomously implement effective interventions that improve access to care with state support and that interventions should incorporate complementary care models, such as home visiting or telehealth modalities, to address transportation and geographic barriers.

Another important lesson learned is that intersectional disparities in rural maternal health require further programmatic focus. Several studies excluded non-English speaking participants as they did not have ability to interpret materials. Many studies also reported a high proportion of non-Hispanic White participants, potentially related to the area's demographics, but were unable to comment on how these programs may best engage racial and ethnic minorities. Promisingly, studies showed that if programs are designed with racial/ethnic minorities in mind, interventions can lessen existing disparities.⁶⁰ Engagement of community stakeholders in research design and program implementation were essential to studies with high proportions of minority participants to ensure interventions did not widen racial/ethnic maternal health disparities in rural populations. It is also critical to note that the most common reason for exclusion of publications was not including a rural population ($n = 105$); maternal health interventions must consider how to enroll both urban and rural populations to ensure equitable implementation.

Limitations

There are some limitations to this review. As with all reviews, there is a possibility that our review missed relevant studies. To help to mitigate this, we employed a broad search strategy across multiple databases. Risk of bias and evidence quality assessment was not conducted as a part of this study, as we aimed to answer questions regarding the current scope of existing interventions. Given the large scope of the

literature we included as well as inability to verify the methodological quality, we did not include gray literature, which may have excluded some interventions that have not been published yet in peer-reviewed formats. Many interventions were complex and had multiple components, making direct comparisons between studies challenging. As we focused our efforts on a thorough peer-reviewed literature review, we did not include nonpeer-reviewed program descriptions.

CONCLUSION

The current literature demonstrates a wide range of promising interventions to improve rural maternal health with broad mechanisms of action. Future interventions should consider the common pitfalls of technical issues, difficulty maintaining fidelity across sites, and ensure appropriate integration of local community resources and culturally informed intervention design to ensure optimal participant experience and outcomes. Use of CFIR can help inform the design of comprehensive rural maternal health interventions by examining the intervention design as well as most appropriate setting. Further work is needed in designing interventions to improve maternal health for racial and ethnic minorities within rural communities.

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CONFLICT OF INTEREST STATEMENT

The authors have no relevant conflicts of interest to disclose.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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