Comparative Effectiveness Review
Number 257

Schedule of Visits and Televisits for Routine Antenatal Care: A Systematic Review

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This report is based on research conducted by the Brown Evidence-based Practice Center (EPC) under contract to the Agency for Healthcare Research and Quality (AHRQ), Rockville, MD (Contract No. 75Q80120D00001). The findings and conclusions in this document are those of the authors, who are responsible for its contents; the findings and conclusions do not necessarily represent the views of AHRQ. Therefore, no statement in this report should be construed as an official position of AHRQ or of the U.S. Department of Health and Human Services.

None of the investigators have any affiliations or financial involvement that conflicts with the material presented in this report.

The information in this report is intended to help healthcare decision makers—patients and clinicians, health system leaders, and policymakers, among others—make well-informed decisions and thereby improve the quality of healthcare services. This report is not intended to be a substitute for the application of clinical judgment. Anyone who makes decisions concerning the provision of clinical care should consider this report in the same way as any medical reference and in conjunction with all other pertinent information, i.e., in the context of available resources and circumstances presented by individual patients.

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Preface

The Agency for Healthcare Research and Quality (AHRQ), through its Evidence-based Practice Centers (EPCs), sponsors the development of systematic reviews to assist public- and private-sector organizations in their efforts to improve the quality of healthcare in the United States. These reviews provide comprehensive, science-based information on common, costly medical conditions, and new healthcare technologies and strategies.

Systematic reviews are the building blocks underlying evidence-based practice; they focus attention on the strength and limits of evidence from research studies about the effectiveness and safety of a clinical intervention. In the context of developing recommendations for practice, systematic reviews can help clarify whether assertions about the value of the intervention are based on strong evidence from clinical studies. For more information about AHRQ EPC systematic reviews, see www.effectivehealthcare.ahrq.gov/reference/purpose.cfm.

AHRQ expects that these systematic reviews will be helpful to health plans, providers, purchasers, government programs, and the healthcare system as a whole. Transparency and stakeholder input are essential to the Effective Health Care Program. Please visit the website (www.effectivehealthcare.ahrq.gov) to see draft research questions and reports or to join an email list to learn about new program products and opportunities for input.

If you have comments on this systematic review, they may be sent by mail to the Task Order Officer named below at: Agency for Healthcare Research and Quality, 5600 Fishers Lane, Rockville, MD 20857, or by email to epc@ahrq.hhs.gov.

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Key Informants

In designing the study questions, the EPC consulted several Key Informants who represent the end-users of research. The EPC sought the Key Informant input on the priority areas for research and synthesis. Key Informants are not involved in the analysis of the evidence or the writing of the report. Therefore, in the end, study questions, design, methodological approaches, and/or conclusions do not necessarily represent the views of individual Key Informants.

Key Informants must disclose any financial conflicts of interest greater than $5,000 and any other relevant business or professional conflicts of interest. Because of their role as end-users, individuals with potential conflicts may be retained. The TOO and the EPC work to balance, manage, or mitigate any conflicts of interest.

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Technical Expert Panel

In designing the study questions and methodology at the outset of this report, the EPC consulted several technical and content experts. Broad expertise and perspectives were sought. Divergent and conflicted opinions are common and perceived as healthy scientific discourse that results in a thoughtful, relevant systematic review. Therefore, in the end, study questions, design, methodologic approaches, and/or conclusions do not necessarily represent the views of individual technical and content experts.

Technical Experts must disclose any financial conflicts of interest greater than $5,000 and any other relevant business or professional conflicts of interest. Because of their unique clinical or content expertise, individuals with potential conflicts may be retained. The TOO and the EPC work to balance, manage, or mitigate any potential conflicts of interest identified.

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Peer Reviewers

Prior to publication of the final evidence report, EPCs sought input from independent Peer Reviewers without financial conflicts of interest. However, the conclusions and synthesis of the scientific literature presented in this report do not necessarily represent the views of individual reviewers.

Peer Reviewers must disclose any financial conflicts of interest greater than $5,000 and any other relevant business or professional conflicts of interest. Because of their unique clinical or content expertise, individuals with potential nonfinancial conflicts may be retained. The TOO and the EPC work to balance, manage, or mitigate any potential nonfinancial conflicts of interest identified.

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Schedule of Visits and Televisits for Routine Antenatal Care: A Systematic Review

Structured Abstract

Background. The American College of Obstetricians and Gynecologists and the Society for Maternal-Fetal Medicine plan a new evidence-based joint consensus statement to address the preferred visit schedule and the use of televisits for routine antenatal care. This systematic review will support the consensus statement.

Methods. We searched PubMed®, Cochrane databases, Embase®, CINAHL®, ClinicalTrials.gov, PsycINFO®, and SocINDEX from inception through February 12, 2022. We included comparative studies from high-income countries that evaluated the frequency of scheduled routine antenatal visits or the inclusion of routine televisits, and qualitative studies addressing these two topics. We evaluated strength of evidence for 15 outcomes prioritized by stakeholders.

Results. Ten studies evaluated scheduled number of routine visits and seven studies evaluated televisits. Nine qualitative studies also addressed these topics. Studies evaluated a wide range of reduced and traditional visit schedules and approaches to incorporating televisits.

In comparisons of fewer to standard number of scheduled antenatal visits, moderate strength evidence did not find differences for gestational age at birth (4 studies), being small for gestational age (3 studies), Apgar score (5 studies), or neonatal intensive care unit (NICU) admissions (5 studies). Low strength evidence did not find differences in maternal anxiety (3 studies), preterm births (3 studies), and low birth weight (4 studies). Qualitative studies suggest that providers believe fewer routine visits may be more convenient for patients and may free up clinic time to provide additional care for patients with high-risk pregnancies, but both patients and providers had concerns about potential lesser care with fewer visits.

In comparisons of hybrid (televisits and in-person) versus in-person only visits, low strength evidence did not find differences in preterm births (4 studies) or NICU admissions (3 studies), but did suggest greater satisfaction with hybrid visits (2 studies). Qualitative studies suggested patients and providers were open to reduced schedules and televisits for routine antenatal care, but importantly, patients and providers had concerns about quality of care, and providers and clinic leadership had suggestions on how to best implement practice changes.

Conclusion. The evidence base is relatively sparse, with insufficient evidence for numerous prioritized outcomes. Studies were heterogeneous in the care models employed. Where there was sufficient evidence to make conclusions, studies did not find significant differences in harms to mother or baby between alternative models, but evidence suggested greater satisfaction with care with hybrid visits. Qualitative evidence suggests diverse barriers and facilitators to uptake of reduced visit schedules or televisits for routine antenatal care. Given the shortcomings of the evidence base, considerations other than proof of differences in outcomes may need to be considered regarding implications for clinical practice. New studies are needed to evaluate prioritized outcomes and potential differential effects among different populations or settings.

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Executive Summary

Main Points

- Reduced visit versus traditional visit schedules for routine antenatal care
    - Studies comparing reduced routine antenatal visit schedules with traditional schedules did not find differences between schedules in gestational age at birth, likelihood of being small for gestational age, likelihood of a low Apgar score, likelihood of neonatal intensive care unit (NICU) admission, maternal anxiety, likelihood of preterm birth, and likelihood of low birth weight.
    - There is insufficient evidence for numerous prioritized outcomes of interest (e.g., completion of the American College of Obstetricians and Gynecologists (ACOG) recommended services and patient experience measures).
    - Qualitative studies reported several potential facilitators and barriers to implementing reduced visit schedules, including:
        - Barriers from patient perspective: hesitancy to take on more responsibility and emotional discomfort with reduced visits.
        - Barriers from both patient and provider perspectives: reduced visits may lead to important gaps in patient knowledge and pregnant individuals vary in confidence in managing their pregnancy independently.
        - Facilitators from provider perspective: reduced visits align with midwifery philosophies of care, improvement in overcrowding (of clinics), may increase clinic time available to be directed to patients with high-risk pregnancies, and patients may value fewer visits and avoiding inconveniences of attending multiple appointments.
        - Barriers from provider perspective: reduced visits may compromise patients' antenatal care and their psychosocial needs, go counter to patients' familiarity with the traditional model across decades of social networks, and may result in repercussions from management should adverse events occur.
- Televisits for routine antenatal care
    - Studies comparing hybrid (televisits and in-person) visits and all in-person visits did not find differences in rates of preterm births, rates of NICU admissions, but found possible greater satisfaction with hybrid visits. However, an additional survey that directly compared televisits and in-person visits found greater satisfaction with in-person visits.
    - There is insufficient evidence for numerous prioritized outcomes.
    - Qualitative studies reported several potential facilitators and barriers to implementing televisits, including:
        - Facilitators from patient and provider perspectives: televisits allow care to be better tailored to the needs of patients; televisits protect patients, providers, and clinics from COVID-19; televisits enhance community and relationship building (although some believed it could hinder); televisits are helped by home monitoring devices use and system supports (e.g., guidance, technology support, translation services).

- Barriers from patient and provider perspectives: potential reduced quality of care with televisits and patients' psychological apprehension and general desire to be seen in-person.
- Barriers from provider perspective: no or limited IT (information technology) literacy of patient or providers; need for onerous training of providers; perception of the added complexity televisits bring to service delivery; difficulty for patients in the initial set-up; difficulty for patients to describe symptoms virtually; lack of buy-in from health-system leadership; a need to integrate televisits within existing workflows; concerns about potentially liability issues and changes in reimbursement policies; limited evidence (or lack of knowledge of evidence) on the use of televisits for routine antenatal care; and difficulty of transitioning to televisits for patient populations with health disparities and those with difficulty accessing the necessary technology.
- Facilitators from provider perspective: guidelines on which types of antenatal visits are (or are not) appropriate for televisits; user-friendly technology and resources to support and encourage health providers and patients engagement; translation of materials for non-English-speaking patients; patients' appreciation for continuity of care; provider ease with technology; access to colleagues with prior telehealth experience; improved patient attendance at visits; and ability to manage low-risk pregnancies at home.
- Facilitator from provider and clinic leadership perspectives: training for staff and regular leadership meetings to ease the transition.
- Facilitator from leadership perspective: support for office staff to ease implementation challenges.
- Tradeoffs of barriers and facilitators from provider perspective: lack of privacy for televisits versus increased ability of family to attend and participate in televisits; and reduced training opportunities for junior clinicians versus improved team cohesion and case discussion between senior and junior clinicians with televisits.

- Studies did not evaluate heterogeneity of treatment effects (whether some specific groups of patients may have had better or worse outcomes with reduced routine visits or televisits) or equity issues (whether certain classes of patients might be disadvantaged by reduction in the number of visits or use of televisits).

Background and Purpose

Antenatal care (also termed prenatal care) is one of the most common preventive health services in the United States, accessed by about 4 million women annually. Antenatal care aims to improve the health and wellbeing of pregnant patients and their babies through (1) medical screening and treatment; (2) anticipatory guidance; and (3) psychosocial support. Though there is strong evidence for many prenatal services (e.g., routine laboratory testing, imaging and vaccinations), the evidence for specific aspects of delivering antenatal care related to frequency and timing of visits, and to televisits for individuals receiving routine antenatal care is less clear.

In the United States, current recommendations include 12 to 14 office-based visits for individuals with low-risk pregnancies, in addition to laboratory testing and ultrasounds. Since

1989, though, several US-based and international guidelines have recommended fewer antenatal visits (6 to 9) for those with low-risk pregnancies.

Telemedicine (the use of electronic communication among providers, patients, healthcare administrators, and others to enable healthcare delivery) is a relatively new approach to routine antenatal care. Televisits (specifically, simultaneous, two-way communication between providers and patients, primarily via internet or phone) are the type of telemedicine that most directly relate to patients' interactions with their providers. The potential benefits and harms or concerns related to televisits, as opposed to in-person care, have yet to be elucidated for routine antenatal care.

ACOG and the Society for Maternal-Fetal Medicine (SMFM) nominated this topic for systematic review (SR) to support a planned new evidence-based joint consensus statement to address the preferred frequency and timing of routine antenatal care visits and the use of televisits for routine antenatal care. This SR aims to inform providers of routine antenatal care, pregnant patients, policymakers, and developers of clinical guidance about the evidence regarding the benefits and harms of less frequent versus traditional visit schedules for routine antenatal care; the benefits and harms of televisits for routine care; and providers', pregnant patients', and others' perspectives, preferences, and experiences related to routine visit schedules and use of televisits for routine antenatal care.

Methods

We used methods consistent with those outlined in the Agency for Healthcare Research and Quality Evidence-based Practice Center Program Methods Guidance. We synthesized both quantitative and qualitative research studies. Our searches targeted comparative studies and qualitative research studies from database inception to February 12, 2022. The PROSPERO protocol registration number is CRD42021272287.

Based on discussions with stakeholders, we prioritized 15 outcomes deemed important to pregnant patients and their babies with the greatest potential to be affected by changes to routine antenatal visits. These included: maternal quality of life, maternal anxiety, maternal depression, satisfaction with antenatal care, lost work time, preterm birth, gestational age at birth, small for gestational age, low birth weight, Apgar score, breastfeeding, completion of ACOG recommended services, unplanned visits, NICU admissions, and delayed diagnoses.

Results

Reduced versus traditional visit schedules: All but one study recruited pregnant patients who were at low antenatal risk. Studies varied greatly in sample size (randomized controlled trials [RCTs]: 80-2692; nonrandomized comparative studies [NRCSs]: 214-3882). Five RCTs and five NRCSs compared reduced with traditional visit schedules for routine antenatal care. The RCTs were mostly at low risk of bias, except that studies could not blind the intervention (one RCT also had a high dropout rate). The NRCSs were generally at high risk of bias due to failure to adjust for potential confounders and fundamental differences between compared groups. Studies varied in the number of scheduled visits employed in both the reduced schedule and the traditional schedule study arms. Traditional schedules were mostly consistent with the ACOG guideline of about 14 scheduled visits, ranging from 12 to 15. In contrast, the number and timing of alternative visit schedules varied substantially, ranging from 6 or 7 (depending on participant parity) to 10. Studies also varied regarding who provided antenatal care; although, most studies provided few details.

Moderate-strength evidence from studies comparing reduced versus traditional visit schedules did not indicate differences in infant outcomes between visit schedules regarding gestational age at birth (2 RCTs and 2 NRCSs; mean difference [MD] about 0 days), being small for gestational age (3 RCTs; summary odds ratio [OR] 1.08, 95% confidence interval [CI] 0.70 to 1.66), low Apgar score (3 RCTs and 2 NRCSs; ORs ranging from 0.62 to 1.26, all statistically nonsignificant; MD 0 at 1 and 5 minutes), and NICU admission (3 RCTs and 2 NRCSs; summary OR 1.05, 95% CI 0.74 to 1.50). Low-strength evidence from studies comparing reduced versus traditional visit schedules did not indicate differences between visit schedules regarding maternal anxiety (3 RCTs, incomplete data reporting), preterm birth (1 RCT and 2 NRCSs; ORs ranged from 0.80 to 1.25, all statistically nonsignificant), and low birth weight (1 RCT and 3 NRCSs; summary OR 1.02, 95% CI 0.82 to 1.25).

Due to inconsistent findings, there was insufficient evidence regarding satisfaction with antenatal care (5 RCTs, 2 NRCSs) and number of unplanned antenatal visits (1 RCT, 2 NRCSs). Numerous prioritized outcomes had insufficient evidence. These included quality of life, depression, lost work time, breastfeeding outcomes, completion of ACOG recommended services, and delayed diagnoses.

Four qualitative studies provided perspectives on reduced scheduled visits from patients, providers, and clinic leadership. The studies suggested that providers perceived that reduced visit schedules could lessen the inconveniences for patients with low-risk pregnancies of attending multiple appointments and may allow more clinic time to be directed to patients with high-risk pregnancies. Patients and providers expressed concerns that some patients may not have the confidence to independently manage their pregnancies under reduced care models and that fewer visits may compromise patients' antenatal care. Providers also expressed concerns that implementation may be hampered by decades of patients' (and their families') familiarity with the traditional care model. Patients noted emotional discomfort with reduced care and inversely positive emotions with a traditional care schedule. Providers also expressed fears that reduced care may lead to staff cutbacks. Finally, providers emphasized their perceived need for a supportive management, without which they expressed fears about repercussions from management in the event of a rare adverse event associated with maternity care.

Televisits versus in-person visits: Two RCTs, four NRCSs, and one survey compared televisits with in-person visits for routine antenatal care. One RCT was at low risk of bias but the other RCT had incomplete reporting in a conference abstract. Neither could blind visits. The NRCSs were at high risk of bias due to failure to adjust for potential confounders and fundamental differences between compared groups. The survey was at low risk of bias. The number of televisits ranged from one to five. Three studies were conducted during the COVID-19 pandemic; neither of the two studies that compared hybrid visits during COVID-19 with in-person visits pre-pandemic accounted for other factors that may have led to different outcomes during the pandemic, such as change in employment, office work, sleep time, societal stressors, social isolation, and changes in diet and exercise. Some of these factors may have reduced risk of poor outcomes (e.g., increased sleep); others may have increased risks (e.g., stressors).

Low-strength evidence from studies comparing hybrid (televisit and in-person) and all in-person visits did not indicate differences regarding preterm births (1 RCT, 3 NRCSs; summary OR 0.93, 95% CI 0.84 to 1.03, P=0.18) or NICU admissions (3 NRCSs; summary OR 1.02, 95% CI 0.82 to 1.28). There was also low-strength evidence that patients receiving hybrid visits were more likely to be satisfied with antenatal care than patients receiving all in-person care (1 RCT, 1 NRCS); however, a survey that directly compared satisfaction with televisits versus satisfaction

with in-person visits (among patients receiving hybrid visits) was inconsistent, finding greater satisfaction with in-person visits.

Numerous prioritized outcomes had insufficient evidence. These included quality of life, mental health (anxiety, depression, and stress), lost work time, gestational age at birth, small for gestational age, low birthweight, Apgar score, breastfeeding, completion of ACOG recommended services, unplanned visits, and delayed diagnoses.

Five qualitative studies provided perspectives on use of televisits for routine antenatal care from patients, providers, and clinic leadership. The studies suggest that patients and providers believe televisits may improve patients' access to and continuity of care, and could allow tailoring of care, but they had mixed views on whether televisits may improve or hamper communication and relationship-building between providers and patients. Patients and providers believed televisits may protect patients from COVID-19 transmission. Provider-perceived facilitators of implementation included guidance from colleagues with telemedicine experience and providers' ease with technology; providers and leadership noted that time and training are needed to help staff transition to televisit care. System supports and home monitoring were considered by patients, providers and clinic leadership as important adjuncts to support the implementation of televisits. Providers noted that they would also value guidelines regarding appropriate care for televisits. Providers and clinic leadership noted that clinic leadership support of office staff is important. Concerns that televisits may hamper safety, quality of care, and worsen health disparities were noted by patients, providers, and clinic leadership. Providers perceived that patients' psychological apprehension with televisits and telehealth technology may pose a barrier to its uptake.

Limitations

The evidence base is small. The approaches to antenatal care delivery evaluated were varied and did not allow for easy comparisons across studies. Reported outcomes mostly included standard birth outcomes without strong plausible biological connection to structural aspects of antenatal care. Numerous prioritized outcomes have no or insufficient evidence. The NRCSs were almost all unadjusted and thus subject to high risk of bias. While the qualitative evidence synthesis provides context to our quantitative findings, it was also relatively sparse in the quantity and diversity of perspectives identified. Further evidence on patient perspectives is needed from patients themselves (rather than from providers), a range of provider disciplines, and clinic leadership (in general, and from diverse healthcare settings and practice models).

Implications and Conclusions

The evidence allowed few specific conclusions. Generally speaking, studies did not report negative effects to reduced schedules of antenatal care or the incorporation of televisits into antenatal care. Although providers and patients had some concerns about reduced visit schedules and use of televisits, several potential benefits were also noted. While the evidence appears to be applicable to a range of populations and settings, there is insufficient evidence about how changes in visit numbers or use of televisits may impact different populations, especially as concerns health disparities, inequities, and social determinants of health. Future research is needed that includes outcomes of most importance and relevance to changing antenatal care visits. Until there is further evidence to provide more definitive conclusions, other factors, importantly patient preferences, may be important to help decide whether or not to implement reduced antenatal care schedules and/or substitute telehealth for select antenatal care visits.

Introduction

Background

Antenatal care (also termed prenatal care) is one of the most common preventive health services in the United States, accessed by about 4 million women annually.[1] Antenatal care aims to improve the health and wellbeing of pregnant patients and their babies through (1) medical screening and treatment; (2) anticipatory guidance; and (3) psychosocial support.[2, 3] The World Health Organization's definition of antenatal care includes the patient-centered goal of a "positive pregnancy experience."[3] Studies have established the benefit to maternal and neonatal outcomes of several evidence-based practices (screenings, routine laboratory testing, imaging, counseling, and vaccinations) delivered during antenatal care visits.[4-6] However, the evidence on specific aspects of delivering antenatal care related to frequency and timing of visits, and use of televisits for individuals receiving routine antenatal care is less clear.

In the United States, current recommendations include 12 to 14 office-based visits for patients with low-risk pregnancies, in addition to laboratory testing and ultrasounds.[2] The overall number and timing of visits has remained unchanged since the schedule was first published by the Children's Bureau in 1930. The 2017 American College of Obstetricians and Gynecologists (ACOG) guidelines recommend the same schedule:[2, 7] monthly visits until 28 weeks, every 2 weeks until 36 weeks, and weekly until delivery.[8, 9] Since 1989, several US-based and international guidelines have recommended fewer antenatal visits (6 to 9) for patients with low-risk pregnancies.[3, 10-12] Example recommended schedules are presented in the Results section. While several health systems in the United States and abroad have implemented alternative antenatal care schedules for individuals with uncomplicated pregnancies, most of U.S. practice has not changed.

Although there is evidence that too few contacts (≤4), which mostly occurs when antenatal care begins late in pregnancy, may result in poorer health outcomes,[13] these data are highly confounded by other psychosocial risk factors that might limit access to care. Alternatively, more care may also not be better, with at least some evidence that more frequent routine visits (>10) in low-risk pregnancies may be associated with higher risk for induction and cesarean delivery without improvement in maternal or perinatal outcomes.[14] However, determination of the true association between number of visits and outcomes is complicated. For example, visit number is not the same as visit quality. A recent retrospective review demonstrated that patients who completed more than six prenatal appointments were not more likely to complete ACOG recommended prenatal services than patients who completed only six.[15] In particular, there is substantial potential for reverse causality or confounding, in which an individual's personal characteristics or medical considerations dictate the number of antenatal care visits amassed, as well as maternal and child outcomes. For example, socioeconomic risk factors (e.g., low-income teenage pregnancy) may lead to both few antenatal visits (that may also be initiated later in pregnancy) and to poor maternal and child outcomes. But an increased number of visits may be an indication of clinician or patient concerns about the pregnancy and an increased likelihood of poor outcomes. Furthermore, individuals who deliver prior to full term do not have the opportunity to accumulate as many antenatal visits as persons who deliver full term or later.

Telemedicine (the use of electronic communication among providers, patients, healthcare administrators, and others to enable healthcare delivery) is a relatively new approach to routine antenatal care. Televisits (specifically, the two-way, synchronous communications between providers and patients, primarily via internet or phone) are the type of telemedicine that most

directly relates to patients' interactions with their providers. Notably, during the COVID-19 pandemic televisits were adopted as a replacement for in-person antenatal visits. Research in non-pregnant populations, conducted primarily during the COVID-19 pandemic, has concluded that, in general, televisits are effective in providing patient care, improving access, and reducing costs, but high quality evidence is lacking.[16] For the general population, facilitators of televisits included reduced waiting times, ease of scheduling, and increased feelings of connections with providers, but lack of training with the technology, lack of privacy in the home, and connectivity issues served as barriers to provider and participant satisfaction.[17] Finally, socioeconomically or medically disadvantaged participants may face greater barriers to successful remote visits.[18] The potential benefits and harms or concerns related to televisits, as opposed to in-person care, have yet to be elucidated for routine antenatal care. The COVID-19 pandemic, furthermore, increased the urgency of determining the ideal timing and frequency of antenatal care. It also highlighted the need to understand which visits are acceptable to be carried out virtually, with a particular focus on maternal and child outcomes and maternal preferences.

Because in-person care during the pandemic was suddenly unavailable or potentially unsafe for both clinicians and patients, alternate models of care were implemented. These included hybrid models with reduced in-person visit schedules for care that could not be delivered remotely, and televisits to maintain contact between visits. Such approaches grew at a more accelerated pace than before the pandemic as promising strategies to reduce a patient's risk of contracting COVID-19 while continuing to deliver consistent and necessary care.[19] These included using televisits to replace in-person visits, implementing at-home monitoring of measures historically captured only in the setting of antenatal office visits, and enabling remote consultation with specialists. More frequent measurements through telemedicine platforms may allow for less frequent antenatal visits while also improving health outcomes. Prior evaluations of these antenatal care delivery models are limited and focused mainly on patient and provider experience,[9] but they warrant further investigation to understand their impact on health and patient-centered outcomes.

Current clinical practice guidelines are based largely on expert opinion.[2, 10] Evidence-based clinical guidance regarding the volume of antenatal care (frequency, timing, etc.) and modern modes of delivery (i.e., televisits) that is based on maintaining or improving important maternal and child outcomes is needed. Such guidance would inform and enable the best care for pregnant patients and their babies without overburdening the healthcare system, pregnant patients, or their families. Alternative visit schedules and televisits offer potential opportunities to improve care with reduced resources, time, and costs.

Purpose of the Review

ACOG and the Society for Maternal-Fetal Medicine (SMFM) nominated the topic of antenatal care to the Agency for Healthcare Research and Quality for systematic review. ACOG and SMFM develop clinical practice guidelines and consensus statements both individually and jointly based on the needs of their members (clinicians who provide gynecologic, obstetric, and high-risk pregnancy care). The current systematic review was developed to support ACOG and SMFM in their effort to create a new evidence-based joint consensus statement to address the preferred frequency and timing of routine antenatal care visits and the use of televisits for routine antenatal care.

To support the needs of guideline developers, clinicians and other providers of antenatal care, healthcare policy makers, and patients, this systematic review summarizes (1) the effectiveness

of routine antenatal care schedules that vary by number and timing of visits; (2) the effectiveness of televisits for providing routine antenatal care; and (3) qualitative evidence of patient, partner/family, and provider perspectives, preferences, and perceptions related to the frequency of antenatal care visits and televisits for routine antenatal care.

Methods

Review Approach

The Brown Evidence-based Practice Center (EPC) conducted this systematic review (SR) based on the Agency for Healthcare Research and Quality (AHRQ) Methods Guide for Effectiveness and Comparative Effectiveness Reviews (available at https://effectivehealthcare.ahrq.gov/topics/cer-methods-guide/overview). This SR also reports in accordance with the Preferred Items for Reporting in Systematic Reviews and Meta-Analyses (PRISMA),[20] A Measurement Tool to Assess Systematic Reviews (AMSTAR 2),[21] and relevant extension statements.

A more detailed version of the SR methodology used can be found in Appendix A.

The topic of this report and preliminary Key Questions (KQs) arose through a process soliciting input from the nominators (the American College of Obstetricians and Gynecologists [ACOG] and the Society for Maternal-Fetal Medicine [SMFM]), a panel of Key Informants (KIs), a Technical Expert Panel (TEP), the public, and AHRQ. The KIs and TEP represented ACOG, SMFM, Federal policymaking agencies (the Office of Women's Health), research and practicing obstetricians, family medicine, obstetric nursing, midwives, doulas, pediatrics/neonatology, obstetrics/gynecology healthcare administration, disparities research, qualitative research, women's health outcomes research, and patients. Initially, the KI panel gave input on the KQs, including the outcomes, to be examined. Based on discussions with the KIs and TEP, the EPC determined a list of prioritized outcomes. AHRQ then posted these KQs and solicited public comment through its Effective Health Care (EHC) Program website and on the Federal Register. No comments were received. The TEP provided high-level content and methodological expertise throughout development of the review protocol. The final protocol was posted on the EHC website at effectivehealthcare.ahrq.gov/products/schedule-visits-antenatal-care/protocol on August 6, 2021. We submitted the protocol for registration in PROSPERO in August 2021. On September 7, 2021, PROSPERO published the protocol with registration number CRD42021272287.

Key Questions (KQs)

KQ 1: What are the benefits and harms of different antenatal care schedules that vary by number or timing of visits for pregnancies requiring routine care and monitoring?

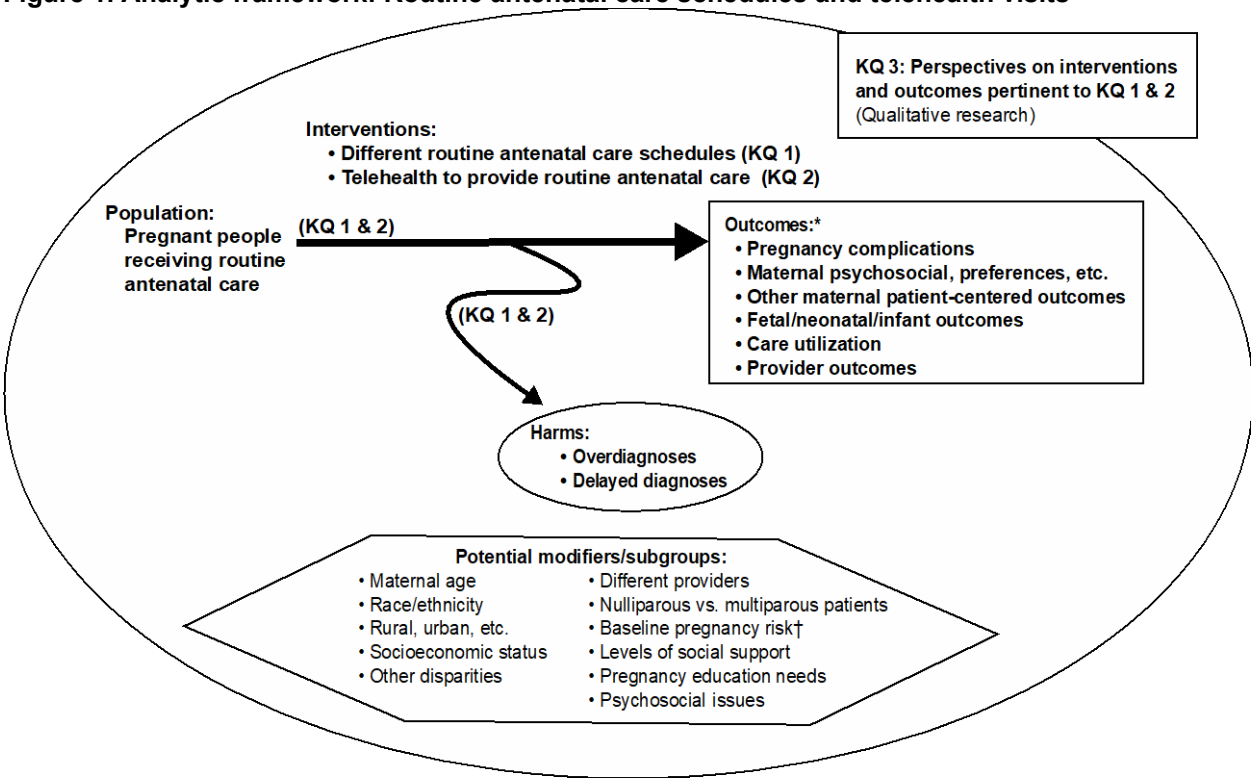
KQ 2: What are the benefits and harms of televisits for providing routine antenatal care during pregnancy?

KQ 3: What are patient, partner/family, and provider perspectives, preferences, and experiences related to (a) antenatal care visit schedules and (b) use of televisits for routine antenatal care?

Analytic Framework

Based on discussions with KIs and TEP, we developed an analytic framework (Figure 1). The framework graphically lays out the populations, interventions, outcomes, and modifiers that pertain to each KQ.

Figure 1. Analytic framework: Routine antenatal care schedules and telehealth visits



Abbreviation: KQ = Key Question.

* Pregnancy complications: maternal mortality, antenatal pregnancy complications (gestational diabetes, gestational hypertension, pre-eclampsia, intrauterine growth restriction, anemia, urinary tract infections), delivery related complications (lacerations, hemorrhage, transfusion need); Other maternal health outcomes: delivery outcomes (cesarean delivery, induction of labor, operative vaginal delivery), inappropriate weight gain, postpartum contraception. Maternal psychosocial, preference, and related outcomes: quality of life measures, psychosocial measures, mental health measures or diagnosis (e.g., anxiety, depression), patient satisfaction with antenatal care, patient preferences, resources (patient financial costs, patient travel, lost work time). Fetal/neonatal/infant outcomes: delivery timing (preterm birth, full-term delivery, post-term delivery, gestational age at birth), mortality, perinatal morbidity (e.g. birth trauma), Apgar score, breastfeeding, need for social services. Care utilization: attendance at planned antenatal visits (adherence), completion of American College of Obstetricians and Gynecologists recommended services, number of unplanned visits, number of referrals, unplanned hospital admissions, emergency room/triage visits, neonatal intensive care unit admissions and length of stay, number of unplanned contacts (e.g., portal/phone messages). Provider outcomes: provider satisfaction with antenatal care. Harms: overdiagnosis, delayed diagnoses, harms to marginalized groups/equity outcomes.

† Within the context of routine antenatal care.

Study Selection

Literature searches were conducted in Medline® (via PubMed®), the Cochrane Register of Clinical Trials, the Cochrane Database of Systematic Reviews, Embase®, CINAHL®, and ClinicalTrials.gov, from inception through February 12, 2022, without language restriction. Additional literature searches were conducted for qualitative studies in PsycINFO® and SocINDEX using the same set of concepts included in the search for quantitative studies, without

study type filters. We also performed citation tracing and other snowballing techniques based on all relevant studies to identify studies that may have been missed in the database searches.[22]

For both KQ 1 (scheduled visits) and KQ 2 (televisits), we included comparative studies (both randomized and observational) of pregnant individuals receiving routine antenatal care. We did not require that study participants had low-risk pregnancies, but did require that the antenatal visits under investigation were for routine care. Studies were restricted to high-income countries, without language restriction. Appendix A (*Inclusion/Exclusion Criteria Details*) includes more detailed eligibility criteria.

For KQ 1, studies had to compare different strategies that scheduled fewer versus more routine antenatal care visits. We excluded studies that compared different providers or added group or home visits without changing the number of scheduled routine visits.

For KQ 2, studies had to compare use of televisits for routine antenatal care versus all in-person visits (or alternative approaches to televisits).

For both KQs, studies had to report at least one outcome listed in Appendix A pertaining to pregnancy complications; other maternal health outcomes; maternal psychosocial, preference, and related outcomes; fetal, neonatal, and infant outcomes; healthcare utilization; provider satisfaction; and harms. For KQ 2, we also included access to telemedicine and home monitoring equipment.

For both KQs, prioritized outcomes included:

- Maternal quality of life
- Maternal mental health measures or diagnosis (e.g., anxiety, depression)
- Patient satisfaction with antenatal care
- Lost work time
- Delivery timing (preterm birth, full-term delivery, gestational age at birth)
- Small for gestational age/low birth weight
- Apgar scare
- Breastfeeding
- Completion of ACOG recommended services
- Number of unplanned visits
- Neonatal intensive care unit admissions
- Delayed diagnoses (e.g., gestational diabetes)

For KQ 3, we included qualitative research studies that examined perspectives and/or preferences about the number of scheduled routine antenatal visits or use of televisits for routine antenatal care. Study participants could include pregnant or postpartum individuals or those considering pregnancy, partners and family members, and any providers of antenatal care. The qualitative studies had to conduct focus groups, interviews, ethnography, or surveys with open-ended questions. We excluded studies of surveys with only closed-ended questions that did not provide data amenable to qualitative analyses.

Risk of Bias Assessment

We evaluated each quantitative study (KQs 1 and 2) for risk of bias and methodological quality. For randomized controlled trials (RCTs), we used the items from the Cochrane Risk of Bias tool 2.0.[23] For nonrandomized comparative studies (NRCSs), we used specific elements from the ROBINS-I Tool (Risk Of Bias In Non-randomized Studies – of Interventions)[24] related

to confounding and selection bias in addition to items from the Cochrane Risk of Bias tool that were not specific to randomized trials.

We evaluated each qualitative study (KQ 3) for risk to rigor using the Critical Appraisal Skills Programme (CASP) appraisal tool for qualitative studies, which addresses issues related to clear qualitative research aims; congruence between the research aims and methodological approach; sampling and data collection; appropriate application of methods; richness/conceptual depth of findings; appropriate interrogation of findings; and reflexivity of the researchers.[25-27]

Data Synthesis and Analysis

Within the main report, data are summarized either (1) in succinct tables that focus on outcome, interventions, and comparative (when applicable) results or (2) in forest plots or succinct summary tables (for most topics). When feasible and appropriate, we conducted random effects model pairwise meta-analyses. For the qualitative synthesis, we categorized extracted data (all relevant primary data from participants and secondary data from study authors) into one of 14 domains defined by the Theoretical Domains Framework (TDF), with a Best Fit Framework approach.[28-30] The TDF is a well-established tool for characterizing the cognitive, affective, social, and environmental factors that may influence ones adoption of a behavior.[28, 29] It is commonly used to diagnose the determinants of behavior in implementation problems (e.g., adopting a new guideline-based practice, technology, policy).[31] We selected the TDF as it was recommended by a member of the TEP with qualitative expertise, was familiar to members of the review team, and was a suitably comprehensive framework to guide our planned Best Fit Framework approach. Details are provided in Appendix A. Appendix B lists the excluded studies. Appendix C contains detailed tables that describe study and participant characteristics, intervention (and comparator) details, outcomes (and definitions), and arm- and comparison-level results. Appendix C also includes tables providing study-level risk of bias or rigor assessments. Appendix D contains more detailed, study-level results for each topic.

Grading the Strength of the Body of Evidence

For KQs 1 and 2, we evaluated the strength of evidence (SoE) addressing each major analysis for each KQ. We graded the SoE as per the AHRQ Methods Guide.[32, 33] We did not grade SoE for the qualitative research but instead, we assessed the confidence for the summary of qualitative findings using the GRADE-CERQual (Grading of Recommendations Assessment, Development and Evaluation - Confidence in Evidence from Reviews of Qualitative research) tool.[25, 34] For each SoE assessment, we evaluated the evidence base for each prioritized outcome, accounting for the number of studies (both RCTs and NRCSs) and study participants, the study limitations (accounting for both study design and risk of bias), the directness of the evidence to the KQs, the consistency of study results, the precision of any estimates of effect, and other limitations (particularly sparseness of evidence, including rare events). Based on these assessments, we assigned a SoE rating as being either high, moderate, low, or insufficient to estimate an effect. Outcomes with highly imprecise estimates (e.g., 95% confidence interval extends beyond both 0.50 and 2.0), inconsistent findings across studies (that do not allow for an overall conclusion), or with data from only one study (unless it was a high quality, broadly generalizable, and adequately powered trial) were deemed to have insufficient evidence to allow a conclusion. For each qualitative finding, we assessed the methodological limitations of the body of data contributing to the finding, and the findings' coherence (in addressing the

complexity and variation of the data),[35] adequacy (defined by richness and quantity of data addressing a finding),[36] and relevance (to the context specified in the review question).[37]

Results

Literature Search Results

The electronic literature search yielded 23,596 unique citations. A total of 26 studies (in 31 articles) met eligibility criteria. Appendix B provides a list of studies excluded during full-text screening. Appendix Figure C-1 summarizes the results of the search and screening processes. The 26 studies comprised 10 comparisons of different routine antenatal care schedules (5 randomized controlled trials [RCTs] and 5 nonrandomized comparative studies [NRCSs]); 7 studies compared televisits and in-person visits (2 RCTs and 5 NRCSs), and 9 were qualitative research studies (4 addressing scheduling and 5 addressing televisits).

We first summarize the evidence regarding routine antenatal visit schedules from both quantitative comparative studies (Key Question [KQ] 1) and qualitative research studies (KQ 3a). The subsequent section summarizes the evidence regarding use of televisits from both quantitative comparative studies (KQ 2) and qualitative research studies (KQ 3b).

Different Visit Schedules for Routine Antenatal Care

Key Points

- Moderate-strength evidence from studies comparing reduced versus traditional visit schedules did not indicate differences in infant outcomes between visit schedules regarding
    - gestational age at birth (2 RCTs, 2 NRCSs; mean difference [MD] 0 days),
    - being small for gestational age (3 RCTs; summary odds ratio [OR] 1.08, 95% confidence interval [CI] 0.70 to 1.66),
    - Apgar score (3 RCTs, 2 NRCSs; nonsignificant ORs, MD 0 at 1 and 5 minutes), and
    - neonatal intensive care unit (NICU) admission (3 RCTs, 2 NRCSs; summary OR 1.05, 95% CI 0.74 to 1.50).
- Low-strength evidence did not indicate differences between visit schedule groups regarding
    - maternal anxiety (3 RCTs; incomplete data reported),
    - preterm birth (1 RCT, 2 NRCSs; nonsignificant ORs), and
    - low birth weight (1 RCT, 3 NRCSs; summary OR 1.02, 95% CI 0.82 to 1.25).
- There is insufficient evidence for numerous prioritized outcomes of interest (e.g., completion of American College of Obstetricians and Gynecologists [ACOG] recommended services and patient experience measures).
- Studies did not evaluate heterogeneity of treatment effect (whether some specific groups of patients may have had better, or worse, outcomes with different visit schedules) or equity issues (whether certain classes of patients might be disadvantaged by introduction of reduced visit schedules).
- Qualitative studies suggest that
    - Providers perceive reduced visit schedules may reduce inconveniences of attending multiple appointments for individuals with low-risk pregnancies and may allow more clinic time to be directed to those with high-risk pregnancies.

- Patients and providers expressed concerns that some patients may not have the confidence to independently manage their pregnancies under reduced care models and that fewer visits may compromise patients' antenatal care in terms of meeting their psychosocial and physical needs. Providers expressed concerns that decades of familiarity with the traditional care model may hamper patients' acceptance of a change in model. Patients noted emotional discomfort with reduced care and inversely positive emotion with a traditional care schedule. Providers expressed fears that reduced care may lead to staff cutbacks and emphasized their perceived need for a supportive management, without which, they expressed concerns about repercussions from management in the event of a rare adverse outcome associated with patients' maternity care.

Summary of Findings

Overall, 10 studies (in 13 publications) compared different antenatal care schedules. Nine studies evaluated typical individual visits.[38-49] The tenth study compared (a reduced number of) group visits with traditional individual visits (and is summarized separately, below).[50] The 10 studies included five RCTs (N = 5748) and five NRCSs (N = 8987). In addition, four qualitative research studies evaluated perspectives on the number of antenatal visits from patients, providers, and clinic leadership. These are summarized following the comparative quantitative studies.

Table 1 lays out the scheduled visits during pregnancy for each group within each study. All studies compared alternative reduced schedules with a "traditional" or "standard" visit schedule (13 or 14 visits). Across studies, traditional (or standard) visit schedules were mostly consistent with the ACOG guideline of about 14 visits: every 4 weeks from week 8 to week 28, every 2 weeks from week 30 to 36, and weekly thereafter. There were some minor variations mostly due to a lack of explicit reporting of visit schedules prior to week 16, allowance for a range of timing (particularly for earlier visits), and whether a visit at week 41 was explicitly included. Overall, reported traditional schedules included 12 to 15 visits. In contrast, the number and timing of alternative visit schedules varied substantially across studies. The number of reduced-schedule visits ranged from 6 or 7 (depending on participant parity) to 10. Most studies scheduled visits at weeks 16, 24, 32, 36, 38, and 40.

The five RCTs[39, 42, 44, 45, 48] and three NRCSs[38, 40, 50] were funded by nonindustry sources. Two NRCSs did not report on the funding source.[43, 49]

Tables in Appendixes C and D provide the design details, participant characteristics, detailed schedule data, and full results.

Table 1. Timing of scheduled routine antenatal visits (weeks)

Source	No. Visits	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Recommended schedules: 1930 Children's Bureau [7] 2017 ACOG [2]	13	.	.	.	.	X	.	.	.	.	.	X	.	.	.	.	.	X	.	.	.	.	.	X	.	X	.	X	.	X	.	X	X	X	X	X	X
Recommended schedule: 1989 NIH [11]	6-8[a]	=	X	=	.	N[b]	.	.	.	=	X	=	.	.	.	.	.	.	.	=	=	X	=	=	.	.	.	X	.	.	.	X	.	N	.	X	X
Recommended schedule: 2016 WHO [3]	8	.	.	.	.	.	.	X[c]	.	.	.	.	.	.	.	X	.	.	.	.	.	X	.	.	.	X	.	.	.	X	.	X	.	X	.	X	.
Study: Berglund 1998 [38]	9-10	.	.	.	.	X	.	.	.	.	.	.	.	.	.	N	.	.	.	X	.	.	X	.	.	X	.	.	X	.	X	X	X	.	X	.	.
	14	.	.	.	.	X	.	X	.	.	.	.	.	.	.	X	.	.	.	X	.	.	X	.	X	.	X	.	X	.	X	X[d]	X	X	X	.	.
Study: Jewell 2000 [39]	≥7-8[e]	.	.	X	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	X	.	N	P	N	.	X	.	N	P
	14	.	.	X	.	.	.	X	.	.	.	X	.	.	.	.	.	.	.	X	.	.	.	X	.	X	.	X	.	X	.	X	X	X	X	X	X
Study: Marko 2019 [40]	9	.	.	Xi	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	X	.	.	.	X	.	.	.	X	.	.	.	X	.	X	X	X	.
	13	.	.	Xi	.	.	.	.	.	.	.	X	.	.	.	X	.	.	.	X	.	.	.	X	.	X	.	X	.	X	.	X	X	X	X	X	.
Study: McDuffie 1996 [41]	9	.	.	X	.	.	.	X[f]	.	.	.	X	.	.	.	.	.	.	.	X	.	.	.	X	.	.	.	X	.	.	.	X	.	X	.	X	.
	14	.	.	X	.	.	.	X	.	.	.	X	.	.	.	X	.	.	.	X	.	.	.	X	.	X	.	X	.	X	.	X	X	X	X	X	.
Study: Partridge 2005 [43]	9	.	=	=	X	=	=	X	.	.	.	=	X	=	.	.	.	.	.	X	.	.	.	X	.	.	.	X	.	.	.	X	.	X	.	X	.
	13	.	=	=	X	=	=	X	.	.	.	X	.	.	.	X	.	.	.	X	.	.	.	X	.	.	.	X	.	X	.	X	X	X	X	X	.
Study: Ross-McGill 2000 [44]	8	.	.	Xi	.	.	.	Xi	.	.	.	Xi	.	.	.	Xi	.	.	.	Xi	.	.	.	.	.	.	.	.	.	X	.	.	.	X	.	.	X
	14-15	.	.	Xi	.	.	.	Xi	.	.	.	Xi	.	.	.	Xi	.	.	.	Xi	.	.	.	X	.	X	.	X	.	X	.	X	X	X	X	X	X
Study: Sikorski 1996 [45]	6-7	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	N	.	P	.	N	.	.	.	X	.	.	.	X	.	X	.	X	X
	13	.	.	.	.	.	.	.	.	.	.	X	.	.	.	X	.	.	.	X	.	.	.	X	.	X	.	X	.	X	.	X	X	X	X	X	X
Study: Tandon 2013[g] [50]	10	.	.	.	.	.	.	.	.	.	.	Gi	.	.	.	Gi	.	.	.	Gi	.	.	.	Gi	.	Gi	.	Gi	.	Gi	.	Gi	.	Gi	.	Gi	.
	12	.	.	.	.	.	.	.	.	.	.	Xi	.	.	.	Xi	.	.	.	Xi	.	.	.	Xi	.	Xi	.	Xi	.	Xi	.	Xi	Xi	Xi	Xi	Xi	.
Study: Walker 1997 [48]	8	.	.	.	.	X	.	.	.	.	=	=	X	=	=	.	.	.	.	=	=	X	=	=	.	.	.	X	.	.	.	X	.	X	X	X	.
	14	.	.	X	.	.	.	X	.	.	.	X	.	.	.	X	.	.	.	X	.	.	.	X	.	X	.	X	.	X	.	X	X	X	X	X	.
Study: Ward 1999 [49]	7-8	=	=	=	X	=	=	=	.	.	.	=	=	X	=	=	.	.	.	=	=	X	=	=	.	.	.	X	.	.	.	X	.	X	.	X	X
	14	.	.	Xi	.	.	.	Xi	.	.	.	Xi	.	.	.	Xi	.	.	.	Xi	.	.	.	Xi	.	Xi	.	Xi	.	Xi	.	Xi	.	Xi	.	Xi	Xi
Source	**No. Visits**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**

The first three rows present major guideline recommended schedules. For each study, the reduced-schedule group is in the upper row and the traditional schedule is in the lower row (with blue shading to enhance visual clarity).

Abbreviations: . = no scheduled visit, = = range of visit times, ACOG = American College of Obstetricians and Gynecologists, G = group session,, Gi = group session, timing implied, N = visit for nulliparous patients only, NIH = National Institutes of Health Public Health Service Expert Panel on the Content of Prenatal Care, P = visit for parous patients only, X = individual visit (for all patients), Xi = individual visit, timing implied, WHO = World Health Organization.

[a] An additional preconception visit is recommended.
[b] May occur by phone for parous individuals.
[c] Or earlier.

[d] Two visits, one with midwife and one with physician.
[e] Additional visits offered, as per patients' wishes.
[f] Televisit for parous patients.
[g] Tandon 2013 is described separately (because it is an evaluation of group visits), but is included in this and other tables to enhance comparison with other studies.

Reduced Versus Traditional Schedule of Individual Visits

Nine studies compared a reduced with a traditional schedule of individual visits (one on one with the provider). Five were RCTs (in 8 articles[39, 41, 42, 44-48]) and four were NRCSs.[38, 40, 43, 49] The studies compared 6 or 7 to 10 scheduled visits to a traditional schedule of about 13 or 14 visits. The five RCTs included between 80 and 2692 pregnant patients (total 5748). The four NRCSs included between 214 and 3882 patients (total 8899).

Five studies were conducted in the United States (Marko 2019, McDuffie 1996, Partridge 2005, Walker 1997, and Ward 1999), three studies in England (Jewell 2000, Ross-McGill 2000, and Sikorski 1996), and one in Sweden (Berglund 1998). Most studies (implicitly or explicitly) included primarily non-minority (White) participants (about 80% to 94%) (Table 2). In contrast, Walker 1997 investigated a mostly minority population in Southern California, 74 percent of whom were Hispanic, 56 percent spoke only Spanish, and 68 percent were not born in the United States. In addition, a study in the Washington, DC area (Marko 2019) evaluated a mixed population, 30 percent of whom were African-American and 7 percent Hispanic. In most studies that reported data, about 85 to 95 percent of participants cohabitated with their partners. The average ages of participants ranged from 24 to 33 years. Only one study (Marko 2019) reported body mass index (BMI), at screening, which was similar between groups (mean 22.9 kg/m^2 in the reduced-schedule group and 24.9 kg/m^2 in the traditional-schedule group).

All but one study recruited pregnant patients who were at low antenatal risk (Table 2). In contrast, Berglund 1998 included all those receiving antenatal care (of whom 25% had undefined "obstetric [or] medical history", 22% had complications during the current pregnancy, and an additional 10% had both); however, this study, like others, evaluated routine obstetrical care. McDuffie 1996 reported that pregestational hypertension was present in 4.5 percent and gestational hypertension (GHTN) was present in 19.0 percent of participants (similar in both groups). Sikorski 1996 reported the mean number of cigarettes smoked per day was 4.8 (not reported whether before or during pregnancy). Notably, though, each study defined risk differently.

Studies were conducted at sites that had a variety of provider patterns, but most studies did not explicitly describe who the providers were at the routine visits. In two studies (conducted in Sweden and England), midwives provided 100 percent of the routine antenatal care (Berglund 1998 and Ross-McGill 2000) (Table 3). One study (in southern California) provided routine care by certified nurse-midwives (Walker 1997). In two studies (conducted in Washington, DC and England) both obstetricians and midwives provided routine care (Marko 2019 and Sikorski 1996); although the percentage of visits by each provider was not provided. One study conducted on a U.S. military base provided care primarily by obstetrics residents and certified nurse practitioners, with oversight by supervising obstetricians (Ward 1999). One study (in Colorado) provided most care by obstetricians, but also by nurses and perinatologists (McDuffie 1996). The remaining three studies did not report the type of providers. Only three studies (McDuffie 1996, Walker 1997, Ward 1999) reported visit duration, which was 45 or 50 minutes for the intake visit and 10 to 15 minutes for return visits. Of note, the intake visit duration from these approximately

25-year-old studies may be longer than what is more commonly allotted in current practices (often 20 to 30 minutes).

The reduced schedules mostly dropped visits in the third trimester (e.g., every 4 instead of 2 weeks from weeks 28 to 36 and every other week instead of weekly thereafter) (Table 1). In two studies (Berglund 1998 and Jewell 2000), parous patients were offered one fewer visit than nulliparous patients. Also as noted above, the RCTs were mostly at low risk of bias (except for possible issues related to lack of blinding and, in one RCT, a high dropout rate), but the NRCSs suffered from lack of adjustment for any potentially confounding differences between studied groups.

Three of the NRCSs (Berglund 1998, Partridge 2005, and Ward 1999) were retrospective pre-post studies based on clinics changing their recommended numbers of visits. The fourth NRCS (Marko 2019) described itself as a "pragmatic controlled trial" that allocated participants into the experimental group versus the control group based on the operating system of the patient's mobile phone (i.e., iOS or Android or Windows). Patients who had iPhones had fewer (9) visits but were provided with a smartphone app (Babyscripts) which delivered educational content and promoted home monitoring of blood pressure and weight with use of a Wi-Fi-connected scale and blood pressure cuff. For this study, evaluation of the difference in scheduled visits is confounded by use of the app and home monitoring. The study employed hierarchical regression models but did not describe what was adjusted for; although, notably, the study did not adjust for participant income, a potentially important confounder given that allocation was based on owning an iPhone.

Assessment of the risk of bias (RoB) of the included studies are presented in Tables C-4-1 (RCTs) and C-4-2 (NRCSs). Among the five RCTs addressing different routine schedules, four had no substantial methodological concerns and were deemed to be at low RoB (Jewell 2000, McDuffie 1997, Ross-McGill 2000, and Sikorski 1996); although the nature of the intervention precluded blinding of either the study participants or providers. One RCT (Walker 1997) had a very high dropout rate of 30 percent, although there were no differences between groups or between dropouts and retained participants; thus, this study was deemed to have some methodological concerns. All four NRCSs addressing different routine schedules were deemed to be at high RoB, primarily due to inadequate statistical analyses in four studies (i.e., they reported only crude, unadjusted analyses). As will be described, few studies evaluated any given outcome. Given the small number of studies per outcome, we could not formally assess risk of publication bias.

None of the studies evaluated or compared subgroups of patients or formally addressed heterogeneity of treatment effect (whether specific individuals or identifiable groups of patients may have better, or worse, outcomes than most patients with the implementation of reduced visit schedules). Similarly, no eligible studies evaluated equity issues (whether classes of patients, such as rural, poor, or non-English speakers, might have been further disadvantaged or have had worse outcomes with the implementation of reduced visit schedules).

Table 2. Study design and sample characteristics of studies addressing timing of scheduled routine antenatal visits

Study	Design Years Sample Size	Setting	Race/ Ethnicity	Risk Factors	Relationship Status	Insurance	Other Factors
Berglund 1998 [38]	Pre-post, retro 1992 vs. 1990 N=3882	Central Hospital, Västerås, Sweden	NR	Undefined 35%	Living alone 5%	NR	Paid employment 81%
Jewell 2000 [39]	RCT 1996-1999 N=544	11 primary care centers Bristol, England	NR	Excluded	Living with a partner 88%	NR	Nulliparous 50% Smoking in pregnancy 19%
Marko 2019 [40]	NRCS, prosp 2015-2016 N=88	GWU hospital Washington, DC	Black 31% Hispanic 7%	Excluded	NR	NR	Nulliparous 63%
McDuffie 1996 [41]	RCT 1992-1994 N=2328	Colorado Region of Kaiser Permanente	White 81% Hispanic 12% Black 4%	Excluded	NR	Unplanned change to another insurer 7%	Nulliparous 40%
Partridge 2005 [43]	Pre-post, retro 2000 vs. 1999 N=3357	Naval Hospital Camp Pendleton CA	NR	"Few" with multiple gestations, preterm labor patients, fetal anomalies, and severe preeclampsia	NR	NR	Percentage with complications 14%
Ross-McGill 2000 [44]	RCT <2000 N=80	General practices Yorkshire, England	White 94%	Excluded	Married 68%	National Health Service	Nulliparous 33%
Sikorski 1996 [45]	RCT 1993-1994 N=2794	Lewisham and Guy's Hospitals London, England	Ethnic minority 21%	Excluded	Living with partner 54% Living alone 4%	NR	Higher education 22%
Tandon 2013[a] [50]	NRCS, prosp 2008-2009 N=214	County clinics Palm Beach, FL	Hispanic 76% Mayan 24%	Excluded	Single 41%	NR	Primiparous 30%
Walker 1997 [48]	RCT 1993-1994 N=81	Birthing center, affiliated with academic medical center Southern CA	Hispanic 74%[b] White 22%	Excluded	Married 60% Cohabit 23%	Medicaid 81% Private 10% Self-pay 2.5%	Mean 9.5 years of school Mean 1.4 prior pregnancies
Ward 1999 [49]	Pre-Post, retro 1994 vs. 1991 N=1445	US Air Force base Biloxi, MS	NR	Excluded[c]	NR	Military (unrestricted, free care)	Middle income

Abbreviations: NR = not (explicitly) reported, NRCS = nonrandomized comparative study, prosp = prospective, RCT = randomized controlled trial, retro = retrospective.

[a] Tandon 2013 is described separately (because it is an evaluation of group visits), but is included in this and other tables to enhance comparison with other studies.
[b] 56% (of total) Spanish-only speakers. Approximately 5.5 years living in the US.
[c] 18% of otherwise eligible population.

Table 3. Summary of interventions in studies addressing timing of scheduled routine antenatal visits

Study	Participants, N	No. Visits	Cointerventions	Provider	Visit Duration
Berglund 1998 [38]	1874	10	None	Midwife 100%	NR
	2008	14	None	Same	NR
Jewell 2000 [39]	265	≥7	None	NR	NR
	279	14	None	NR	NR
Marko 2019 [40]	47	9	**Babyscripts app and home monitoring**	OB % NR Midwife %NR	NR
	41	13	None	Same	NR
McDuffie 1996 [41]	1175	9	None	OB 87% Nurse 11% Perinatology 4%	45 min intake visit 10-15 min return visits
	1176	14	None	OB 88% Nurse 9.5% Perinatology 3.5%	Same
Partridge 2005 [43]	1710	9	None	NR	NR
	1647	13	None	NR	NR
Ross-McGill 2000 [44]	40	≥4 [a]	**Home BPM**	Midwife 100%	NR
	40	≥10 [a]	None	Same	NR
Sikorski 1996 [45]	1416	6-7	None	OB % NR Midwife %NR	NR
	1378	14	None	Same	NR
Tandon 2013[b] [50]	144	10	Group visits	NR	NR
	70	10-12	Individual visits	NR	NR
Walker 1997 [48]	43	8-9	None	CNW 100%	Initial 45 min F/up 15 min
	38	14 (ACOG)	None	Same	Same
Ward 1999 [49]	734	7-8	None	2 supervising OBs 16 OB residents 3 CNPs	Initial 40 min F/up 10 min
	711	14 (ACOG, implied)	None	Same	Same

Text in some cells in bold font only to emphasize difference with other studies. Shading included to better distinguish fewer visits (shaded) from more visits (unshaded) and individual studies (alternate colors).

Abbreviations: ACOG = American College of Obstetricians and Gynecologists recommended practice, BPM = blood pressure monitoring with instruction, CNP = certified nurse practitioner, CNW = certified nurse-midwife, F/up = followup, min = minutes, NR = not reported, OB = obstetricians.

[a] Study began in 3rd trimester (week 28); thus, exact number and timing of visits unclear.
[b] Tandon 2013 is described separately (because it is an evaluation of group visits), but is included in this and other tables to enhance comparison with other studies.

In the following text, the results are organized by outcome. We first describe the outcomes prioritized by stakeholders for which there are data (pertaining to maternal psychosocial, preference, and related outcomes; fetal, neonatal, and infant outcomes; care utilization; and harms). These are followed by other included outcomes; other included outcomes that were reported by only a single study are grouped together at the end of the list of outcomes.

Across studies, for all outcomes, there were no reported analyses of subgroups, subgroup differences, or heterogeneity of treatment effect. Except as noted, study findings were consistent with each other (generally finding no significant differences) such that no discernible differences could be found across studies that may suggest actual differences in effect by patient, provider, clinic, or other differences.

Prioritized Outcomes (Reduced Versus Traditional Visit Schedules)

We evaluated the strength of evidence (SoE) for prioritized outcomes (Table 4). Based on discussions with stakeholders, we prioritized 15 outcomes that were deemed both important to pregnant patients and their babies and also most likely to be affected by changes to routine antenatal visit schedules. These included: maternal quality of life, maternal anxiety, maternal depression, satisfaction with antenatal care, lost work time, preterm/full term birth, gestational age at birth, small for gestational age, low birth weight, Apgar score, breastfeeding, completion of ACOG recommended services, unplanned visits, NICU admissions, and delayed diagnoses.

To summarize the overall findings, moderate-strength evidence from studies comparing reduced versus traditional visit schedules did not indicate differences in infant outcomes between visit schedules regarding gestational age at birth, likelihood of being small for gestational age, likelihood of a low Apgar score, and likelihood of NICU admission. Low-strength evidence did not indicate differences between visit schedule groups regarding maternal anxiety, likelihood of preterm birth, and likelihood of low birth weight. Due to inconsistent findings across studies, there is insufficient evidence regarding satisfaction with antenatal care and number of unplanned antenatal visits. Several prioritized outcomes were not reported or were reported by only a single eligible study, precluding conclusions. These included maternal quality of life, maternal depression, lost work time, breastfeeding outcomes, completion of ACOG recommended services, and delayed diagnoses.

Table 4. Evidence profile for reduced versus traditional visit schedules

Outcome[a]	No. Studies (Subjects)	Risk of Bias	Consistency	Precision	Directness	Other	Overall SoE	Conclusion Statements
Maternal QoL	0	N/A	N/A	N/A	N/A	N/A	Insufficient	No evidence
Maternal anxiety	3 RCTs [44, 45, 48] (1247)	Low	Consistent	Imprecise	Direct	Incomplete data	Low	No evidence of a difference Incomplete data reporting
Maternal depression	1 [45] (1102)	Low	N/A	Precise	Direct	Single study	Insufficient	No conclusion
Satisfaction with antenatal care	5 RCTs [39, 41, 44, 45, 48] (3686) 2 NRCSs [40, 43] (3944)	Low	Inconsistent	Imprecise	Indirect[b]	None	Insufficient	Inconsistent findings
Lost work time	0	N/A	N/A	N/A	N/A	N/A	Insufficient	No evidence
Preterm birth	1 RCT [41] (2328) 2 NRCSs [38, 43] (7239)	Moderate	Consistent	Imprecise	Direct	None	Low	No evidence of a difference OR 0.80-1.25, all NS
Gestational age at birth	2 RCT [39, 41] (2895) 2 NRCSs [43, 49] (4802)	Moderate	Consistent	Precise	Direct	None	Moderate	No evidence of a difference MD ~ 0 days
Small for gestational age	3 RCTs [39, 41, 45] (3454)	Low	Consistent	Imprecise	Direct	None	Moderate	No evidence of a difference Summary OR 1.08 (0.70, 1.66)
Low birth weight	1 RCT [41] (2351) 3 NRCSs [38, 43, 49] (8684)	High	Consistent	Precise	Direct	None	Low	No evidence of a difference Summary OR 1.02 (0.82, 1.25)[c]
Apgar score	3 RCTs [39, 41, 45] (5621) 2 NRCSs [38, 49] (5327)	Moderate	Consistent	Precise	Direct	None	Moderate	No evidence of a difference OR 0.62-1.26, all NS[d] MD 0 at 1 and 5 minutes
Breastfeeding	1 RCT [45] (707)	Low	N/A	Precise	Direct	Single study	Insufficient	No conclusion
Completion of ACOG recommended services	0	N/A	N/A	N/A	N/A	N/A	Insufficient	No evidence
Unplanned visits	1 RCT [48] (81) 2 NRCSs [38, 43] (7239)	High	Inconsistent[e]	Precise	Indirect[f]	None	Insufficient	Inconsistent findings
NICU admissions	3 RCTs [39, 45, 48] (3376) 2 NRCSs [38, 43] (7239)	Low	Consistent	Imprecise	Direct	None	Moderate	No evidence of a difference Summary OR 1.05 (0.74, 1.50)[g]
Delayed diagnoses	0	N/A	N/A	N/A	N/A	N/A	Insufficient	No evidence

Abbreviations: ACOG = American College of Obstetricians and Gynecologists, MD = mean difference, N/A = not applicable, NICU = neonatal intensive care unit, NRCS = nonrandomized (observational) comparative study, NS = not statistically significant, OR = odds ratio (with 95% confidence interval), RCT = randomized controlled trials, SoE = strength of evidence.

[a] The evidence profile includes only outcomes prioritized by stakeholders.
[b] Each study used a different measure of satisfaction or preference, sometimes conflating the two concepts.
[c] Meta-analysis of 3 RCTs for birth weight <2500 g. 1 RCT had consistent findings. Findings for lower birth weights were consistent but with less precision.

[d] Apgar <7 at 5 minutes. Similar findings for other thresholds and time points.
[e] Both across studies and within the Berglund 1998 pre-post study.
[f] Each study evaluated its own self-defined measure and definitions of outcomes were unclear.
[g] Meta-analysis of 3 RCTs. The NRCSs had similar findings.

Mental Health

Anxiety

Three RCTs (Ross-McGill 2000, Sikorski 1996, Walker 1997) reported on anxiety. Ross-McGill 2000 and Walker 1997 reported the State Trait Anxiety Inventory (STAI) anxiety scale. In Ross-McGill, scores were near-identical at multiple timepoints between groups. Walker 1997 also reported no change in anxiety scores over time or significant differences between groups (but no data were reported). The Sikorski 1999 RCT (reported in Clement 1999[46]) found no difference in the anxiety component of the Hospital Anxiety and Depression Scale (HADS): mean 5.2 vs. 5.3, P = 0.78.

Overall, we found low SoE of no evidence of a difference between visit schedules in maternal anxiety (Table 4). Our confidence was reduced due to a lack of precision and incomplete outcome reporting.

Other Mental Health Outcomes

The Sikorski 1999 RCT (reported in Clement 1999[46]) also found no difference in the HADS depression score (mean 5.7 vs. 6.1, P =0.97), overall parenting stress index (mean 220.5 vs. 219.9, P = 0.45), or in the percent of patients who self-reported a psychological or emotional problem (18.4% vs. 16.4%; OR 1.14, 95% CI 0.83 to 1.58) or who underwent treatment for a psychological or emotional problem (13.5% vs. 10.9%; OR 1.27, 95% CI 0.87 to 1.86).

The Sikorski 1999 RCT also found no difference in the overall Parenting Stress Index score between groups (mean 219.9 vs. 220.5, P = 0.45). According to the study, this is a validated psychometric scale that "gives an indication of the mother-child relationship" and for which high scores (not defined) are associated with "dysfunctional parenting behavior, negative interactions between parents and their child, and deviant child development."

Based on the single study, there is insufficient evidence to yield a conclusion regarding the effect of different visit schedules on maternal depression (Table 4).

Patient Satisfaction With and Preference for Antenatal Care

Five RCTs (Jewell 2000, McDuffie 1996, Ross-McGill 2000, Sikorski 1996, and Walker 1997) and two NRCSs (Partridge 2005, Marko 2019) reported on patient satisfaction with care, but each defined the outcome differently (Appendix Table D-1-1).

The studies had inconsistent findings. There were no clear discernible reasons for different findings across the studies beyond the inconsistency in how satisfaction with care and preference for a given schedule were measured and the degree to which the two concepts were conflated.

The two RCTs from the United States found statistically significantly higher satisfaction with or preference for reduced schedules, at least in part. In a study of mostly Mexican-born, Hispanic, patients in southern California, Walker 1997 evaluated the Patient Satisfaction with Prenatal Care instrument but reported only P (and F) values between groups. Participants in the reduced-schedule group were significantly more satisfied with both provider (P = 0.02) and the antenatal care system (P = 0.04) than in the traditional-schedule group. Related to preference, McDuffie 1996 found that more patients in the reduced-schedule group stated that the number of visits was "just right" (89.2%) than the traditional-schedule group (82.8%; OR 1.40, 95% CI 1.04 to 1.87, reported P = 0.002). However, they reported that satisfaction—"quality of prenatal

care" rated as excellent or good—was similar between groups (97.5% vs. 97.8%). This study was conducted in a population described as mostly White and well-educated.

In contrast, two of the RCTs from England found statistically significantly lower rates of satisfaction (in part) with reduced schedules. Jewell 2000 reported on satisfaction with care provided by midwives, family doctors, and hospitals. Patients in the reduced-schedule group were less likely to be "very satisfied" (60%) than those with traditional schedules (72%; OR 0.59, 95% CI 0.40 to 0.87). However, satisfaction with family doctors (42% vs. 51%) and with care provided by hospitals (42% vs. 54%) were statistically similar. Sikorski 1996 reported on dissatisfaction with visit frequency (defined as a preference for more visits in the reduced-schedule group, or vice versa); overall, throughout pregnancy, twice as many patients in the reduced-schedule group (32.5%) would have preferred the alternate schedule than those in the traditional-schedule group (16.2%; OR 2.50, 95% CI 2.00 to 3.11). In addition, Sikorski 1996 reported that partner dissatisfaction with visit frequency was considerably higher in the reduced-schedule group (39.8%) than the traditional-schedule group (5.8%; OR 10.75, 95% CI 7.23 to 15.99). Regarding a related outcome, Sikorski 1996 also found that patients in the reduced-schedule group were more likely to report "not feeling remembered from one visit to the next" (OR 1.52, 95% CI 1.25 to 1.89). These two English studies concluded that patients who received fewer visits were left feeling "not properly looked after"[39] or they had less time to talk at visits.[45] However, Ross-McGill 2000, a third RCT from England, reported that across the two groups 58% preferred a reduced schedule, but patients tended to prefer the group to which they were assigned: 82.5 percent in the reduced-schedule group would prefer a similar schedule in future pregnancies, while 65 percent in the traditional-schedule group would prefer the traditional schedule in future pregnancies.

The two United States-based NRCSs studies found no significant differences in satisfaction (or assessment of quality of care) between groups. In their pre-post study, Partridge 2005 reported that patient satisfaction measured by the Department of Defense patient satisfaction survey did not change with introduction of the reduced schedule at a military community hospital, but they did not report data (despite describing this as a primary conclusion of the study). Marko 2019 reported a modified Likert scale from a hospital consumer assessment of healthcare providers and systems survey instrument. Overall, across six timepoints between the first trimester and postpartum, the study reported no significant difference in patient satisfaction.

Overall, there were mixed findings across the five studies regarding satisfaction or preference for reduced- or traditional schedule visits. The studies were highly heterogeneous regarding the ethnicity, socioeconomic factors, and country of the pregnant individuals. Both studies noting dissatisfaction with reduced visit schedules were from England. Despite multiple studies evaluating satisfaction with antenatal care, there is insufficient evidence to yield a conclusion regarding the effect of different visit schedules on satisfaction (Table 4). The studies had inconsistent findings precluding an overall conclusion.

Delivery Timing, Gestational Age, and Infant Size

The prioritized outcomes related to delivery timing, gestational age, and infant size are highly correlated measures. Nevertheless, across studies, each measure (preterm birth, gestational age at birth, small for gestational age, and low birth weight) was reported as an independent outcome. Thus, for example, the outcome low birth weight does not account for the gestational age of the low birth weight babies.

Preterm Birth

One RCT (McDuffie 1996) and two NRCSs (Berglund 1998, Partridge 2005) reported on preterm birth at <37 weeks. Each study found no significant difference between groups. The RCT (McDuffie 1996) yielded an OR of 1.17 (95% CI 0.82 to 1.65) for births before 37 weeks and an imprecise OR of 1.25 (95% CI 0.49 to 3.18) for births before 32 weeks. The two NRCSs had similar findings. Berglund 1998 yielded ORs of 1.04 (95% CI 0.80 to 1.35) and 0.80 (95% CI 0.41 to 1.57) for births before 37 and 32 weeks, respectively. Partridge 2005 yielded an OR of 0.98 (95% CI 0.76 to 1.25) for births before 37 weeks.

Overall, we found low SoE of no evidence of a difference between visit schedules in preterm birth (Table 4). Our confidence was reduced due to methodological limitations of the studies and a lack of precision in findings.

Premature Rupture of Membranes (PROM) With Preterm Birth

Two RCTs (McDuffie 1997, Sikorski 1996) and one NRCS (Berglund 1998) reported PROM with preterm birth. All three studies found no significant difference, but mostly with some degree of imprecision in estimates of OR: McDuffie 1996 1.00 (95% CI 0.80 to 1.25), Sikorski 0.76 (95% CI 0.48 to 1.31), and Berglund 0.85 (95% CI 0.48 to 1.53).

Gestational Age at Birth

Two RCTs (Jewell 2000, McDuffie 1996) and two NRCSs (Partridge 2005, Ward 1999) reported on gestational age at birth. All studies found no difference between groups, with identical mean gestational ages in three studies (Jewell 2000, McDuffie 1996, and Ward 1999) and only an about 8-hour difference (0.05 weeks) in gestational age in Partridge 2005.

Overall, we found moderate SoE of no evidence of a difference between visit schedules in gestational age at birth (Table 4). Our confidence was reduced due to some methodological limitations.

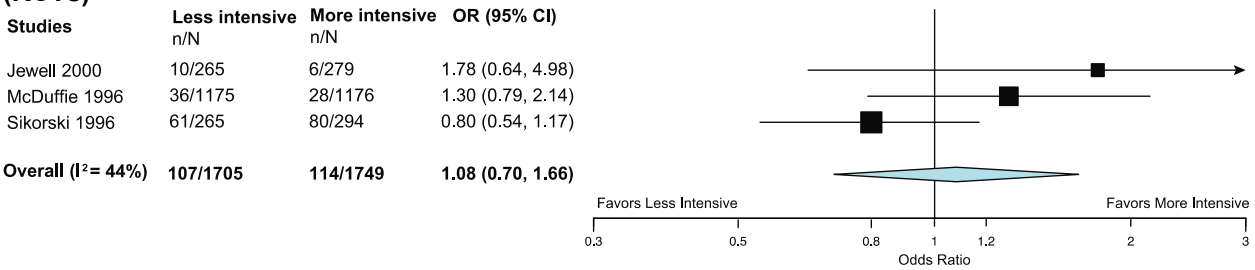
Small for Gestational Age

Three RCTs (Jewell 2000, McDuffie 1996, Sikorski 1996) reported on the rates of infants who were small for gestational age (SGA). McDuffie 1996 and Sikorski 1996 defined small for gestational age as less than the 10^{th} percentile; Jewell 2000 did not define the outcome. Each study found no significant difference between groups.

Across studies, the summary OR for small for gestational age (<10^{th} percentile) is 1.08 (95% CI 0.70 to 1.66), also suggesting no difference in the rate of SGA related to antenatal visit schedule (Figure 2). There was moderate heterogeneity across studies, given the range of effect size estimates; although, individual studies had wide confidence intervals. Sikorski 1996 also reported small for gestational age less than the 3^{rd} percentile, which yielded an OR of 0.84 (95% CI 0.64 to 1.12).

Overall, we found moderate SoE of no evidence of a difference between visit schedules in small for gestational age (Table 4). Our confidence was reduced to moderate due to a lack of precision in findings.

Figure 2. Meta-analysis of reduced versus traditional visit schedules: Small for gestational age (RCTs)



Abbreviations: CI = confidence interval, OR = odds ratio, RCTs = randomized controlled trials.

Low Birth Weight

One RCT (McDuffie 1996) and three NRCSs (Berglund 1998, Partridge 2005, Ward 1999) reported on low birth weight. Across studies (but not consistently), low birth weight was categorized as <2500 g, <1500 g, and <1000 g.

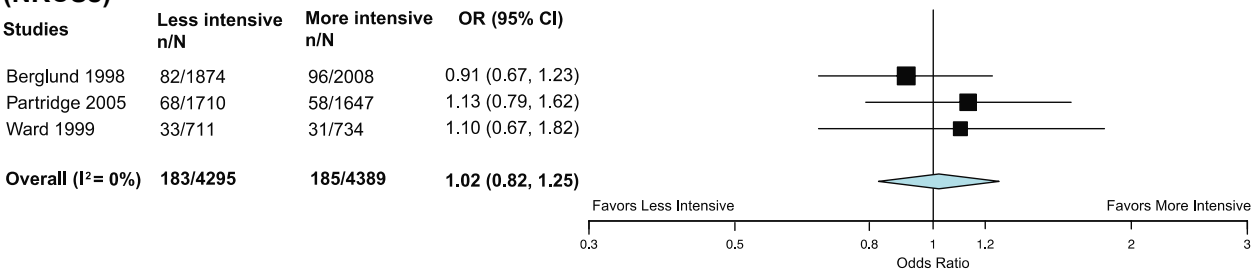
Across the three NRCSs, which all reported birth weight <2500 g, differences were nonsignificant and the summary OR was 1.02 (95% CI 0.82, 1.25) (Figure 3). The studies were statistically homogeneous. The RCT (McDuffie 1996) had a similar finding: OR 0.89 (0.64, 1.23). Including the RCT in the meta-analysis as a sensitivity analysis did not substantively change the findings.

For birth weight <1500 g, the two NRCSs (Berglund 1998 and Partridge 2005) and the RCT (McDuffie 1996) also found no significant differences between groups, but with less precision and a wider range of OR estimates: McDuffie 1996 1.17 (95% CI 0.39 to 3.49), Berglund 1998 0.59 (95% CI 0.28 to 1.23), and Partridge 2005 2.05 (95% CI 0.55 to 7.59).

For birthweight <1000 g, two NRCSs (Partridge 2005 and Ward 1999) found highly imprecise estimates of OR: Partridge 2005 0.64 (95% MCI 0.11 to 3.85) and Ward 1999 1.03 (95% CI 0.21 to 5.13).

Overall, we found low SoE of no evidence of a difference between visit schedules in low birth weight (Table 4). Our confidence was reduced due to methodological limitations of the studies.

Figure 3. Meta-analysis of reduced versus traditional visit schedules: Low birth weight <2500 g (NRCSs)



Abbreviations: CI = confidence interval, NRCSs = nonrandomized comparative studies, OR = odds ratio.

Apgar Score

Three RCTs (Jewell 2000, McDuffie 1996, Sikorski 1996) and two NRCSs (Berglund 1998, Ward 1999) reported on Apgar score. Similar to the above gestational age and infant size measures, the analyses of Apgar score did not account for gestational age.

Three of the studies (McDuffie 1996, Berglund 1998, Ward 1999) evaluated Apgar scores <7 at 5 minutes. Each study found no significant difference between the two groups, with OR estimates of 0.62 (95% CI 0.34 to 1.11), 0.62 (95% CI 0.36 to 1.07), and 1.26 (95% CI 0.73 to 2.18), respectively.

The unadjusted NRCS Berglund 1998 found a near-significant difference, in the direction of favoring reduced schedule for Apgar score <5 at 5 minutes (OR 0.45, 95% CI 0.20 to 1.03). The other unadjusted NRCS, Ward 1999, found no significant difference for Apgar score <3 at 1 minute (OR 1.24, 95% CI 0.73 to 2.11).

Jewell 2000 and Sikorski 1996 reported Apgar scores as continuous outcomes. All mean Apgar scores were identical at 1 minute (Sikorski 1996) and 5 minutes (Sikorski 1996 and Jewell 2000).

Overall, we found moderate SoE of no evidence of a difference between visit schedules in Apgar scores (Table 4). Our confidence was reduced due to some methodological limitations.

Breastfeeding

The Sikorski 1996 RCT was the only study to report on breastfeeding outcomes. The reduced-schedule group breastfed for a nonsignificantly longer duration (29.7 weeks) than the traditional-schedule group (27.0 weeks), yielding an MD of 2.7 (95% CI −0.9, 6.3) weeks.

Based on the single study, there is insufficient evidence to yield a conclusion regarding the effect of different visit schedules on breastfeeding (Table 4).

Unplanned Visits

One RCT (Walker 1997) and two NRCSs (Berglund 1998 and Partridge 2005) reported variations of unplanned visits. Each reported a different, self-defined measure.

The RCT implied that the difference in the mean number of unscheduled “drop-in” office visits per patient between groups was not statistically significant, but there were more such visits in the reduced-schedule group: 0.23 (SD 0.57) versus 0.08 (SD 0.27) (calculated MD 0.15, 95% CI −0.04 to 0.34, P = 0.11).

The Partridge 2005 NRCS reported “outpatient visits to Labor & Delivery Unit per delivery,” but did not define this outcome further. They reported significantly more outpatient visits in the reduced-schedule group (2.9) than the traditional-schedule group (2.5), yielding a calculated difference of 0.4 (95% CI 0.1 to 0.7) visits per delivery.

The Berglund 1998 NRCS (a pre-post study) reported patient-initiated extra midwife visits, staff-initiated extra midwife visits, patient-initiated extra doctor visits, and staff-initiated extra doctor visits. Both patient- and staff-initiated extra visits to *midwives* were increased after institution of the reduced-schedule protocol (by 0.62 staff-initiated visits and 0.01 patient-initiated visits), but both patient- and staff-initiated *doctor* visits were less (by 0.15 staff-initiated visits and 0.15 patient-initiated visits). The study did not report statistical significance, but our calculations of differences between group suggested the differences were statistically significant (in this large study with 3882 participants), if not clinically significant. However, the differences in the number of staff- and patient-initiated visits found may have been driven, at least in part, by differences between groups (or between time periods) other than the number of scheduled visits.

Despite multiple studies evaluating unplanned visits, there is insufficient evidence to yield a conclusion regarding the effect of different visit schedules on the outcome (Table 4). The studies had inconsistent findings precluding an overall conclusion.

Neonatal Intensive Care Unit Admission

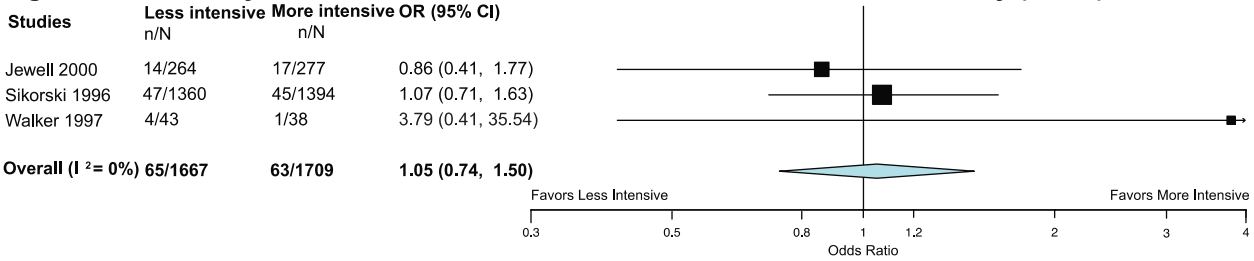
Three RCTs (Jewell 2000, Sikorski 1996, Walker 1997) and two NRCSs (Berglund 1998, Partridge 2005) reported on admission to NICU. The three RCTs all found no significant difference in the numbers of infants with NICU admissions. Across RCTs, the summary OR was 1.05 (95% CI 0.74 to 1.50) (Figure 4). The studies were statistically homogeneous.

The two NRCSs had similar findings. Partridge 2005 had similar rates of NICU admissions between groups (OR 0.97, 95% CI 0.77 to 1.24). The Berglund 1998 pre-post study reported no significant difference between groups (OR 0.75, 95% CI 0.31 to 1.80).

The Sikorski 1996 RCT also reported mean length of stay in the NICU, which was not significantly different between groups: MD 5.4 days (95% CI −5.9 to 16.7).

Overall, we found moderate SoE of no evidence of a difference between visit schedules in NICU admissions (Table 4). Our confidence was reduced due to imprecision in study findings.

Figure 4. Meta-analysis of reduced versus traditional visit schedules: NICU stay (RCTs)



Abbreviations: CI = confidence interval, NICU = neonatal intensive care unit, OR = odds ratio, RCTs = randomized controlled trials.

Prioritized Outcomes Not Reported by Eligible Studies

Several outcomes of interest to stakeholders were not evaluated by eligible studies. Among the prioritized outcomes, these include:

- Maternal psychosocial, preference, and related outcomes
  - Quality of life
  - Lost work time
- Fetal, neonatal, and infant outcomes
  - Breastfeeding
- Care utilization
  - Completion of ACOG recommended services

Other Outcomes (Reduced Versus Traditional Visit Schedules)

Gestational Hypertension

Two RCTs (Jewell 2000 and Walker 1997) and 1 NRCS (Berglund 1998) reported on GHTN.

The two RCTS yielded imprecise (for Walker 1997, highly imprecise) estimates of effect sizes: Jewell 2000 OR 1.31 (95% CI 0.74 to 2.31), Walker 1997 OR 1.80 (95% CI 0.16 to 20.7). In contrast, the Berglund 1998 pre-post study found a substantial and significantly lower risk of diagnosed uncomplicated GHTN (excluding pre-eclampsia) with a reduced schedule (7.4% vs. 11.9%, unadjusted P <0.001; OR 0.59, 95% CI 0.48 to 0.74). Including pre-eclampsia yields similar findings (10.0% vs. 14.3%, OR 0.70, 95% CI 0.59 to 0.83). The study authors explain the difference in uncomplicated GHTN as being due to “the smaller number of observations during

late pregnancy, when the majority of cases occur" (i.e., due to a lower rate of diagnosis in the reduced-schedule group, not necessarily due to a lower true risk of GHTN).

Pre-Eclampsia

Two RCTs (McDuffie 1996, Sikorski 1996) and two NRCSs (Berglund 1998, Ward 1999) reported on pre-eclampsia. All studies found no significant differences between the two groups. Across studies, the ORs ranged from 0.67 (95% CI 0.43 to 1.05) to 1.10 (95% CI 0.73 to 1.64).

Intrauterine Growth Restriction (IUGR)

One RCT (Walker 1997) and one NRCS (Berglund 1998) reported on IUGR. Both studies found no significant difference between groups. The RCT was highly imprecise, with only a single pregnancy affected by IUGR; the NRCS had an OR of 0.79 (95% CI 0.59 to 1.06).

Anemia

One RCT (Walker 1997) and one NRCS (Berglund 1998) reported on anemia. The RCT did not define anemia. Berglund 1998 defined anemia as hemoglobin <10 g/dL. The RCT was highly imprecise, with only a single episode of anemia in each study group; the NRCS had an OR of 0.90 (95% CI 0.65 to 1.26).

Preterm Labor

Two RCTs (McDuffie 1996 and Walker 1997) reported on preterm labor. The RCT was highly imprecise, with few episodes of preterm labor (OR 0.28, 95% CI 0.03 to 2.79); the NRCS risk ratio (RR) of 1.01 (95% CI 0.86 to 1.18).

Hemorrhage

Two RCTs (McDuffie 1996, Sikorski 1996) and one NRCS (Berglund 1998) reported on peripartum hemorrhage. Each study found no significant difference between groups. Across studies, the OR for hemorrhage ranged from 0.86 to 1.01.

Sikorski 1996 also reported antenatal hemorrhage, the rate of which was also similar between groups (OR 0.97, 95% CI 0.69 to 1.35).

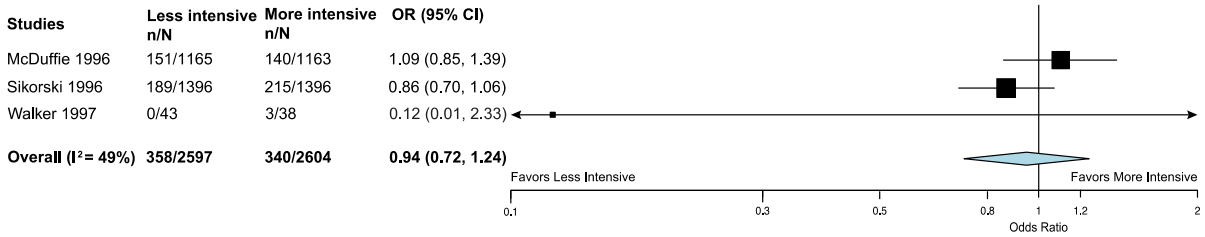
Cesarean Delivery

Three RCTs (McDuffie 1996, Sikorski 1998, Walker 1997) reported on cesarean delivery. No NRCS adjusted for differences in patient or obstetrician preferences regarding cesarean delivery. However, we summarize one NRCS (Berglund 1998) that reported on emergency cesarean deliveries (which are unlikely to be affected by patient or provider preferences).

The three RCTs found no evidence of a difference in cesarean delivery rate between groups; however, Walker 1997 provided a highly imprecise estimate due to small numbers of cesarean deliveries. Across the three studies, the ORs ranged from 0.12 to 1.09. Meta-analysis yielded a summary OR of 0.94 (95% CI 0.72 to 1.24), with moderate heterogeneity related to the imprecise Walker 1997 study (Figure 5).

The McDuffie 1996 RCT also reported on cesarean delivery for fetal distress, with similar event rates between groups (OR 0.88, 95% CI 0.50 to 1.55). In addition, the Sikorski 1996 RCT yielded an OR of 0.81 (95% CI 1.78 to 0.36) for cesarean delivery for pregnancy-related hypertension. One NRCS (Berglund 1998) also reported on emergency cesarean, also finding similar event rates between groups (OR 0.92, 95% CI 0.67 to 1.28).

Figure 5. Meta-analysis of reduced versus traditional visit schedules: Cesarean delivery (RCTs)



Abbreviations: CI = confidence interval, OR = odds ratio, RCTs = randomized controlled trials.

Induction of Labor

Two RCTs (Jewell 2000, Sikorski 1996) and two NRCSs (Berglund 1998, Partridge 2005) reported on induction of labor. Each study found no significant difference between the two groups. Across studies, the OR for induction of labor is close to null and ranged from 0.92 and 1.18. The Sikorski 1996 RCT also reported on induction of labor due to pregnancy-related hypertension, again finding no significant difference between groups (OR 0.91, 95% CI 0.57 to 1.47).

Operative Vaginal Delivery

Two RCTs (Sikorski 1996, Walker 1997) and one NRCS (Partridge 2005) reported on operative vaginal delivery, defined as either forceps or vacuum delivery (or instrumental or assisted delivery). The two RCTs found no significant difference between groups. Sikorski 1996 had similar event rates (OR 1.09, 95% CI 0.85 to 1.39), while Walker 1997 was highly imprecise (OR 0.43, 95% CI 0.04 to 4.92) related to small number of events. In contrast, the Partridge 2005 pre-post study found that significantly fewer operative vaginal deliveries occurred in the reduced-schedule group (2.9% vs. 6.6%; OR 0.42, 95% CI 0.30 to 0.59). The authors hypothesized that this may have been related to somewhat higher rates of small-for-gestational age babies and a concomitant decrease in large-for-gestational age babies after implementation of a reduced routine visit schedule, together with (otherwise unreported) use of continuous epidural analgesia.

Spontaneous Vaginal Delivery

Two RCTs (Jewell 2000 and Sikorski 1996) reported on spontaneous vaginal delivery. Both found no significant difference between groups: Jewell 2000 OR 1.16 (95% CI 0.79 to 1.71), Sikorski 1996 OR 1.04 (95% CI 0.64 to 4.98).

Infant/Fetal Mortality

None of the eligible studies explicitly defined mortality outcomes to distinguish among different perinatal deaths. Neonatal and fetal mortality are sufficiently rare that studies are generally underpowered to evaluate the outcomes.

Stillbirth

Two RCTs (McDuffie 1996, Sikorski 1996) and one NRCS (Ward 1999) reported on rates of stillbirth (or intrauterine fetal death). Stillbirth was uncommon in all studies; thus, effect estimates were highly imprecise: McDuffie 1996 RCT: OR 1.00 (95% CI 0.29 to 3.47; Sikorski 1996 RCT: OR 0.85 (95% CI 0.26 to 2.81); Ward 1999 NRCS: OR 2.07 (95% CI 0.52 to 8.32) for intrauterine fetal death.

Neonatal Mortality

Two NRCSs (Partridge 2005 and Ward 1999) reported on neonatal mortality. Both found no significant difference between groups, but the effect estimate from Ward 1999 was highly imprecise (OR 0.74, 95% CI 0.23, 2.33) and from Partridge also had a wide confidence interval (OR 0.62, 95% CI 0.27 to 1.43).

Perinatal Death

One RCT (Sikorski 1996) and two NRCSs (Berglund 1998 and Ward 1999) reported on perinatal death. All found no significant difference in event rates between groups; however, findings were imprecise. The RCT yielded an OR of 0.72 (95% CI 0.27 to 1.89). The Berglund 1998 NRCS yielded a more imprecise estimate (OR 0.86, 95% CI 0.34 to 2.18). Ward 1999 reported incidence rates of 3 per 1000 births in the reduced-schedule group versus 4 per 1000 births in the traditional-schedule group, which was statistically nonsignificant.

Perinatal Morbidity

One RCT (Walker 1997) and one NRCS (Ward 1999) reported on four different types of perinatal mortality. Due to small sample size and low event rates, the RCT provided highly imprecise estimates of effect sizes between groups for sepsis (OR 1.79, 95% CI 0.06 to 54.8), hyperbilirubinemia (OR 0.88, 95% CI 0.05 to 14.6), and respiratory distress (OR 5.63, 95% CI 0.27 to 116). The NRCS found a nonsignificantly lower rate of bronchopulmonary dysplasia in the less intensive group (OR 0.31, 95% CI 0.08 to 1.12).

Unplanned Hospital Admissions (Maternal)

Three RCTs (McDuffie 1996, Ross-McGill 2000, Sikorski 1996) and one NRCS (Berglund 1998) reported on unplanned hospital admission for the pregnant patient. Two RCTs (McDuffie 1996, Sikorski 1996) reported no differences in the numbers of patients who had unplanned inpatient antenatal admissions (OR 1.15, 95% CI 0.77 to 1.72), outpatient antenatal admissions (OR 1.13, 95% CI 0.95 to 1.34), or admission to a special care unit (OR 1.07, 95% CI 0.70 to 1.62). One RCT (Ross-McGill 2000) and the NRCS (Berglund 1998) found no significant differences in the number of hospital visits. Berglund 1998 found a less than 0.1 difference between groups in the mean numbers of total hospital visits, emergency hospital visits, and referral-based hospital visits. Ross-McGill 2000 reported only that the mean numbers of pregnancy-related hospital visits between 28 and 41 weeks were 1.2 for the reduced-schedule group and 1.4 for the traditional-schedule group.

Emergency Department Visits (Maternal)

Two RCTs (McDuffie 1996 and Walker 1997) reported on emergency department visits by the pregnant patient. McDuffie 1996 reported similar percentages of patients who made emergency department visits regardless of visit schedule (OR 1.08, 95% CI 0.89 to 1.32). Walker 1997 reported no significant difference in the mean number of emergency department visits (MD 0.06, 95% CI −0.04 to 0.16).

Other Outcomes Reported by a Single Study Each

The Sikorski 1996 RCT reported on **maternal death**. However, only one patient in the study died, resulting in a highly imprecise estimate of differences between groups (OR 3.08, 95% CI 0.13 to 75.7). In the same trial, among both pregnancies with malpresentation and with placenta

previa, similar percentages were undiagnosed at the time of labor between the reduced-schedule and traditional-schedule groups: **undiagnosed malpresentation** (25.0% vs. 29.1%), **undiagnosed placenta previa** (33.3% vs. 32.7%).

The McDuffie 1996 RCT reported that in both groups, 1.5 percent of patients were diagnosed with **diabetes**, there was no significant difference between groups in the risk of **placental abruption** (OR 1.55, 95% CI 0.72 to 3.33), and there was a highly imprecise estimate of differences between groups of **chorioamnionitis** (OR 0.82, 95% CI 0.34 to 1.98).

The Partridge 2005 pre-post study reported that **post-term delivery** occurred less frequently after implementation of the reduced visit schedule than the prior traditional schedule (8.1% vs. 10.4%; OR 0.76, 95% CI 0.60 to 0.97). However, the study implied that this outcome may have occurred due to other changes in the clinic practice related to "management of postdates pregnancy." The study also reported statistically significantly fewer babies **large for gestational age**, defined as ≥4000 g after implementation of the reduced schedule than the prior use of a traditional schedule (10.6% vs. 13.0%; OR 0.79, 95% CI 0.64 to 0.98). Larger infants (≥4500 g) were not significantly different between groups (1.3% vs. 1.6%; OR 0.81, 95% CI 0.46 to 1.44). However, the study implied that these outcomes may have occurred due to other changes in the clinic practice related to "management of postdates pregnancy."

Only the Walker 1997 RCT provided a clearly defined measure of **adherence** with assigned visit schedule. The mean number of missed ("no show") visits were similar between groups (0.26 vs. 0.28).

The only study to report on **harms**, was the Sikorski 1996 RCT, which reported total and "correctly" diagnosed birthweight; although, the concept of correct diagnosis was not defined. From these measures, we calculated "incorrectly" diagnosed birthweight, which we interpreted as overdiagnoses of small for gestational age during pregnancy. About 7 percent of fetuses/infants were diagnosed as <3rd percentile weight, only about one-third of which were categorized as "correct"; thus, about 5 percent were incorrectly diagnosed. Similarly, about 21 percent of fetuses/infants were diagnosed as <10th percentile weight, only about one-quarter of which were categorized as "correct"; thus, 16 percent were incorrectly diagnosed. However, rates of incorrect diagnoses were similar in both groups. Overall, the OR for incorrectly diagnosed <3rd percentile birthweight was 0.93 (95% CI 0.67 to 1.30) and for incorrectly diagnosed <10th percentile birthweight was 1.00 (95% CI 0.82 to 1.23).

Reduced-Schedule Group Versus Traditional-Schedule Individual Visits

A single study, Tandon 2013, compared group with individual visits with a difference in the number of total scheduled routine antenatal care visits.[50] It was a retrospective parallel study comparing patients who self-selected a lower visit-frequency CenteringPregnancy program of 10 structured 2-hour group visits led by a nurse practitioner and health educator or the traditional 12 individual visits with nurse practitioners. Notably, the study did not adjust for differences between study groups.

The study was conducted at a Florida clinic that serves primarily Spanish-speaking (93%) self-identified Hispanics (76%) or Mayans (21%) mostly from Mexico and Central America (90%); 41 percent of the patients were single and 30 percent were primiparous (Table 2).

The only reported outcome pertinent to this review was satisfaction with antenatal care. The study used the Patient Participation and Satisfaction Questionnaire (PPSQ) with satisfaction with care and satisfaction with participation subscales. For both subscales, participants were

statistically significantly more satisfied in the reduced-schedule group visits than with the traditional-schedule individual visits, with about 10- to 20-point differences (on an implied 100-point scale). Estimates of minimal important differences were not reported.

Similarly, participants receiving reduced-schedule group visits were substantially more likely to be very satisfied than those with traditional-schedule individual visits. Among patients in the reduced-schedule group visit study arm, 98 percent were very satisfied with time spent with the provider while only 19 percent were very satisfied in the traditional-schedule individual visit study arm (reported relative risk 5.14, 95% CI 2.85 to 9.25).

Qualitative Evidence Pertaining to Number of Visits

Four studies (Meiser 2021, Sanders 1999, Sanders 2000, and Sikorski 1995) provided qualitative data on antenatal care visit schedules,[51-54] three from practices in England (Bristol metropolitan area and London) and one from the United States (Lubbock, Texas). Two related English studies provided different perspectives—midwives (Sanders 1999) and pregnant individuals (Sanders 2000)—on their experiences with "flexible" versus "traditional" care that were evaluated in the Bristol Antenatal Care Study (Jewell 2000, included in KQ 1).[39] The London-based study (Sikorski 1995) sought to ascertain the view of midwives, obstetricians, and general practitioners on "possible changes in the provision of antenatal care" (in 1993) that were implemented in a later RCT, included above (Sikorski 1996).[45] The Texas-based study (Meiser 2021) sought to "better understand the patient perspective on alternative antenatal care schedules."

Two studies collected data via questionnaires that invited open-ended responses exclusively (Sikorski 1995, Sanders 2000). One study each collected data via questionnaires and subsequent follow-up interviews (Meiser 2021) and focus group (Sanders 1999). Sample sizes ranged from 14 to 438, although the depth of qualitative analysis and data from the larger sample studies (Sikorski 1995 and Meisner 2021) was limited. All studies conducted thematic content analysis to identify themes within the qualitative data relevant to their study question.

We assessed studies to have variable risks to rigor. Sanders 2000 was assessed to have high risks to rigor (related to a lack of statement of aims and incomplete reporting of methodology) and Sikorski 1995 moderate risk to rigor (related to a lack of consideration of the relationship between researcher and participants or ethical issues). Meiser 2021 and Sanders 1999 were assessed to have low risks to rigor. Appendix C Table C-4-3 summarizes the risk to rigor assessment of the studies. Most findings had no or minor concerns regarding potential risks to rigor (Appendix D Table D-3-2 presents the GRADE-CERQual [Grading of Recommendations Assessment, Development and Evaluation - Confidence in Evidence from Reviews of Qualitative research] table). The exception related to the findings regarding knowledge and beliefs about capabilities where we had moderate concerns because the pertinent studies had higher risks to rigor. We had no concerns or minor concerns with the coherence of findings (i.e., the synthesized findings reflected the complexity and variation of the data) but minor to moderate concerns with the adequacy of several findings due to the limited number of studies, perspectives sought (often midwives and no other providers, and often providers sharing perceived perspectives of patients rather than patients themselves), and geographical/health setting representation.

We coded data provided by the four studies into seven of the Theoretical Domains Framework (TDF) domains including: knowledge; social/professional role and identity; beliefs about capabilities; beliefs about consequences; environmental context and resources; social influences; and emotion. We did not find evidence from extracted qualitative data for the

remaining seven TDF domains of skills; optimism; reinforcement; intentions; goals; memory, attention, and decision processes; and behavioral regulation. Table 5 summarizes the barrier and facilitator themes related to adopting a reduced antenatal care schedule. Themes are presented within the seven TDF domains identified, organized by whether the themes related to patients, providers, or the clinic/office. Providers discussed their own, but also perceived patient perspectives. Notably, across studies, most patient-related themes were shared by providers, and few were based directly on patient-reported perspectives. No study provided either clinic leadership or partner perspectives.

Appendix D Table D-3-1 provides the extracted text from studies linked to their synthesized themes. Appendix D Table D-3-2 is the GRADE-CERQual table summarizing the findings for each TDF theme. Only one finding (related to the TDF domain social/professional role and identity) was supported by three studies; four findings (related to the TDF domains of knowledge; beliefs about capabilities, beliefs about consequences, and emotion) were supported by two studies, and two findings (related to the TDF domains of environmental context and resources; and social influences) were supported by one study.

TDF Domain: Knowledge

Two studies (Sanders 1999, Sanders 2000) provided evidence pertaining to patient knowledge, from both the patient and provider perspectives. The studies reported that pregnant patients value information on how to behave early in pregnancy and want to know the purpose of tests later in pregnancy (regardless of care schedule). Providers and patients had concerns that reduced visits may lead to patients receiving less information, or less timely information that they may need during pregnancy. Additionally, providers think it is important that patients have contact information for their providers.

TDF Domain: Social/Professional Role and Identity

Three studies (Sanders 1999, Sanders 2000, Sikorski 1995) provided evidence pertaining to patients' and providers' roles and identity. Pregnant patients noted hesitancy to take on more responsibility with reduced visit schedules. From the provider perspective, midwives value flexible, reduced care models as it aligns with their philosophies of practice in which pregnancy is viewed as normal and they embraced sharing responsibility with pregnant patients.

TDF Domain: Beliefs About Capabilities

Two studies (Sanders 1999, Sanders 2000) provided evidence pertaining to beliefs about patient capabilities, from both the patient and provider perspectives. The studies reported that both patients and providers were concerned that pregnant individuals vary in terms of their confidence in managing their pregnancy independently under reduced care models.

TDF Domain: Beliefs About Consequences

Two studies (Sanders 1999, Sikorski 1995) provided evidence pertaining to beliefs about consequences for patients and providers, from the provider perspective. The studies reported that providers were concerned that reduced visits may compromise patients' antenatal care and their psychosocial needs. Specific concerns were not always noted by providers; however, one study noted a fear of patients developing pre-eclampsia if monitored less-frequently. Although providers were concerned that physical and psychosocial needs of patients may not be met, they

believed that a reduced care model may allow more clinic time to be directed to patients with high-risk pregnancies.

TDF Domain: Environmental Context and Resources

A single study (Sanders 1999) provided evidence pertaining to environmental context and resources, all from the provider perspective, related to patient, provider, and clinic themes. The study reported that providers believed that patients may value fewer visits, which would reduce the inconveniences of attending multiple appointments. However, the providers also reported that patients may face barriers to contacting care providers if clear and consistent processes were not established. Providers noted that they may feel uncomfortable providing fewer visits if they perceive that there may be repercussions from management in the event of a rare adverse event. Some providers believed that reduced care schedules would help with overcrowding while others did not.

TDF Domain: Social Influences

A single study (Sanders 1999) provided evidence pertaining to social influences on patients, from the provider perspective. The study reported that providers believed that patients' familiarity with the traditional model across decades of social networks may be a barrier to the introduction of reduced visit models.

TDF Domain: Emotion

Two studies (Meiser 2021, Sikorski 1995) provided evidence pertaining to emotion from either the patient or provider perspectives. The studies reported that patients' distress with reduced care (and inversely emotional appreciation for appointments) and providers' fears of staff cutbacks may pose psychological barriers to reduced visit schedules.

Table 5. Coding extracts for antenatal care visit schedules into the Theoretical Domains Framework

Domain	Patient-Related Themes	Provider-Related Themes	Clinic/Office-Related Themes
Knowledge	Barriers: • Provider perspective: Patients need information about worrying signs to look for and how to contact care providers (Sanders 1999)[53] • Patient perspective: Patients wanted more information to guide behaviors early in pregnancy and to understand procedures (e.g., purpose of tests) throughout pregnancy [both flexible and traditional schedule groups] (Sanders 2000)[52] Facilitators: • Provider perspective: Importance of patients' having contact information for provider (Sanders 1999)[53]	Barriers: • [No data] Facilitators: • [No data]	Barriers: • [No data] Facilitators: • [No data]
Social/professional role and identity	Barriers: • Patient perspective: Hesitancy by the patients to take on more responsibility (Sanders 2000)[52] Facilitators: • [No data]	Barriers: • Provider perspective: Reluctance of providers to change practice (Sanders 1999[a])[53] Facilitators: • Provider perspective: Sense that flexible [reduced] care was normal practice for [for midwives] and reaffirmed practice philosophies and belief that pregnancy is normal. Midwives valued working in partnership with patients and giving patients tools to be more responsible for their pregnancies (Sanders 1999, Sikorski 1995)[53, 54]	Barriers: • [No data] Facilitators: • [No data]
Beliefs about capabilities	Mixed: • Patient and provider perspectives: Patients' beliefs about their capabilities varied: some patients expressed confidence and wanted to be left alone while others expressed concern and preferred traditional care schedules for guidance and reassurance (Sanders 1999, Sanders 2000)[52, 53]	Barriers: • [No data] Facilitators: • [No data]	Barriers: • [No data] Facilitators: • [No data]

Domain	Patient-Related Themes	Provider-Related Themes	Clinic/Office-Related Themes
Beliefs about consequences	Barriers: • Provider perspective: Patient and provider [midwife] discomfort with 8-week gap between visits [as indicated by flexible care protocol] citing concerns about missing signs for pre-eclampsia, fears that physical and psychosocial needs would not be met, and general unease (Sanders 1999)[53] • Provider perspective: Doubt about whether patients' psychosocial needs could be met with a reduced care schedule (Sikorski 1995)[54] Facilitators: • [No data]	Barriers: • Provider perspective: Patient and provider [midwife] discomfort with 8-week gap between visits [as indicated by flexible care protocol] citing concerns about missing signs for pre-eclampsia, fears that physical and psychosocial needs would not be met, and general unease (Sanders 1999)[53] Facilitators: • Provider perspective: Belief that seeing low-risk groups less often allows more time to be directed to high-risk groups (Sikorski 1995)[54]	Barriers: • [No data] Facilitators: • [No data]
Environmental context and resources	Barriers: • Provider perspective: Inconsistent procedures for patients to access clinical care (e.g., what phone numbers given and instructions on when to access them) (Sanders 1999)[53] Facilitators: • Provider perspective: Reduced inconvenience of patients needing to attend multiple visits and allowed them to continue working until closer to delivery (Sanders 1999)[53]	Barriers: • Provider perspective: Fear of repercussions from management in the event of a rare adverse event; need for supportive management (Sanders 1999)[53] Facilitators: • [No data]	Barriers: • [No data] Facilitators: • [No data] Mixed: • Provider perspective: Some providers [midwives] believed that reduced care may help with clinic overcrowding; others believed it would result in the same number of visits dictated by women's needs rather than care provider policies (Sanders 1999)[53]
Social influences	Barriers: • Provider perspective: Social familiarity with traditional model of care across generations of families; traditional model is what patients have come to expect with their prior pregnancies (Sanders 1999)[53] Facilitators: • [No data]	Barriers: • [No data] Facilitators: • [No data]	Barriers: • [No data] Facilitator: • [No data]

Domain	Patient-Related Themes	Provider-Related Themes	Clinic/Office-Related Themes
Emotion	Barriers: • Patient perspective: Negative emotion associated with reduced visit schedule (e.g., anxiety, nervousness, need for reassurance) (Meiser 2021)[51] • Patient perspective: Positive emotion associated with traditional care schedule (e.g., see visits as important milestones, help reduce worry) (Sanders 2000)[52] Facilitators: • [No data]	Barriers: • Provider perspective: Concern that reduced care schedules may result in staff cutbacks (Sikorski 1995)[54] Facilitators: • [No data]	Barriers: • [No data] Facilitators: • [No data]

There was no evidence for the following Theoretical Domains Framework domains: skills; optimism; reinforcement; intentions; goals; memory, attention, and decision processes; or behavioral regulation.

[a] Noted in article's discussion.

Televisits for Routine Antenatal Care

Key Points

- Low-strength evidence comparing hybrid (televisit and in-person) visits and all in-person visits
    - did not indicate differences in rates of preterm births (1 RCT and 3 NRCSs; summary OR 0.93, 95% CI 0.84 to 1.03, P=0.18), and
    - did not indicate differences in rates of NICU admissions (3 NRCSs; summary OR 1.02, 95% CI 0.82 to 1.28).
- There is insufficient evidence for numerous prioritized outcomes of interest (e.g., completion of ACOG recommended services and patient experience measures).
- Studies did not evaluate heterogeneity of treatment effect (whether some specific groups of patients may have had better, or worse, outcomes with televisits) or equity issues (whether classes of patients might be disadvantaged by use of televisits).
- Qualitative studies suggest that
    - Providers' perceive televisits may improve patients' access to care, continuity of care, and attendance at visits and may allow individuals with low-risk pregnancies to be safely managed at home. While some providers believe that televisits may reduce training opportunities for junior clinicians, others believe televisits increase team cohesion and case discussions between junior and senior clinicians. Some providers believe there is limited evidence on the value of televisits for routine antenatal care or that existing evidence is not universally recognized.
    - Patients and providers believe televisits may improve communication and relationship-building (though some believe it may hinder it), allow tailoring to the needs of patients, and (during the COVID-19 pandemic) protect patients from COVID-19 transmission.
    - Providers believe facilitators to implementation of televisits include providers' ease with technology and access to colleagues with experience with telemedicine, as well as guidelines on which types of visits are appropriate for televisits.
    - Some providers doubted patients' ability to describe their symptoms virtually and expressed discomfort in their own ability to deliver care with complex televisit technologies. They also expressed concerns about potential liability issues or changes to reimbursement policies associated with the delivery of televisits.
    - Training for staff (e.g., online modules) and regular leadership meetings to learn and refine processes were noted by providers and leadership as important facilitators, respectively. The need for "onerous" training however was perceived by some providers to be a barrier to the implementation of televisits for routine antenatal care. Providers also believe that leadership support during the transition can help facilitate the implementation of televisits (and conversely, lack of buy-in from leadership, can be a barrier).
    - Patients and providers noted system supports (e.g., guidance, technology support, translation services) and home monitoring are important adjuncts to televisits. Providers noted the importance of user-friendly technology to support engagement by both providers and patients.

- Patients and providers expressed concerns about safety and reduced quality of care with televisits.
- Providers expressed concerns of possible worsening of health disparities related to difficulty accessing Web-based visits and internet technologies in general and noted the need for audio and visual translation to minimize inequities particularly among non-English speaking patients.
- Providers and leadership noted that the implementation of televisits added clinic operational challenges.
- Providers noted concerns that patients' psychological apprehension with televisits and difficulty to initially set up televisits may pose a barrier to its uptake. Some patients noted a general desire to be able to choose to be seen in-person.
- While some providers reported patients' lack of privacy as a barrier others noted the attendance and participation of patient's families during televisits as a facilitator.

Summary of Findings

Overall, seven studies (in 9 publications) compared televisits (or hybrid visits) with in-person visits for routine antenatal care.[55-63] These included two RCTs,[55, 56] four NRCSs,[57-62] and one survey.[63] The studies mostly compared groups of patients who either had a hybrid schedule, including both televisits and in-person visits, with those who had in-person visits only. In contrast, the Futterman 2021 survey evaluated a single cohort of patients who had both televisits and in-person visits and asked them to compare the two visit types.[63] We, thus, present results from the survey separately below. Across studies, the number of televisits varied from one to six (Table 6). Three of the studies (Duryea 2021, Futterman 2021, and Palmer 2021) were conducted during the COVID-19 pandemic.[57, 58, 63]

Three studies were funded by nonindustry sources (Butler Tobah 2019, Duryea 2021, and Pflugeisen 2017), one was unfunded (Palmer 2021), and the other three did not report information on funding source. Pflugeisen 2016 and Pflugeisen 2017 both evaluated a "Virtual Visit" program, but the patients did not appear to overlap. Pflugeisen 2016 enrolled patients from 2011 to 2013. Pflugeisen 2017 contacted patients in 2016.

Tables in Appendixes C and D provide the design details, participant characteristics, detailed schedule data, and results.

Hybrid Visits Versus In-Person Visits

Six studies compared hybrid antenatal visit schedules (both televisits and in-person visits) with in-person antenatal visits only. Two were RCTs (Barbour 2017, Butler Tobah 2019)[55, 56] and four were NRCSs (Duryea 2021, Palmer 2021, Pflugeisen 2016, Pflugeisen 2017).[57-60] Except for Palmer 2021 (conducted in Australia), the studies were conducted in the United States, in Salt Lake City, Minnesota, Dallas, and around Seattle. The two RCTs included 200 and 267 patients each. Two NRCSs that compared pre- and post-pandemic periods (Duryea 2021 and Palmer 2021) were relatively large (N = 12,607 and 17,237), but neither compared hybrid visits during COVID-19 with in-person visits pre-pandemic or accounted for factors other than visit type that may have led to different outcomes during the pandemic. The remaining two NRCSs included 171 and 1058 participants. Palmer 2021 reported on two groups of pregnant individuals: "low" and "high" risk. These categories were not defined but high-risk individuals comprised 23 percent of the overall sample and had their care provided by obstetricians; they had more overall

and more in-person visits. Low-risk individuals were seen by midwives. Consistent with our eligibility criteria, we summarize the findings only for the low-risk cohort. Findings from the high-risk cohort were similar overall to those for the low-risk cohort and can be found in the primary article.[58]

Only four of the six studies reported the number of visits and timing of the televisits (Table 6), but all at least implied that ACOG (or equivalent) guidance was followed (approximately 10 to 14 scheduled visits depending on gestational age at presentation). One study (Palmer 2021) scheduled six televisits, two studies (Butler Tobah 2019 and Pflugeisen 2016) scheduled five antenatal televisits (and one additional postpartum televisit). One study (Duryea 2021 scheduled three televisits. The Barbour 2017 study (which was reported only as a conference abstract) stated only that five visits were in-clinic, but did not report the number of televisits. One study (Pflugeisen 2017) did not report visit timing and included participants who had at least one televisit. (The survey comparing experiences with both televisits and in-person visits, addressed in the next section, also did not report visit timing and included participants who had at least one televisit.) In the three studies (in two settings) that reported information, televisits were all conducted by nurse practitioners; in one of these (Butler Tobah 2019), the providers of in-person visits were not reported and in the other two (related) studies (Pflugeisen 2016, Pflugeisen 2017), in-person visits were conducted by obstetricians.

Among the five studies that reported data, the average ages of participants ranged from 27.7 to 31.4 years. Most participants included in three studies (Butler Tobah 2019, Pflugeisen 2016, Pflugeisen 2017) were White (72%-92%), one study (Duryea 2021) had a majority (76%) Hispanic patients, and two studies (Barbour 2017 and Palmer 2021) did not report information on race/ethnicity (Table 7). Among two studies that reported information on participants' body mass index (BMI), Duryea 2021 reported an average BMI of 29 at first encounter, Butler Tobah 2019 reported an average BMI of 26 with 15 percent of the participants having a BMI over 30 at enrollment (implied), and Palmer 2021 reported a median BMI of 25 (interquartile range 22 to 29). Three studies (Butler Tobah 2019, Pflugeisen 2016, Pflugeisen 2017) reported on participants' relationship status; the majority of participants were married, partnered, or co-habiting (71-97%). The studies varied in the percentage of patients who were nulliparous, ranging from 30 to 67 percent.

Limited information on participants' baseline morbidities or pregnancy risk factors was reported (Table 7). Barbour 2017 included parous patients with low-risk pregnancies at <16 weeks' gestation with a singleton. Butler Tobah 2019 included participants with low-risk pregnancies, defined as no concurrent medical or obstetric complications (e.g., hypertension, diabetes, preterm delivery history). Duryea 2021 included individuals who had a delivery of an infant weighing more than 500 g (live or stillbirth) but included participants with chronic hypertension (4.5%) and pregestational diabetes (1.9%). Notably, if the number of very-low weight infants differed between groups, this study would provide biased results related to other birth and infant outcomes. In Pflugeisen 2016, 30 percent of participants were tobacco users, 7 percent were illicit drug users, and 22 percent had a prior pregnancy loss. Pflugeisen 2017 included patients with low-risk pregnancies who were assessed and stratified as low risk by their physician (no specific criteria were reported). Duryea 2021 was conducted among patients with medical indigence (per source population) while all other studies included general population pregnant patients. In Palmer 2021, 6 percent of patients smoked during pregnancy (in high- and low-risk groups). The studies were conducted between 2004 and 2020.

The studies varied in the technologies used to enable televisits (Table 8), although most studies did not fully describe the technologies. Four studies (Barbour 2017, Palmer 2021, Pflugeisen 2016, Pflugeisen 2017) used Web-based videoconferencing, one study used only telephone visits (Duryea 2021), and one study used both Web-based and phone visits (Butler Tobah 2019). The study using only telephone visits (Duryea 2021) was conducted in a hospital system that serves a medically indigent population "without ready access to the resources and technologic literacy necessary to engage in video visits".[57]

Assessment of the RoB of the included studies are presented in Tables C-4-1 (RCTs) and C-4-2 (NRCSs). The two RCTs (Barbour 2017 and Butler Tobah 2019) did not report any issues that raise concerns of high risk of bias, except that neither study could blind patients or providers to the intervention. The Butler Tobah 2019 RCT was deemed to be at low risk of bias, but the Barbour 2017 was downgraded to medium risk of bias because reporting information was missing in this conference abstract. The four NRCSs that compared groups of patients who received hybrid or all in-person visits (Duryea 2021, Pflugeisen 2016, Pflugeisen 2017) were all deemed to be high risk of bias. Three studies did not adjust their findings for potential confounders or fundamental differences between groups of patients. Pflugeisen 2016 did adjust for baseline differences between groups with logistic regression; in addition, the providers differed between groups, confounding interpretation of the televisit intervention. As will be described, few studies evaluated any given outcome. Given the small number of studies per outcome, we could not formally assess risk of possible publication bias.

None of the studies evaluated or compared subgroups of patients or formally addressed heterogeneity of treatment effect (whether specific individuals or identifiable groups of patients may have better, or worse, outcomes than most patients with the implementation of televisits). Similarly, no eligible studies evaluated equity issues (whether classes of patients, such as non-English speakers or those without access to stable internet communication, might have been further disadvantaged or have had worse outcomes with the implementation of televisits).

Table 6. Timing of routine antenatal in-person and televisits (weeks)

Study	No. Visits	No. Televisits	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
Barbour 2017 [55]	NR	NR−5[a]	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Butler Tobah 2019 [56]	12[b]	5[c]	P	.	.	.	P	.	.	.	T	.	.	.	.	.	.	.	T	.	.	.	P	.	.	.	.	T	.	.	P	.	T	P	T	P
Duryea 2021 [57]	13	3	.	.	P	.	.	.	T	.	.	.	=	P	=	.	.	.	P	.	.	.	P	.	.	.	P		T	.	P	T	P	P	P	P
Futterman 2021[d] [63]	NR	≥1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Palmer 2021 [58]	9	6	=	=	=	T	=	=	=	=	T	.	.	.	.	.	T	.	.	.	.	.	P	.	.	T	.	.	T	.	P	.	T	.	.	P
Pflugeisen 2016 [59]	14[b]	5[c]	=	=	P	=	=	=	T	=	T	.	.	.	P	.	.	.	T	.	.	.	P	.	T	.	P	.	T	.	P	P	P	P	P	.
Pflugeisen 2017 [60]	NR	≥1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Study	No. Visits	No. Televisits	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41

Shaded rows, with no visits marked, indicate that the studies did not report visit timing (or number of televisits). The in-person visits are shaded blue and the televisits are shaded in pink for emphasis.

Abbreviations: . = no scheduled visit or visit schedule not reported, = = range of visit times, NR = not reported, P = in-person visits, T = televisits.

[a] Five visits were in-person.
[b] Plus two postpartum visits.
[c] Plus one postpartum televisit.
[d] Futterman 2021 is described separately (because it is a survey directly comparing televisits with in-person visits in patients having hybrid visits), but is included in this and other tables to enhance comparison with other studies.

Table 7. Study design and sample characteristics of studies addressing televisits

Topic	Study	Design Years Sample Size	Setting	Race/ Ethnicity	Risk Factors	Relationship Status	Insurance	Other Factors
Hybrid vs. in-person	Barbour 2017 [55]	RCT NR N=200	NR Salt Lake City, UT	NR	Excluded	NR	NR	NR
Hybrid vs. in-person	Butler Tobah 2019[56]	RCT 2014-2015 267	Mayo Clinic, Rochester, MN	White 91%	Excluded	Married/ marriage-like relationship 97%	Private 88%	College graduate 69%
Hybrid vs. in-person	Duryea 2021[57]	Pre-Post 2020 vs. 2019 N=12,607	Parkland Hospital, Dallas, TX	Hispanic 76% White 4% Black 17%	Excluded	NR	Medicaid or CHIP 86% Self-pay or free care 8% Commercial insurance 6%	Nulliparous 30% Medical indigence 100%
Hybrid vs. in-person	Palmer 2021 [58]	Pre-Post 2018-3/2020 vs. 4-7/2020 N=17,237	Monash Health, Victoria, Australia	NR	Excluded	NR	National 100%	Nulliparous 40%
Hybrid vs. in-person	Pflugeisen 2016 [59]	NRCS 2011-2013 N=1058	MultiCare Health System South Puget Sound, WA	White 74%	Excluded	Partnered 73%	NR	Nulliparous 67% WIC 34%
Hybrid vs. in-person	Pflugeisen 2017 [60]	NRCS 2013-2016 N=171	MultiCare Health System South Puget Sound, WA	White 77%	Excluded	Partnered 91%	Subsidized insurance 32%	Prior pregnancy loss 22%
Televisit vs. in-person	Futterman 2021[a] [63]	NRCS 2020 (survey) N=104	NYC Health + Hospitals / Metropolitan, NYC, NY	Hispanic 74% Black 13% White 9%	Care for high-risk (not explicitly defined) 28%	NR	NR	Nulliparous 27% English speaking 46% Online access to personal medical record 35% Prior cesarean delivery 17% Poor obstetrical history 5%

Rows are shaded blue or pink only to distinguish the topics listed in the first column.

Abbreviations: CHIP = Children's Health Insurance Program, NA = not applicable, NR = not reported, NRCS = nonrandomized controlled study, RCT = randomized controlled trial, WIC = Women Infants & Children Supplemental Nutrition Program.

[a] Futterman 2021 is described separately (because it is a survey directly comparing televisits with in-person visits in patients having hybrid visits), but is included in this and other tables to enhance comparison with other studies.

Table 8. Description of televisits

Topic	Study	Participants, N	No. Televisits	Televisit Technology	Providers	Home Monitoring	During COVID-19 Pandemic
Hybrid vs. in-person	Barbour 2017 [55]	200	NR	Web-based platform	NR	Patients entered weight, blood pressure, and fetal heart rate into the electronic medical record patient portal	No
Hybrid vs. in-person	Butler Tobah 2019 [56]	267	5	Phone or online	Televisits: NP In-person: NR	Home blood pressure and fetal heart rate evaluation (with handheld fetal Doppler) Also: online antenatal care community social network	No
Hybrid vs. in-person	Duryea 2021 [57]	12,607	3	Telephone	NR	None (implied)	Yes (versus prior to pandemic)
Hybrid vs. in-person	Palmer 2021 [58]	17,237	6	Video conferencing	MW	Added suite of information sheets, home blood pressure monitoring, self-measured symphyseal-fundal heights	Yes (versus prior to pandemic)
Hybrid vs. in-person	Pflugeisen 2016 [59]	1058	5	Video conferencing	Televisits: NP In-person: OB	OBCareConnect™ with home blood pressure and fetal heart rate evaluation (with handheld fetal Doppler)	No
Hybrid vs. in-person	Pflugeisen 2017 [60]	171	≥1	Video conferencing	Televisits: NP In-person: OB	OBCareConnect™ with home blood pressure and fetal heart rate evaluation (with handheld fetal Doppler)	No
Televisit vs. in-person	Futterman 2021[a] [63]	104	≥1	NR	Physician 60% Midwife 40%	None (implied)	Yes

Rows are shaded blue or pink only to distinguish the topics listed in the first column.

Abbreviations: MW = midwife, NP = nurse practitioner, NR = not reported, OB = obstetrician, RN = registered nurse.

[a] Futterman 2021 is described separately (because it is a survey directly comparing televisits with in-person visits in patients having hybrid visits), but is included in this and other tables to enhance comparison with other studies.

Study results are organized by outcome. We first describe outcomes related to prioritized outcomes for which there are data (pertaining to maternal psychosocial, preference, and related outcomes; fetal, neonatal, and infant outcomes; care utilization; and harms). These are followed by other included outcomes; other included outcomes that were reported by only a single study are grouped together at the end of the list of outcomes.

Across studies, for all outcomes, there were no reported analyses of subgroups, subgroup differences, or heterogeneity of treatment effect. Except as noted, study findings were consistent with each other (generally finding no significant differences) such that no discernable differences could be found across studies that may suggest actual differences in effect by patient, provider, clinic, or other differences.

Prioritized Outcomes (Hybrid Visits Versus In-Person Visits)

We evaluated the strength of evidence for prioritized outcomes (Table 9).

In general, outcomes were sparsely reported across studies. No outcome was evaluated by both RCTs. Low-strength evidence from studies comparing hybrid (televisits and in-person visits) and all in-person visits did not indicate differences in rates of preterm births or NICU admission of the newborn. However, there is low-strength evidence that satisfaction with antenatal care was greater in patients receiving hybrid visits. Several prioritized outcomes were not reported or were reported by only a single eligible study, precluding conclusions. These included maternal stress, lost work time, gestational age at birth, low birthweight, Apgar score (and abnormal cord blood pH), and completion of ACOG recommended services.

Table 9. Evidence profile for hybrid (televisits and in-person) versus in-person visits

Outcome[a]	No. Studies (Subjects)	Risk of Bias	Consistency	Precision	Directness	Other	Overall SoE	Conclusion Statements
Maternal QoL	0	N/A	N/A	N/A	N/A	N/A	Insufficient	No evidence
Maternal anxiety or depression	0	N/A	N/A	N/A	N/A	N/A	Insufficient	No evidence
Maternal stress	1 RCT [56] (267)	Low	N/A	Precise	Direct	Single study	Insufficient	No conclusion
Satisfaction with antenatal care	1 RCT [56] (267) 1 NRCS [60] (1170)	Moderate	Consistent	Precise	Indirect[b]	None	Low	Greater satisfaction with televisits
Lost work time	1 RCT [55] (200)	Moderate	N/A	Precise	Direct	Single study	Insufficient	No conclusion
Preterm birth	1 RCT [56] (267) 3 NRCSs [57-59] (30,949)	High	Consistent	Mixed[c]	Direct	None	Low	No evidence of a difference Summary OR 0.93 (0.84, 1.03)
Gestational age at birth	1 NRCS [59] (1058)	Moderate	N/A	Precise	Direct	Single study	Insufficient	No conclusion
Small for gestational age	0	N/A	N/A	N/A	N/A	N/A	Insufficient	No evidence
Low birth weight	1 RCT [56] (267) 1 NRCS [58] (17,237)	Moderate	Consistent	Mixed[c]	Direct	None	Insufficient[d]	No conclusion
Apgar score	1 RCT [56] (267)[e]	Low	N/A	Imprecise	Direct	Single study	Insufficient	No conclusion
Breastfeeding	0	N/A	N/A	N/A	N/A	N/A	Insufficient	No evidence
Completion of ACOG recommended services	1 RCT [56] (267)	Low	N/A	Precise	Direct	Single study	Insufficient	No conclusion
Unplanned visits	0	N/A	N/A	N/A	N/A	N/A	Insufficient	No evidence
NICU admissions	3 NRCSs [57-59] (30,949)	High	Consistent	Precise	Direct	None	Low	No evidence of a difference Summary OR 1.02 (0.82, 1.28)
Delayed diagnoses	0	N/A	N/A	N/A	N/A	N/A	Insufficient	No evidence

Abbreviations: ACOG = American College of Obstetricians and Gynecologists, MD = mean difference, N/A = not applicable, NICU = neonatal intensive care unit, NICU = neonatal intensive care unit, NRCS = nonrandomized (observational) comparative study, NS = not statistically significant, OR = odds ratio (with 95% confidence interval), QoL = quality of life, RCT = randomized controlled trials, SoE = strength of evidence.

[a] The evidence profile includes only outcomes prioritized by stakeholders.
[b] The RCT used a validated measure. The NRCS designed their own Likert scale measure.
[c] The RCT was highly imprecise.
[d] The RCT was highly imprecise; thus, only the single NRCS provided interpretable evidence. Since the conclusion is based on a single, high risk of bias NRCS, we conclude there is insufficient evidence.
[e] One additional NRCS (N = 12,607) reported on abnormal arterial cord blood pH.

Mental Health

Pregnancy-Related Stress

One RCT (Butler Tobah 2019) reported on pregnancy-related stress as an outcome using the PreNatal Maternal Stress survey at 14, 24, and 36 weeks of gestation. Patients having hybrid visits reported having statistically significant less pregnancy-related stress than patients having in-person visits at 14 weeks (on a 2-point scale, MD −0.09, 95% CI −0.14 to −0.04) and 36 weeks (MD −0.06, 95% CI −0.11 to −0.01). Stress levels were not found to be different at 24 weeks. There was no indication of clinical importance of the differences.

Based on the single study, there is insufficient evidence to yield a conclusion regarding the effect of televisits on maternal stress (Table 9).

Patient Satisfaction With Antenatal Care

One RCT (Butler Tobah 2019) and one NRCS (Pflugeisen 2017) reported on patient satisfaction with antenatal care. The Butler Tobah 2019 RCT measured patient satisfaction by using the Modified Littlefield and Adams 16 item self-reported validated satisfaction subscale survey. Patients having hybrid visits reported a significantly higher level of satisfaction than those receiving in-person visits (on a 100-point scale, MD 15.0, 95% CI 13.4 to 16.6). The unadjusted Pflugeisen 2017 NRCS reported a higher score on overall rating of antenatal care among patients in the hybrid group compared with the all in-person group (on a 5-point Likert scale, MD 0.25, 95% CI 0.06 to 0.44) but no difference in scores for satisfaction with televisits versus in-person visits (MD 0.11, 95% CI −0.14 to 3.35). There was no indication of clinical importance of the differences.

The two studies found higher satisfaction with use of hybrid visits (although one study found no difference in satisfaction with the televisits versus the in-person visits). However, given small number of studies, the methodological limitations (particularly the lack of adjustment in the NRCS), and the lack of validation of the satisfaction measure in the NRCS, we deemed there to be low SoE suggesting increased patient satisfaction with use of televisits.

Lost Time

One RCT (Barbour 2017) reported on lost time including lost personal time and lost work time. Lost personal time was less among patients having hybrid visits compared to those having in-person visits (MD −1.28 hours, 95% CI −2.44 to −0.13). The difference in work time lost was similar to personal time, but the difference between groups was not statistically significant (MD −1.27 hours, 95% CI −3.11, 0.56).

Based on the single study, there is insufficient evidence to yield a conclusion regarding the effect of televisits on lost time (Table 9).

Delivery Timing, Gestational Age, and Infant Size

As for studies of routine visit schedules, the prioritized outcomes related to delivery timing, gestational age, and infant size are highly correlated measures. Nevertheless, across studies, each measure (preterm birth, gestational age at birth, small for gestational age, and low birth weight) was reported as an independent outcome. Thus, for example, the outcome low birth weight does not account for gestational age.

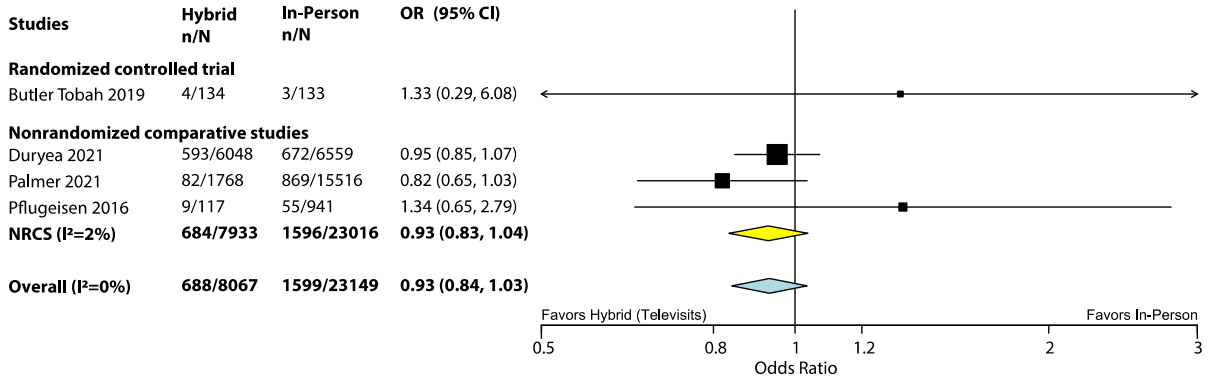
Preterm Birth

One RCT (Butler Tobah 2019) and three NRCSs (Duryea 2021, Palmer 2021, Pflugeisen 2016) reported on preterm birth (birth <37 weeks). All four studies found that preterm birth occurred at similar rates between patients having hybrid visits and in-person visits for antenatal care. The effect sizes across studies ranged from 0.96 to 1.34; the RCT provided a highly imprecise effect size estimate with few preterm birth events. Meta-analysis of the three NRCSs yielded a nonsignificant difference in risk of preterm births by visit type (OR 0.93, 95% CI 0.84 to 1.04; P=0.18); addition of the highly imprecise RCT did not affect the estimate (Figure 6). Of note, the two studies that trended toward lower risk of preterm births with hybrid visits (Duryea 2021 and Palmer 2021) both compared hybrid visits during the COVID-19 pandemic with in-person visits pre-pandemic. Neither study attempted to adjust for underlying differences between pre-pandemic and pandemic era patients such as change in work status, office work, societal stressors, and changes in diet and exercise.

The Duryea 2021 NRCS also reported births <34 weeks, with similar rates reported between the two groups (3.3% vs. 3.1%, unadjusted RR 1.08, 95% CI 0.89 to 1.31).

Overall, we found low SoE of no evidence of a difference between hybrid visits (with televisits) and all in-person visits in preterm birth (Table 9). Our confidence was reduced due to methodological limitations of the studies and a lack of precision in findings in the RCT.

Figure 6. Meta-analysis of hybrid versus in-person visits: Preterm births (RCT and NRCSs)



Abbreviations: CI = confidence interval NRCSs = nonrandomized comparative studies, OR = odds ratio, RCT = randomized controlled trial..

Gestational Age at Birth

One NRCS (Pflugeisen 2016) reported on gestational age at birth. Similar gestational ages at birth (38.9 weeks vs. 39.1 weeks) were reported between patients having hybrid visits and in-person visits for antenatal care.

Based on the single study, there is insufficient evidence to yield a conclusion regarding the effect of televisits on gestational age at birth (Table 9).

Low Birth Weight

One RCT (Butler Tobah 2019) and one NRCS (Palmer 2021) reported on low birth weight. The RCT had few low-birth-weight infants (defined as <2500 g) and thus provided a highly imprecise estimate of effect size (OR 0.49, 95% CI 0.04 to 5.50) between groups. The NRCS reported on multiple definitions of low birth weight but found no differences between groups for any outcome. The OR for singletons at <3rd percentile was 1.06 (95% CI 0.76 to 1.49), for full-term singletons at <3rd percentile was imprecise at 0.95 (95% CI 0.46 to 1.97), and for singletons at <10th percentile was 0.97 (95% CI 0.82 to 1.15).

We found there is insufficient evidence to yield a conclusion regarding the effect of televisits on low birth weight (Table 9). The RCT was highly imprecise; thus, only the single NRCS provided interpretable evidence. Since the conclusion is based on a single, high risk of bias NRCS, we conclude there is insufficient evidence.

Apgar Score

One RCT (Butler Tobah 2019) reported on infants with an abnormal Apgar score (<7). The study had few low Apgar events and thus provided a highly imprecise estimate of effect size (OR 1.50, 95% CI 0.25 to 9.12) between groups. The analysis did not account for gestational age.

Based on the single study, there is insufficient evidence to yield a conclusion regarding the effect of televisits on Apgar score (Table 9).

Abnormal Umbilical Cord Blood

One NRCS (Duryea 2021) reported on umbilical cord blood pH <7.0. Similar rates (0.3% vs. 0.4%, RR 0.84, 95% CI 0.46 to 1.62) were reported between patients having hybrid visits and those having in-person visits for antenatal care.

Completion of ACOG Recommended Services

One RCT (Butler Tobah 2019) reported on completion of ACOG recommended services at 36 weeks of gestation. The study found no significant difference between patients having hybrid visits and those having in-person visits in terms of having influenza vaccine (80.2% vs. 83.8, P = 0.44), Tdap booster (90.8% vs. 90.0%, P = 0.82), mid-pregnancy education (96.6% vs. 94.6%, P = 0.35), group B Streptococcus screening (97.7% vs. 99.2%, P = 0.32), and depression screening (99.2% both groups).

Based on the single study, there is insufficient evidence to yield a conclusion regarding the effect of televisits on completion of ACOG recommended services (Table 9).

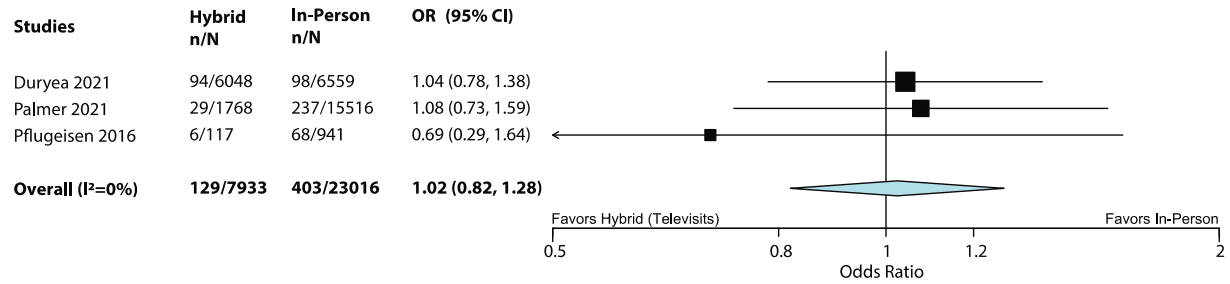
Neonatal Intensive Care Unit Admission

Three NRCSs (Duryea 2021, Palmer 2021, Pflugeisen, 2016) reported on NICU admission. All found no significant differences in NICU admissions between groups with ORs ranging from

0.69 to 1.08. Meta-analysis of the three NRCSs found no difference in risk of NICU admission by visit type (OR 1.02, 95% CI 0.82 to 1.28) (Figure 7).

Overall, we found low SoE of no evidence of a difference between hybrid visits (with televisits) and all in-person visits in NICU admission (Table 9). Our confidence was reduced due to methodological limitations of the unadjusted NRCSs.

Figure 7. Meta-analysis of hybrid versus in-person visits: NICU admission (NRCSs)



Abbreviations: CI = confidence interval, NICU = neonatal intensive care unit, NRCSs = nonrandomized comparative studies, OR = odds ratio.

Prioritized Outcomes Not Reported by Eligible Studies

Numerous outcomes of interest to stakeholders were not evaluated by eligible studies. Among the prioritized outcomes, these include:

- Maternal psychosocial, preference, and related outcomes
  - Quality of life
  - Anxiety or depression
- Fetal, neonatal, and infant outcomes
  - Small for gestational age
  - Breastfeeding
- Resource use
  - Unplanned visits
- Harms
  - Delayed diagnoses (e.g., gestational diabetes)

Other Outcomes (Hybrid Visits Versus In-Person Visits)

Pre-Eclampsia

One NRCS (Pflugeisen 2016) reported on pre-eclampsia only, a second NRCS (Duryea 2021) reported on pre-eclampsia with severe features only, and a third NRCS (Palmer 2021) reported on both. Pflugeisen 2016 reported a higher rate of pre-eclampsia (8.5% vs. 3.4%, OR 2.65, 95% CI 1.27 to 5.55) among patients having hybrid visits than those having in-person visits. In contrast, Palmer 2021 reported similar rates of pre-eclampsia (2.8% vs. 2.9%, OR 0.94, 95% CI 0.70 to 1.27). Both Palmer 2021 and Duryea 2021 also reported similar rates of pre-eclampsia with severe features. However, the rates of reported preeclampsia with severe features were very different between studies. In Palmer 2021, 0.11% (hybrid) and 0.13% (in-person) experienced the outcome, yielding an imprecise OR (0.88, 95% CI 0.20 to 3.75). In contrast, Duryea 2021 reported much higher rates of pre-eclampsia with severe features that were also similar between groups (10.7% vs. 10.6%, RR 1.01, 95% CI 0.91 to 1.12). In a personal

communication with the authors of Duryea 2021, the hospital system in Dallas, Texas, uses a "conservative" approach toward defining severe features and determining whether to implement magnesium sulfate treatment (2+ urine protein *or* headache). Their reported rate of severe pre-eclampsia is consistent with the overall rate at their hospital system.

Cesarean Delivery

One RCT (Butler Tobah 2019) and one eligible NRCS (Pflugeisen 2016) reported on cesarean delivery. Both studies found no significant difference in rate of cesarean deliveries between groups (RCT OR 0.82, 95% CI 0.41 to 1.65; NRCS adjusted OR 0.71, 95% CI 0.45 to 1.12). The NRCS was adjusted for gestational age, age, gestational diabetes, pre-eclampsia, smoking, and drug use, but, notably, not factors related to patient or obstetrician preferences.

Patient Travel

Two RCTs (Butler Tobah 2019, Barbour 2017) reported on patient travel-related outcomes. Butler Tobah 2019 reported driving cost and total miles driven. Compared to patients having in-person visits, Butler Tobah 2019 reported that a hybrid visit schedule resulted in a small, but statistically significant, difference in driving costs (median values $2.8 vs. $3.5, P=0.032) and total miles driven (median difference: −6.8, P=0.032).

Barbour 2017 reported on travel time and travel time cost. Compared to patients having in-person visits, the study reported saved travel time (MD −0.83 hours, 95% CI −1.18 to −0.48) and saved travel time cost (MD −$35.66, 95% CI −68.61 to −2.72) among patients having hybrid visits.

Stillbirth or Miscarriage

One RCT (Butler Tobah 2019) and two NRCSs (Duryea 2021 and Palmer 2021) reported outcomes related to stillbirth or miscarriage. The Butler Tobah 2019 RCT reported similar rates of miscarriage (2.2% vs. 2.3%, OR 0.99, 95% CI 0.20 to 5.01) between the two groups. Both NRCSs compared pre-pandemic and pandemic eras but did not adjust for potential confounders. The Duryea 2021 NRCS reported on stillbirth and found similar rates (0.5% vs. 0.6%, OR 0.79, 95% CI 0.49 to 1.27) between patients having hybrid visits and in-person visits for antenatal care. The Palmer 2021 NRCS also found similar rates (0.6% vs. 0.7%, OR 0.92, 95% CI 0.49 to 1.71) between the two groups.

Other Outcomes Reported by a Single Study Each

The Pflugeisen 2016 NRCS reported similar rates of **gestational diabetes** (17.9% vs. 16.4%, OR 1.12, 95% CI 0.68 to 1.85), **unplanned hospital admissions** (19.7% vs. 24.8%, OR 0.74, 95% CI 0.46 to 1.20), and at least one **emergency room/urgent care center encounter** (7.7% vs. 10.6%, OR 0.70, 95% CI 0.34 to 1.43) between patients having hybrid visits and in-person visits for antenatal care.

The Duryea 2021 NRCS reported similar unadjusted rates of **gestational hypertension** (19.0% vs. 20.1%, RR 0.94, 95% CI 0.88 to 1.01, P=0.10), **placental abruption** (0.7% vs. 0.9%, OR 0.77, 95% CI 0.52 to 1.16), **hysterectomy** (0.2% vs. 0.4%, OR 0.54, 95% CI 0.28 to 1.05, P=0.07), and **postpartum hemorrhage**, defined as blood loss greater than 1000 ml (9.4% vs. 8.8%, RR 1.07, 95% CI 0.95 to 1.19). The study, however, reported that patients having hybrid visits were less likely to require a **transfusion** than those having in-person visits (3.6% vs. 4.3%, RR 0.71, 95% CI 0.71 to 1.00, P=0.049) in an unadjusted analysis. Similar results were found

after adjusting for race/ethnicity and BMI at delivery, although this adjustment for factors measured after the intervention seemed inappropriate. The study also reported lower incidence of **vaginal forceps assisted delivery** among patients having hybrid visits than in-person visits (1.4% vs. 1.8%, OR 0.75, 95% CI 0.57 to 0.99) and a lower rate of **shoulder dystocia** (0.2% vs. 0.5%, RR 0.49, 95% CI 0.26 to 0.92) among patients having hybrid visits than those having in-person visits for antenatal care.

The Palmer 2021 NRCS reported on **induction of labor f**or suspected fetal growth restriction (for singletons), finding no difference between hybrid and all in-person groups (4.6% vs 4.3%, OR 1.08, 95% CI 0.86 to 1.37). The study also reported on **attendance of visits**. While there was a large increase in lack of attendance of scheduled visits during the COVID-19 pandemic (9.2%) and pre-pandemic (5.2%), there was only a small but statistically significant, difference in rates of lack of attendance between televisits and in-person visits during the pandemic (8.5% vs. 7.2%, OR 1.18, 95% CI 1.07 to 1.31).

The Barbour 2017 RCT reported on **patient financial costs** (USD), and it found that personal time costs were saved (MD −$24.8, 95% CI −47.0 to −2.6) among patients having hybrid visits compared to those having in-person visits. The difference in work time costs was similar to personal time costs, but not statistically significant (MD −$25.1, 95% CI −60.0 to 9.9).

Televisits Versus In-Person Visits

One survey study (Futterman 2021) compared patient satisfaction with televisits versus in-person visits among patients who had hybrid care (i.e., they had both televisits and in-person visits).[63] The study was conducted in the New York City region during the COVID-19 pandemic from March 1 to May 1, 2020. The average age of the 104 included patients was 31.2 years, 46 percent were English speakers, and 74 percent were Hispanic. Race was unknown for the large majority of participants. Most participants (73%) were multiparous, and 17 percent had prior cesarean delivery. The majority (72%) received low-risk level of care while 28 percent received high-risk level of care. Antenatal care was provided by either physicians (60%) or midwives (40%).

Patient Satisfaction With Antenatal Care

The only reported outcome reported by Futterman 2021[63] pertinent to this review was patient satisfaction measured by Short Assessment of Patient Satisfaction (SAPS). The SAPS survey was conducted by phone. The survey includes seven questions, each of which is scored from 0 to 4, with higher scores indicating greater satisfaction. The study reported that total SAPS scores of 0 to 10 indicate “very dissatisfied”, 11 to 18 “dissatisfied”, 19 to 26 “satisfied”, and 27 to 28 “very satisfied”. The study reported median scores for all participants and compared various subgroups.

The study found a lower level of satisfaction, overall, with televisits than in-person visits (median scores 20 vs. 24, P=0.008), but both median scores were in the “satisfied” range. Among 104 participants, 10 were dissatisfied with televisits, while seven were dissatisfied with in-person visits (P=0.45). Among the participants, 67 percent were “satisfied” with televisits and 69 percent were “satisfied” with in-person visits.

The study reported median satisfaction for different subgroups of participants finding very similar median scores in all subgroups (televisit median scores 22 to 23 vs. in-person median scores 22 to 25.5). While statistically significant differences between satisfaction with televisits and in-person visits were found in some subgroups, favoring in-person visits, the findings are

somewhat difficult to interpret because all median scores are within the "satisfied" range. Statistically significant differences (favoring in-person visits) were found among multiparous patients, English-speaking patients, non-Hispanic patients, those receiving low-risk care, and those receiving care from midwives (although the reported median scores for the subgroup seen by midwives were identical to each other). Furthermore, the study did not account for multiple testing across multiple subgroups. The study also compared different subgroups' satisfaction with televisits (separate from comparisons of televisits and in-person visits), but found no statistically significant differences; although, the study was unlikely to be powered for multiple subgroup analyses.

Incorporating this study with the two studies comparing hybrid (televisits and in-person) visits versus in-person visits alone (Table 9) would add inconsistency. We would, thus, deem there to be inadequate evidence with no conclusion.

Qualitative Evidence Pertaining to Televisits

Five studies (Madden 2020, Mary 2021, Peahl 2021, Quinn 2021, and Stanhope 2022) provided qualitative data on televisits for routine antenatal care.[64-68] Four studies were based in the United States and one study (Quinn 2021) was based in England.

Madden 2020 explicitly sought to understand providers' experiences with transitioning to use of televisits; both providers and clinic leadership were surveyed.[64] The study interviewed 11 providers (including "operations leaders"), mostly (83%) physicians, but not patients, at two affiliated New York City hospitals.

Mary 2021 sought to explore the implementation of a new perinatal telemedicine network linking Level I and II hospitals with the Level IV hospitals in Maryland.[65] The telemedicine network included both a new system for conducting televisits and telemedicine communications among the hospitals and the clinicians. The study interviewed 24 obstetric clinicians (nurse, nurse-midwives, obstetricians) and "telemedicine experts", but not patients.

Peahl 2021 sought to understand institutional-level adoption and patient and provider experiences with an antenatal care model implemented due to the COVID-19 pandemic, which was largely delivered via televisits.[66] The study sought patient, provider, and clinic leadership perspectives. The study sent questionnaires with open-ended responses to 203 patients (26% of sample) and providers at affiliated hospitals around Ann Arbor, Michigan. The patients were mostly White (71%), with few Black or Hispanic patients (<5%). Patients mostly had private insurance (78%) and were well-educated (2/3 with bachelors or advanced degree). The providers were mostly physicians with general obstetrics and gynecology (35%) or family medicine (38%) practices; 12 percent of providers were certified nurse-midwives.

Quinn 2021 sought to assess the experiences of patients and healthcare providers with virtual antenatal clinic appointments during the COVID-19 pandemic.[67] The study sent questionnaires with open-ended responses to 240 patients and 45 healthcare professionals (both clinical staff delivering virtual care and clerical staff organizing virtual care) in a tertiary obstetric unit in Leicester, England who experienced at least one virtual consultation. The patient and healthcare professional surveys had a 62% (148/240) and 82% (37/45) response rate, respectively. Patient respondents were typically multiparous (90%), had an average age of 31 years, and were predominantly White (79%). Healthcare professional respondents reflected diverse clinical roles (consultants 38%, registrars 38%, junior doctors 16%, and midwives 4%) with diverse years of obstetric experience and experience with virtual consultations.

Stanhope 2022 sought to assess patients' perceptions of quality of care and their satisfaction with care following changes to delivery of care during the COVID-19 pandemic in a hospital in Atlanta, Georgia.[68] The study employed a sequential mixed-methods design, first surveying patients with a quantitative survey followed by in-depth interviews with a purposive sample of those who consented to be contacted for further information. Sixteen individuals participated in the interviews, the majority of whom were non-Hispanic Black, between 20 and 35 years old, multiparous, and Medicaid-insured.

All studies except Quinn 2022 conducted thematic content analysis to identify themes within the qualitative data relevant to their study questions. Quinn 2022 reported findings from open-ended responses but did not report their qualitative analysis methods. We considered the reporting of the qualitative findings to be thin in this study due to sparse reporting or analysis of their open-ended text data.

Madden 2020, Mary 2021, and Stanhope 2022 were assessed to have low risk to rigor. Peahl 2021 and Quinn 2021 was assessed to have moderate risk to rigor due to limited conduct (and/or reporting) of qualitative methods and analysis plans, and a lack of consideration of the relationship between researcher and participants. Appendix C Table C-4-3 summarizes the risk to rigor assessment of the studies. With the exception of the domain of optimism, which was based on the finding of one thin study with moderate risk to rigor (Quinn 2021), all synthesized findings had no concerns or minor concerns with risks to rigor (Appendix Table D-3-4). We had no concerns or minor concerns with the coherence of findings (i.e., the synthesized findings reflected the complexity and variation of the data) but minor to moderate concerns with the adequacy of findings due to the limited number of studies, geographical/health setting, and population representation.

We coded data provided by the five studies into eight of the TDF domains including: knowledge; skills; beliefs about capabilities; optimism; beliefs about consequences; environmental context and resources; social influences; and emotion. We did not find evidence from extracted qualitative data for the remaining six TDF domains: social/professional role and identity; reinforcement; intentions; goals; memory, attention, and decision processes or behavioral regulation. Table 10 summarizes the barrier and facilitator themes related to adopting televisits for routine antenatal care. Themes are presented with the eight TDF domains identified, organized by whether the themes related to patients, providers, or the clinic/office. Providers, some of whom were also in clinic leadership positions, discussed their own, but also perceived patient and health system perspectives. No study provided data on partner perspectives.

Appendix D Table D-3-3 provides the extracted text from studies linked to their synthesized themes. Appendix D Table D-3-4 is the GRADE-CERQual table summarizing findings and conclusions for each TDF theme. One finding (related to the TDF domain of environmental context and resources) was supported by five studies, two findings (related to the TDF domains of beliefs about consequences and emotion) were supported by four studies, two findings (related to the TDF domains of knowledge and skills) were supported by three studies, one finding (related to the TDF domain of social influences) was supported by two studies, and two findings (related to the TDF domains beliefs about capabilities and optimism) were supported by one study.

TDF Domain: Knowledge

Two studies (Madden 2020, Mary 2021) provided evidence pertaining to knowledge. Some providers believed there was limited evidence to justify the use of televisits in routine obstetric

care; others believed the value of perinatal telemedicine services are not universally recognized. Providers would value guidelines on which types of antenatal visits are (or are not) appropriate for televisits.

TDF Domain: Skills

Three studies (Madden 2020, Mary 2021, Peahl 2021) provided evidence pertaining to skills. Providers perceived the lack of IT (information technology) literacy to be a barrier to implementing televisits for themselves and their patients, as were the onerous training required for providers and patients' difficulty in initial televisit set up. Both providers and patients saw a need for increased preparation and setting of expectations. Providers' ease with technology was viewed as a facilitator to implementing televisits. Providers and leadership noted that clinics need time to train and incorporate televisit systems. It was suggested (by providers and clinic leadership) that training for staff and regular leadership meetings to refine televisit processes may ease the transition to televisit care.

TDF Domain: Beliefs About Capabilities

One study (Mary 2021) provided evidence pertaining to beliefs about capabilities. The study reported that providers perceived that patients have difficulties describing their symptoms virtually. Providers also perceived that televisits add complexity to service delivery and express discomfort with navigating the technology.

TDF Domain: Optimism

One study (Quinn 2021) provided thin evidence pertaining to optimism, suggesting that patients were initially skeptical about televisits but that these concerns were alleviated once they tried it.

TDF Domain: Beliefs About Consequences

Four studies (Madden 2020, Peahl 2021, Stanhope 2022, Quinn 2021) provided evidence pertaining to beliefs about consequences. The studies reported that patients and providers were concerned about safety and reduced quality of care with televisits, but they also believed it allows care to be tailored to the needs of the patients and protects patients, providers, and clinics from COVID-19. Providers valued how televisits ensure continued access to care, allow individuals with low-risk pregnancies to be managed at home, and improve patient attendance at visits. While some patients and providers believed that televisits enhance communication and relationship building between patients and providers, others did not. Additionally, while some providers believed televisits reduce training opportunities for junior clinicians, others believed televisits increase team cohesion between junior and senior clinicians.

TDF Domain: Environmental Context and Resources

All five studies provided evidence pertaining to environmental context and resources (Madden 2020, Mary 2021, Peahl 2021, Stanhope 2022, Quinn 2021). Providers noted that transitioning to use of televisits is challenging for patient populations with health disparities and those with difficulty accessing necessary technologies. Patients and providers emphasized the importance of home monitoring device use in conjunction with virtual visits and providers valued system supports (e.g., guidance, technology support, translation services). Providers noted concerns about liability issues and changes in reimbursement as potential barriers to the

implementation of televisits. It was also noted by providers and clinic leadership that organizations may find that implementing televisits can add challenges to clinic operations, but providers noted that clinic leadership support for office staff, providers, and patients can ease these barriers. Lack of buy-in from leadership was viewed by providers as a barrier.

TDF Domain: Social Influences

Two studies (Madden 2020 and Mary 2021) provided evidence pertaining to social influences. Providers reported that access to colleagues with prior telehealth experience may help them adopt televisits. Mixed findings were noted for patients' privacy: while some providers reported patients' lack of privacy as a barrier to the implementation of televisits for prenatal care, others noted the ability of patient's families to attend and participate in televisits as a facilitator.

TDF Domain: Emotion

Four studies (Madden 2020, Mary 2021, Stanhope 2022, Quinn 2021) provided evidence pertaining to emotion. The studies reported that providers perceived that patients' psychological apprehension with televisits and general preference for in-person visits may pose a barrier to the uptake of telehealth technology. However, providers noted that patients' appreciation for continuity of care and humanized interaction may be a facilitator.

Table 10. Coding extracts for antenatal televisits into the Theoretical Domains Framework

Domain	Patient-Related Themes	Provider-Related Themes	Clinic/Office-Related Themes
Knowledge	Barriers: • [No data] Facilitators: • [No data]	Barriers: • Provider perspective: Limited evidence on the use of telehealth for routine obstetrics (Madden 2020)[64] • Provider perspective: The value of [perinatal telemedicine] services was not universally recognized (Mary 2021)[65] Facilitators: • [No data]	Barriers: • [No data] Facilitators: • Provider perspective: Development of guidelines on which antenatal visits are appropriate for telehealth (Madden 2020)[64]
Skills	Barriers: • Provider perspective: Difficult to initially set up (Madden 2020; Mary 2021)[64, 65] • Patient and provider perspectives: Need for increased preparation and setting of expectations (Peahl 2021)[66] • Provider perspective: No or limited IT literacy (Mary 2021)[65] Facilitators: • [No data]	Barriers: • Patient and provider perspective: Need for increased preparation and setting of expectations (Peahl 2021)[66] • Provider perspective: No or limited IT literacy (Mary 2021)[65] • Provider perspective: Need for onerous training (Mary 2021)[65] Facilitators: • Provider perspective: [Providers'] ease of use of telehealth technology (Madden 2020)[64]	Barriers: • Provider perspective: [Clinic's] rapid uptake (Madden 2020)[64] • Provider and leadership perspectives: Time and training needed to familiarize staff with telehealth technology and guidelines (e.g., which patients to schedule in person vs. telehealth) (Madden 2020)[64] Facilitators: • Provider perspective: [Clinic's] online modules for support staff (Madden 2020)[64] • Leadership perspective: Regular leadership meetings to learn and refine telehealth processes (Madden 2020)[64]
Beliefs about capabilities	Barriers: • Provider perspective: Difficulty in describing symptoms virtually (Mary 2021)[65] Facilitators: • [No data]	Barriers: • Provider perspective: Perception of the added complexity telemedicine brings to service delivery and discomfort with new technology (Mary 2021)[65] Facilitators: • [No data]	Barriers: • [No data] Facilitators: • [No data]
Optimism	Barrier: • Patient perspective: Initial concern about the concept of a virtual clinic (Quinn 2021)[67] Facilitators: • [No data]	Barriers: • [No data] Facilitators: • [No data]	Barriers: • [No data] Facilitators: • [No data]

Domain	Patient-Related Themes	Provider-Related Themes	Clinic/Office-Related Themes
Beliefs about consequences	Barriers: • Patient and provider perspectives: Concerns about safety and reduced quality of prenatal care, including less monitoring (Peahl 2021, Quinn 2021, Stanhope 2022)[66-68] • Patient and provider perspectives: Communication and relationship building can be limited [though some respondents believed it could be enhanced] (Peahl 2021)[66] Facilitators: • Patient and provider perspectives: Care can be tailored to the needs of women (Peahl 2021)[66] • Provider perspective: Ensures continued access to care (Madden 2020, Quinn 2021)[64, 67] • Patient and provider perspectives: Protection from COVID-19 (Madden 2020; Peahl 2021)[64, 66] • Provider perspective: Allows low-risk pregnancies to be managed safely at home (Quinn 2021)[67] • Provider perspective: Improves patient compliance [with visits] and attendance (Quinn 2021)[67]	Barriers: • Patient and provider perspectives: Concerns about safety and reduced quality of prenatal care, including less monitoring (Peahl 2021)[66] • Patient and provider perspectives: Communication and relationship building can be limited [though some respondents believed it could be enhanced] (Peahl 2021)[66] • Provider perspective: Reduces training opportunities for junior doctors (Quinn 2021)[67] Facilitators: • Patient and provider perspectives: Care can be tailored to the needs of women (Peahl 2021)[66] • Provider perspective: Ensures continued access to care (Madden 2020)[64] • Patient and provider perspectives: Protection from COVID-19 (Madden; Peahl)[64, 66] • Provider perspective: Improves team cohesion (i.e., discussing cases among senior and junior clinicians) (Quinn 2021)[67]	Barriers: • [No data] Facilitators: • Patient and provider perspectives: Protection from COVID-19 (Madden; Peahl)[64, 66]

Domain	Patient-Related Themes	Provider-Related Themes	Clinic/Office-Related Themes
Environmental context and resources	Barriers: • Patient and provider perspectives: [I]mportance of home device use in conjunction with virtual visits (Peahl 2021)[66] • Provider perspective: [T]he transition to virtual prenatal care was more challenging for patients with Medicaid insurance receiving care at health clinics than for women with commercial insurance in generalist and maternal fetal medicine faculty practices (Madden 2020)[64] • Patient, providers, and leadership perspectives: Added potential barriers to patients, particularly those from equity-seeking populations (e.g., increased challenges for non-English speaking patients; need for access to devices and stable WiFi) (Madden 2020, Mary 2021, Peahl 2021)[64-66] • Provider perspective: Technological difficulties with logging on and maintaining continuous Wi-Fi or data connection through visit (Madden 2020)[64] Facilitators: • Leadership perspective: Reminders (text and phone call) increased patient attendance [for in person and telehealth visits] (Madden 2020)[64] • Patient and provider perspectives: Removes traditional barriers to care (time, travel, etc.); increased convenience (Madden 2020 Mary 2021, Peahl 2021, Quinn 2021, Stanhope 2022)[64-68] • Provider and leadership perspectives: System supports for patients (e.g., call center and outreach calls to troubleshoot technological difficulties) (Madden 2020)[64] • Provider perspective: Audio and visual translation were suggested as a means of alleviating inequities in service provision (Mary 2021)[65] • Provider perspective: Value of user-friendly technology and resources to support and encourage health provider and patient engagement (Mary 2021)[65]	Barriers: • Patient and provider perspectives: [I]mportance of home device use in conjunction with virtual visits (Peahl 2021)[66] • Provider perspective: Technological difficulties with logging on • Provider perspective: Need for [perinatal telemedicine] services to be integrated within existing clinical workflows (Mary 2021)[65] • Provider perspective: Concerns about unfavorable changes in reimbursement policies for telehealth and [perinatal telemedicine] and potential liability issues (Mary 2021)[65] Facilitators: • Provider and leadership perspectives: System supports for providers (e.g., workflow documents/how-to's for using telehealth system; telehealth-enabled EMR; continuous IT assistance) (Madden 2020)[64] • Provider perspective: Value of user-friendly technology and resources to support and encourage health provider and patient engagement (Mary 2021)[65]	Barriers: • Provider and leadership perspectives: Telehealth added challenges to clinic operation (billing issues, lack of up-to-date contact information, need for additional support staff, challenges with patient scheduling, reorganization of clinic workflow) (Madden 2020, Mary 2021)[64, 65] • Provider perspective: Lack of buy-in from health-system leadership (Mary 2021)[65] • Provider perspective: Need for [perinatal telemedicine] services to be integrated within existing clinical workflows (Mary 2021)[65] Facilitators: • Provider perspective: System supports (e.g., assistance for telehealth scheduling and administration, training resources on using the platform, continuous IT support) (Madden 2020, Mary 2021)[64, 65]

Domain	Patient-Related Themes	Provider-Related Themes	Clinic/Office-Related Themes
Social influences	Barriers: • Provider perspective: Patients' potential lack of privacy to conduct a telemedicine consultation within their home or work environment (Mary 2021)[65] Facilitators: • Provider perspective: Family could attend and participate (Mary 2021)[65]	Barriers: • [No data] Facilitators: • Provider perspective: Access to colleagues with prior telehealth experiences (Madden 2020)[64]	Barriers: • [No data] Facilitators: • [No data]
Emotion	Barriers: • Leadership perspective: Fear of COVID-19 led patients to delay or avoid care [for in person and telehealth visits] (Madden 2020)[64] • Patient and Provider perspectives: Patients' psychological discomfort with telehealth visits and telehealth technology or general desire to be seen in-person (Madden 2020, Quinn 2021)[64, 67] Facilitators: • Provider perspective: Appreciation of continuity of care (Madden 2020, Stanhope 2022)[64, 68] • Provider perspective: Appreciate for humanized care delivered via telemedicine (Mary 2021)[65]	Barriers: • [No data] Facilitators: • [No data]	Barriers: • [No data] Facilitators: • [No data]

There was no evidence for the following Theoretical Domains Framework domains: social/professional role and identity; reinforcement; intentions; goals; memory, attention, and decision processes or behavioral regulation.

Abbreviations: EMR = electronic medical record, IT = information technology.

Discussion

Although routine antenatal care is one of the most common reasons that women contact the healthcare system (3.8% of annual office visits),[69] utilized by almost 4 million women annually in the United States,[1] the evidence base of studies comparing traditional visit schedules with reduced visit schedules included only 10 studies (5 randomized controlled trials [RCTs] and 5 nonrandomized (observational) comparative studies [NRCSs], which provided few conclusions. Notably there was insufficient evidence for eight of 15 prioritized outcomes.

In summary, moderate-strength evidence from studies comparing reduced versus traditional visit schedules did not indicate differences in infant outcomes between visit schedules for four outcomes: gestational age at birth, being small for gestational age, Apgar score, and neonatal intensive care unit (NICU) admission. Low-strength evidence did not indicate differences between visit schedule groups for three outcomes: maternal anxiety, preterm birth, and low birth weight. Of note, though, studies were generally small, and outcomes of interest were relatively uncommon; thus, the evidence base may not be adequately powered to discern small differences (i.e., type II errors or false negative findings cannot be excluded). All four meta-analyses conducted comparing reduced versus traditional visit schedules were too imprecise to discern differences in effect of less than about 20 percent (95% confidence intervals mostly spanned both 0.8 and 1.2).

The evidence base of studies comparing hybrid visits (televisits and in-person) with in-person visits alone for routine antenatal care is even more sparse, with only two RCTs, four NRCSs, and one survey. The studies were inconsistent in the number and timing of televisits employed. Different clinics used different providers for their routine antenatal care and two (related) studies had different providers for televisits than for in-person visits. These two studies and two others also explicitly incorporated home monitoring of blood pressure and fetal heart rate with televisits, but not traditional in-person visits. Low-strength evidence did not indicate differences in rates of preterm births or NICU admissions between patients who had hybrid or all in-person visits, but did suggest greater satisfaction with antenatal care among patients having hybrid visits (although a survey directly comparing televisits and in-person visits found greater satisfaction with in-person visits). There was insufficient evidence for 12 of 15 prioritized outcomes. Interestingly, although we concluded that there is low strength of evidence of no difference in risk of preterm births, the meta-analysis summary estimate did trend toward a lower risk in patients receiving hybrid visits (odds ratio [OR] 0.93, 95% confidence interval [CI] 0.84 to 1.03). However, more than 95 percent of the evaluated patients came from two studies comparing hybrid visits during the COVID-19 pandemic with in-person visits pre-pandemic. Neither study attempted to adjust for underlying differences between groups that may have also impacted risk of preterm birth (for example, change in employment, office work, sleep time, societal stressors, social isolation, and changes in diet and exercise). Some of these factors may have reduced risk of poor outcomes (e.g., increased sleep); others may have increased risks (e.g., stressors). The trend toward lower risk was similar to overall lower risks found in a systematic review of nearly 10 million patients comparing the pandemic period with the pre-pandemic period (summary unadjusted OR 0.95, 95% CI 0.93 to 0.98),[70] suggesting that differences were likely mostly attributable to factors other than mode of routine antenatal visits.

Similar to the quantitative study evidence, the evidence base of qualitative studies was relatively small, with only four studies contributing evidence on antenatal care visit schedules and five studies contributing evidence on televisits. However, the qualitative studies mostly had strong or moderate methodological quality, thus, providing fairly rich and trustworthy data. The

qualitative data provided helpful insights into the perspectives, preferences, and experiences of pregnant individuals, their providers, and in some cases the clinic leadership with respect to implementing reduced scheduled visits or televisits for routine antenatal care. The qualitative studies suggested that patients and providers may be open to both reduced scheduled visits and healthcare delivered via televisits in principle, but there are concerns that patient education and care quality may be compromised. A particular concern regarding televisits relates to equity issues, given that not all patients may have the devices and stable WiFi access necessary for Web-based televisits. Providers were also concerned about the complexity of incorporating televisits into clinic workflow and the need for supports for patients and providers to ease the transition. Providers also raised concerns about potential liability, potential reimbursement issues, and that a lack of a supportive clinic culture, particularly from leadership, may undermine willingness to reduce the number of visits or of in-person visits. However, several facilitators of changes to practice delivery were noted, including a general support for reducing number of visits and implementing televisits, less patient time and costs spent on visits, the view that pregnancy is a normal state (as opposed to a more medicalized condition), and enhancement of shared responsibility between patient and provider.

While the evidence base is generally limited (with few low risk of bias studies and sparse reporting of most prioritized outcomes), the studies that compared the different models of care identified neither benefits of traditional visit schedules or all in-person visits nor harms of reduced schedules or use of televisits. However, these comparisons should be taken in context in that the existing standard model of about 14 in-person antenatal visits is based on tradition developed in the 1930s and on the structure of the US healthcare system that favors clinic-based care.

To a large degree, the conclusion about lack of differences between models of care is due to there being only a small evidence base, comprising mostly underpowered studies, particularly for rare, clinically serious outcomes such as stillbirth. The studies do not demonstrate (nor were they designed to demonstrate) that alternative care strategies are equivalent, but instead they fail to demonstrate clinical or statistically significant differences in outcomes with the different strategies. The only finding of a difference was, with low strength of evidence, that patients who had hybrid visits (with televisits) had greater satisfaction with their antenatal care. Implications of these findings may depend on one's perspective. With the evidence providing no signal of harms of lower-resource routine antenatal care (fewer scheduled visits and/or use of televisits), maternal health clinics, providers, and patients may have greater comfort with implementation of these alternative care models. In fact, some patients are likely to prefer the options of fewer visits and hybrid visits to allow them greater flexibility and a reduced burden and costs of frequent visits. However, it is likely that many providers and patients would prefer to opt out of such care until there is better evidence that the alternative models do not cause harm. Future studies are needed not only to confirm and strengthen our conclusions, but also to evaluate other alternative models of care, such as greater use of group visits to replace routine individual visits and more extensive availability of short televisits to replace traditionally scheduled in-person visits.

Strengths and Limitations

Strengths and Limitations of the Evidence Base

Although there have been numerous studies published on the topic of antenatal care, the evidence specific to almost all questions regarding delivery of routine antenatal care is sparse.

The approaches to antenatal care delivery examined by RCTs and prospective studies were varied and did not allow for easy comparisons across studies. The reported outcomes included mostly the standard birth outcomes that are evaluated for many antenatal interventions. As a result, some of the outcomes with the most evidence available for meta-analysis (e.g. postpartum hemorrhage, operative vaginal delivery) do not have strong plausible biological connection to structural aspects of antenatal care, such as scheduling and mode of visit, except possibly to the degree that missed opportunities for the patient to ask questions, for the clinician to provide guidance, or for finding and addressing problems due to lack of hands-on examination may impact risk of poor maternal and neonatal outcomes. In contrast, several priority outcomes of interest (e.g., completion of American College of Obstetricians and Gynecologists (ACOG) recommended services and patient experience measures) that most plausibly could be directly affected by visit frequency and mode were understudied (or not reported at all), providing at best low strength of evidence.

Traditionally, the adequacy of antenatal care has been assessed using gestational age at first antenatal care visit and total number of antenatal care visits. Several indices of antenatal care that integrate these components have been developed, but each have different scoring systems and thresholds for what is considered adequate care.[71] Timing of visit initiation and total number of visits are useful because they are commonly available in administrative records, but are not ideal quality metrics because they give little insight into quality of care delivered. Indices often do not attempt to score high-risk and low-risk pregnancies differently, though they may require different intensity of management and the indices focus on the number of visits without assessing content or the mode of how care is delivered. This review focuses on prioritized outcomes important to the health of mothers and babies, but as we found, further research is needed to adequately discern the potential effect of changing modes of care on important utilization metrics and clinical outcomes.

While we were able to categorize studies as having reduced versus traditional (or standard) visit schedules, few schedules were repeated across studies. While this may be expected for alternative care regimens, we also found a fair degree of heterogeneity in the definition of standard care (in terms of number and timing of visits) and little reporting about the time spent at each visit. Only 3 of 10 studies reported on visit duration, with 40- to 45-minute initial visits and 10- to 15-minute follow-up visits. The evidence base does not address the impact of fewer visits in an era when the lengths of appointments may also be shortening.

Similarly, there was sparse information about how televisits were conducted and what the full range of differences in care was between televisits and in-person visits, including utilization of home monitoring of routine obstetric parameters such as blood pressure and weight.

Adding to the complexity of the diverse interventions, studies reported diverse outcomes and had different definitions for outcomes. Inconsistency among outcome definitions makes cross-study comparisons difficult, particularly when studies span different locations and decades. We saw variations in outcome definitions for small for gestational age, low birth weight, Apgar score, NICU admission, hemorrhage, large for gestational age, perinatal mortality, and mental health outcomes.

Studies did not evaluate subgroups of patients or attempt to assess heterogeneity of treatment effect. In particular, there were no analyses regarding how alternative visit structures may differentially impact groups of pregnant individuals based on race/ethnicity, age groups, socioeconomic status, insurance coverage, internet access, and other social determinants of health.

We assessed most of the RCTs to have a low risk of bias, although an important caveat is that neither patients nor providers could be blinded. For most evaluated outcomes, the lack of blinding may not have been of concern, but the necessary lack of blinding may have impacted some patient-reported outcomes (such as satisfaction and preference). Nevertheless, none of the studies reported blinding outcome assessors (research staff), which could have been feasible, for objective maternal and newborn health outcomes.

The NRCSs were generally at high risk of bias, primarily because most observational studies did not adjust for confounders. Some studies had a pre-post design around a change in clinic policy regarding number of visits or implementation of televisits, but none accounted for potential differences and confounders among patients and the care provided before and after a policy change. Some changes in practice also included ancillary changes such as who provided care or whether home monitoring was employed, further confounding conclusions about the independent effects of the care delivery model.

Regarding the televisit studies conducted during the COVID-19 pandemic, it is important to consider whether studies during the COVID-19 pandemic era will be generalizable to post-pandemic healthcare. Considerations about potential dangers of in-person visits may have a disproportionate impact on satisfaction and preferences in the pandemic era studies. In addition, the COVID-19 pandemic affected other stressors for pregnant patients and their families, including quarantine and isolation, lost (or added) work, work from home, altered school and daycare schedules, etcetera. The studies that compared pre-pandemic and pandemic eras did not attempt to control for any differences in populations or other factors specifically related to COVID-19 and societal changes that occurred during the pandemic.

Strengths and Limitations of the Systematic Review Process

We followed contemporary standards for conducting systematic reviews, including multiple stakeholder engagement in Key Question (KQ) development and refinement and careful adherence to recommended methods for literature searching, screening, data extraction, risk of bias assessment, qualitative synthesis, quantitative synthesis, and SoE assessment. The systematic review was narrowly focused on studies related to the delivery and timing of antenatal care.

During protocol development, we prioritized interventions in consultation with panels of Key Informants. However, due to the varied birth outcomes and patient satisfaction measures reported across studies, many of the outcomes were reported in an insufficient number of studies to allow conclusions from our narrative synthesis (or to support meta-analysis or meta-regression).

One of the largest challenges we faced was disentangling timing of visits from composition of those visits. The decision was made to focus on overall schedules for antenatal care that were predetermined and spanned the duration of pregnancy. We did not include studies that assessed a change in the timing of delivery of one component of care. However, studies rarely provided details about timing or delivery of specific components.

Not truly a limitation, but an important caveat is that for quantitative studies we required a within-study comparison of different antenatal schedules or between televisits and in-person only visits. Outcomes related to patient satisfaction were most commonly reported in cross-sectional single group studies with closed-end surveys asking patients about the care they received, without direct, actual comparisons between different schedules or visit types. Thus, the majority of studies reporting on satisfaction were not eligible for either KQs 1 or 2 (quantitative analyses of comparative studies) or for KQ 3 (qualitative research).

This systematic review incorporates a synthesis of qualitative research studies. This is a relatively novel addition to the reviews conducted for the Evidence-based Practice Center Program. In contrast with prior reviews, we sought to summarize the evidence on perspectives and opinions of diverse stakeholders regarding interventions under review. We followed contemporary standards for the conduct of the qualitative synthesis and coded extracted content to an established theoretically informed framework of behavioral determinants. We also produced an overall summary of findings table using the GRADE CERQual (Grading of Recommendations Assessment, Development and Evaluation - Confidence in Evidence from Reviews of Qualitative research) tool,[25, 34] which further allowed us to interrogate synthesized themes and contextualize them with risks to rigor assessments.

Applicability

It is unclear how findings may have differed across settings or for different groups of pregnant patients. One survey of patients compared experiences with both televisits and in-person visits, but did not find clear differences between subgroups of patients. The remaining studies did not analyze effects in different subgroups of patients. The studies were conducted in a range of different settings, including urban and nonurban communities in several states (California, Colorado, Florida, Michigan, Minnesota, Mississippi, New York, Texas, Utah, Washington, and Washington DC) and England, Australia, and Sweden. The heterogeneity of study location, and thus of the ethnic, socioeconomic, and cultural make-up of the included study participants may have had the greatest impact on satisfaction with care in studies comparing reduced- and traditional visit schedules. It was notable that the two trials that found greater dissatisfaction with reduced visits were both English. This finding may correlate with one of the English qualitative research studies conducted among pregnant individuals who were concerned about receiving less information and having to take on greater responsibility with fewer visits.

Studies also evaluated a variety of different practice models, including all midwife care, all obstetrician care, and mixes of provider types. However, it was not possible to discern whether outcomes may vary across different settings. Study participants were predominantly White, but two studies had a focus on mostly (or all) Hispanic and/or Spanish-speaking patients. Socioeconomic status also varied, with studies of medically indigent populations, fully insured patients, and other patients. Given the populations in whom most studies were conducted, our findings are mostly applicable to White, likely middle-class individuals with adequate (preconception and postpartum) medical insurance, across a range of practice settings and healthcare providers. Although, the studies with a focus on non-White or non-English speaking pregnant individuals had consistent findings with other studies. Thus, the conclusions of this review likely are applicable to the general U.S. population. However, an important caveat is that no study compared outcomes across different subgroups of participants (e.g., by race, insurance status, socioeconomic status).

Despite the breadth of study populations and settings, it is difficult to determine whether the lack of clear differences in results across studies reflects the effect of different visit schedules or modalities or, more likely, that there is just insufficient evidence to evaluate such potential differences. Similarly, regarding visit schedules, we could not discern differences in outcomes across studies that implemented a wide range of reduced visits, from six or seven visits (a reduction to about half the number of visits) to 10 visits (mostly a reduction from weekly to biweekly visits in the third trimester). It is unclear whether a very small number of routine visits yields equivalent outcomes as a somewhat-reduced schedule, or if the lack of apparent difference

is related to there being insufficient evidence. Nevertheless, the lack of discernable differences in outcomes based on scheduled number of routine visits may suggest that visit number do not drive antenatal outcomes. However, this review was unable to determine whether alternative drivers of outcomes are related to, for example, antenatal services delivered, different providers of routine antenatal care, different healthcare systems, individual patients and provider characteristics, or other unknown factors.

The televisit studies included both telephone only and Web-based visits in a variety of socioeconomic settings, with various providers, and with a range in the number of visits conducted virtually. In addition, studies evaluated both COVID-19 and pre-pandemic eras. Only four studies (two of which were in the same setting) reported outcomes for which we were able to reach (low strength of evidence) conclusions. These studies evaluated both White and Hispanic populations, privately insured and medically indigent populations, and conducted televisits by phone and/or Web-based platforms. However, two also included home monitoring only in the televisit group and one also effectively compared nurse practitioners (conducting televisits) and obstetricians (conducting in-person visits).

By design, this systematic review focused on routine antenatal care. Thus, although some studies explicitly included pregnant individual with high-risk conditions (mostly gestational hypertension and diabetes), overall, our findings are most-applicable to individuals with low-risk pregnancies receiving routine antenatal care.

Implications for Clinical Practice

The evidence base to support a possible change to the standard 14 visits of antenatal care is limited and largely inconclusive. Given that the standard of 14 visits has existed for decades, despite a lack of evidence to support this schedule of visits, any change in the frequency of planned antenatal care visits would necessitate a change in scheduling and staffing in practices that provide antenatal care. However, the studies found low to moderate SoE that reduced visits are not harmful and may result in equivalent clinical outcomes for mother and child. However, it is important to note that our review and the included studies did not explicitly address the content of care provided. At least implicitly, among studies, the content of care provided was the same between study arms, regardless of the number and timing of visits. Our findings should not imply that a reduction in the number of visits or a change to use of televisits would include a reduction in the content (components of care) provided.

Evidence about patients' satisfaction and preferences remains unclear, although patients were generally satisfied with the care they received and there is some suggestion that patients ultimately preferred the schedule to which they were assigned. Qualitative studies suggest that some patients may be hesitant to reduce their planned visit schedule, while other patients are confident to manage their pregnancy more independently. An important issue to consider is the issue of possible repercussions and medicolegal implications of rare adverse pregnancy outcomes in the setting of reduced visit schedules. Although, this concern may be lessened if there is a change in guidance from professional organizations about frequency of routine antenatal visits and about use of televisits.

The few eligible televisit studies indicated that patients may be accepting of telehealth and may prefer it. The studies did not find evidence of harms related to televisits. Qualitative studies suggest that while patients value interactions with healthcare providers, some patients may appreciate the enhanced opportunities for communication and reduced inconveniences of travel and time off for appointments that televisits afford.

Until there is further evidence to provide more definitive conclusions, other factors may be important to help decide whether or not to implement reduced antenatal care schedules and/or the substitution of telehealth for select antenatal care visits. Examples of possible factors that may favor reduced visits and/or televisits include patient barriers to care (e.g., transportation, child care, work), constrained clinical capacity, patient preference, and the continuing COVID-19 pandemic; factors that may favor traditional approaches include patient preferences and anxiety about "reduced" care, internet and technology limitations, and other issues related to disparities and inequities.[64, 66, 72-77] We have provided detailed extraction of content of these care schedules which decision makers may consider in conjunction with our extraction of outcomes. For example, clinics and providers considering reduced antenatal care schedules can identify studies in our review that have care models that fit their system and may be feasible to implement based on available resources and patient input from the populations for which they provide care.

Implications for Research

Additional, well-conducted studies are needed to determine the optimal model of routine antenatal care and, in regard to the specific KQs addressed here, to clarify whether and how routine care visit schedules can safely be altered and whether incorporation of televisits into routine antenatal care will continue to be appropriate after the COVID-19 pandemic. Related, additional questions of interest, that were beyond the scope of this review, include further investigations of the optimal structure for routine antenatal care, including location of services (e.g., clinic, home), components of care (e.g., ACOG recommended services), provider of services (e.g., obstetrician, certified nurse practitioner, nurse midwife, doula), the impact of shorter initial and follow-up visits, among others. The current state of the evidence regarding vital questions related to the structure of healthcare for millions of pregnant individuals annually and their babies is largely inadequate to support changes that have the potential to make antenatal care more efficient, less time- and resource-intensive for patients, and possibly to improve outcomes. The current evidence base does not adequately address concerns about how changes to routine antenatal care may affect current inequities and health disparities or are impacted by social determinants of health.

Further research is needed to address various questions set out by this systematic review to determine the safety and acceptability of alternative antenatal care programs and antenatal care incorporating telehealth. This includes interventions delivered in various settings by various personnel. Well-executed, sufficiently powered RCTs are needed. New NRCSs can also provide strong evidence, but only if they use appropriate methods to control for known and unknown differences between groups, ideally by using a propensity score matching or equivalent methodology.[78] Particularly for several of the prioritized outcomes that occur relatively infrequently (e.g., NICU admissions, preterm birth, and small for gestational age), it is likely that additional large studies are needed in order to be sufficiently powered to find differences. Adding to the required power, if one hypothesizes that fewer scheduled visits or televisits are equally safe as their alternatives, then studies need to be powered for equivalence studies.

Further work is needed by funders, researchers, and clinicians to orchestrate an overall program of antenatal care research that supports more efficient and synergistic learning across studies: namely through inclusion of prioritized outcomes of interest, standardizing alternative care interventions that would be feasible and acceptable to implement, and assessing patient preference and feedback in a systematic way. Given current inequities in maternal outcomes, prioritization of patient-centeredness and meaningful patient engagement in care model research

is a crucial component in future research. These suggestions for future directions in research have the opportunity to efficiently build a body of antenatal care evidence that truly seeks to enable evidence-based decision making about which interventions should be offered to persons initiating antenatal care to achieve the best clinical outcomes and patient satisfaction, and to be cost- and resource-effective for the health system, patients, and their caregivers.

For interventions, disentangling the timing versus components of care (for example, as per the ACOG recommended services),[2] would greatly enhance the validity and efficiency of subsequent evidence syntheses of these studies, and ideally lend itself to more robust quantitative syntheses, such as multivariable meta-regression to estimate the independent effects of specific components.

In order for evidence synthesis to be more informative, outcomes studied need to more strongly align with the goals of antenatal care. Stakeholders indicated that ensuring patients receive the required elements of antenatal care were of most importance. ACOG has a statement on these components, but only one study referenced ACOG requirements in their outcomes. We compiled a list of prioritized outcomes based on discussions with stakeholders. However, more formal development of a core outcome set for process of care interventions in antenatal care (including visit scheduling and incorporation of televisits) would help future researchers to focus on high priority outcomes. Similarly, a stakeholder panel including a wide range of providers, policymakers, and, importantly, patients and their families should be convened to determine the scope of issues to be addressed by future qualitative research studies.

For reporting, future studies should ensure that all *a priori* outcomes are clearly reported in the results.

While the current qualitative studies provide a range of important insights, more studies are needed to enrich the evidence base. For example, it is particularly important to gather more robust evidence from diverse patient voices as well as providers from different settings and practice settings.

Conclusions

Although we found several relevant studies, the body of evidence was relatively small and we were able to make only a few specific conclusions in this systematic review. Generally speaking, studies did not report negative effects to reduced schedules of antenatal care or the incorporation of televisits into antenatal care. There is some evidence of patient preference for antenatal care that replaces some in-person visits with televisits and that reduced antenatal care visits and televisits are perceived to be cost-saving for patients. Future research is needed that includes outcomes of most importance and relevance to the goal of high-quality antenatal care.

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Glossary of Abbreviations

ACOG	American College of Obstetricians and Gynecologists
AHRQ	Agency for Healthcare Research and Quality
BMI	body mass index
CI	confidence interval (about an estimate)
GHTN	gestational hypertension
HADS	Hospital Anxiety and Depression Scale
I^2	a measure of statistical heterogeneity; the percentage of the differences in study results across studies *not* attributable to random chance
KI	Key Informant
KQ	Key Question
NICU	neonatal intensive care unit
NRCS	nonrandomized comparative study
OR	odds ratio
RCT	randomized controlled trial
RoB	risk of bias
RR	risk ratio (relative risk)
SD	standard deviation
SGA	small for gestational age
SMFM	Society for Maternal-Fetal Medicine
SoE	strength of evidence
SR	systematic review
STAI	State Trait Anxiety Inventory
TEP	Technical Expert Panel

Appendix A. Methods

Study Selection (Details)

Quantitative Studies (Key Question [KQ] 1 & 2)

We searched for studies and existing systematic reviews in MEDLINE (via PubMed), The Cochrane Register of Clinical Trials, The Cochrane Database of Systematic Reviews, Embase, and CINAHL from inception to February 11, 2022. Duplicate citations were be removed prior to screening. There was no date or language restriction, but we excluded studies tagged as being from low- or middle-income countries (per the World Bank classification). Search strategies include filters to remove nonhuman studies and articles that are not primary studies, systematic reviews, or clinical practice guidelines.

The searches include MeSH or Emtree terms, along with free-text words, related to antenatal care, prenatal care, obstetric care, and pregnancy care; telemedicine, and telemedicine; and office visits, care schedules, and appointments. Searches were independently peer reviewed by a librarian at another Evidence-based Practice Center. The planned search strategies are included below.

Additional searches were conducted in the ClinicalTrials.gov registry for unpublished study protocols, unpublished study results, and ongoing studies. The reference lists of relevant existing systematic reviews were screened for additional eligible studies.

Qualitative Studies (KQ 3)

We searched for qualitative studies as part of the overall search described for the quantitative studies but extended our database searches to also include PsycINFO and SocINDEX using the same set of concepts included in the search for quantitative studies. No study type filters were used in any search query, so all study types were retrieved, including those likely to include qualitative data. We also performed citation tracing and other snowballing techniques based on all relevant studies to identify studies that may have been missed in the database searches.

All Key Questions

During Topic Refinement, we conducted a highly focused search in MEDLINE yielding approximately 600 citations. These were entered into Abstrackr software (http://abstrackr.cebm.brown.edu/) to enable abstract screening. All 600 citations were screened by all team members and all conflicts were resolved in conference. Citations found by the full literature searches were subsequently added to the already-screened citations in Abstrackr. We then continued abstract screening in duplicate. The Abstrackr software has machine learning capabilities that predict the likelihood of relevance of each citation. Daily, the list of unscreened abstracts is sorted so that the most potentially relevant articles are presented first.

As has become standard for our Center, we took advantage of the machine learning capacities of Abstrackr to limit resources spent on abstract screening. We stopped double screening when the predicted likelihood of the remaining unscreened papers being relevant was 0.40 and we rejected 400 consecutive subsequent citations. This threshold is based on experience with several dozen screening projects and an analysis in preparation for publication, and the

sample size of 400 was chosen because the upper 97.5% confidence interval bound for a proportion of 0/400 is less than 1%.

Potentially relevant citations were retrieved in full text and rescreened in duplicate.

Database Search Strategies

Medline (via PubMed)

Key Question 1 (and 3): Scheduling

("Prenatal Care"[Mesh]
OR "Pregnancy"[Mesh]
OR "Pregnant Women"[Mesh]
OR "Pregnancy Trimesters"[Mesh]
OR pregnancy
OR pregnant
OR antenatal
OR ante-natal
OR pregnancies
OR prenatal
OR pre-natal
OR obstetrics
OR gestation)

AND

("Prenatal Care/organization and administration"[Mesh]
OR "Continuity of Patient Care/standards"[Mesh]
OR "Delivery of Health Care/methods"[Mesh]
OR "Office Visits"[Mesh]
OR "Standard of Care"[Mesh]
OR appointment*
OR visit*)

AND

("Appointments and Schedules"[Mesh]
OR ((number OR frequency OR cadence OR schedule) AND (Visit* OR Appointment* OR "Office Visits"[Mesh]))
OR Schedule*)

Key Question 2 (and 3): Telemedicine

("Prenatal Care"[Mesh]
OR "Pregnancy"[Mesh]
OR "Pregnant Women"[Mesh]

OR pregnancy
OR pregnant
OR antenatal
OR ante-natal
OR pregnancies
OR prenatal
OR pre-natal
OR obstetrics)

AND

("Telemedicine"[Mesh] OR "Remote Consultation"[Mesh] OR ehealth OR e-health* OR mhealth* OR m-health* OR telemedicine OR telehealth OR smartphone* OR "smart phone*" OR "smart-phone*" OR "cell phone*" OR "mobile phone*"
OR ((remote* OR video OR virtual) AND (care OR consult* OR visit* OR service*))
OR "remote monitoring"
OR Telemonitoring
OR wearable
OR wireless
OR portable)

Key Question 1 search OR Key Question 2 search

NOT

(“Africa”[Mesh] OR "Algeria"[Mesh] OR "Angola"[Mesh] OR "Bangladesh"[Mesh] OR "Benin"[Mesh] OR "Bhutan"[Mesh] OR "Bolivia"[Mesh] OR "Cabo Verde"[Mesh] OR "Cambodia"[Mesh] OR "Cameroon"[Mesh] OR "Comoros"[Mesh] OR "Cote d'Ivoire"[Mesh] OR "Democratic Republic of the Congo"[Mesh] OR "Djibouti"[Mesh] OR "Egypt"[Mesh] OR "El Salvador"[Mesh] OR "Eswatini"[Mesh] OR "Ghana"[Mesh] OR "Honduras"[Mesh] OR "India"[Mesh] OR "Kenya"[Mesh] OR "Kyrgyzstan"[Mesh] OR "Laos"[Mesh] OR "Lesotho"[Mesh] OR "Mauritania"[Mesh] OR "Micronesia"[Mesh] OR "Moldova"[Mesh] OR "Mongolia"[Mesh] OR "Morocco"[Mesh] OR "Myanmar"[Mesh] OR "Nepal"[Mesh] OR "Nicaragua"[Mesh] OR "Nigeria"[Mesh] OR "Pakistan"[Mesh] OR "Papua New Guinea"[Mesh] OR "Philippines"[Mesh] OR "Sao Tome and Principe"[Mesh] OR "Senegal"[Mesh] OR "Sri Lanka"[Mesh] OR "Tanzania"[Mesh] OR "Timor-Leste"[Mesh] OR "Tunisia"[Mesh] OR "Ukraine"[Mesh] OR "Uzbekistan"[Mesh] OR "Vanuatu"[Mesh] OR "Vietnam"[Mesh] OR "Zambia"[Mesh] OR "Zimbabwe"[Mesh] OR "Afghanistan"[Mesh] OR "Burundi"[Mesh] OR "Burkina Faso"[Mesh] OR "Central African Republic"[Mesh] OR "Eritrea"[Mesh] OR "Ethiopia"[Mesh] OR "Guinea"[Mesh] OR "Gambia"[Mesh] OR "Guinea-Bissau"[Mesh] OR "Haiti"[Mesh] OR "Liberia"[Mesh] OR "Madagascar"[Mesh] OR "Mali"[Mesh] OR "Mozambique"[Mesh] OR "Malawi"[Mesh] OR "Niger"[Mesh] OR "Democratic People's Republic of Korea"[Mesh] OR "Rwanda"[Mesh] OR "Sudan"[Mesh] OR "Sierra Leone"[Mesh] OR "Somalia"[Mesh] OR "South Sudan"[Mesh] OR "Syria"[Mesh] OR "Chad"[Mesh] OR "Togo"[Mesh] OR "Tajikistan"[Mesh] OR "Uganda"[Mesh] OR "Yemen"[Mesh] OR Somaliland OR "Albania"[Mesh] OR "Argentina"[Mesh] OR "Armenia"[Mesh] OR "American

Samoa"[Mesh] OR "Azerbaijan"[Mesh] OR "Bulgaria"[Mesh] OR "Bosnia and Herzegovina"[Mesh] OR "Republic of Belarus"[Mesh] OR "Belize"[Mesh] OR "Brazil"[Mesh] OR "Botswana"[Mesh] OR "China"[Mesh] OR "Colombia"[Mesh] OR "Costa Rica"[Mesh] OR "Cuba"[Mesh] OR "Dominica"[Mesh] OR "Dominican Republic"[Mesh] OR "Ecuador"[Mesh] OR "Fiji"[Mesh] OR "Gabon"[Mesh] OR "Georgia (Republic)"[Mesh] OR "Equatorial Guinea"[Mesh] OR "Grenada"[Mesh] OR "Guatemala"[Mesh] OR "Guyana"[Mesh] OR "Indonesia"[Mesh] OR "Iran"[Mesh] OR "Iraq"[Mesh] OR "Jamaica"[Mesh] OR "Jordan"[Mesh] OR "Kazakhstan"[Mesh] OR "Lebanon"[Mesh] OR "Libya"[Mesh] OR "Saint Lucia"[Mesh] OR "Indian Ocean Islands"[Mesh] OR "Mexico"[Mesh] OR "Micronesia"[Mesh] OR "Republic of North Macedonia"[Mesh] OR "Montenegro"[Mesh] OR "Malaysia"[Mesh] OR "Namibia"[Mesh] OR "Peru"[Mesh] OR "Paraguay"[Mesh] OR "Russia"[Mesh] OR "Serbia"[Mesh] OR "Suriname"[Mesh] OR "Thailand"[Mesh] OR "Turkmenistan"[Mesh] OR "Tonga"[Mesh] OR "Turkey"[Mesh] OR "Saint Vincent and the Grenadines"[Mesh] OR "Venezuela"[Mesh] OR "Samoa"[Mesh] OR "Kosovo"[Mesh] OR "South Africa"[Mesh] OR "address"[pt] OR "autobiography"[pt] OR "bibliography"[pt] OR "biography"[pt] OR "comment"[pt] OR "dictionary"[pt] OR "directory"[pt] OR "festschrift"[pt] OR "historical article"[pt] OR "lecture"[pt] OR "legal case"[pt] OR "legislation"[pt] OR "news"[pt] OR "newspaper article"[pt] OR "patient education handout"[pt] OR "periodical index"[pt] OR "comment on" OR ("Animals"[Mesh] NOT "Humans"[Mesh]))

Cochrane Databases

Key Question 1 Search

#1 MeSH descriptor: [Prenatal Care] explode all trees
#2 MeSH descriptor: [Pregnancy] explode all trees
#3 MeSH descriptor: [Pregnant Women] explode all trees
#4 pregnancy OR pregnant OR antenatal OR ante-natal OR pregnancies OR prenatal OR pre-natal OR obstetrics
#5 #1 OR #2 OR #3 OR #4
#6 MeSH descriptor: [Maternal Health Services] explode all trees
#7 MeSH descriptor: [Delivery of Health Care] explode all trees
#8 MeSH descriptor: [Office Visits] explode all trees
#9 MeSH descriptor: [Standard of Care] explode all trees
#10 appointment* OR visit*
#11 #6 OR #7 OR #8 OR #9 OR #10
#12 #4 AND #11
#13 MeSH descriptor: [Appointments and Schedules] explode all trees
#14 ((number OR frequency OR cadence OR schedule) AND (Visit* OR Appointment*))
#15 #13 OR #14
#16 #12 AND #15

Search 2

ID Search Hits
#1 MeSH descriptor: [Prenatal Care] explode all trees
#2 MeSH descriptor: [Pregnancy] explode all trees

#3 MeSH descriptor: [Pregnant Women] explode all trees
#4 pregnancy OR pregnant OR antenatal OR ante-natal OR pregnancies OR prenatal OR pre-natal OR obstetrics
#5 #1 OR #2 OR #3 OR #
#6 MeSH descriptor: [Telemedicine] explode all trees
#7 telemedicine or telehealth
#8 "virtual care"
#9 video or virtual
#10 visit or consultation or appointment
#11 #9 AND #10
#12 #6 or #7 or #8 or #11
#13 #5 and #12

Embase

#21 (#14 OR #19) AND ([article]/lim OR [article in press]/lim) AND [humans]/lim
#20 #14 OR #19
#19 #5 AND #18
#18 #15 OR #16 OR #17
#17 (video OR virtual) AND (care OR consult* OR visit* OR service*)
#16 'virtual care'
#15 'telemedicine'
#14 #5 AND #13
#13 #11 AND #12
#12 #6 OR #7 OR #8 OR #9
#11 number OR frequency OR cadence OR schedule
#10 (number OR frequency OR cadence OR schedule) AND (visit OR appointment)
#9 visit
#8 appointment
#7 'health care delivery'
#6 'ambulatory care'
#5 #1 OR #2 OR #3 OR #4
#4 'obstetrics'
#3 'prenatal care'
#2 'pregnant woman'
#1 'pregnancy'/exp OR 'pregnancy'

CINAHL/PsycINFO/SocINDEX

pregnancy OR pregnant OR antenatal OR ante-natal OR pregnancies OR prenatal OR pre-natal OR obstetrics

AND

telehealth or telemedicine or ((video or virtual) and (visit or consultation or appointment)) OR ((number OR frequency OR cadence OR schedule) AND (Visit* OR Appointment*))

Inclusion/Exclusion Criteria Details

Study Eligibility Criteria for KQ 1 (Routine Antenatal Scheduling)

Population

- Pregnant individuals receiving routine / standard / basic / traditional antenatal care
- Allow studies of pregnant individuals at increased risk of poor outcomes (e.g., with gestational diabetes, gestational hypertension, fetal growth restriction, those receiving part of their antenatal care by maternal-fetal medicine [MFM] or other specialists), as long as the study pertains to their routine antenatal care (i.e., not specifically to their enhanced care for their high-risk condition)

Exclude:

- *Non-routine care provided by MFM or other specialists*
- *Care specific to high-risk conditions (e.g., home glucose or blood pressure monitoring)*
-

Modifiers/Subgroups of interest:

- Age groups
- Race/ethnicity or different cultural groups
- Location (rural, urban, etc.)
- Socioeconomic status
- Disparities, incl. socioeconomic, healthcare, other
- Other social determinants of health
- Different providers
- Baseline pregnancy risk of complications, poor outcomes etc. (within the context of routine care)
- Nulliparous vs. multiparous
- Different levels of social support
- Different pregnancy education needs (e.g., because of health literacy differences, education, adolescent vs. adult)
- Other modifiers/subgroups analyzed in studies

Interventions

- Defined routine antenatal care schedules with focus on:
  - Total number of planned visits
  - Overall schedule (timing, frequency, cadence)
  - Number of planned in-person visits
- Providers of routine antenatal visits include
  - Obstetricians/gynecologists, nurse practitioners, nurse midwives, nurses, physician assistants, family medicine clinicians

  Exclude
  - Doulas, social workers, counselors, dieticians, non-licensed or non-medical personnel

Include

- Interventions designed to evaluate different types of providers (e.g., a nurse instead of a doctor) if there is a concomitant comparison of different schedule of planned visits
- Interventions designed to evaluate group visits if the group visits replace individual visits and there is a concomitant comparison of different schedule of planned visits
- Interventions designed to evaluate home visits if the home visits replace in-clinic visits and there is a concomitant comparison of different schedule of planned visits

  Exclude
  - Interventions where the different provider visits, group visits, or home visits are simply added on to the standard of care visits (with no change made to the scheduled standard visits).

Exclude:

- *Observational studies of realized visits (as opposed to scheduled or planned visits)*
- *Events that occur separately from/outside of routine visits (that do not occur during the visit)*
- *Interventions conducted during specific visits or their timing (unrelated to frequency of use of interventions) e.g. ultrasound (U/S) at the week 18 vs. week 22 visit*
- *Addition of interventions conducted during antenatal care for specific evaluation (e.g., U/S screening for intrauterine growth retardation or cervical length)*
- *Novel (nonstandard) clinical interventions conducted during visits, (e.g., electrocardiography at every visit)*
- *Evaluations of behavioral interventions (e.g., smoking cessation, exercise) or screening during antenatal care (e.g. substance use, domestic violence)*
- *Interventions outside of the scope of typical antenatal care, (e.g., teeth cleaning at antenatal care visit, psychiatric care)*
- *Specialist visits*
- *Unplanned office or emergency department visits, other ancillary or risk/complaint-driven care visits*
- *Preconception care*
- *Care for a pregnant person who is in labor*
- *Postpartum care*
- *Interventions spanning pregnancy and periods before or after pregnancy*

Comparators

- Standard, routine, or alternative antenatal care schedule (as defined by the study)

Outcomes (prioritized outcomes have an asterisk)

- Pregnancy complications:
  - Maternal mortality
  - Antenatal pregnancy complications
    - Gestational diabetes
    - Gestational hypertension
    - Pre-eclampsia

        - Placental abruption
        - Intrauterine growth restriction (IUGR)
        - Anemia
        - Urinary tract infections
        - Pre-term labor
    - Delivery-related complications
        - Lacerations
        - Hemorrhage
        - Transfusion need
        - Hysterectomy
- Other maternal health outcomes:
    - Delivery outcomes
        - Cesarean delivery—must be adjusted (to account for provider/patient preferences)
        - Induction of labor
        - Operative vaginal delivery: forceps and vacuum
        - Spontaneous vaginal delivery
    - Inappropriate weight gain
    - Postpartum contraception—must be adjusted (to account for patient preferences)
- Maternal psychosocial, preference, and related outcomes:
    - **Quality of life measures***
    - **Mental health measures or diagnosis (e.g., anxiety, depression)***
    - **Patient satisfaction with antenatal care***
    - Psychosocial measures
    - Patient preferences
    - Resources
        - **Lost work time (including used vacation/health days)***
        - Patient financial costs
        - Patient travel (e.g., driving miles or costs)
- Fetal/neonatal/infant outcomes:
    - Delivery timing
        - **Preterm birth***
        - **Full-term delivery***
        - **Gestational age at birth***
        - Post-term delivery
    - **Small for gestational age*** (e.g., birth weight <10%ile for similar age neonates)
        - **Low birth weight*** (e.g., <2.5 kg [5 lb, 8 oz])
    - **Abnormal Apgar score*** (threshold, e.g. <7) (including abnormal cord pH [e.g., <7])
    - **Breastfeeding***—must be adjusted to account for patient preferences
    - Mortality
    - Stillbirth
    - Perinatal morbidity (e.g., birth trauma [e.g., shoulder dystocia])
    - Need for social services
- Care utilization:
    - **Completion of ACOG recommended services***

    - **Number of unplanned visits***
    - **Neonatal intensive care unit [NICU] admissions*** / length of stay
    - Adherence/compliance
    - Number of referrals to other providers
    - Unplanned hospital admissions
    - Emergency room/triage visits
    - Number of unplanned contacts (e.g., portal/phone messages)
- Provider outcomes:
    - Provider satisfaction with antenatal care
- Harms:
    - **Delayed diagnoses (e.g., gestational diabetes)***
    - Overdiagnosis ("unnecessary" negative workups or misdiagnoses)
    - Harms to marginalized groups / equity outcomes

*** Prioritized outcomes**

Study Designs

- Comparative studies (comparisons of different interventions), including parallel design, pre-post studies, and other comparisons
    - Randomized or observational (nonrandomized)
    - Prospective or retrospective
- Surveys that compare interventions (specifically for patient preferences and satisfaction)
- Registry (e.g., PRAMS [Pregnancy Risk Assessment Monitoring System], National family study) and other retrospective data sources may be eligible, but only if the comparison is between different numbers of planned or scheduled visits
- Single group studies (no direct comparison of interventions)
    - Preference and satisfaction outcomes only

- N ≥10 per intervention group

- (Existing systematic reviews and guidelines will be used as sources of otherwise missed eligible studies)

<u>*Exclude*</u>

- *Retrospective studies comparing number of realized visits (i.e., where differences in care were not planned)*
- *Single group studies (no direct comparison of interventions) except for preference and satisfaction outcomes*

Timing

- Interventions: During antenatal period (excluding labor and delivery)
- Followup/Outcomes: Any (antenatal, peripartum, postpartum, or later)

Setting

- High income countries based on World Bank classifications

- Outpatient care

Study Eligibility Criteria for KQ 2 (Telehealth)

Population

- Same as KQ 1

Interventions

- Antenatal care programs using telemedicine, including remote synchronous (real-time visits such as video calls) and asynchronous interactions (e.g., portal email discussions)
    - Allow inclusion of devices designed to transmit information only if use of the devices are part of telemedicine interactions between patients and providers

Exclude

- *Exclusions listed for KQ 1*
- *Telemedicine monitoring specifically for gestational diabetes, gestational hypertension, fetal growth restriction (<10% normal), or other high-risk pregnancies*
- *Communications that do not provide opportunity for two-way discussion, that include only a single round of communication (e.g., an email asking a question and an email response to that question), that are based on forms to be completed, or that include one-direction information (e.g., educational materials from the provider, bot messages such as appointment reminders)*
- *Devices or interactions that do not employ contemporary internet connectivity (or human interaction by phone), e.g., mail, fax, patient-completed charts brought to office visits for review*
- *Mobile health (mHealth) applications that are not part of clinical care delivery (clinic does not communicate through the app)*
- *Social media or peer groups*
- *Non-routine antenatal care provided by MFM specialists*
- *Teleconsultations between clinicians (e.g., remote U/S or telerobotics)*
- *Evaluation of remote device accuracy (e.g., of home blood pressure monitor) or comparison of specific devices (e.g., different monitors)*
- *Proof of* concept or development studies of new medical technologies or apps

Comparators

- All in-person care, alternative telemedicine/remote care
- No (explicit) comparator

Outcomes

- Same as KQ 1
- Access to telemedicine, equipment (e.g., home blood pressure cuff, phone, internet)

Study Designs

- Comparative studies (comparisons of different interventions), including parallel design, pre-post studies, and other comparisons

    - Randomized or observational (nonrandomized)
    - Prospective or retrospective
- Surveys that compare interventions (specifically for patient preferences and satisfaction)
- Registry (e.g., PRAMS, National family study) and other retrospective data sources may be eligible, but only if there is a specific evaluation of telemedicine
- Single group studies (no comparator)
    - Preference and satisfaction outcomes only

- N ≥10 per intervention group

- (Existing systematic reviews and guidelines will be used as sources of otherwise missed eligible studies)

Timing

- Interventions: During antenatal period (excluding labor and delivery)
- Followup/Outcomes: Any (antenatal, peripartum, postpartum, or later)

Setting

- High income countries based on World Bank classifications
- Outpatient care

Study Eligibility Criteria for KQ 3 (Qualitative Research)

Population

- Pregnant individuals
- Postpartum individuals
- Individuals considering or planning pregnancy
- Partners/family
- Providers of antenatal care (any profession or licensure)

- Allow studies that include high-risk patients, as long as the interventions being assessed pertain to routine care

Interventions

- Routine antenatal care, specific to interventions covered in KQ 1 (visit schedule) and KQ 2 (televisits)

Comparators

- Not applicable

Outcomes

- Perspectives and preferences related to visit schedule and televisits
- Barriers and facilitators related to visit schedule and televisits

Exclude:

- *Perspectives on high-risk antenatal care, such as provided by MFM clinicians*
- *Perspectives on antenatal care or interactions with providers and others unrelated to visit schedule or televisits.*

Study Design

- Qualitative studies
  - Interviews
  - Focus groups
  - Ethnographic studies
  - Surveys with open-ended questions amenable to qualitative analysis
- Any size

Exclude

- *Surveys with closed-ended questions with only quantitative analyses*

Timing

- Any (as long as interventions of interest occurred during antenatal period)

Setting

- High income countries based on World Bank classifications
- Outpatient care

Data Extraction (Details)

For KQs 1 and 2, data were extracted directly into the Systematic Review Data Repository (SRDR) at https://srdr.ahrq.gov/. We created a combined data extraction form for KQs 1 and 2. We extracted information on study characteristics, eligibility criteria, participant characteristics, intervention and comparator details, outcome definitions, and results (including event numbers, effect sizes, and P values). Study- and outcome-level risk of bias assessment was conducted during data extraction within SRDR.

For KQ 3, eligible qualitative studies were extracted in Google sheets (to allow team editing) and subsequently Excel (for easier data manipulation). For each study, we extracted publication data, study setting, and study design features (e.g., recruitment methods, qualitative data collection and analysis methods). We extracted the qualitative findings (i.e., perspectives, preferences, and experiences) separately for routine antenatal care schedules (KQ 1 topic) and televisits for antenatal care (KQ 2 topic), and within topics, separately for different stakeholders as reported by the study report (e.g., pregnant people, providers). One team member indepedently extracted all relevant text (exact quotations from the article text) that provided participants' perspectives, preferences, or experiences. The extracted data included summary statements written by the study authors and direct quotes from participants. We included data primarily from the results section (including tables) and the discussion, but reviewed other sections for relevant data.

We categorized the extracted data into one of 14 domains defined by the Theoretical Domains Framework (TDF).[1, 2] The TDF was developed to assist in identifying the cognitive, affective, social, and environmental factors that may influence an individuals' performance of a health behavior. However, it can also be used to conceptualize the determinants to performing any behavior more broadly (e.g., adopting a reduced care schedule or implementing televisits). The 14 domains include:

1. Knowledge
2. Skills
3. Social/professional role and identity
4. Belief about capabilities
5. Optimism
6. Beliefs about consequences
7. Reinforcement
8. Intention
9. Goals
10. Memory, attention, and decision processes
11. Environmental context and resources
12. Social influences; e
13. Emotion
14. Behavioral regulation.

A priori, we decided to use a Best Fit Framework approach. In this approach, data are categorized into the chosen framework as appropriate but additional data that do not fit are extracted for further interrogation.[3] Notably, though, we did not identify any data that did not fit into the 14 TDF domains.

Congruent with qualitative methods for individual studies, qualitative data extraction and synthesis was conducted both in tandem and iteratively. The first study we assessed was coded independently by all researchers, after which we met and thoroughly discussed our coding decisions. We reached group consensus and coding rules to facilitate subsequent coding. Thereafter, two researchers independently extracted each of the remaining studies. Two senior investigators (EMB, VAD) independently reviewed the extracted text and selected their own TDF codes (and confirmed that no additionally relevant text from the study was missed). Finally, another senior investigator (KJK) trained in qualitative methods reviewed the findings from the two independent reviewers for each paper and used their judgement to come to a decision on the final TDF codes. These were iteratively revised by the final researcher who further interrogated the data within domains to identify themes.

Risk of Bias/Methodological Quality Assessment (Details)

We evaluated each study for risk of bias and methodological quality. For RCTs, we used the items from the Cochrane Risk of Bias tool 2.0,[4]. For NRCSs, we used specific elements from the ROBINS-I Tool[5] related to confounding and selection bias in addition to items from the Cochrane Risk of Bias tool that were not specific to randomized trials.

For RCTs, we asked:

1.1 Was the allocation sequence random?

1.2 Was the allocation sequence concealed until participants were enrolled and assigned to interventions?

1.3 Did baseline differences between intervention groups suggest a problem with the randomization process?

2.1. (effect of assignment to intervention) Were participants aware of their assigned intervention during the trial?

2.2. (effect of assignment to intervention) Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?

2.3. (effect of assignment to intervention) If Y/PY/NI to 2.1 or 2.2: Were there deviations from the intended intervention that arose because of the experimental context?

2.4. (effect of assignment to intervention) If Y/PY to 2.3: Were these deviations from intended intervention balanced between groups?

2.5. (effect of assignment to intervention) If N/PN/NI to 2.4: Were these deviations likely to have affected the outcome?

2.6. (effect of assignment to intervention) Was an appropriate analysis used to estimate the effect of assignment to intervention?

2.7. (effect of assignment to intervention) If N/PN/NI to 2.6: Was there potential for a substantial impact (on the result) of the failure to analyse participants in the group to which they were randomized?

2.1. (effect of adhering to intervention) Were participants aware of their assigned intervention during the trial?

2.2. (effect of adhering to intervention) Were carers and people delivering the interventions aware of participants' assigned intervention during the trial?

2.3. (effect of adhering to intervention) If Y/PY/NI to 2.1 or 2.2: Were important co-interventions balanced across intervention groups?

2.4. (effect of adhering to intervention) Were there failures in implementing the intervention that could have affected the outcome?

2.5. (effect of adhering to intervention) Was there non-adherence to the assigned intervention regimen that could have affected participants' outcomes?

2.6. (effect of adhering to intervention) If N/PN/NI to 2.3 or 2.5 or Y/PY/NI to 2.4: Was an appropriate analysis used to estimate the effect of adhering to the intervention?

3.1. Were data for this outcome available for all, or nearly all, participants randomized?

3.2. If N/PN/NI to 3.1: Is there evidence that the result was not biased by missing outcome data?

3.3. If N/PN to 3.2: Could missingness in the outcome depend on its true value?

3.4. If Y/PY/NI to 3.3: Is it likely that missingness in the outcome depended on its true value?

4.1. Was the method of measuring the outcome inappropriate?

4.2. Could measurement or ascertainment of the outcome have differed between intervention groups?

4.3. If N/PN/NI to 4.1 and 4.2: Were outcome assessors aware of the intervention received by study participants?

4.4. If Y/PY/NI to 4.3: Could assessment of the outcome have been influenced by knowledge of intervention received?

4.5. If Y/PY/NI to 4.4: Is it likely that assessment of the outcome was influenced by knowledge of intervention received?

5.1. Were the data that produced this result analysed in accordance with a pre-specified analysis plan that was finalized before unblinded outcome data were available for analysis?

5.2. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple outcome measurements (e.g. scales, definitions, time points) within the outcome domain?

5.3. Is the numerical result being assessed likely to have been selected, on the basis of the results, from multiple analyses of the data

Other potential bias

For NRCSs, we asked:

1.1 Is there potential for confounding of the effect of intervention in this study?

1.2 Was the analysis based on splitting participants' follow up time according to intervention received?

1.3 Were intervention discontinuations or switches likely to be related to factors that are prognostic for the outcome?

1.4. Did the authors use an appropriate analysis method that controlled for all the important confounding domains?

1.5. If Y/PY to 1.4: Were confounding domains that were controlled for measured validly and reliably by the variables available in this study?

1.6. Did the authors control for any post-intervention variables that could have been affected by the intervention?

1.7. Did the authors use an appropriate analysis method that adjusted for all the important confounding domains and for time-varying confounding?

1.8. If Y/PY to 1.7: Were confounding domains that were adjusted for measured validly and reliably by the variables available in this study?

2.1. Was selection of participants into the study (or into the analysis) based on participant characteristics observed after the start of intervention?

2.2. If Y/PY to 2.1: Were the post-intervention variables that influenced selection likely to be associated with intervention?

2.3 If Y/PY to 2.2: Were the post-intervention variables that influenced selection likely to be influenced by the outcome or a cause of the outcome?

2.4. Do start of follow-up and start of intervention coincide for most participants?

2.5. If Y/PY to 2.2 and 2.3, or N/PN to 2.4: Were adjustment techniques used that are likely to correct for the presence of selection biases?

3.1 Were intervention groups clearly defined?

3.2 Was the information used to define intervention groups recorded at the start of the intervention?

3.3 Could classification of intervention status have been affected by knowledge of the outcome or risk of the outcome?

4.1. Were there deviations from the intended intervention beyond what would be expected in usual practice?

4.2. If Y/PY to 4.1: Were these deviations from intended intervention unbalanced between groups and likely to have affected the outcome?

4.3. Were important co-interventions balanced across intervention groups?

4.4. Was the intervention implemented successfully for most participants?

4.5. Did study participants adhere to the assigned intervention regimen?

4.6. If N/PN to 4.3, 4.4 or 4.5: Was an appropriate analysis used to estimate the effect of starting and adhering to the intervention?

5.1 Were outcome data available for all, or nearly all, participants?

5.2 Were participants excluded due to missing data on intervention status?

5.3 Were participants excluded due to missing data on other variables needed for the analysis?

5.4 If PN/N to 5.1, orY/PY to 5.2 or 5.3: Are the proportion of participants and reasons for missing data similar across interventions?

5.5 If PN/N to 5.1, orY/PY to 5.2 or 5.3: Is there evidence that results were robust to the presence of missing data?

6.1 Could the outcome measure have been influenced by knowledge of the intervention received?

6.2 Were outcome assessors aware of the intervention received by study participants?

6.3 Were the methods of outcome assessment comparable across intervention groups?

6.4 Were any systematic errors in measurement of the outcome related to intervention received?

7.1. (Is the reported effect estimate likely to be selected, on the basis of the results, from) multiple outcome measurements within the outcome domain?

7.2. (Is the reported effect estimate likely to be selected, on the basis of the results, from) multiple analyses of the intervention-outcome relationship?

7.3. (Is the reported effect estimate likely to be selected, on the basis of the results, from) different subgroups?

For KQ 3 qualitative studies, we assessed risk to rigor using the Critical Appraisal Skills Programme (CASP) appraisal tool for qualitative studies, which addresses issues related to clear qualitative research aims; congruence between the research aims and methodological approach; sampling and data collection; appropriate application of methods; richness/conceptual depth of findings; appropriate interrogation of findings; reflexivity of the researchers.[6-8]

Data Synthesis and Analysis (Details)

Overall Synthesis

For KQs 1 and 2 (quantitative evidence), we summarized the evidence both in summary and quantitatively. For each set of studies, we provide summary descriptions of their design, characteristics, and included participants. We focused, as pertinent, on study participant characteristics and specific definitions of outcomes. We also summarized the risk of bias or methodological concerns for each set of studies. With rare exceptions, we did not narratively describe each study.

For KQ 3 (qualitative evidence), we synthesized qualitative evidence using a Best Fit Framework approach which is useful in qualitative syntheses of complex interventions.[1, 2] We used the TDF to broadly characterize the determinant domains that emerged among the various populations sampled, separately for antenatal care visit schedules and telemedicine for routine antenatal care. Within each, we defined the "target behavior" as the adoption of the reduced care schedule or telemedicine, respectively and summarized themes of barriers and facilitators of the

target behavior within domains and across patient, provider, and clinic/office perspectives. No study provided data on partner perspectives.

Within the main report we summarized findings either in high-level summary tables that focus on the intervention, sample size, outcome, and results. Further details are included in Appendixes C and D. Appendix C contains detailed tables that describe study and participant characteristics, intervention (and comparator) details, outcomes (and definitions), and arm- and comparison-level results. Appendix C also includes tables providing study-level risk of bias assessments. Appendix D contains more detailed, study-level results for each topic.

Metrics

As pertinent, we calculated event (or findings) rates (i.e., the percentage of participants with the outcome), the odds ratio (OR), or differences between groups. For continuous outcomes, we estimated mean differences between groups or net mean differences (difference-in-differences) between groups based on reported data. If multivariable metrics (e.g., adjusted OR) were reported, we preferentially used those over the unadjusted (crude) metrics.

Meta-Analysis

We conducted meta-analyses when at least three studies (or study groups) of the same design (i.e., at least three RCTs or at least NRCSs) evaluated sufficiently similar interventions in sufficiently similar patients and reported the same outcome. We used our judgment to determine sufficient similarities. We did not exclude meta-analyses solely for statistical heterogeneity (differences across studies in effect size estimates).

We conducted restricted maximum likelihood (REML) model meta-analyses of the OR for outcomes in OpenMeta.

Interpretation of Estimates

In determining conclusions based on the estimates, both for individual studies and from meta-analyses, we interpreted estimates based on their precision. While we did not universally highlight statistical significance, we noted when conclusions (e.g., evidence of an association) are based on estimates that are not statistically significant. We labeled OR estimates with 95 percent confidence intervals that extend beyond both 0.5 and 2.0 (or close to that) as imprecise. Regardless of the magnitude of the estimate, we do not suggest directionality or effect when the confidence is imprecise.

Grading the Strength of the Body of Evidence (Details)

We evaluated the strength of evidence (SoE) addressing each major conclusion for KQ 1 and KQ 2. We graded the SoE as per the Agency for Healthcare Research and Quality (AHRQ) Methods Guide.[9, 10] We did not evaluate the SoE for qualitative evidence (KQ 3).

For each SoE assessment, we considered the number of studies, the study limitations (i.e., risk of bias and overall methodological quality), the directness of the evidence to the KQs, the consistency of study results, the precision of any estimates of effect, the likelihood of reporting bias, other limitations, and the overall findings across studies. Based on these assessments, we assigned a SoE rating as being either high, moderate, low, or insufficient to estimate an effect. For conclusions that are based on ORs, we deemed the evidence to be imprecise if the

nonsignificant lower confidence interval is <0.8 (for estimates >1) or upper confidence interval is >1.25 (for estimates <1).

Outcomes with highly imprecise estimates, inconsistent findings across studies, or with data from only one study were deemed to have insufficient evidence to allow a conclusion. In this instance, we defined highly imprecise as above, for individual studies, when the OR's 95 percent confidence intervals extends beyond both 0.5 and 2.0. This overall approach is consistent with the concept that for imprecise evidence "any estimate of effect is very uncertain," the definition of Very Low quality evidence per GRADE.[11]

We did not evaluate the SoE for qualitive studies (KQ 3), but we assessed the confidence for the summary of qualitative findings using the GRADE-CERQual tool.[6, 12] For each finding, we assessed the methodological limitations of the body of data contributing to the finding, and the findings' coherence[13] (in addressing the complexity and variation of the data), adequacy[14] (defined by richness and quantity of data addressing a finding) and relevance[15] (to the context specified in the review question).

Peer Review and Public Commentary

A preliminary draft version of this report [is being] reviewed from [X to Y], 2021 by invited reviewers, an AHRQ Associate Editor, and AHRQ personnel. A revised version [will be] provided for a public review process from [X to Y], 2022. Revisions to the drafts [will be] made to address reviewer comments. The findings and conclusions are those of the authors, who are responsible for the contents of the report.

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Appendix B. Excluded Articles

[Anonymous.] Pilot Randomized Controlled Trial of Diabetes Group Prenatal Care. Obstetrical & gynecological survey. Identifier: CN-02236314.
I/C: Not scheduling or televisit comparison

[Anonymous.] Prenatal care. Appointment study: a survey by the Infant Mortality Work Group of the Mayor's Advisory Council on Child Health. Bull N Y Acad Med. Identifier: 8401467.
D: Not primary study

Ahrne, Malin; Schytt, Erica; Andersson, Ewa; Small, Rhonda; Adan, Aisha; Essén, Birgitta; Byrskog, Ulrika. Antenatal care for Somali-born women in Sweden: Perspectives from mothers, fathers and midwives. Midwifery. Identifier: 136088544.
I/C: Not scheduling or televisit comparison

Al-Ofi, E. A.; Mosli, H. H.; Ghamri, K. A.; Ghazali, S. M. Management of postprandial hyperglycaemia and weight gain in women with gestational diabetes mellitus using a novel telemonitoring system. J Int Med Res. Identifier: 30442052.
I/C: Not scheduling or televisit comparison

Alanazy, W.; Rance, J.; Brown, A. Exploring maternal and health professional beliefs about the factors that affect whether women in Saudi Arabia attend antenatal care clinic appointments. Midwifery. Identifier: 31154158.
I/C: Not scheduling or televisit comparison

Aydin R, Aktaş S. An investigation of women's pregnancy experiences during the COVID-19 pandemic: A qualitative study. Int J Clin Pract. 2021 Sep;75(9):e14418. doi: 10.1111/ijcp.14418. PMID: 34046977.
I/C: Not scheduling or televisit comparison

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D: Not primary study

Bacchus, L. J.; Bullock, L.; Sharps, P.; Burnett, C.; Schminkey, D. L.; Buller, A. M.; Campbell, J. Infusing Technology Into Perinatal Home Visitation in the United States for Women Experiencing Intimate Partner Violence: Exploring the Interpretive Flexibility of an mHealth Intervention. J Med Internet Res. Identifier: 27856405.
P/I: Not routine antenatal care

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O: No outcome of interest

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P/I: Not routine antenatal care

Bayrampour, H.; Trieu, J.; Tharmaratnam, T. Effectiveness of eHealth Interventions to Reduce Perinatal Anxiety: A Systematic Review and Meta-Analysis. J Clin Psychiatry. Identifier: 30688418.
I/C: Not scheduling or televisit comparison

Beeckman, K.; Louckx, F.; Downe, S.; Putman, K. The relationship between antenatal care and preterm birth: the importance of content of care. Eur J Public Health. Identifier: 22975393.
D: KQ1 Experienced, not scheduled, visits

Beeckman, K.; Louckx, F.; Putman, K. Determinants of the number of antenatal visits in a metropolitan region. BMC Public Health. Identifier: 20809951.
D: KQ1 Experienced, not scheduled, visits

Bennett, C.; Macdonald, G.; Dennis, J. A.; Coren, E.; Patterson, J.; Astin, M.; Abbott, J. Home-based support for disadvantaged adult mothers. Cochrane Database of Systematic Reviews. Identifier: CD003759.
P/I: Not routine antenatal care

Berglund, A.; Lindmark, G. The impact of obstetric risk factors and socioeconomic characteristics on utilization of antenatal care. J Public Health Med. Identifier: 9923954.
O: No additional relevant data

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I/C: Not scheduling comparison

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P/I: Not routine antenatal care

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P/I: Not routine antenatal care

Blondel, B.; Mellier, G. Home visits during pregnancy. Review of randomized trials and open questions. Journal de Gynecologie Obstetrique et Biologie de la Reproduction. Identifier: No PMID or other identifier.
P/I: Not routine antenatal care

Boehm, F. H.; Glass, C. A.; Reed, G. W. Prevention of preterm birth. Role of daily telephone contact. J Reprod Med. Identifier: 8866388.
I: Not scheduling or televisit comparison

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I/C: Not scheduling or televisit comparison

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I/C: Not scheduling or televisit comparison

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I/C: Not scheduling or televisit comparison

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I/C: Not scheduling or televisit comparison

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I/C: Not scheduling or televisit comparison

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I/C: Not scheduling or televisit comparison

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I/C: Not scheduling or televisit comparison

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I/C: Not scheduling or televisit comparison

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P/I: Not routine antenatal care

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P/I: Not routine antenatal care

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C: Unclear comparator

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I/C: Not scheduling or televisit comparison

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I/C: Not scheduling or televisit comparison

van den Heuvel, J. F. M.; Lely, A. T.; Huisman, J. J.; Trappenburg, J. C. A.; Franx, A.; Bekker, M. N. SAFE@HOME: Digital health platform facilitating a new care path for women at increased risk of

preeclampsia ,Äì A case-control study. Pregnancy Hypertension. Identifier: No PMID or other identifier.
P/I: Not routine antenatal care

van den Heuvel, J. F. M.; van Lieshout, C.; Franx, A.; Frederix, G.; Bekker, M. N. SAFE@HOME: Cost analysis of a new care pathway including a digital health platform for women at increased risk of preeclampsia. Pregnancy Hypertens. Identifier: 33813364.
I/C: Not scheduling or televisit comparison

Varnfield, M.; Redd, C.; Stoney, R. M.; Higgins, L.; Scolari, N.; Warwick, R.; Iedema, J.; Rundle, J.; Dutton, W. M,ô°THer, an mHealth System to Support Women with Gestational Diabetes Mellitus: Feasibility and Acceptability Study. Diabetes Technol Ther. Identifier: 33210954.
I/C: Not scheduling or televisit comparison

Vasilevski V, Sweet L, Bradfield Z, et al. Receiving maternity care during the COVID-19 pandemic: Experiences of women's partners and support persons. Women Birth. 2021 Apr 27. doi: 10.1016/j.wombi.2021.04.012. PMID: 33941497.
I/C: Not scheduling or televisit comparison

Veith, Sharon T.; Chisholm, Christian; Novicoff, Wendy; Rheuban, Karen; Cohn, Wendy. Perinatologists and Advanced Practice Nurses Collaborate to Provide High-Risk Prenatal Care in Rural Virginia Communities. JOGNN: Journal of Obstetric, Gynecologic & Neonatal Nursing. Identifier: 103980209.
P/I: Not routine antenatal care

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S: Not high income country

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I/C: Not scheduling or televisit comparison

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I/C: Not scheduling or televisit comparison

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S: Not high income country

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I/C: Not scheduling or televisit comparison

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I/C: Not scheduling or televisit comparison

Walker, D. S. Evaluation of an alternative prenatal care visit schedule for low-risk pregnant women. Dissertation/ thesis. Identifier: CN-02109188.
O: No additional relevant data

Walker, D. S.; Day, S.; Diroff, C.; Lirette, H.; McCully, L.; Mooney-Hescott, C.; Vest, V. Reduced frequency prenatal visits in midwifery practice: attitudes and use. J Midwifery Womens Health. Identifier: 12138935.
D: KQ3 Not QR (survey, quantitative analysis, no comparison of interventions)

Walton R. B. Shaffer S. Heaton J. Group Prenatal Care Outcomes in a Military Population: A Retrospective Cohort Study. Identifier: 26126255.
C: Unclear comparator

Wang N; Deng Z; Wen LM; Ding Y; He G. Understanding the Use of Smartphone Apps for Health Information Among Pregnant Chinese Women: Mixed Methods Study. JMIR mHealth and uHealth. Identifier: 31215516.
I/C: Not scheduling or televisit comparison

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I/C: Not scheduling or televisit comparison

Willcox, J. C.; Wilkinson, S. A.; Lappas, M.; Ball, K.; Crawford, D.; McCarthy, E. A.; Fjeldsoe, B.; Whittaker, R.; Maddison, R.; Campbell, K. J. A mobile health intervention promoting healthy gestational weight gain for women entering pregnancy at a high body mass index: the txt4two pilot randomised controlled trial. Bjog. Identifier:

28220604.
I/C: Not scheduling or televisit comparison

Wilson AN, Sweet L, Vasilevski V, et al. Australian women's experiences of receiving maternity care during the COVID-19 pandemic: A cross-sectional national survey. Birth. 2022 Mar;49(1):30-9. doi: 10.1111/birt.12569. PMID: 34180087.
I/C: Not scheduling or televisit comparison

Windsor, R.; Woodby, L.; Miller, T.; Hardin, M. Effectiveness of Smoking Cessation and Reduction in Pregnancy Treatment (SCRIPT) methods in Medicaid-supported prenatal care: Trial III. Health Educ Behav. Identifier: 21551424.
I/C: Not scheduling or televisit comparison

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I/C: Not scheduling or televisit comparison

Wu Z.; Viisainen K.; Li X.; Hemminki E. Maternal care in rural China: A case study from Anhui province. Identifier: 18331626.
D: KQ1 Experienced, not scheduled, visits

Wulf K. H.; Steck T. The impact of timing and frequency of prenatal visits on the outcome of pregnancy in the perinatal registry of Bavaria 1987-1988. Identifier: 7859909.
D: KQ1 Experienced, not scheduled, visits

Xiaojing Fan; Zhongliang Zhou; Shaonong Dang; Yongjian Xu; Jianmin Gao; Zhiying Zhou; Min Su; Dan Wang; Gang Chen; Fan Xiaojing; Zhou Zhongliang; Dang Shaonong; Xu Yongjian; Gao Jianmin; Zhou Zhiying; Su Min; Wang Dan; Chen Gang. Exploring status and determinants of prenatal and postnatal visits in western China: in the background of the new health system reform. Identifier: 28728550.
D: KQ1 Experienced, not scheduled, visits

Yang X; Song B; Wu A; Mo PKH; Di J; Wang Q; Lau JTF; Wang L. Social, Cognitive, and eHealth Mechanisms of COVID-19-Related Lockdown and Mandatory Quarantine That Potentially Affect the Mental Health of Pregnant Women in China: Cross-Sectional Survey Study. Journal of medical Internet research. Identifier: 33302251.
S: Not high income country

Yang, P.; Lo, W.; He, Z. L.; Xiao, X. M. Medical nutrition treatment of women with gestational diabetes mellitus by a telemedicine system based on smartphones. J Obstet Gynaecol Res. Identifier: 29797375.
I/C: Not scheduling or televisit comparison

Zalar R. W. Frequency of prenatal care visits and perinatal outcome. Identifier: No PMID or other identifier.
D: Not primary study

Zhang, R.; Qu, P. F.; Dang, S. N.; Wang, Q. L.; Liu, D. M.; Li, S. S.; Yan, H. Multilevel linear model analysis of the relationship between prenatal care and neonatal birth weight in Shaanxi Province. Journal of Xi'an Jiaotong University (Medical Sciences). Identifier: No PMID or other identifier.
D: KQ1 Experienced, not scheduled, visits

Zhao P; Diao Y; You L; Wu S; Yang L; Liu Y. The influence of basic public health service project on maternal health services: an interrupted time series study. Identifier: 31242879.
D: KQ1 Experienced, not scheduled, visits

Zhou Z; Su Y; Heitner J; Si Y; Wang D; Zhou Z; Yuan C. The Effects on Inappropriate Weight for Gestational Age of an SMS Based Educational Intervention for Pregnant Women in Xi'an China: A Quasi-Randomized Controlled Trial. International journal of environmental research and public health. Identifier: 32106558.
I/C: Not scheduling or televisit comparison

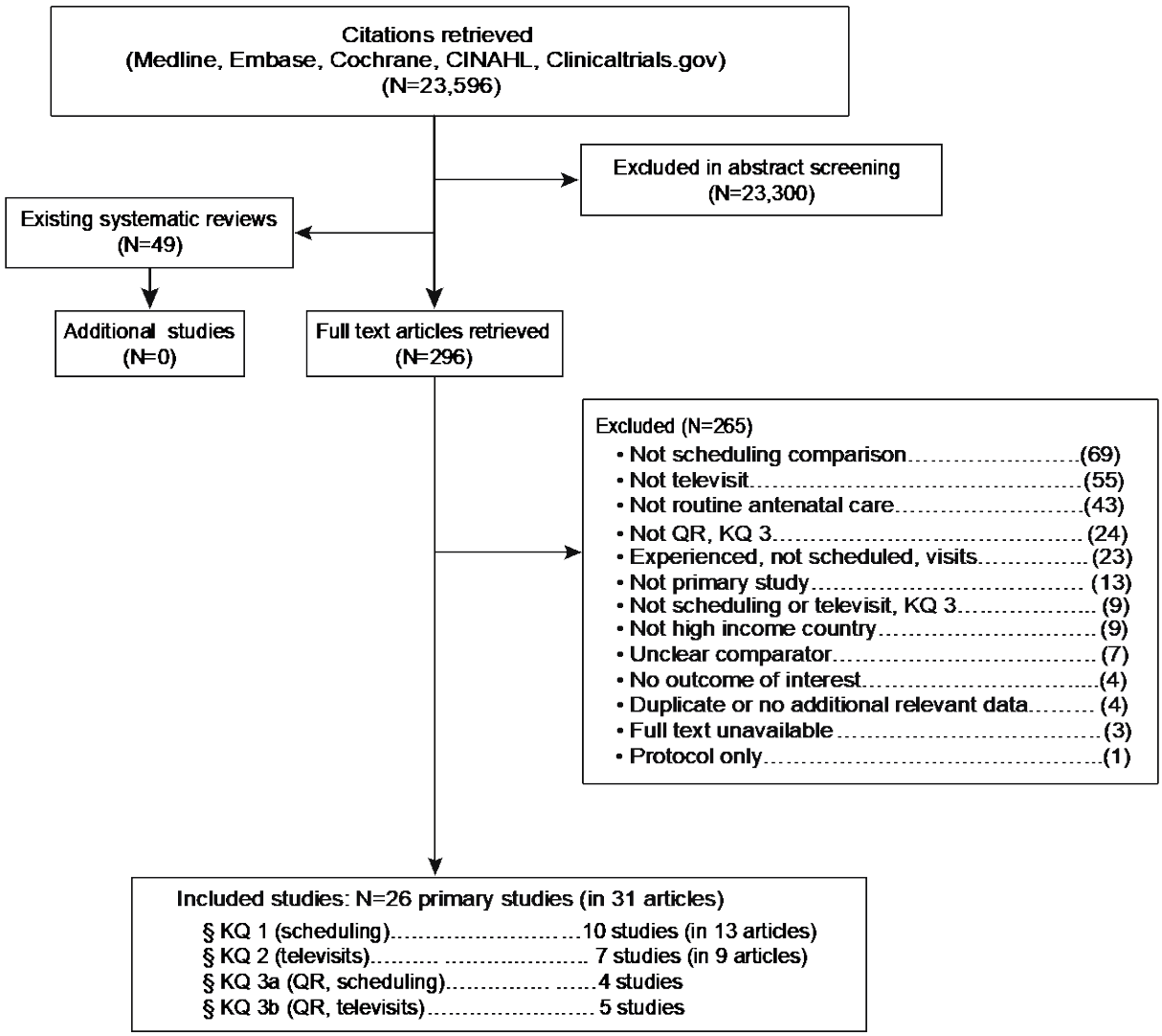
Zhu XH; Tao J; Jiang LY; Zhang ZF. Role of Usual Healthcare Combined with Telemedicine in the Management of High-Risk Pregnancy in Hangzhou, China. Journal of healthcare engineering. Identifier: 31198524.
S: Not high income country

Zielinski, R et al. Improving Infant and Maternal Health through CenteringPregnancy: A Comparison of Maternal Health Indicators and Infant Outcomes between Women Receiving Group versus Traditional Prenatal Care. Open Journal of Obstetrics and Gynecology, 2014, 4, 497-505. Identifier: No Pubmed or other identifier.
D: KQ1 Experienced, not scheduled, visits

Appendix C. Search Results; Study Design, Arm Details, Baselines, and Quality

Search Results

Figure C-1. Literature flow diagram



Abbreviations: KQ = Key Question, QR = qualitative research (study).

Included Articles

Key Question 1 (Schedule)

Berglund AC, Lindmark GC. Health services effects of a reduced routine programme for antenatal care. An area-based study. Eur J Obstet Gynecol Reprod Biol. 1998 Apr;77(2):193-9. doi: 10.1016/s0301-2115(97)00270-4. PMID: 9578278.

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Marko KI, Ganju N, Krapf JM, et al. A Mobile Prenatal Care App to Reduce In-Person Visits: Prospective Controlled Trial. JMIR Mhealth Uhealth. 2019 May 1;7(5):e10520. doi: 10.2196/10520. PMID: 31042154.

McDuffie RS, Jr., Beck A, Bischoff K, et al. Effect of frequency of prenatal care visits on perinatal outcome among low-risk women. A randomized controlled trial. Jama. 1996 Mar 20;275(11):847-51. PMID: 8596222.

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Tandon SD, Cluxton-Keller F, Colon L, et al. Improved adequacy of prenatal care and healthcare utilization among low-income Latinas receiving group prenatal care. J Womens Health (Larchmt). 2013 Dec;22(12):1056-61. doi: 10.1089/jwh.2013.4352. PMID: 24117000.

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Ward N, Bayer S, Ballard M, et al. Impact of prenatal care with reduced frequency of visits in a residency teaching program. J Reprod Med. 1999 Oct;44(10):849-52. PMID: 10554744.

Key Question 2 (Televisit)

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Key Question 3 (Qualitative Studies)

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Meiser RJ, Wlazlo TG; Riese C. Prenatal Care Visit Frequency: The Patient Perspective. Journal of Medical Practice Management. 2021;36(4):222-225.

Peahl AF, Powell A, Berlin H, et al. Patient and provider perspectives of a new prenatal care model introduced in response to the coronavirus disease 2019 pandemic. Am J Obstet Gynecol. 2021 Apr;224(4):384.e1-.e11. doi: 10.1016/j.ajog.2020.10.008. PMID: 33039393.

Quinn LM, Olajide O, Green M, et al. Patient and Professional Experiences With Virtual Antenatal Clinics During the COVID-19 Pandemic in a UK Tertiary Obstetric Hospital: Questionnaire Study. J Med Internet Res. 2021 Aug 31;23(8):e25549. doi: 10.2196/25549. PMID: 34254940

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Stanhope KK, Piper K, Goedken P, et al. Quality and satisfaction with care following changes to the structure of obstetric care during the COVID-19 pandemic in a safety-net hospital in Georgia: Results from a mixed-methods study. J Natl Med Assoc. 2022 Feb;114(1):94-103. doi: 10.1016/j.jnma.2021.12.017. PMID: 35039177.

Study Design, Arm, and Participant Characteristics, Risk of Bias

Key Question 1 (Schedule)

Table C-1-1. KQ 1 (schedule) design details

Author, Year, PMID, Study Name, Country, Funder	Study Design	Study Dates	Study Location Details	Inclusion Criteria	Exclusion Criteria	Specific Population
Berglund 1998 9578278 Sweden Non−Industry	NRCS Retrospective	1990-1992	Central Hospital, Vasteras Multicenter	All women who gave birth at the Central Hospital	NR	No (all comers or not specified)
Jewell 2000 11028575 Bristol, UK Non−Industry	RCT	1996-1997	NR Multicenter	pregnant women booking for antenatal care who were at low risk of obstetric complications	stillbirth or neonatal death; preterm birth (<37 weeks of gestation); a baby born with birthweight less than 2.5 kg; severe pregnancy induced hypertension (not otherwise defined); woman's mother having a history of severe pregnancy induced hypertension (nulliparous women only); severe medical condition in current pregnancy; addiction to controlled drugs; recurrent (three or more consecutive) miscarriages	No (all comers or not specified)
Marko 2019 31042154 Washington DC Non-industry	NRCS Prospective	2015-2016	George Washington University hospital	18 to 40 years of age, presenting for a first trimester (up to 13 weeks gestational age) verification of pregnancy or new OB visit, and who were considered low−risk	antepartum diagnosis of fetal abnormalities, placenta previa, intrauterine growth restriction, pregnancy−induced hypertension, gestational diabetes, or premature rupture of membranes	No (all comers or not specified)
McDuffie 1996 8596222 Colorado Non−Industry	RCT	1992-1994	Kaiser Permanente Colorado region Multicenter	1st trimester (≤13 week), presenting for intake	<18, >39, past or current high−risk OB: multiple gestation (if known at intake), pregnancy conceived through assisted reproductive technology, and large (>4 cm) leiomyomata.	No (all comers/not specified)
Partridge 2005 16322418 California NR	NRCS Retrospective	1999-2000	Naval Hospital Camp Pendleton US Navy medical treatment facility Single center	Women who received their prenatal care at Naval Hospital Camp Pendleton (NHCP) and had a perinatal outcome documented in our inpatient databases	Patients with incomplete data or patients were transferred for their pre−natal care to tertiary care facilities and did not deliver at NHCP	Population specified

Ross−McGill 2000 10688505 Leeds and Yorkshire, UK Non−Industry	RCT	NR	four large urban general practices and three smaller rural practices Multicenter	Women undergoing either shared general practitioner and hospital antenatal care, or entirely general practitioner care	multiple pregnancy, bp ≥ 140/90 mmHg, or with previous early onset (before 34 weeks) pre−eclampsia, serious medical disease, or previous pregnancy loss after 24 weeks	No (all comers or not specified)
Sikorski 1996 8595286 London, UK Non-Industry	RCT	1993-1994	Lewisham or Guy's Hospitals Multicenter	women <22 week gestation at booking, patients of general practitioners, booked for delivery at Lewisham or Guy's Hospitals or St Thomas's Hospitals or at home, low antenatal risk	NR	No (all comers or not specified)
Tandon 2013 FL, US Non-industry	NRCS Prospective	2008-2009	Palm beach county clinics Multicenter	confirmed pregnancy, self-identified as Hispanic or Mayan, and were ≤20 weeks gestation	NR	Population specified
Walker 1997 9277060 California Non−Industry	RCT	1993-1994	Southern California Single center	low risk pregnancy, beginning prenatal care before 26 weeks' gestation, >18 years of age	NR	Population specified
Ward 1999 Biloxi, MS NR	NRCS Ambidirectional	1991-1994	Keesler Medical Center Air Force medical center in the Department of Defense Single center	NR	patients with hypertension, connective tissue disease, serious blood disorder, seizure disorder, thyroid disease, heart disease, kidney disease, diabetes, thyroid disease, heart disease, kidney disease, diabetes, prior low birth weight infant and history of recurrent miscarriages	Population specified

Table C-1-2. KQ 1 (schedule) arm details

Author, Year, PMID, Study Name, Country	Arm	Arm Description	Total No. Planned (Mean Achieved) Visits	Schedule (Wk)*	Individual / Group	Providers	Other Visit Characteristics	Other Differences
Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	10 (9) visits	10 (9) visits to the local ANC clinic	Midwife: 10, (20), 24, 27, 30, 33, 35 (nulliparous), 37, 39 Doctor: end of the first trimester and 36	NR	NR	NR	None explicit
	More intensive (14 visits)	14 visits	14 visits to the local ANC clinic	Midwife: 10, 20, 24, 27, 29, 31, 33, 35, 36, 37, 38, 39 Doctor: end of the first trimester and 36	NR	NR	NR	(same)
Jewell 2000 11028575 Bristol, UK	Less intensive (≥7 visits)	Flexible care: It was intended to define a minimum number of visits, with additional visits determined by the participating women's own wishes.	NR	nulliparous: 8, 16, 24, 32, 34, 36, 38, 40 parous: 8, 16, 24, 32, 35, 38, 41 Additional visits offered, per women's wishes.	NR	NR	All office visits (same)	None explicit (same)
	More intensive (14 visits)	Traditional care: It was intended to define exactly when women were seen.	NR	8, 12, 16, 24, 28, 30, 32, 34, 36, 37, 38, 39, 40, 41	NR	NR	(same)	(same)
Marko 2019 31042154 Washington DC	Less intensive (9 visits)	Baby scripts	9 visits	New OB visit, 16, 24, 28, 32, 36, 38, 39, 40	NR	NR	The Babyscripts app was designed with 2 major goals: (1) to deliver educational content via a mobile app and (2) to remotely monitor blood pressure and weight.	None explicit
	More intensive (13 visits)	Standard care	13 visits	New OB visit, 16, 20, 24, 28, 30, 32, 34, 36, 37, 38, 39, 40	NR		NR	(same)
McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	9 visits	9 [1 televisit if parous] (NR)	8, 12, 16, 24, 28, 32, 36, 38, 40	9/0	OB/NP 85.8% Nurse 10.0% Perinatology 3.8%	Initial visit 45 min, then 15 min w/practitioner or 10 min with OB	None explicit
	More intensive (14 visits)	14 visits	14 (NR)	8, 12, 16, 20, 24, 28, 30, 32, 34, 36, 38, 39, 40, 41	14/0	OB/NP 87.8% Nurse 9.5% Perinatology 3.5%	(same)	(same)

Author, Year, PMID, Study Name, Country	Arm	Arm Description	Total No. Planned (Mean Achieved) Visits	Schedule (Wk)*	Individual / Group	Providers	Other Visit Characteristics	Other Differences
Partridge 2005 16322418 California	Less intensive (9 visits)	Goal−oriented guideline with 9 prenatal visits	9 visits	7−12, ≤12, 16−18, 24, 28, 32, 36, 38, 40	9/0	NR		(same)
	More intensive (13 visits)	Routine care with 13 prenatal visits	13 visits	7−12, ≤12, 16, 20, 24, 28, 32, 34, 36, 37, 38, 39, 40	13/0	NR		None explicit
Ross-McGill 2000 10688505 Leeds and Yorkshire, UK	Less intensive (8 visits)	8 visits	3 visits after 24 weeks, plus weekly bp monitoring at home (assuming women had 5 visits through 24 weeks)	Visits through 24 weeks, 34, 38, and 41	3/0	NR	weekly BP monitoring at home; women recruited at 24 to 28 weeks, scheduling before that NR	None explicit
	More intensive (14 visits)	14 visits	9 visits after 24 weeks (assuming women had 5 visits through 24 weeks)	Visits through 24 weeks, (30, 32, 34, 36, 37, 38, 39, 40 and 41)	9/0	NR	women recruited at 24 to 28 weeks, scheduling before that NR	(same)
Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	6−7 visits (new style intervention)	7 visits for nulliparous women and 6 visits for parous women	24, 28, 32, 36, 38, 40, 41 (nulliparous) 26, 32, 36, 38, 40, 41 (parous)	6,7/0	NR	All office visits	None explicit
	More intensive (13 visits) us	13 visits (traditional)	13 visits	16, 20, 24, 28, 30, 32, 34, 36, 37, 38, 39, 40,41	13/0	NR	(same)	(same)
Tandon 2013 FL, US	Less intensive (10 visits)	Group care	10 visits	First 4 sessions monthly, last 6 sessions biweekly	0/10	NR	2 hours	None explicit
	More intensive (10−12 visits)	Traditional care	10−12 visits	NR	NR	NR	NR	(same)
Walker 1997 9277060 California	Less intensive (8 visits)	Alternative prenatal care visit schedule	8 (NR)	10, 15−19, 24−28, 32, 36, 38, 39, 40	8/0	NR	45 mins initial visit; 15 minutes all followup visits	None explicit
	More intensive (14 visits)	Traditional prenatal care visit schedule	14 (NR)	8, 12, 16, 20, 24, 28, 30, 32, 34, 36, 37, 38, 39, 40	14/0	NR	(same)	(same)
Ward 1999 Biloxi, MS	Less intensive (8 visits)	control	NR	6−12, 16−20, 24−28, 32, 36, 38, 40, weekly thereafter	NR	NR	40 mins initial visit, 10 mins follow up visit	None explicit
	More intensive (14 visits)	1991 historical cohort	NR	14 (ACOG guidelines)	NR	NR	40 mins initial visit, 10 mins follow up visit	(same)

Abbreviations: ACOG = American College of Obstetricians and Gynecologists, PMID = PubMed Identifier, NR= not reported

Table C-1-3. KQ 1 (schedule) participant characteristics

Author, Year, PMID, Study Name	Arm	Enrolled (Analyzed)	Race / Ethnicity, %	Age, Mean (SD) or %	Nulliparous, %	Multiple Gestation, %	Gestation at Initial Visit Mean (SD)	BMI	SES	Relationship Status
Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	1874 (1874)	NR	<20y: 0.8 20−35y: 84.4 >35y: 14.8	40.8	1.3	NR	NR	Unemployed: 7.5	NR
	More intensive (14 visits)	2008 (2008)	NR	<20y: 1.4 20−35y: 85.8 >35y: 12.8	43.2	1.3	NR	NR	Unemployed: 4.5	NR
Jewell 2000 11028575 Bristol, UK	Less intensive (≥7 visits)	309 (265)	NR	28.2	51.6	NR	NR	NR	NR	NR
	More intensive (14 visits)	300 (279)	NR	28.0	48.4	NR	NR	NR	NR	NR
Marko 2019 31042154 Washington DC	Less intensive (9 visits)	60 (47)	Black 30.0 Hispanic 6.0	33.0 (3.0)	36	NR	NR	22.9 (3.2)	College or above: 96	NR
	More intensive (13 visits)	58 (41)	Black 30.0 Hispanic 6.0	32.2 (3.2)	39	NR	NR	24.9 (4.0)	College or above: 88	NR
McDuffie 1996[132] 8596222 Colorado	Less intensive (9 visits)	1382 (1165)	White 80.9 Black 4.2 Hispanic 12.1 Other 2.8	28.5 (4.9)	46.6	0.9	8.6 (1.7)	NR	Private insurance 100%	NR
	More intensive (14 visits)	1382 (1163)	White 82.1 Black 4.5 Hispanic 11.4 Other 1.9	28.5 (4.8)	50.5	1.0	8.6 (1.6)	NR	Private insurance 100%	NR
Partridge 2005 16322418 California	Less intensive (9 visits)	1710 (1710)	NR	23.9 (4.79)	Gravidity 2.2±1.3, Parity 1.4±1.22	Twin 0.21	NR	NR	NR	NR
	More intensive (13 visits)	1647 (1647)	NR	23.6 (4.57)	Gravidity 2.1±1.3, Parity 1.2±0.96	Twins 1.06	NR	NR	NR	NR

Author, Year, PMID, Study Name	Arm	Enrolled (Analyzed)	Race / Ethnicity, %	Age, Mean (SD) or %	Nulliparous, %	Multiple Gestation, %	Gestation at Initial Visit Mean (SD)	BMI	SES	Relationship Status
Ross-McGill 2000 10688505 Leeds and Yorkshire, UK	Less intensive (3 visits)	40 (40)	Member of an ethnic minority (12.5)	29.0 (5.5)	35	0	NR	NR	Professional/intermediate 50,Skilled/partly skilled 35,Unskilled/unemployed 15	Living with partner 92.5
	More intensive (9 visits)	40 (40)	Member of an ethnic minority (2.5)	28.0 (4.8)	30	0	NR	NR	Professional/intermediate 45, Skilled/partly skilled 37.5, Unskilled/unemployed 17.5	Living with partner 87.5
Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	1416 (1416)	Ethnic minority 32.8	28.03 (5.001)	NR	NR	13.07 (3.2)	NR	Higher education 31.7	NR
	More intensive (13 visits)	1378 (1378)	Ethnic minority 31.0	27.96 (4.912)	NR	NR	13.04 (3.0)	NR	Higher education 34.8	NR
Tandon 2013 FL, US	Less intensive (10 visits)	144 (144)	Hispanic 76 Mayan 22	27.0 (6.4)	32.0	NR	NR	NR	High school 31	Unmarried but marriage−like relationship: 37
	More intensive (10−12 visits)	70 (70)	Hispanic 77 Mayan 20	27.2 (6.4)	37.0	NR	NR	NR	High school 31	Unmarried but marriage−like relationship: 37
Walker 1997 9277060 California	Less intensive (8 visits)	61 (43)	White 20.9 Asian 2.3 Hispanic 74.4	24.49 (26.17) Median (18.3, 35.70)	NR	NR	NR	NR	Private insurance 11.6 Medicaid 76.7 self−pay 2.3 Missing 9.3	Marriage like relationships 62.8 Single 14 Divorced, separated or widowed 2.3
	More intensive (14 visits)	61 (38)	White 23.0 Asian 0 Hispanic 73.7	26.17 (5.41) Median (19.8, 39.9)	NR	NR	NR	NR	Private insurance 7.9 Medicaid 86.8 self−pay 2.6 Missing 2.6	Marriage like relationships 52.6 Single 8.9 Divorced, separated or widowed 10.5
Ward 1999 Biloxi, MS	Less intensive (8)	734 (734)	NR	NR	NR	NR	NR	NR	NR	NR
	More intensive (14)	711 (711)	NR	NR	NR	NR	NR	NR	NR	NR

Abbreviations: BMI= Body Mass Index, PMID = PubMed Identifier, NR= not reported

Table C-1-4. KQ 1 (schedule) participant morbidities/conditions

Author, Year, PMID, Study Name	Arm	HTN, Pregestational / Chronic, %	HTN, Gestational, %	DM, Pregestational, %	DM, Gestational, %	Mental Health, %	Tobacco, %	Prior High Risk, %	Other, %
Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	NR	NR	NR	NR	NR	NR	NR	NR
	More intensive (14 visits)	NR	NR	NR	NR	NR	NR	NR	NR
Jewell 2000 11028575 Bristol, UK	Less intensive (≥7 visits)	NR	NR	NR	NR	NR	NR	NR	NR
	More intensive (14 visits)	NR	NR	NR	NR	NR	NR	NR	NR
McDuffie 1996[132] 8596222 Colorado	Less intensive (9 visits)	4.5	19.0	1.8	7.4	NR	NR	NR	NR
	More intensive (14 visits)	4.5	20.1	2.0	7.0	NR	NR	NR	NR
Marko 2019 31042154 Washington DC	Less intensive (9 visits)	NR	NR	NR	NR	NR	NR	NR	NR
	More intensive (13 visits)	NR	NR	NR	NR	NR	NR	NR	NR
Partridge 2005 16322418 California	Less intensive (9 visits)	NR	NR	NR	NR	NR	NR	NR	NR
	More intensive (13 visits)	NR	NR	NR	NR	NR	NR	NR	NR
Ross-McGill 2000 10688505 Leeds and Yorkshire, UK	Less intensive (3 visits)	NR	NR	0	NR	NR	NR	NR	Any serious medical condition: 0
	More intensive (9 visits)	NR	NR	0	NR	NR	NR	NR	Any serious medical condition: 0
Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	NR	NR	NR	NR	NR	number of cigarettes per day 4.76	NR	NR
	More intensive (13 visits)	NR	NR	NR	NR	NR	number of cigarettes per day 4.91	NR	NR

Author, Year, PMID, Study Name	Arm	HTN, Pregestational / Chronic, %	HTN, Gestational, %	DM, Pregestational, %	DM, Gestational, %	Mental Health, %	Tobacco, %	Prior High Risk, %	Other, %
Tandon 2013 FL, US	Less intensive (10 visits)	NR	NR	NR	NR	NR	NR	NR	NR
	More intensive (10−12 visits)	NR	NR	NR	NR	NR	NR	NR	NR
Walker 1997 9277060 California	Less intensive (8 visits)	NR	NR	NR	NR	NR	NR	NR	NR
	More intensive (14 visits)	NR	NR	NR	NR	NR	NR	NR	NR
Ward 1999 Biloxi, MS	Less intensive (8 visits)	NR	NR	NR	NR	NR	NR	NR	NR
	More intensive (14 visits)	NR	NR	NR	NR	NR	NR	NR	NR

Abbreviations: DM = Diabetes Mellitus, HTN = Hypertension, PMID = PubMed Identifier, NR= not reported

Key Question 2 (Televisits)

Table C-2-1. KQ 2 (televisits) design details

Author, Year, PMID, Study Name, Country, Funder	Study Design	Study Dates	Study Location Details	Inclusion Criteria	Exclusion Criteria	Specific Population	Comments
Barbour 2017 NoPMID UT, US NR	RCT	NR	Salt Lake City, UT US NR	Low risk parous women <16 0/7 weeks' gestation and carrying a singleton fetus	NR	No	(none)
Butler Tobah 2019 31228414 MN, US Non-Industry	RCT	2014, 2015	Rochester, Minnesota Mayo Clinic A tertiary care academic center serving approximately 2400 Single center	English-speaking pregnant women between 18 and 36 years old, at <13 weeks of gestation, and without a concurrent medical or obstetric complication	Diagnoses of any chronic medical conditions, including hypertensive disorders, coagulopathies, diabetes, class 3 obesity, immunodeficiency conditions, genetic disorders, multi-fetal gestation, prior history or risk factors for preterm delivery, pulmonary disorders, unstable mental health conditions	No	(none)
Duryea 2021 33852002 TX, US Non-Industry	NRCS: Pre-Post Retrospective	2019, 2020	Parkland Hospital, Dallas, TX Serves indigent and needy populations Single center	All deliveries of infants weighing more than 500 g, whether live or stillborn	NR	Women with medical indigence (per source population)	All women delivering at Parkland Hospital were enrolled in care at a neighborhood clinic for antenatal and postpartum care continuity. Women with medical or pregnancy complications are referred to a centrally located maternal-fetal medicine clinic.
Futterman 2021 33038898 NY, US NR	NRCS: Retrospective (survey)	2020	Valhalla, New York NYC Health + Hospitals and NYC Health + Hospitals/Metropolitan An inner city, safety net hospital Single center	Patients received at least one televisit and one in-person visit during the 2020 COVID-19 pandemic	NR	No	Comparison of tele-visit and in-person visit for the same individual

Author, Year, PMID, Study Name, Country, Funder	Study Design	Study Dates	Study Location Details	Inclusion Criteria	Exclusion Criteria	Specific Population	Comments
Palmer 2021 34217399 Melbourne, Australia Non-Industry	NRCS: Retrospective	2018, 2020	Monash Health, Melbourne, Australia Secondary and tertiary referral hospitals (largest local maternity service) Single center	Births >=20 weeks gestation or >=400 g.	Missing data	No	Interrupted time series around the the start of the pandemic. Implementation period (3/23/22 - 4/19/22) omitted from extraction.
Pflugeisen 2016 26474477 OB Care ConnectTM WA, US NR	NRCS: Prospective	2011, 2013	Washington State MultiCare Health System in the South Puget Sound region NR	Low-risk pregnant women who initiate prenatal care in the first trimester of a singleton pregnancy, women who had given birth within our health system at the time of data extraction and who were enrolled in OB Care ConnectTM for ≥100 days	NR	No	(none)
Pflugeisen 2017 28176034 OB Care ConnectTM WA, US Non-Industry	NRCS: Retrospective	2013, 2016	Tacoma, WA MultiCare Health System, Institute for Research & Innovation NR	All Virtual-care patients (low-risk pregnancy) who completed at least one Virtual Visit between March 2013 and January 2016, and those who enrolled in traditional care program (low-risk pregnancy) during the same time.	Patients with a known high-risk pregnancy at the time of enrollment	No	(none)

Table C-2-2. KQ 2 (televisits) arm details

Author, Year, PMID, Study Name, Country	Arm	Arm Description	Tele-Visits Technology	Timing of Tele-Visits (Weeks of Gestation)	Total No. Planned (Mean Achieved) Visits)	Planned No. Tele/In-Person Visits (Mean Achieved) Visits)	Home Monitor	Providers	Occurred Due to the COVID Pandemic	Other Visit Characteristics
Barbour 2017 NoPMID UT, US	Hybrid visits	A combination of telemedicine and 5 scheduled in clinic prenatal visits	A web-based platform (patients entered weight, blood pressure, and fetal heart rate into the electronic medical record patient portal)	NR	NR (7.2)	Planned: NR/5 Achieved: 4.37/NR	NR	NR	No	Overall number of prenatal visits was unaltered between two groups
	In person visits	Traditional in clinic care	NA	NA	NR (11.3)	Planned: NA/NR	NR	NR	No	Overall number of prenatal visits was unaltered between two groups
Butler Tobah 2019 31228414 MN, US	Hybrid visits	8 scheduled clinic appointments + 5 virtual (phone or online) with an OB Nest registered nurse	Phone or online (synchronous)	16, 24, 33, 38, 40	14 (11.25 for on-site visits)	Planned: 6/8	Yes	Nurse practitioner 100 for tele visits but NR for the in-person visits	No	Timing of visits: 1-7, 8, 12, 16, 18, 24, 28, 33, 36, 38, 39, 40, 41 Minor difference in the planned total number of visits between arms
	In person visits	Usual care with 12 clinic appointments	NA	NA	12 (14.69 for on-site visits)	Planned: 0/12	No	NR	No	Timing of visits: 1-7, 8, 12, 18, 24, 28, 33, 36, 38, 39, 40, 41 (Per ACOG recommendation) Minor difference in the planned total number of visits between arms
Duryea 2021 33852002 TX, US	Hybrid visits	Audio-only virtual prenatal visits replacing some in-person visits	Telephone (synchronous)	14, 34, 27	13 (12.2)	Planned: 3/10	No	NR	Yes	Timing followed WHO and ACOG recommendations
	In person visits	Traditional in-person prenatal care	NA	NA	13 (11.8)	Planned: 0/13	No	NR	No	(same)
Futterman 2021 33038898 NY, US	Tele visits	A same individual received tele visits during pandemic	NR	Experienced timing of tele-visits: Mean (SD): 28.9 (7.43)	NR	Achieved: 1.8 for tele visits	NR	OB/GYN 60 Midwife 40	Yes	28% were high risk care while 72% were low risk care

Author, Year, PMID, Study Name, Country	Arm	Arm Description	Tele-Visits Technology	Timing of Tele-Visits (Weeks of Gestation)	Total No. Planned (Mean Achieved) Visits)	Planned No. Tele/In-Person Visits (Mean Achieved) Visits)	Home Monitor	Providers	Occurred Due to the COVID Pandemic	Other Visit Characteristics
	In person visits	A same individual received in person visits during pandemic	NA	NA	NR	NR	NR	OB/GYN 60 Midwife 40	Yes	28% were high risk care while 72% were low risk care
Palmer 2021 34217399 Melbourne, Australia Non-Industry	Tele visits	Hybrid: Televisits and in-person visits	Video call (5% via telephone) (Healthdirect Australia)	16, 22, 31, 34, 38	9	NR	Yes	OB/GYN 11 Midwife 89	Yes	Added suite of information sheets, home BP monitoring, self-measured symphyseal-fundal heights
	In person visits	Conventional, all in-person visits	NA	28, 36, 40	10	NR	No	NR	No	NR
Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	Hybrid visits	14 visits with a mix of in person and tele visits	Video conferencing (synchronous)	12-15, 16, 24, 30, 34	14 (14.9)	Planned: 5/9	Yes	OB/GYN 64.3 Nurse practitioner/ registered nurse 35.7	No	Timing of visit (weeks): 4-8; 8-12; 12-15; 16; 20; 24; 28; 30; 32; 34;36; 37,38,39;40
	In person visits	14 visits	NA	NA	14 (15.6)	Planned: 0/14	No	OB/GYN 100	No	Timing followed ACOG recommendation
Pflugeisen 2017 28176034 OB Care ConnectTM WA, US	Hybrid visits	Completed at least one virtual visit	Video conferencing (synchronous)	NR	NR	Achieved: ≥1 for tele visits (by inclusion criteria)	Yes	Nurse practitioner 100 for tele visits but NR for the in-person visits	No	NR
	In person visits	Traditional care	NA	NA	NR	NR	NR	NR	No	NR

Table C-2-3. KQ 2 (televisits) participant characteristics

Author, Year, PMID, Study Name	Arm	Enrolled (Analyzed)	Race / Ethnicity, %	Age, Mean (SD) or %	Nulliparous, %	Multiple Gestation, %	Gestation at Initial Visit, Week	BMI	SES	Relationship Status
Barbour 2017 NoPMID UT, US	Hybrid visits	100 (100)	NR	NR	NR	NR	NR	NR	NR	NR
	In person visits	100 (100)	NR	NR	NR	NR	NR	NR	NR	NR
Butler Tobah 2019 31228414 MN, US	Hybrid visits	150 (134)	White 91.3	29.5 (3.3) Maternal age≥35 8.7	Gravida of 1: 32; Parity of 1: 60	0	NR	25.3 (5.4) BMI >30 14.7	<$40,000 annual household income 12 $40,000 to $79,999 annual household income 28 ≥80,000 annual household income 54 High school graduate or less 2.7 Some college or associate's degree 22.0 Four-year college graduate 38.7 Graduate/professional school degree 31.3 Private insurance 90	Married/marriage-like relationship 97.3
	In person visits	150 (133)	White 91.3	29.7 (3.6) Maternal age≥35 8	Gravida of 1: 33.3; Parity of 1: 59.3	0	NR	26.0 (6.7) BMI >30 14.7	<$40,000 annual household income 9.3 $40,000 to $79,999 annual household income 29.3 ≥80,000 annual household income 52 High school graduate or less 4.7 Some college or associate's degree 20.0 Four-year college graduate 36.0 Graduate/professional school degree 31.3 Private insurance 86	Married/marriage-like relationship 97.3

Author, Year, PMID, Study Name	Arm	Enrolled (Analyzed)	Race / Ethnicity, %	Age, Mean (SD) or %	Nulliparous, %	Multiple Gestation, %	Gestation at Initial Visit, Week	BMI	SES	Relationship Status
Duryea 2021 33852002 TX, US	Hybrid visits	6048 (6048)	White 4 Black 18 Hispanic 76	27.7 (6.5)	29.2	1.5	Median (IQR): 11 (8-17)	29.4 (6.7)	NR	NR
	In person visits	6559 (6559)	White 3 Black 16 Hispanic 77	27.8 (6.4)	29.8	1.3	Median (IQR): 12 (9-18)	29.3 (6.7)	NR	NR
Futterman 2021 33038898 NY, US	Tele visits	104 (104)	White 9 Black 13 Hispanic 74	31.2 (6.28)	27	1.9	Gestational age at tele visits mean (SD): 28.9 (7.43)	NR	Online access to personal medical record 35	NR
	In person visits	104 (104)	White 9 Black 13 Hispanic 74	31.2 (6.28)	27	1.9	NR	NR	Online access to personal medical record 35	NR
Palmer 2021 34217399 Melbourne, Australia Non-Industry	Hybrid visits	1767 (1767)	NR	31.6 (5.31)	39	2.2	NR	Median 25 (IQR 22,29)	NR	NR
	In person visits	15470 (15470)	NR	31.3 (5.2)	40	1.9	NR	Median 25 (IQR 22,29)	NR	NR
Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	Hybrid visits	117 (117)	White 83.8	30.3 (4.5)	88.0	NR	NR	NR	WIC enrolled 17.1	Partnered 88.0
	In person visits	941 (941)	White 72.3	29.1 (5.4)	64.4	NR	NR	NR	WIC enrolled 36.1	Partnered 70.9
Pflugeisen 2017 28176034 OB Care ConnectTM WA, US	Hybrid visits	75 (75)	White 78.7	31.5 (4)	22.7	NR	NR	NR	Household income >100k 36 Working during pregnancy 66.7 < 5 miles from OB clinic 21.3	Partnered 94.7
	In person visits	96 (96)	White 75.0	31.2 (5)	44.8	NR	NR	NR	Household income >100k 33.3 Working during pregnancy 78.1 < 5 miles from OB clinic 24.0	Partnered 88.5

Table C-2-4. KQ 2 (televisits) participant morbidities/conditions

Author, Year, PMID, Study Name	Arm	HTN, Pregestational / Chronic, %	HTN, Gestational, %	DM, Pregestational, %	DM, Gestational, %	Mental Health, %	Tobacco, %	Prior High Risk, %	Other, %
Barbour 2017 NoPMID UT, US	Hybrid visits	NR	NR	NR	NR	NR	NR	NR	NR
	In person visits	NR	NR	NR	NR	NR	NR	NR	NR
Butler Tobah 2019 31228414 MN, US	Hybrid visits	0	NR	0	NR	NR	NR	0	Class 3 obesity 0
	In person visits	0	NR	0	NR	NR	NR	0	Class 3 obesity 0
Duryea 2021 33852002 TX, US	Hybrid visits	4.5	19.0	1.8	7.4	NR	NR	NR	NR
	In person visits	4.5	20.1	2.0	7.0	NR	NR	NR	NR
Futterman 2021 33038898 NY, US	Tele visits	Chronic hypertension 3.8	NR	NR	12.5	NR	NR	Poor obstetrical history: history of preterm pre-labor rupture of mem-branes, intrauterine fetal demise, and preterm birth 4.8	Prior cesarean delivery 17
	In person visits	Chronic hypertension 3.8	NR	NR	12.5	NR	NR	Poor obstetrical history: history of preterm pre-labor rupture of mem-branes, intrauterine fetal demise, and preterm birth 4.8	Prior cesarean delivery 17
Palmer 2021 34217399 Melbourne, Australia Non-Industry	Hybrid visits	NR	NR	NR	NR	NR	6.4	NR	NR
	In person visits	NR	NR	NR	NR	NR	6.3	NR	NR
Pflugeisen 2016 26474477 OB Care ConnectTM US	Hybrid visits	NR	NR	NR	NR	NR	24.8	NR	Illicit drug use 2.6
	In person visits	NR	NR	NR	NR	NR	30.9	NR	Illicit drug use 7.5

Author, Year, PMID, Study Name	Arm	HTN, Pregestational / Chronic, %	HTN, Gestational, %	DM, Pregestational, %	DM, Gestational, %	Mental Health, %	Tobacco, %	Prior High Risk, %	Other, %
Pflugeisen 2017 28176034 OB Care ConnectTM WA, US	Hybrid visits	NR	NR	NR	NR	NR	NR	Prior pregnancy loss 22.9	NR
	In person visits	NR	NR	NR	NR	NR	NR	Prior pregnancy loss 21.3	NR

Table C-4-1. Risk of bias, randomized controlled trials

KQ: Study, PMID	Random	Allocation Concealed	Groups Different	Patient Blind	Providers Blind	Deviations	ITT	Co-interventions Balanced	Implementation Failure	Non-adherence	Missing Data	Outcome Measurement Appropriate	Ascertainment Differed	Outcome Assessors Blind	Prespecified Analysis	Selective Reporting	Overall RoB
KQ 1: Jewell 2000 11028575	Y	Y	N	N	N	N	Y	Y	N	PN	N	Y	N	N	Y	N	Low
KQ 1: McDuffie 1996 8596222	Y	Y	N	N	N	PN	Y	Y	N	NI	N	Y	N	NI	Y	N	Low
KQ 1: Ross-McGill 2000 10688505	Y	Y	N	N	N	N	Y	Y	N	N	N	Y	N	N	Y	N	Low
KQ 1: Sikorski 1996 8595286	Y	Y	PN	N	N	N	Y	Y	N	N	N	Y	PN	NI	Y	N	Low
KQ 1: Walker 1997 9277060	Y	NI	N	N	N	N	Y	Y	N	N	Y[a]	Y	N	N	Y	N	Some concerns[b]
KQ 2: Barbour 2017 None	Y	NI	NI	N	N	PN	Y	NI	PN	PN	NI	Y	N	NI	PY	N	Some concerns[c]
KQ 2: Butler Tobah 2019 31228414	Y	Y	N	N	N	PN	Y	Y	N	N	PN[d]	Y	N	Y	Y	N	Low

Abbreviations: ITT = intention-to-treat (analysis), KQ = Key Question, N = no, NI = not indicated (i.e., unclear), PMID = PubMed Identifier, PN = probably no, PY = probably yes, RoB = risk of bias, Y = yes.

Colors used to distinguish Key Questions and risk of bias ratings are for emphasis only.

[a] 30% but no differences between groups or between dropouts and retained participants
[b] High dropout rate
[c] Limited information from conference abstract
[d] 11% missing

Table C-4-2. Risk of bias, nonrandomized comparative studies

KQ: Study, PMID	Cofounding	Appropriate Analysis	Unbiased Eligibility	Intervention Timing Bias	Interventions Clearly Defined, Unproblematic	Co-interventions Balanced	Crossover	Missing Data	Outcome Biased by No Blinding	Outcome Assessors Blind	Outcome Assessment Comparable	Outcome Measurement Error	Selective Reporting	Overall Risk of Bias
KQ 1: Berglund 1998 9578278	Y	N[a]	Y	N	Y	N[b]	PN	N	N	N	Y	N	N	High[c]
KQ 1: Marko 2019 31042154	N	PY[d]	Y	N	Y	N[e]	NI	NI	N	NI	Y	N	N	High[f]
KQ 1: Partridge 2005 16322418	Y[g]	N[h]	Y	N	Y	NI	PN	Y[i]	N	NI	N[j]	N	N	High[k]
KQ 1: Tandon 2013 24117000	N	N[l]	Y	N	Y	NI	PN	N	N	NI	Y	N	N	High[m]
KQ 1: Ward 1999 10554744	N	N[n]	Y	N	Y	NI	NI	NI	N	NI	Y	N	N	High[o]
KQ 2: Duryea 2021 33852002	Y	N[p]	N[q]	N	PN	Y	Y[r]	N	N	N	Y	N	N	High[s]
KQ 2: Futterman 2021 33038898	N	Y[t]	Y	N	Y	NI	N	N	N	N	Y	N	N	Low
KQ 2: Palmer 2021 34217399	Y	N[u]	N	N	N	Y	N	N	N	N	Y	N	N	High
KQ 2: Pflugeisen 2016 26474477	PN	PN[v]	Y	N	Y	N[w]	N	N	N	PN	Y	N	N	High[x]
KQ 2: Pflugeisen 2017 28176034	PY[y]	N[z]	Y	N	PY[aa]	NI	NI	N	N	PN	Y	N	N	High[bb]

Abbreviations: KQ = Key Question, N = no, NI = not indicated (i.e., unclear), PMID = PubMed Identifier, PN = probably no, PY = probably yes, RoB = risk of bias, Y = yes.

Colors used to distinguish Key Questions and risk of bias ratings are for emphasis only.

[a] Unadjusted
[b] Routine sonographic examination + screening program for gestational diabetes in 1992 not 1990
[c] Unadjusted
[d] Quasirandomized (based on participants' smartphone (iPhone versus other) with regression
[e] Participants receiving fewer visits also used smartphone app with home monitoring devices not provided to the traditional care group.
[f] Scheduling ntervention confounded by cointervention, adjusted by simple regression only.

[g] 850 (out of 1710) women analyzed in the postguideline group actually initiated their care before the guideline implementation but were transitioned to the new guideline during their pregnancy.
[h] Unadjusted
[i] In the preguideline group, 276 patients had incomplete data on the inpatient record and 223 in the post-guideline group. These records were excluded from analysis.
[j] Change during postguideline period was made in the inpatient electronic health record allowing for easier input of conditions complicating prenatal care.
[k] Unadjusted
[l] Unadjusted
[m] Unadjusted
[n] Unadjusted
[o] Unadjusted
[p] Regression adjustment for race/ethnicity and BMI only, but not high risk conditions (which differed between groups) or other factors. Adjusted for post-delivery (post-intervention) BMI.
[q] Eligibility based on post-delivery factor (infant weighing >500 g).
[r] >50% of audio had 0 or 1 audio visits (out of 3-5 scheduled)
[s] Eligibility and adjustment based on (post-delivery/post-intervention) outcomes
[t] Effectively a crossover study
[u] Unadjusted
[v] Adjusted logistic regression models. Propensity score analyses (or equivalent) would have been preferred.
[w] Different providers in two groups (in-person = 100% physician; televisits with nurse practitioner).
[x] Inadequate analysis for possible confounders; intervention confounded by different providers.
[y] Retrospective, voluntary response survey studies and the relatively low response rates, possibility to cross-over
[z] Unadjusted, matched by enrollment year only
[aa] No details on how many virtual visit occurred
[bb] Unadjusted

Table C-4-3. Risk to rigor, qualitative studies (Key Question 3)

Study, Year, PMID	Aims	Qualitative	Design	Recruitment	Data Collection	Relationship	Ethical Issues	Analysis	Findings	Valuable	Overall
Meiser 2021 No PMID	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Sanders 1999 11216259	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Sanders 2000 No PMID	No	Can't tell	Can't tell	Can't tell	Can't tell	No	No	No	Yes	Yes	High
Sikorski 1995 7616860	Yes	Yes	Can't tell	Yes	Yes	No	No	Yes	Yes	Yes	Moderate
Madden 2020 32516816	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Low
Peahl 2021 33039393	Yes	Yes	Can't tell	Yes	Yes	No	Yes	Can't tell	Yes	Yes	Moderate
Mary 2021 34498838	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Low
Quinn 2021 34254940	Yes	Yes	No	Yes	Yes	No	Yes	Can't tell	Yes	No	Moderate
Stanhope 2022 35039177	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Low

Abbreviation: PMID = PubMed Identifier.

From the Critical Appraisal Skills Programme (each item rated as Yes, No, or Can't tell). .

- Aim: Was there a clear statement of the aims of the research?
- Qualitative: Is a qualitative methodology appropriate?
- Design: Was the research design appropriate to address the aims of the research?
- Recruitment: Was the recruitment strategy appropriate to the aims of the research?
- Data collection: Was the data collected in a way that addressed the research issue?
- Relationship: Has the relationship between researcher and participants been adequately considered?
- Ethical issues: Have ethical issues been taken into consideration?
- Analysis: Was the data analysis sufficiently rigorous?
- Findings: Is there a clear statement of findings?
- Valuable: How valuable is the research?

Overall risk of bias assessed as **HIGH**, **MODERATE**, or **LOW**.

Colors used to distinguish risk of bias ratings are for emphasis only.

Appendix D. Full Results Tables

Key Question 1 (Schedule)

Table D-1-1. Schedule: Categorical outcome results

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
Abnormal Apgar score	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	At delivery	<7 at 5 minutest	21/1874 (1.1)	0.62 (0.36, 1.07)*	0.093
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	At delivery	.	36/2008 (1.8)	.	.
	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	At delivery	<5 at 5 minutes	~8/1874 (0.4)	0.45 (0.20, 1.03)	0.055
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	At delivery	.	~19/2008 (1.0)	.	.
	McDuffie 1996 8596222 CO, US	Less intensive (9 visits)	At delivery	<7 at 5 minutes	18/1175 (1.6)	RR 0.77 (0.53, 1,10) 0.62 (0.34, 1.11)*	0.95
	McDuffie 1996 8596222 CO, US	More intensive (14 visits)	At delivery	.	29/1176 (2.5)	.	.
	Ward 1999 Biloxi, MS	Less intensive (8 visits)	At delivery	<3 at 1 minutes	31/711 (4.4)	1.24 (0.73, 2.11)*	NS
	Ward 1999 Biloxi, MS	More intensive (14 visits)	.	.	24/734 (3.3)	.	.

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
	Ward 1999 Biloxi, MS	Less intensive (8 visits)	At delivery	<7 at 5 minutes	29/711 (4.1)	1.26 (0.73, 2.18)*	NS
	Ward 1999 Biloxi, MS	More intensive (14 visits)	.	.	24/734 (3.3)	.	.
Anemia	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	<40 weeks	Hb <100 g/L	66/1874 (3.5)	0.90 (0.65, 1.26)*	NS
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	<40 weeks	.	78/2008 (3.9)	.	.
	Walker 1997 9277060 California	Less intensive (8 visits)	~ 40 weeks	NR	1/43 (0.02)	0.88 (0.05, 14.6)*	NR
	Walker 1997 9277060 California	More intensive (14 visits)	~ 40 weeks	.	1/38 (0.03)	.	.
Cesarean delivery	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	At delivery	Overall cesarean delivery	151/1165 (13)	RR 1.04 (0.93, 1.17) OR 1.09 (0.85, 1.40)*	0.25
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	140/1163 (12)	.	.
	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	At delivery	Cesarean delivery for fetal distress	23/1165 (2.0)	RR 0.94 (0.69, 1.27) OR 0.88 (0.50, 1.55)*	0.67
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	26/1163 (2.2)	.	.

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	At delivery	Any (elective + emergent)	158/1874 (8.4)	1.00 (0.80, 1.26)* [omitted, unadjusted]	NS
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	169/2008 (8.4)	.	.
	Berglund 1998 Sweden	Less intensive (9/10 visits)	At delivery	Emergent	71/1874 (3.8)	0.92 (0.67, 1.28)*	NS
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	82/2008 (4.1)	.	.
	Walker 1997 9277060 California	Less intensive (8 visits)	At delivery	NR	0/43 (0)	0.12 (0.01, 2.32)*	NS
	Walker 1997 9277060 California	More intensive (14 visits)	.	.	3/38 (7.9)	.	.
	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	NR	189/1396 (13.9)	0.86 (0.70, 1.06)*	NR
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	215/1396 (15.4)	.	.
	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	Cesarean due to pregnancy related hypertension	11/1359 (0.8)	0.81 (0.36, 1.78)*	0.63
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	14/1396 (1.0)	.	.
	Ward 1999 Biloxi, MS	Less intensive (8 visits)	At delivery	NR	128/711 (18.0)	0.74 (0.57, 0.96)* [omitted, unadjusted]	NR

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
	Ward 1999 Biloxi, MS	More intensive (14 visits)	.	.	168/734 (23.0)	.	.
	Partridge 2005 16322418 California	Less intensive (9 visits)	At delivery	Cesarean section (primary and repeat)	313/1710 (18.3)	1.14 (0.95, 1.37)* [omitted, unadjusted]	NR
	Partridge 2005 16322418 California	More intensive (13 visits)	.	.	270/1647 (16.4)	.	.
Chorioamnionitis	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	At delivery	NR	9/1165 (0.8)	RR 0.9 (0.55, 1.46) 0.82 (0.34, 1.98)*	0.68
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	11/1163 (0.9)	.	.
Emergency room/triage visits	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	At delivery	NR	253/1165 (21.7)	RR 1.1 (0.9, 1.2) 1.08 (0.89, 1.32)*	0.43
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	237/1163 (20.4)	.	.
Gestational diabetes	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	At delivery	NR	18/1165 (1.5)	RR 1.0 (0.72, 1.39)	0.50
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	18/1163 (1.5)	.	.
Gestational hypertension	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	At delivery	NR	139/1874 (7.4)	**0.59 (0.48, 0.74)***	**<0.001**

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	239/2008 (11.9)	.	.
	Walker 1997 9277060 California	Less intensive (8 visits)	At delivery	NR	2/43 (0.05)	1.80 (0.16, 20.7)*	NR
	Walker 1997 9277060 California	More intensive (14 visits)	.	.	1/38 (0.03)	.	.
	Jewell 2000 11028575 Bristol, UK	Less intensive (≥7 visits)	At delivery	Hypertension identified	29/265 (10.9)	1.31 (0.74, 2.31)*	0.36
	Jewell 2000 11028575 Bristol, UK	More intensive (14 visits)	.	.	24/279 (8.6)	.	.
Hemorrhage	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	At delivery	Hemorrhage at vaginal delivery (>750 ml) and cesarean delivery (>1500 ml)	34/1165 (2.92)	0.94 (0.59, 1.52)*	NR
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	36/1163 (3.09)	.	.
	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	At delivery	NR	24/1874 (1.3)	0.86 (0.50, 1.47)*	NS
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	30/2008 (1.5)	.	.
	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	Antenatal hemorrhage	70/1360 (5.1)	0.97 (0.69, 1.35)	NR
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	74/1391 (5.3)	.	.

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	Primary postpartum hemorrhage	135/1358 (9.9)	1.01 (0.79, 1.62)	NR
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	137/1390 (9.9)	.	.
Induction of labor	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	At delivery	NR	137/1874 (7.3)	1.18 (0.92, 1.51)*	NS
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	126/2008 (6.3)	.	.
	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	for any reason	244/1358 (18.0)	1.08 (0.89, 1.31)	NR
	Sikorski 1996 8595286 London, UK	More intensive (13 visits	.	.	236/1395 (16.9)	.	.
	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	Induction of labor due to pregnancy related hypertension	33/1358 (2.4)	0.91 (0.57, 1.47)*	NR
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	37/1395 (2.7)	.	.
	Jewell 2000 11028575 Bristol, UK	Less intensive (≥7 visits)	Prior to labour	Any reason	53/265 (20.0)	Difference in proportions −1.1 (NR) 0.93 (0.61, 1.41)*	0.74
	Jewell 2000 11028575 Bristol, UK	More intensive (14 visits)	.	.	59/279 (21.1)	.	.
	Partridge 2005 16322418 California	Less intensive (9 visits)	At delivery	Pitocin induction	111/1710 (6.5)	0.92 (0.71, 1.21)*	0.43

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
	Partridge 2005 16322418 California	More intensive (13 visits)	.	.	115/1647 (7.0)	.	.
Intrauterine growth restriction (IUGR)	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	At delivery	NR	82/1874 (4.4)	0.79 (0.59, 1.06)*	NS
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	110/2008 (5.5)	.	.
	Walker 1997 9277060 California	Less intensive (8 visits)	At delivery	NR	0/43 (1.1)	0.29 (0.01, 7.24)*	NR
	Walker 1997 9277060 California	More intensive (14 visits)	.	.	1/38 (0.03)	.	.
Large for gestational age	Partridge 2005 16322418 California	Less intensive (9 visits)	At delivery	>4000 g	181/1710 (10.6)	**0.79 (0.64, 0.98)***	**0.03**
	Partridge 2005 16322418 California	More intensive (13 visits)	.	.	214/1647 (13.0)	.	.
	Partridge 2005 16322418 California	Less intensive (9 visits)	At delivery	>4500 g	22/1710 (1.3)	0.81 (0.46, 1.44)*	0.41
	Partridge 2005 16322418 California	More intensive (13 visits)	.	.	26/1647 (1.6)	.	.
Low birth weight	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	At delivery	<2500 g	64/1175 (5.4)	RR 0.94 (0.78, 1.12)	0.76

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	72/1176 (6.1)	.	.
	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	At delivery	<1500 g	7/1175 (0.3)	RR 1.08 (0.65, 1.79)	0.39
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	6/1176 (0.3)	.	.
	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	At delivery	<2500 g	82/1874 (4.4)	0.91 (0.67, 1.23)*	0.605
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	96/2008 (4.8)	.	.
	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	At delivery	<1500 g	11/1874 (0.6)	0.59 (0.28, 1.23)*	0.225
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	20/2008 (1.0)	.	.
	Ward 1999 Biloxi, MS	Less intensive (8 visits)	At delivery	<2500 g	33/711 (1.5)	1.10 (0.67, 1.82)*	NR
	Ward 1999 Biloxi, MS	More intensive (14 visits)	.	.	31/734 (4.2)	.	.
	Ward 1999 Biloxi, MS	Less intensive (8 visits)	At delivery	<1000 g	3/711 (0.4)	1.03 (0.21, 5.13)*	NS

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
	Ward 1999 Biloxi, MS	More intensive (14 visits)	.	.	3/734 (0.4)	.	.
	Partridge 2005 16322418 California	Less intensive (9 visits)	At delivery	<2500 g	68/1710 (4.0)	1.13 (0.79, 1.62)*	0.5
	Partridge 2005 16322418 California	More intensive (13 visits)	.	.	58/1647 (3.5)	.	.
	Partridge 2005 16322418 California	Less intensive (9 visits)	At delivery	<1500 g	7/1710 (0.4)	2.05 (0.55, 7.59)*	0.7
	Partridge 2005 16322418 California	More intensive (13 visits)	.	.	3/1647 (0.2)	.	.
	Partridge 2005 16322418 California	Less intensive (9 visits)	At delivery	<1000 g	2/1710 (0.1)	0.64 (0.11, 3.85)*	0.62
	Partridge 2005 16322418 California	More intensive (13 visits)	.	.	3/1647 (0.2)	.	.
Maternal death	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	NR		1/1360 (0.1)	3.08 (0.13, 75.72)*	NR
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	0/1396 (0)	.	.
NICU admission	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	Admitted to SCBU or NICU	47/1360 (3.5)	1.07 (0.71, 1.63)*	1.63
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	45/1394 (3.1)	.	.

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
	Jewell 2000 11028575 Bristol, UK	Less intensive (≥7 visits)	At delivery	NR	14/264 (5.3)	0.86 (0.41, 1.77)*	NR
	Jewell 2000 11028575 Bristol, UK	More intensive (14 visits)	.	.	17/277 (6.1)	.	.
	Partridge 2005 16322418 California	Less intensive (9 visits)	At delivery	Admission to level 2 nursery	149/1710 (8.7)	0.97 (0.77, 1.24, 0.77)*	0.77
	Partridge 2005 16322418 California	More intensive (13 visits)	.	.	147/1647 (8.9)	.	.
	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	At delivery	NR	~150/1874 (8%)	~0.75 (0.31, 1.80)*	0.061
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	~200/2008 (10%)	.	.
	Walker 1997 9277060 California	Less intensive (8 visits)	At delivery	Any duration	4/43 (9.3)	3.523 (0.41, 30.3)*	NS
	Walker 1997 9277060 California	More intensive (14 visits)	.	.	1/38 (2.6)	.	.
Neonatal mortality	Ward 1999 Biloxi, MS	Less intensive (8)	At delivery	NR	5/711 (0.7)	0.74 (0.23, 2.33)*	NS
	Ward 1999 Biloxi, MS	More intensive (14)	.	.	7/734 (0.9)	.	.
	Partridge 2005 16322418 California	Less intensive (9 visits)	At delivery	NR	9/1710 (0.54)	0.62 (0.27, 1.43)*	0.43

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
	Partridge 2005 16322418 California	More intensive (13 visits)	.	.	14/1647 (0.85)	.	
Not feeling remembered from one visit to next	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	NR	NR	314/882 (35.6)	**1.52 (1.24, 1.89)***	**<0.05**
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	249/934 (26.7)	.	.
Operative vaginal delivery	Walker 1997 9277060 California	Less intensive (8 visits)	At delivery	Vacuum or forceps delivery	1/43 (2.3)	0.43 (0.04, 4.92)*	NS
	Walker 1997 9277060 California	More intensive (14 visits)	.	.	2/38 (5.3)	.	.
	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	Instrumental vaginal delivery (vacuum or forceps)	148/1360 (10.9)	1.09 (0.85, 1.39)*	0.43
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	141/1396 (10.1)	.	.
	Partridge 2005 16322418 California	Less intensive (9 visits)	At delivery	Vacuum or forceps delivery	49/1710 (2.9)	**0.42 (0.30, 0.59)***	NR
	Partridge 2005 16322418 California	More intensive (13 visits)	.	.	108/1647 (6.6)	.	.
Other mental health outcomes	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	Treatment for psychosocial/emotional problem	74/548 (13.5)	1.27 (0.87, 1.86)*	NR
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	60/550 (10.9)	.	.

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
Partner dissatisfaction with visit frequency	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	NR	214/538 (39.8)	**10.75 (7.23, 15.99)***	**<0.05**
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	32/553 (5.8)	.	.
Patient preferences	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	6−week postpartum visit	No. of prenatal visits: just right	494/589 (89.2)	**1.40 (1.04, 1.87)***	**0.002**
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	473/600 (82.8)	.	.
	Ross−McGill 2000 10688505 Leeds and Yorkshire, UK	Less intensive (3 visits)	>40	Would prefer a reduced schedule in the future	33/40 (82.5)		
	Ross−McGill 2000 10688505 Leeds and Yorkshire, UK	More intensive (9 visits)	.	.	14/40 (35.0)	.	.
	Ross−McGill 2000 10688505 Leeds and Yorkshire, UK	Both groups	>40	Preferred reduced schedule	45/77 (58.4)		
	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	Would have preferred more/fewer visits (“dissatisfied” with visit frequency)	298/916 (32.5)	**2.5 (2.0, 3.1)**	**<0.05**
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	155/957 (16.2)	.	.
Patient satisfaction with antenatal care	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	6−week postpartum visit	Quality of prenatal care as excellent or good	574/589 (97.5)	0.85 (0.40, 1.80)*	0.67

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	587/600 (97.8)	.	.
	Tandon 2013 FL, US	Less intensive (10 visits)	At delivery	Satisfied with time spent with provider (% very satisfied	119/121 (98.0)	**RR 5.14 (2.85, 9.25)***	**<0.001**
	Tandon 2013 FL, US	More intensive (10−12 visits)	.	.	9/47 (19.0)	.	.
	Jewell 2000 11028575 Bristol, UK	Less intensive (≥7 visits)	At birth	Satisfaction with care provided by midwives	135/224 (60.0)	**Difference in proportions −11.6 (−20.2, −3.1)**	**0.01**
	Jewell 2000 11028575 Bristol, UK	More intensive (14 visits)	.	.	174/242 (72.0)	.	.
	Jewell 2000 11028575 Bristol, UK	Less intensive (≥7 visits)	At birth	Satisfaction with care provided by family doctors	90/196 (42.0)	Difference in proportions −5.3 (−14.9, 4.4)	0.76
	Jewell 2000 11028575 Bristol, UK	More intensive (14 visits)	.	.	109/213 (51.0)	.	.
	Jewell 2000 11028575 Bristol, UK	Less intensive (≥7 visits)	At birth	Satisfaction with provided by hospital	36/86 (42.0)	Difference in proportions −15.0 (−29.6, −2.7)	0.18
	Jewell 2000 11028575 Bristol, UK	More intensive (14 visits)	.	.	50/88 (54.0)	.	.
Perinatal death	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	NR	NR	2/1361 (0.2)	0.72 (0.27, 1.89)	NR
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	4/1396 (0.3)	.	.

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	At delivery	NR	8/1874 (0.4)	0.86 (0.34, 2.18)*	0.822
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	10/2008 (0.5)	.	.
	Ward 1999 Biloxi, MS	Less intensive (8 visits)	NR	NR	Incidence Rate (per 1000) 3	NR	NS
	Ward 1999 Biloxi, MS	More intensive (14 visits)	.	.	Incidence Rate (per 1000) 4	.	.
Perinatal morbidity	Walker 1997 9277060 California	Less intensive (8 visits)	At delivery	Sepsis	1/43 (0.02)	1.79 (0.06, 54.77)*	NR
	Walker 1997 9277060 California	More intensive (14 visits)	.	.	0/38 (0)	.	.
	Walker 1997 9277060 California	Less intensive (8 visits)	At delivery	Hyperbilirubinemia	1/43 (0.02)	0.88 (0.05, 14.59)*	NR
	Walker 1997 9277060 California	More intensive (14 visits)	.	.	1/38 (2.6)	.	.
	Walker 1997 9277060 California	Less intensive (8 visits)	At delivery	Respiratory distress	3/43 (0,07)	5.63 (0.27, 116.00)*	NR
	Walker 1997 9277060 California	More intensive (14 visits)	.	.	0/38 (0)	.	.
	Ward 1999 Biloxi, MS	Less intensive (8 visits)	at 28 d	Bronchopulmonary dysplasia	3/711 (0.4)	0.31 (0.08, 1.12)*	NR

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
	Ward 1999 Biloxi, MS	More intensive (14 visits)	.	.	10/734 (0.7)	.	.
Placental abruption	McDuffie 1996 8596222 CO, US	Less intensive (9 visits)	At delivery	NR	17/1165 (1.5)	RR 1.21 (0.90, 1.64) 1.55 (0.72, 3.33)*	0.13
	McDuffie 1996 8596222 CO, US	More intensive (14 visits)	At delivery	.	11/1163 (0.9)	.	.
Post-term delivery	Partridge 2005 16322418 California	Less intensive (9 visits)	>42	NR	139/1710 (8.1)	**0.76 (0.60, 0.97)***	**0.01**
	Partridge 2005 16322418 California	More intensive (13 visits)	.	.	171/1647 (10.4)	.	.
Pre-eclampsia	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	At delivery	Mild and severe	69/1165 (5.9)	1.04 (0.74, 1.49)*	NR
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	66/1163 (5.7)	.	.
	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	At delivery	NR	49/1874 (2.6)	1.10 (0.73, 1.64)*	NS
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	48/2008 (2.4)	.	.
	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	NR	9/1240 (0.7)	0.85 (0.35, 2.05)*	NR

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	11/1286 (0.9)	.	.
	Ward 1999 Biloxi, MS	Less intensive (8 visits)	At delivery	NR	34/711 (5.0)	0.67 (0.43, 1.05)*	NS
	Ward 1999 Biloxi, MS	More intensive (14 visits)	.	.	51/734 (7.0)	.	.
Preterm birth	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	<37	NR	118/1874 (6.3)	1.04 (0.80, 1.35)*	0.848
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	122/2008 (6.1)	.	.
	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	<32	NR	15/1874 (0.8)	0.80 (0.41, 1.57)*	0.427
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	20/2008 (1.1)	.	.
	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	<37	NR	73/1165 (6.3)	RR 1.08 (0.92, 1.27)	0.19
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	63/1163 (5.4)	.	.
	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	<32	NR	10/1165 (0.9)	RR 1.11 (0.73, 1.68)	0.32

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	8/1163 (0.7)	.	.
	Partridge 2005 16322418 California	Less intensive (9 visits)	<37	NR	140/1710 (8.2)	0.98 (0.76, 1.25)*	0.7
	Partridge 2005 16322418 California	More intensive (13 visits)	.	.	138/1647 (8.4)	.	.
Preterm labor	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	At delivery	NR	79/1165 (6.8)	RR 1.01 (0.86, 1.18)	0.44
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	77/1163 (6.6)	.	.
	Walker 1997 9277060 California	Less intensive (8 visits)	At delivery	NR	1/43 (2.3)	0.28 (0.03, 2.79)*	NR
	Walker 1997 9277060 California	More intensive (14 visits)	.	.	3/38 (7.9)	.	.
PROM with preterm birth	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	<40	NR	22/2008 (1.1)	0.85 (0.48, 1.53)*	NS
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	24/1874 (1.3)	.	.
	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	At delivery	NR	38/1165 (3.3)	1.00 (0.80, 1.25)	0.5

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	38/1163 (3.3)	.	.
	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	<37	NR	24/1360 (1.8)	0.76 (0.48, 1.31)	NR
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	32/1394 (2.3)	.	.
Receipt of adequate or adequate plus prenatal care (%)	Tandon 2013 FL, US	Less intensive (10 visits)	At delivery	calculated using the Adequacy of Prenatal Care Index. This index defines ‘‘adequate’’ prenatal care as receipt of between 80% and 109% of expected visits and ‘‘adequate plus’’ prenatal care as receipt of >109% of expected visits.	129/144 (90.0)	**5.08 (2.47, 10.5)***	**0.001**
	Tandon 2013 FL, US	More intensive (10−12 visits)	.	.	44/70 (63.0)	.	.
Small for gestational age	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	At delivery	<10th percentile	36/1175 (3.1)	RR 1.13 (0.91, 1.41)	0.16
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	28/1176 (2.4)	.	.
	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	<10 percentile (correctly diagnosed)	61/265 (23.0)	0.80 (0.55, 1.17)	NR
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	80/294 (27.2)	.	.
	Jewell 2000 11028575 Bristol, UK	Less intensive (≥7 visits)	Diagnosed prior to labor	NR	10/265 (3.8)	1.78 (0.64, 4.98)*	0.26

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
	Jewell 2000 11028575 Bristol, UK	More intensive (14 visits)	.	.	6/279 (2.2)	.	.
Spontaneous vaginal delivery	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	NR	1023/1360 (75.2)	1.04 (0.87, 1.23)	NR
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	1040/1396 (74.5)	.	.
	Jewell 2000 11028575 Bristol, UK	Less intensive (≥7 visits)	At delivery	NR	203/265 (76.7)	1.16 (0.79, 1.71)*	0.45
	Jewell 2000 11028575 Bristol, UK	More intensive (14 visits)	.	.	206/279 (73.8)	.	.
Stillbirth	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	At delivery	>20 weeks' gestation	5/1175 (0.4)	1.00 (0.29, 3.47)*	0.5
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	5/1176 (0.4)	.	.
	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	NR	5/1361 (0.4)	0.85 (0.26, 2.81)	NR
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	6/1396 (0.4)	.	.
	Ward 1999 Biloxi, MS	Less intensive (8 visits)	NR	Intrauterine fetal death	6/711 (0.8)	2.07 (0.52, 8.32)*	NS
	Ward 1999 Biloxi, MS	More intensive (14 visits)	.	.	3/734 (0.4)	.	.

Outcome	Study PMID Location	Arm	Time (Mo)	Outcome Definition	n/N (%)	OR (95% CI)	Reported P Value
Undiagnosed malpresentation	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	Among those with malpresentation	12/48 (25.0)		NR
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	16/55 (29.1)	.	.
Undiagnosed placenta previa	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	Among those with placenta previa	1/3 (33.3)		NR
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	5/14 (32.7)	.	.
Unplanned hospital admissions	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	At delivery	Inpatient antepartum admission	54/1165 (4.6)	1.15 (0.77, 1.72)*	0.48
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	47/1163 (4.0)	.	.
	McDuffie 1996 8596222 Colorado	Less intensive (9 visits)	At delivery	Outpatient antepartum admission	413/1165 (35.5)	RR 1.1 (1.0, 1.2) 1.13 (0.95, 1.34)*	0.17
	McDuffie 1996 8596222 Colorado	More intensive (14 visits)	.	.	381/1163 (32.8)	.	.
	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	Admitted to special care unit	47/1359 (3.5)	1.07 (0.70, 1.62)	NR
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	45/1394 (3.2)	.	.

Abbreviations: . = no applicable data and/or same as above, Adj = adjusted, CI = confidence interval, g = grams, mo = months, NR = not reported, OR = odds ratio, PMID = PubMed identifier, PROM = premature rupture of membranes, RR = risk ratio, wk = weeks.

*Calculated by review team.

Table D-1-2. Schedule: Continuous outcome results

Outcome*	Study, PMID	Arm*	Time (Wk)	Outcome Definition	N	Mean (SD)	MD (95% CI)	Reported P Value
Adherence	Walker 1997 9277060 California	Less intensive (8 visits)	~ 40 weeks	Missed (no show) visits	43	0.28 (0.59)	0.02 (−0.23, 0.27)	NS
	Walker 1997 9277060 California	More intensive (14 visits)	.	.	38	0.26 (0.55)	.	.
Anxiety	Ross−McGill 2000 10688505 Leeds and Yorkshire, UK	Less intensive (3 visits)	28	STAI state anxiety	37	40 (95% CI 34, 40)	1.0 (−3.9, 5.9)*	NR
	Ross−McGill 2000 10688505 Leeds and Yorkshire, UK	More intensive (9 visits)	.	.	37	39 (95% CI 32, 40)	.	.
	Ross−McGill 2000 10688505 Leeds and Yorkshire, UK	Less intensive (3 visits)	34	STAI state anxiety	36	32 (95% CI 32, 40)	4.0 (−0.9, 8.9)*	NR
	Ross−McGill 2000 10688505 Leeds and Yorkshire, UK	More intensive (9 visits)	.	.	37	28 (95% CI 34, 41)	.	.
	Ross−McGill 2000 10688505 Leeds and Yorkshire, UK	Less intensive (3 visits)	38	STAI state anxiety	38	24 (95% CI 34, 41)	1.0 (−3.3, 5.3)*	NR
	Ross−McGill 2000 10688505 Leeds and Yorkshire, UK	More intensive (9 visits)	.	.	38	23 (95% CI 32, 42)	.	.

Outcome*	Study, PMID	Arm*	Time (Wk)	Outcome Definition	N	Mean (SD)	MD (95% CI)	Reported P Value
	Ross−McGill 2000 10688505 Leeds and Yorkshire, UK	Less intensive (3 visits)	6 post delivery	STAI state anxiety	35	40 (95% CI 32, 37)	2.0 (−1.9, 5.9)*	NR
	Ross−McGill 2000 10688505 Leeds and Yorkshire, UK	More intensive (9 visits)	.	.	35	38 (95% CI 32, 38)	.	.
	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	2.7 years after delivery	HADS, anxiety subscale	549	5.3 (3.79)	0.1 (−0.6, 0.8)*	0.781
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	541	5.2 (3.41)	.	.
	Walker 1997 9277060 California	Less intensive (8 visits)	36−38	STAI state anxiety	43	NR	5.0 (NR)	NS
	Walker 1997 9277060 California	More intensive (14 visits)	.	.	38	NR	.	.
Apgar score	Jewell 2000 11028575 Bristol, UK	Less intensive (≥7)	At delivery	at 5 minutes	265	9.4 (NR)	0.07 (−0.1, 0.3)	0.41
		More intensive (14)	.	.	279	9.4 (NR)	.	.
	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	at 1 minute	1386	8.2 (1.56)	0 (−0.1, 0.1)*	0.971
		More intensive (13 visits)	At delivery	.	1340	8.2 (1.56)	.	.
	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	at 5 minutes	1383	9.4 (0.99)	0 (−0.1, 0.1)*	0.43
		More intensive (13 visits)	At delivery	.	1337	9.4 (1.06)	.	.

Outcome*	Study, PMID	Arm*	Time (Wk)	Outcome Definition	N	Mean (SD)	MD (95% CI)	Reported P Value
Baby length of stay in SCBU/NICU	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	Postpartum	NR	47	22.6 (13.4, 31.8)	MD 5.4 (−5.9, 16.7)*	NR
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	45	17.2 (10.6, 23.8)	.	.
Depression	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	N/A	Antenatal and postnatal depression score (0−30)	NR	7.75 (5.38)	0.9 (NR)*	NR
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	NR	6.85 (5.01)	.	.
	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	HADS, Depression subscale	554	6.1 (5.24)	0.4 (−17.5, 18.3)	0.965
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	548	5.7 (4.6)	.	.
Duration of breastfeeding (weeks)	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	N/A	NR	356	29.7 (26.8)	2.7 (NR)*	0.139
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	351	27.0 (25.69)	.	.
Emergency room/triage visits	Walker 1997 9277060 California	Less intensive (8 visits)	<40	No. of visits	43	0.09 (0.29)	0.06 (−0.04, 0.16)*	NR
	Walker 1997 9277060 California	More intensive (14 visits)	.	.	38	0.03 (0.16)	.	.
Gestational age at birth	Jewell 2000 11028575 Bristol, UK	Less intensive (≥7)	At delivery	days	265	278 (NR)	0 (NR)	0.71
	Jewell 2000 11028575 Bristol, UK	More intensive (14)	.	.	279	278 (NR)	.	.

Outcome*	Study, PMID	Arm*	Time (Wk)	Outcome Definition	N	Mean (SD)	MD (95% CI)	Reported P Value
	McDuffie 1992 8596222 Colorado	Less intensive (9 visits)	At delivery	weeks	1175	39.2 (1.9)	0 (NR)*	0.66
	McDuffie 1992 8596222 Colorado	More intensive (14 visits)	.	.	1176	39.2 (1.9)	.	.
	Partridge 2005 16322418 California	Less intensive (9 visits)	At delivery	weeks	1710	39.1 (1.9)	0.05 (-0.11, 0.21)*	0.19
	Partridge 2005 16322418 California	More intensive (13 visits)	.	.	1647	39.05 (2.7)	.	.
	Ward 1999 Biloxi, MS	Less intensive (8 visits)	At delivery	weeks	711	38 (NR)	0 (NR)*	NS
	Ward 1999 Biloxi, MS	More intensive (14 visits)	.	.	734	38 (NR)	.	.
Number of unplanned visits	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	<40	Extra midwife visits staff−initiated	1874	1.11 (1.31)	0.62 (0.54, 0.70)	NR
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	2008	0.49 (1.10)	.	.
	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	<40	Extra midwife visits patient−initiated	1874	0.05 (0.24)	0.01 (0, 0.02)	NR
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	2008	0.04 (0.20)	.	.
	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	<40	Extra doctor visits staff−initiated	1874	0.30 (0.64)	−0.15 (−0.19, −0.11)	NR
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	2008	0.45 (0.75)	.	.

Outcome*	Study, PMID	Arm*	Time (Wk)	Outcome Definition	N	Mean (SD)	MD (95% CI)	Reported P Value
	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	<40	Extra doctor visits—patient−initiated	1874	0.32 (0.61)	−0.07 (−0.10, −0.04)	NR
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	2008	0.25 (0.54)	.	.
	Partridge 2005 16322418 California	Less intensive (9 visits)	At delivery	Outpatient visits to Labor & Delivery Unit per delivery (not otherwise defined)	1710	2.9 (0.4)	0.4 (0.1, 0.7)*	0.01
	Partridge 2005 16322418 California	More intensive (13 visits)	.	.	1647	2.5 (0.2)	.	.
	Walker 1997 9277060 California	Less intensive (8 visits)	<40	Unscheduled "drop in" office visits	43	0.23 (0.57)	0.15 (−0.04, 0.34)*	NR
	Walker 1997 9277060 California	More intensive (14 visits)	.	.	38	0.08 (0.27)	.	.
Parenting stress index: overall score	Sikorski 1996 8595286 London, UK	Less intensive (7 visits)	At delivery	This measure gives an indication of the mother-child relationship. High levels of stress as measured by the PSI have been shown to be associated with dysfunctional parenting behavior, negative interactions between parents and their child, and deviant child development.	508	219.9 (39.96)	−0.6 (−5.4, 4.2)*	0.445
	Sikorski 1996 8595286 London, UK	More intensive (13 visits)	.	.	518	220.5 (37.96)	.	.
Patient satisfaction with antenatal care	Marko 2019 31042154 Washington DC	Less intensive (9 visits)	First trimester	4 point Likert scale modified from the hospital consumer assessment of health care providers and systems survey instrument	47	0.58 (NR)	0.07 (NR)*	NS

Outcome*	Study, PMID	Arm*	Time (Wk)	Outcome Definition	N	Mean (SD)	MD (95% CI)	Reported P Value
	Marko 2019 31042154 Washington DC	More intensive (13 visits)	.	.	41	0.51 (NR)	.	.
	Marko 2019 31042154 Washington DC	Less intensive (9 visits)	30	4 point Likert scale modified from the hospital consumer assessment of health care providers and systems survey instrument	47	0.77 (NR)	0.04 (NR)*	NS
	Marko 2019 31042154 Washington DC	More intensive (13 visits)	.	.	41	0.73 (NR)	.	.
	Marko 2019 31042154 Washington DC	Less intensive (9 visits)	Postpartum	4 point Likert scale modified from the hospital consumer assessment of health care providers and systems survey instrument	47	1.2 (NR)	0.1 (NR)*	NS
	Marko 2019 31042154 Washington DC	More intensive (13 visits)	.	.	41	1.1 (NR)	.	.
	Partridge 2005 16322418 California	Less intensive (9 visits)	At delivery	Department of Defense patient satisfaction survey	1933	NR	NR	NS
	Partridge 2005 16322418 California	More intensive (13 visits)	.	.	1923	.	.	.
	Tandon 2013 FL, US	Less intensive (10 visits)	At delivery	Patient Participation and Satisfaction Questionnaire (PPSQ): Satisfaction with care subscale 5-point Likert type scale with 1 = ‘‘very dissatisfied’’ and 5 = ‘‘very satisfied.’’	122	84.3 (3.1)	19.4 (16.2, 22.6)*	<0.001
	Tandon 2013 FL, US	More intensive (10−12 visits)	.	.	46	64.9 (10.8)	.	.
	Tandon 2013 FL, US	Less intensive (10 visits)	At delivery	Patient Participation and Satisfaction Questionnaire (PPSQ): satisfaction with participation subscale 5-point Likert type	124	39.7 (1.8)	11.6 (9.4, 13.8)*	<0.001

Outcome*	Study, PMID	Arm*	Time (Wk)	Outcome Definition	N	Mean (SD)	MD (95% CI)	Reported P Value
				scale with 1 = ‘‘very dissatisfied’’ and 5 = ‘‘very satisfied.’’				
	Tandon 2013 FL, US	More intensive (10−12 visits)	.	.	46	28.1 (7.6)	.	.
	Walker 1997 9277060 California	Less intensive (8 visits)	~ 40 weeks	Patient Satisfaction with Prenatal Care instrument: satisfaction with prenatal care provider	43	NR (NR)	NR (NR)	0.02
	Walker 1997 9277060 California	More intensive (14 visits)	.	.	38	NR (NR)	.	.
	Walker 1997 9277060 California	Less intensive (8 visits)	~ 40 weeks	Patient Satisfaction with Prenatal Care instrument: satisfaction with prenatal care system	43	NR (NR)	NR (NR)	0.04
	Walker 1997 9277060 California	More intensive (14 visits)	.	.	38	NR (NR)	.	.
Unplanned hospital admissions	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	~ 40 weeks	Visits to the hospital	1874	0.98 (1.64)	0.09 (-0.008, 0.188))*	NR
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	2008	0.89 (1.47)	.	.
	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	~ 40 weeks	Referrals	1874	0.69 (1.44)	0.07 (-0.02, 0.16)*	NR
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	2008	0.62 (1.30)	.	.
	Berglund 1998 9578278 Sweden	Less intensive (9/10 visits)	~ 40 weeks	Emergencies	1874	0.29 (0.70)	0.02 (-0.02, 0.06)*	NR
	Berglund 1998 9578278 Sweden	More intensive (14 visits)	.	.	2008	0.27 (0.67)	.	.

Outcome*	Study, PMID	Arm*	Time (Wk)	Outcome Definition	N	Mean (SD)	MD (95% CI)	Reported P Value
	Ross-McGill 2000 10688505 Leeds and Yorkshire, UK	Less intensive (8 visits)	28−41 weeks	Antenatal pregnancy related hospital visits	40	1.2 (NR)	NR (NR)	NR
	Ross-McGill 2000 10688505 Leeds and Yorkshire, UK	More intensive (14 visits)	.	.	40	1.4 (NR)	.	.

Abbreviations: . = no applicable data and/or same as above, BMI = Body Mass Index, CI = confidence interval, g = grams, IQR= Interquartile range, mo = month, MD = mean difference (between groups), N/A= not applicable, NR = not reported, NS = not statistically significant, PPSQ = Patient Participation and Satisfaction Questionnaire, PMID = PubMed identifier, SD = standard deviation, STAI = State−Trait Anxiety Inventory, wk = weeks

*Calculated by review team

Key Question 2 (Televisits)

Table D-2-1. Televisits: Categorical outcome results

Outcome	Study PMID Location	Time	Outcome Definition	Arm*	n/N (%)	OR (95% CI)	Reported P-Value
Attendance at scheduled visits	Palmer 2021 34217399 Melbourne, Australia	During pregnancy	NR	In-person	8538/165,363 (5.2%)	.	.
	Palmer 2021 34217399 Melbourne, Australia	.	.	Hybrid visits: televisits	907/10,731 (8.4%)	1.18 (1.07, 1.31)*	NR
	Palmer 2021 34217399 Melbourne, Australia	.	.	Hybrid visits: in-person visits	682/9423 (7.2%)	.	.
Gestational diabetes	Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	During pregnancy	NR	Hybrid visits	21/117 (17.9)	1.12 (0.68, 1.85)*	NR
	Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	.	.	In person visits	154/941 (16.4)	.	.
Gestational hypertension	Duryea 2021 33852002 TX, US	During pregnancy	NR	Hybrid visits	1147/6048 (19.0)	RR 0.94 (0.88, 1.01)	0.1
	Duryea 2021 33852002 TX, US	.	.	In person visits	1320/6559 (20.1)	.	.
Pre-eclampsia	Duryea 2021 33852002 TX, US	At delivery	Pre-eclampsia with severe features	Hybrid visits	649/6048 (10.7)	RR 1.01 (0.91, 1.12)	0.85
	Duryea 2021 33852002 TX, US	.	.	In person visits	697/6559 (10.6)	.	.
	Palmer 2021 34217399 Melbourne, Australia	At deivery	Pre-eclampsia	Hybrid visits	49/1768 (2.8)	0.94 (0.7, 1.27)*	0.70
	Palmer 2021 34217399 Melbourne, Australia	.	.	In person visits	455/15493 (2.9)	.	.
	Palmer 2021 34217399 Melbourne, Australia	At deivery	Pre-eclampsia with severe features	Hybrid visits	2/1768 (0.11)	0.88 (0.2, 3.75)*	0.94

Outcome	Study PMID Location	Time	Outcome Definition	Arm*	n/N (%)	OR (95% CI)	Reported P-Value
	Palmer 2021 34217399 Melbourne, Australia	.	.	In person visits	20/15493 (0.13)	.	.
	Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	At delivery	Pre-eclampsia	Hybrid visits	10/117 (8.5)	**2.65 (1.27, 5.55)***	**0.02**
	Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	.	.	In person visits	32/941 (3.4)	.	.
Placental abruption	Duryea 2021 33852002 TX, US	At delivery	NR	Hybrid visits	40/6048 (0.7)	RR 0.77 (0.52, 1.16)	0.21
	Duryea 2021 33852002 TX, US	.	.	In person visits	56/6559 (0.9)	.	.
Hemorrhage	Duryea 2021 33852002 TX, US	At delivery	Postpartum hemorrhage>1000 ml	Hybrid visits	570/6048 (9.4)	RR 1.07 (0.95, 1.19)	0.26
	Duryea 2021 33852002 TX, US	.	.	In person visits	580/6559 (8.8)	.	.
Transfusion need	Duryea 2021 33852002 TX, US	At delivery	Require a transfusion during or following delivery	Hybrid visits	216/6048 (3.6)	**RR 0.84 (0.71, 1.00)**	**0.049**
	Duryea 2021 33852002 TX, US	.	.	In person visits	279/6559 (4.3)	.	.
Hysterectomy	Duryea 2021 33852002 TX, US	At delivery	NR	Hybrid visits	13/6048 (0.2)	RR 0.54 (0.28, 1.05)	0.07
	Duryea 2021 33852002 TX, US	.	.	In person visits	26/6559 (0.4)	.	.
Cesarean delivery	Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	At delivery	NR	Hybrid visits	32/117 (27.4)	0.71 (0.45, 1.12) Adjusted for gestational age, age, gestational diabetes, preeclampsia, smoking, and drug use	0.14
	Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	.	.	In person visits	289/941 (30.7)	.	.
	Butler Tobah 2019 31228414 MN, US	At delivery	NR	Hybrid visits	17/134 (12.7)	0.82 (0.41, 1.65)*	0.56

Outcome	Study PMID Location	Time	Outcome Definition	Arm*	n/N (%)	OR (95% CI)	Reported P-Value
	Butler Tobah 2019 31228414 MN, US	.	.	In person visits	20/133 (14.9)	.	.
Operative vaginal delivery	Duryea 2021 33852002 TX, US	At delivery	Vaginal, forceps assisted	Hybrid visits	82/6048 (1.4)	**RR 0.75 (0.57, 0.99)**	**0.04**
	Duryea 2021 33852002 TX, US	.	.	In person visits	119/6559 (1.8)	.	.
Preterm birth	Duryea 2021 33852002 TX, US	At delivery	Birth <37 weeks	Hybrid visits	593/6048 (9.8)	RR 0.96 (0.86, 1.06)	0.41
	Duryea 2021 33852002 TX, US	.	.	In person visits	672/6559 (10.2)	.	.
	Duryea 2021 33852002 TX, US	At delivery	Birth <34 weeks	Hybrid visits	202/6048 (3.3)	RR 1.08 (0.89, 1.31)	0.44
	Duryea 2021 33852002 TX, US	.	.	In person visits	203/6559 (3.1)	.	.
	Palmer 2021 34217399 Melbourne, Australia	At delivery	Birth <37 weeks	Hybrid visits	82/1768 (4.6)	0.82 (0.65, 1.03)*	0.10
	Palmer 2021 34217399 Melbourne, Australia	.	.	In person visits	869/15516 (5.6)	.	.
	Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	At delivery	Birth <37 weeks	Hybrid visits	9/117 (7.7)	1.34 (0.65, 2.79)*	0.65
	Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	.	.	In person visits	55/941 (5.8)	.	.
	Butler Tobah 2019 31228414 MN, US	At delivery	Birth <37 weeks	Hybrid visits	4/134 (3.0)	1.33 (0.29, 6.08)*	0.56
	Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	.	.	In person visits	3/133 (2.3)	.	.
Stillbirth / Miscarriage	Duryea 2021 33852002 TX, US	During pregnancy	Stillbirth	Hybrid visits	29/6048 (0.5)	RR 0.79 (0.49, 1.27)	0.32

Outcome	Study PMID Location	Time	Outcome Definition	Arm*	n/N (%)	OR (95% CI)	Reported P-Value
	Duryea 2021 33852002 TX, US	.	.	In person visits	40/6559 (0.6)	.	.
	Butler Tobah 2019 31228414 MN, US	During pregnancy	Miscarriage	Hybrid visits	3/134 (2.2)	0.99 (0.20, 5.01)*	>0.99
	Butler Tobah 2019 31228414 MN, US	.	.	In person visits	3/133 (2.3)	.	.
	Palmer 2021 34217399 Melbourne, Australia	During pregnancy	Stillbirth	Hybrid visits	11/1768 (0.6)	0.92 (0.49, 1.71)*	0.79
	Palmer 2021 34217399 Melbourne, Australia	.	.	In person visits	105/15516 (0.7)	.	.
Shoulder dystocia	Duryea 2021 33852002 TX, US	At delivery	Shoulder dystocia	Hybrid visits	14/6048 (0.2)	**RR 0.49 (0.26, 0.92)**	0.02
	Duryea 2021 33852002 TX, US	.	.	In person visits	31/6559 (0.5)	.	.
Low birth weight	Butler Tobah 2019 31228414 MN, US	At delivery	<2500g	Hybrid visits	1/134 (0.7)	0.49 (0.04, 5.50)*	0.56
	utler Tobah 2019 31228414 MN, US	.	.	In person visits	2/133 (1.5)	.	.
	Palmer 2021 34217399 Melbourne, Australia	At delivery	Singletons <3rd percentile (“fetal growth restriction”)	Hybrid visits	39/1767 (2.2)	1.06 (0.76, 1.49)*	0.72
	Palmer 2021 34217399 Melbourne, Australia	.	.	In person visits	322/15470 (2.1%)	.	.
	Palmer 2021 34217399 Melbourne, Australia	At delivery	Singletons <10th percentile (“fetal growth restriction”)	Hybrid visits	167/1767 (9.5)	0.97 (0.82, 1.15)*	0.71
	Palmer 2021 34217399 Melbourne, Australia	.	.	In person visits	1506.15470 (9.7)	.	.
	Palmer 2021 34217399 Melbourne, Australia	At delivery	Singletons full-term <3rd percentile	Hybrid visits	8/1767 (0.5)	0.95 (0.46, 1.97)*	0.93

Outcome	Study PMID Location	Time	Outcome Definition	Arm*	n/N (%)	OR (95% CI)	Reported P-Value
	Palmer 2021 34217399 Melbourne, Australia	.	.	In person visits	74/15470 (0.5)	.	.
	Palmer 2021 34217399 Melbourne, Australia	At delivery	Induction of labor for suspected fetal growth restriction	Hybrid visits	82/1767 (4.6)	1.08 (0.86, 1.37)*	0.50
	Palmer 2021 34217399 Melbourne, Australia	.	.	In person visits	665/15470 (4.3)	.	.
Abnormal Apgar score	Butler Tobah 2019 31228414 MN, US	At delivery	<7	Hybrid visits	3/134 (2.2)	1.50 (0.25, 9.12)*	0.66
	Butler Tobah 2019 31228414 MN, US	.	.	In person visits	2/133 (1.5)	.	.
Arterial cord gas pH <7.0	Duryea 2021 33852002 TX, US	At delivery	NR	Hybrid visits	17/6048 (0.3)	RR 0.84 (0.46, 1.62)	0.64
	Duryea 2021 33852002 TX, US	.	.	In person visits	22/6559 (0.4)	.	.
Completion of ACOG recommended services	Butler Tobah 2019 31228414 MN, US	36 weeks of gestation	Influenza vaccine	Hybrid visits	105/134 (80.2)	0.80 (0.44, 1.46)*	0.44
	Butler Tobah 2019 31228414 MN, US	.	.	In person visits	109/133 (83.8)	.	.
	Butler Tobah 2019 31228414 MN, US	36 weeks of gestation	Tdap booster	Hybrid visits	119/134 (90.8)	1.08 (0.51, 2.29)*	0.82
	Butler Tobah 2019 31228414 MN, US	.	.	In person visits	117/133 (90.0)	.	.
	Butler Tobah 2019 31228414 MN, US	36 weeks of gestation	Mid-pregnancy education	Hybrid visits	127/134 (96.6)	1.48 (0.54, 4.00)*	0.35
	Butler Tobah 2019 31228414 MN, US	.	.	In person visits	123/133 (94.6)	.	.
	Butler Tobah 2019 31228414 MN, US	36 weeks of gestation	Screen for group B Streptococcus	Hybrid visits	128/134 (97.7)	0.66 (0.18, 2.40)*	0.32
	Butler Tobah 2019 31228414 MN, US	.	.	In person visits	129/133 (99.2)	.	.
	Butler Tobah 2019 31228414 MN, US	36 weeks of gestation	Depression screening	Hybrid visits	130/134 (99.2)	1.01 (0.25, 4.12)*	1.00
	Butler Tobah 2019 31228414 MN, US	.	.	In person visits	129/133 (99.2)	.	.
Unplanned hospital admissions	Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	During pregnancy	≥2 Hospital encounters	Hybrid visits	23/117 (19.7)	0.74 (0.46, 1.20)*	0.56

Outcome	Study PMID Location	Time	Outcome Definition	Arm*	n/N (%)	OR (95% CI)	Reported P-Value
	Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	.	.	In person visits	233/941 (24.8)	.	.
Emergency room/triage visits	Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	During pregnancy	≥1 ED/UCC (urgent care center) encounters	Hybrid visits	9/117 (7.7)	0.70 (0.34, 1.43)*	0.44
	Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	.	.	In person visits	100/941 (10.6)	.	.
Neonatal intensive care unit [NICU] admission	Duryea 2021 33852002 TX, US	At delivery	Full-term NICU admission	Hybrid visits	94/6048 (1.6)	RR 1.04 (0.79, 1.38) 1.04 (0.78, 1.38)*	0.78
	Duryea 2021 33852002 TX, US	.	.	In person visits	98/6559 (1.5)	.	.
	Palmer 2021 34217399 Melbourne, Australia	At delivery	NICU admission	Hybrid visits	29/1768 (1.6)	1.08 (0.73, 1.59)*	0.60
	Palmer 2021 34217399 Melbourne, Australia	.	.	In person visits	237/15516 (1.5)	.	.
	Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	At delivery	NICU admission	Hybrid visits	6/117 (5.1)	0.69 (0.29, 1.64)*	0.08
	Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	.	.	In person visits	68/941 (7.2)	.	.

Abbreviations: . = no applicable data and/or same as above, CI = confidence interval, NR = not reported, OR = odds ratio, PMID = PubMed identifier, RR = risk ratio.

* Calculated by review team.

Table D-2-2. Televisits: Continuous outcome results

Outcome*	Study, PMID	Time	Outcome Definition	Arm*	N	Mean (SD)	MD (95% CI)	Reported P Value
Pregnancy−related stress	Butler Tobah 2019 31228414 MN, US	14 weeks of gestation	PreNatal Maternal Stress survey (range: 0-2, a higher score indicating higher levels of stress)	Hybrid visits	134	0.32 (0.21)	**−0.09 (−0.14, −0.04)**	**<0.01**
	Butler Tobah 2019 31228414 MN, US	.	.	In person visits	133	0.41 (0.23)	.	.
	Butler Tobah 2019 31228414 MN, US	24 weeks of gestation	PreNatal Maternal Stress survey (range: 0-2, a higher score indicating higher levels of stress)	Hybrid visits	134	0.31 (0.21)	−0.04 (−0.09, 0.01)	0.19
	Butler Tobah 2019 31228414 MN, US	.	.	In person visits	133	0.35 (0.21)	.	.
	Butler Tobah 2019 31228414 MN, US	36 weeks of gestation	PreNatal Maternal Stress survey (range: 0-2, a higher score indicating higher levels of stress)	Hybrid visits	134	0.34 (0.23)	**−0.06 (−0.11, −0.01)**	**0.03**
	Butler Tobah 2019 31228414 MN, US	.	.	In person visits	133	0.40 (0.22)	.	.
Patient satisfaction with antenatal care	Pflugeisen 2017 28176034 OB Care ConnectTM WA, US Non-Industry	Delivery	Overall rating of care received (range: 1-5, a higher score indicating better rating of care)	Hybrid visits	75	4.78 (NR)	**0.25 (0.06, 0.44)***	**0.01**
	Pflugeisen 2017 28176034 OB Care ConnectTM WA, US Non-Industry	.	.	In person visits	96	4.53 (NR)	.	.
	Pflugeisen 2017 28176034 OB Care ConnectTM WA, US Non-Industry	Delivery	Satisfaction with virtual visits/prenatal care (range: 1-5, a higher score indicating higher levels of satisfaction)	Hybrid visits	75	4.64 (NR)	0.11 (−0.14, 3.35)*	0.39

Outcome*	Study, PMID	Time	Outcome Definition	Arm*	N	Mean (SD)	MD (95% CI)	Reported P Value
	Pflugeisen 2017 28176034 OB Care ConnectTM WA, US Non-Industry	.	.	In person visits	96	4.53 (NR)	.	.
	Butler Tobah 2019 31228414 MN, US	36 weeks of gestation	Modified Littlefield and Adams 16−item self−reported validated Satisfaction subscale survey (range: 0-100, a higher score indicating higher levels of satisfaction)	Hybrid visits	134	93.9 (NR)	**15.01 (13.38, 16.64)**	**<0.01**
	Butler Tobah 2019 31228414 MN, US	.	.	In person visits	133	78.89 (NR)	.	.
	Futterman 2021 33038898 NY, US	No more than 5 days after the last prenatal encounter	Short Assessment of Patient Satisfaction (range: 1-28, a higher score indicating higher levels of satisfaction) (**All Participants**)	Tele visits	104	Median (IQR) 20 (20, 25)	**Median Difference −2 (NR)***	**0.008**
	Futterman 2021 33038898 NY, US	.	.	In person visits	104	Median (IQR) 24 (22, 26)	.	.
	Futterman 2021 33038898 NY, US	Same	Same (**Nulliparous**)	Tele visits	28	Median (IQR) 23 (22, 26)	Median Difference 0 (NR)*	0.222
	Futterman 2021 33038898 NY, US	.	.	In person visits	28	Median (IQR) 25 (22, 27)	.	.
	Futterman 2021 33038898 NY, US	Same	Same (**Multiparous**)	Tele visits	76	Median (IQR) 22 (20, 25)	**Median Difference −1.25 (NR)***	**0.013**
	Futterman 2021 33038898 NY, US	.	.	In person visits	76	Median (IQR) 23 (21, 26)	.	.

Outcome*	Study, PMID	Time	Outcome Definition	Arm*	N	Mean (SD)	MD (95% CI)	Reported P Value
	Futterman 2021 33038898 NY, US	Same	Same (**English speaking**)	Tele visits	48	Median (IQR) 22 (20, 26)	**Median Difference −1.75 (NR)***	**0.042**
	Futterman 2021 33038898 NY, US	.	.	In person visits	48	Median (IQR) 25 (22, 27)	.	.
	Futterman 2021 33038898 NY, US	Same	Same (**Other language speaking**)	Tele visits	56	Median (IQR) 23 (20, 25)	Median Difference −1.5 (NR)*	0.101
	Futterman 2021 33038898 NY, US	.	.	In person visits	56	Median (IQR) 23 (22, 25)	.	.
	Futterman 2021 33038898 NY, US	Same	Same (**Hispanic**)	Tele visits	77	Median (IQR) 23 (20, 25)	Median Difference −1.5 (NR)*	0.082
	Futterman 2021 33038898 NY, US	.	.	In person visits	77	Median (IQR) 23 (22, 26)	.	.
	Futterman 2021 33038898 NY, US	Same	Same (**Non-Hispanic**)	Tele visits	27	Median (IQR) 22 (21, 25)	**Median Difference −1 (NR)***	**0.019**
	Futterman 2021 33038898 NY, US	.	.	In person visits	27	Median (IQR) 26 (22, 27)	.	.
	Futterman 2021 33038898 NY, US	Same	Same (**Physician provider**)	Tele visits	62	Median (IQR) 23 (21, 25)	Median Difference −1 (NR)*	0.184
	Futterman 2021 33038898 NY, US	.	.	In person visits	62	Median (IQR) 24 (22, 26)	.	.
	Futterman 2021 33038898 NY, US	Same	Same (**Midwife provider**)	Tele visits	42	Median (IQR) 22 (20, 25)	**Median Difference 0 (NR)***	**0.012**
	Futterman 2021 33038898 NY, US	.	.	In person visits	42	Median (IQR) 22 (20, 25)	.	.

Outcome*	Study, PMID	Time	Outcome Definition	Arm*	N	Mean (SD)	MD (95% CI)	Reported P Value
	Futterman 2021 33038898 NY, US	Same	Same (**High risk care**)	Tele visits	29	Median (IQR) 22 (22, 25)	Median Difference −1 (NR)*	0.389
	Futterman 2021 33038898 NY, US	.	.	In person visits	29	Median (IQR) 22 (21, 25)	.	.
	Futterman 2021 33038898 NY, US	Same	Same (**Low risk care**)	Tele visits	75	Median (IQR) 23 (20, 25)	**Median Difference −1.75 (NR)***	**0.009**
	Futterman 2021 33038898 NY, US	.	.	In person visits	75	Median (IQR) 24 (22, 27)	.	.
	Futterman 2021 33038898 NY, US	Same	Same (**Prior cesarean delivery**)	Tele visits	18	Median (IQR) 22 (20, 26)	Median Difference −1 (NR)*	0.624
	Futterman 2021 33038898 NY, US	.	.	In person visits	18	Median (IQR) 23 (21, 26)	.	.
	Futterman 2021 33038898 NY, US	Same	Same (**Access to online electronic medical record**)	Tele visits	37	Median (IQR) 23 (21, 25)	Median Difference 1 (NR)*	0.596
	Futterman 2021 33038898 NY, US	.	.	In person visits	37	Median (IQR) 23 (20, 24)	.	.
Patient financial costs	Barbour 2017 NoPMID UT, US	During pregnancy	Work time cost (USD)	Hybrid visits	100	NR	−$25.1 (−60.0, 9.9)	0.16
	Barbour 2017 NoPMID UT, US	.	.	In person visits	100	NR	.	.
	Barbour 2017 NoPMID UT, US	During pregnancy	Personal time cost (USD)	Hybrid visits	100	NR	**−$24.8 (−47.0, −2.6)**	**0.03**
	Barbour 2017 NoPMID UT, US	.	.	In person visits	100	NR	.	.
Patient travel	Barbour 2017 NoPMID UT, US	During pregnancy	Travel time (hours)	Hybrid visits	100	NR	**−0.83 (−1.18, −0.48)**	**<0.01**

Outcome*	Study, PMID	Time	Outcome Definition	Arm*	N	Mean (SD)	MD (95% CI)	Reported P Value
	Barbour 2017 NoPMID UT, US	.	.	In person visits	100	NR	.	.
	Butler Tobah 2019 31228414 MN, US	During pregnancy	Patients driving costs (USD)	Hybrid visits	131	Median (IQR) 2.8 (1.0, 94)	**Median Difference −0.7 (NR)***	**0.032**
	Butler Tobah 2019 31228414 MN, US	.	.	In person visits	130	Median (IQR) 3.5 (1.3, 16.1)	.	.
	Butler Tobah 2019 31228414 MN, US	During pregnancy	Patients total miles driven	Hybrid visits	131	Median (IQR) 29.6 (11, 98.4)	**Median Difference −6.8 (NR)***	**0.032**
	Butler Tobah 2019 31228414 MN, US	.	.	In person visits	130	Median (IQR) 36.4 (14, 169)	.	.
	Barbour 2017 NoPMID UT, US	During pregnancy	Travel time cost (USD)	Hybrid visits	100	NR	**−35.7 (−68.6, −2.7)**	**0.03**
	Barbour 2017 NoPMID UT, US	.	.	In person visits	100	NR	.	.
Lost work time	Barbour 2017 NoPMID UT, US	During pregnancy	Personal time (hours)	Hybrid visits	100	NR	**−1.28 (−2.44, −0.13)**	**0.03**
	Barbour 2017 NoPMID UT, US	.	.	In person visits	100	NR	.	.
	Barbour 2017 NoPMID UT, US	During pregnancy	Work time (hours)	Hybrid visits	100	NR	−1.27 (−3.11, 0.56)	0.17
	Barbour 2017 NoPMID UT, US	.	.	In person visits	100	NR	.	.
Gestational age at birth	Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	At delivery	Gestational age at (weeks)	Hybrid visits	117	38.9 (NR)	−0.2 (NR)*	0.18

Outcome*	Study, PMID	Time	Outcome Definition	Arm*	N	Mean (SD)	MD (95% CI)	Reported P Value
	Pflugeisen 2016 26474477 OB Care ConnectTM WA, US	.	.	In person visits	941	39.1 (NR)	.	.

Abbreviations: . = no applicable data and/or same as above, CI = confidence interval, IQR = interquartile range, MD = mean difference (between groups), NR = not reported, NS = not statistically significant, OR = odds ratio, PMID = PubMed identifier, SD = standard deviation.

* Calculated

Key Question 3 (Qualitative Studies)

Table D-3-1. Full text coding of extracts for antenatal care visit schedules to Theoretical Domains Framework

TDF Domain	Study, Year, PMID	Extracted Text[a]	Theme	Location	Perspective	Entity	Barrier/ Facilitator
1. Knowledge	Sanders, 1999, 11216259	One midwife emphasised the importance women placed on having a method of contacting a midwife: "The fact that they've got a contact (telephone number) is actually all the reassurance some of them need, so they don't need frequent appointments."	Importance of having contact information for provider	Results	Provider	Patient	Facilitator
1. Knowledge	Sanders, 1999, 11216259	However, some of the midwives considered that if women were to have fewer antenatal attendances they would need additional information in order to feel confident, such as how to make additional appointments, how to contact a midwife if necessary and signs of pregnancy- related complications.	Need information about worrying signs to look for and how to contact care providers	Results	Provider	Patient	Barrier
1. Knowledge	Sanders, 1999, 11216259	Another midwife stressed the importance of information for women who plan less frequent antenatal attendances: "I think they've got to be well informed... (they are confident) as long as they've got the information of what they should look for, what are the worrying signs if necessary, and how to get hold of you, they've just got to be informed really."	Need information about worrying signs to look for and how to contact care providers	Results	Provider	Patient	Barrier
1. Knowledge	Sanders, 2000, No PMID	The only point I would make is that the procedures and blood tests were not explained to me again. Luckily I remembered most of them and although this is second time around it has been two very eventful years since I was in this position and I can't be expected to remember everything. (Parous woman, Traditional care group)	Women wanted more information to guide behaviors early in pregnancy and to understand procedures (e.g., purpose of test) throughout pregnancy [both flexible and traditional schedule groups]	Information	Patient	Patient	Barrier

TDF Domain	Study, Year, PMID	Extracted Text[a]	Theme	Location	Perspective	Entity	Barrier/ Facilitator
1. Knowledge	Sanders, 2000, No PMID	Women attached importance to obtaining information early in pregnancy, recognising early pregnancy to be the 'most vulnerable time in fetal development' and considering care in early pregnancy to be 'extremely important'. Several women stated that much of the information was given too late to be of maximum value, particularly in relation to diet in pregnancy: "Leaflets given at booking, especially concerning which foods etc to avoid in pregnancy, could do with being given earlier in pregnancy or pre-pregnancy. Given at this stage could cause concern about food already eaten in pregnancy even though risks are minimal". (Nulliparous woman/ Traditional care group). "I did not see the midwife until week 9 of my pregnancy, up until this time I was unsure of foods that I should not be eating and that could harm the baby. A leaflet posted earlier to me would have been a great help." (Parous woman I Flexible care group) "I feel it would be reassuring, especially for a first pregnancy if you could see a midwife for a brief discussion as soon as your pregnancy is confirmed just for reassurance about what you should or shouldn't be eating etc and just to talk about any worries you may have." (Parous woman I Traditional care group) "Having found out quite early that I was pregnant it seemed a long wait before I was booked in to see the midwife. Even though my doctor was lovely and told me the food I shouldn't be eating I came away thinking 'oh is that it'! I appreciate there isn 't much that can be said or done in early pregnancy, but I found out more information from buying a pregnancy book and reading magazines." (Nulliparous woman/ Flexible care group) From the comments made about the care some women received in early pregnancy, it would appear that this is an area in which midwifery care has not changed sufficiently to keep pace with the changing experience of early pregnancy, transformed by modern home pregnancy tests. Women are able to confirm their pregnancy from the day of their first missed period and midwives should ensure they are easily accessible for advice at this time.	Women wanted more information to guide behaviors early in pregnancy and to understand procedures (e.g., purpose of tests) throughout pregnancy [both flexible and traditional schedule groups]	Information	Patient	Patient	Barrier

TDF Domain	Study, Year, PMID	Extracted Text[a]	Theme	Location	Perspective	Entity	Barrier/ Facilitator
3. Social/professional role and identity	Sanders, 2000, No PMID	Although midwives view positively the involvement of women in planning their care, some women expressed concern at being asked to share responsibility for planning their antenatal care. Additionally, some parous women expressed concern that nulliparous women may not receive the care they require. "I feel that a lot of responsibility has been put on myself. In my other pregnancies the doctors/midwifes told me what to do next. Yet in this pregnancy it is the other way round" (Parous women/flexible care group)	Hesitancy to take on more responsibility	Main Text	Patient	Patient	Barrier
3. Social/professional role and identity	Sanders, 1999, 11216259	[M]idwives involved in this study were reluctant to integrate many changes in their practice. [Discussion point]	Reluctance to chance practice	Discussion	Provider	Provider	Barrier
3. Social/professional role and identity	Sanders, 1999, 11216259	In general, midwives seemed to support a move away from the traditional schedule of antenatal attendances. A flexible schedule was perceived to reinforce the normality of pregnancy. There was a feeling that the need for regular appointments during pregnancy suggested that pregnancy was an illness. "There must be something wrong because you don't go to the doctor's normally every month or fortnight for anything else, do you?'	Sense that flexible [reduced] care was normal practice for [for midwives] and reaffirmed practice philosophies and belief that pregnancy is normal and should be tailored to women's needs. Midwives valued working in partnership with women and given women tools to be more responsible for their pregnancy	Results	Provider	Provider	Facilitator

TDF Domain	Study, Year, PMID	Extracted Text[a]	Theme	Location	Perspective	Entity	Barrier/ Facilitator
3. Social/professional role and identity	Sanders, 1999, 11216259	Midwives spoke of reduced attendances as representing "working in partnership" with women, and "women taking some responsibility" for their health. The prevailing view was that pregnant women represent a group of mainly healthy individuals who should be encouraged to take more responsibility for their health during pregnancy. A reduction in routine antenatal attendances with encouragement for women to recognise concerns or complications warranting additional attendances, was one expression of this philosophy of care: "Pregnancy is normal. And as long as you inform them enough for them to know what isn't normal, it goes back to them taking some responsibility as well. And I think that's taken away in traditional care. You take on that responsibility. And it must, I am sure, to a point make them feel, well, gosh, if I need to be seen every month then every fortnight for 28 weeks you know there must be something wrong."	Sense that flexible [reduced] care was normal practice for [for midwives] and reaffirmed practice philosophies and belief that pregnancy is normal and should be tailored to women's needs. Midwives valued working in partnership with women and given women tools to be more responsible for their pregnancy	Results	Provider	Provider	Facilitator
3. Social/professional role and identity	Sanders, 1999, 11216259	Midwives used to providing flexible care said it had felt `strange' or `odd' to have to return to providing traditional care for some women during the trial.	Sense that flexible [reduced] care was normal practice for [for midwives] and reaffirmed practice philosophies and belief that pregnancy is normal and should be tailored to women's needs. Midwives valued working in partnership with women and given women tools to be more responsible for their pregnancy	Results	Provider	Provider	Facilitator

TDF Domain	Study, Year, PMID	Extracted Text[a]	Theme	Location	Perspective	Entity	Barrier/ Facilitator
3. Social/professional role and identity	Sanders, 1999, 11216259	During recruitment of the practices, some midwives who currently provided a reduced schedule of antenatal attendances to all women at low obstetric risk, declined to participate as they did not wish to provide a traditional schedule of antenatal care to women in their care. They considered this would be a retrograde step that would lead to an unmanageable increase in their workload. This contrasted with the views of local consultant obstetricians, who during the consultation phase of the study had expressed concern at a move away from the traditional schedule of antenatal visits.	Sense that flexible [reduced] care was normal practice for [for midwives] and reaffirmed practice philosophies and belief that pregnancy is normal and should be tailored to women's needs. Midwives valued working in partnership with women and given women tools to be more responsible for their pregnancy	Discussion	Provider	Provider	Failitator
3. Social/professional role and identity	Sanders, 1999, 11216259	Some midwives suggested that a more flexible approach to the scheduling of antenatal attendances was already incorporated into normal practice. Midwives who worked in a midwifery team, spoke of seeing women "when they want to be seen" feeling this to be "the ideal really".	Sense that flexible [reduced] care was normal practice for [for midwives] and reaffirmed practice philosophies and belief that pregnancy is normal and should be tailored to women's needs. Midwives valued working in partnership with women and given women tools to be more responsible for their pregnancy	Results	Provider	Provider	Facilitator
3. Social/professional role and identity	Sanders, 1999, 11216259	Several midwives proposed that there had been a move towards the adoption of flexible antenatal care in the area, but in an unsystematic way, refected in a variety of schedules being offered by different practices. One midwife stated "I think it (flexible care) has been happening for quite a long time without people really realising".	Sense that flexible [reduced] care was normal practice for [for midwives] and reaffirmed practice philosophies and belief that pregnancy is normal and should be tailored to women's needs. Midwives valued working in partnership with women and given women tools to be more responsible for their pregnancy	Results	Provider	Provider	Faciltator

TDF Domain	Study, Year, PMID	Extracted Text[a]	Theme	Location	Perspective	Entity	Barrier/ Facilitator
3. Social/professional role and identity	Sikorski, 1995, 7616860	Turning to health professionals' views on how much antenatal care should be provided, some of the reasons given for wanting to see a reduction in the number of routine antenatal visits included the inflexibility of established visit patterns and the hope that fewer visits might lead to more time being spent on each check-up: "Antenatal care should be tailor-made to meet individual needs. After all, pregnancy is a normal, natural process for the majority of women." (Midwife)	Sense that flexible [reduced] care was normal practice for [for midwives] and reaffirmed practice philosophies and belief that pregnancy is normal and should be tailored to women's needs. Midwives valued working in partnership with women and given women tools to be more responsible for their pregnancy	Findings	Provider	Provider	Facilitator
4. Beliefs about capabilities	Sanders, 2000, No PMID	"The best aspects of my antenatal care so far are the flexible number of check-ups, if there are not any problems, why see the midwife/doctor?"(parous woman/ flexible care group)	Women's beliefs about their capabilities varied: some women expressed confidence and wanted to be left alone while others expressed concern and preferred traditional care schedules for guidance and reassurance	Traditional or Flexible Schedules	Patient	Patient	Benefit
4. Beliefs about capabilities	Sanders, 2000, No PMID	"If I have any problems all I have to do is phone and make an appointment"(parous woman/ flexible care group)	Women's beliefs about their capabilities varied: some women expressed confidence and wanted to be left alone while others expressed concern and preferred traditional care schedules for guidance and reassurance	(Valery did not code)	Patient	Patient	Facilitator
4. Beliefs about capabilities	Sanders, 1999, 11216259	Midwives also described parous women who expressed a wish to follow the traditional schedule of antenatal attendances, having gained confidence in the traditional model of care during previous pregnancies. The midwives considered that reassurance was the main reason women wished to attend clinic regularly and that this could only be provided by face-to-face contact between the woman and health professional: "I think it was the contact, that they actually wanted, not so much that they had a particular worry. If they had a particular worry they would have phoned, but it was just the actual contact".	Women's beliefs about their capabilities varied: some women expressed confidence and wanted to be left alone while others expressed concern and preferred traditional care schedules for guidance and reassurance	Results	Provider	Patient	Barrier

TDF Domain	Study, Year, PMID	Extracted Text[a]	Theme	Location	Perspective	Entity	Barrier/ Facilitator
4. Beliefs about capabilities	Sanders, 2000, No PMID	"I personally feel seeing that I'm on my third pregnancy, that I know if there's anything wrong so why not leave me alone until the seventh month of pregnancy?" (Parous woman/traditional care group)	Women's beliefs about their capabilities varied: some women expressed confidence and wanted to be left alone while others expressed concern and preferred traditional care schedules for guidance and reassurance	Traditional or Flexible Schedules	Patient	Patient	Facilitator
4. Beliefs about capabilities	Sanders, 2000, No PMID	"I like taking part in this flexible antenatal care programme. I don't like too much fussing about. I just want to be left alone, but its nice to know that I can ring the surgery and talk to someone if something's wrong"(parous woman/ flexible care group)	Women's beliefs about their capabilities varied: some women expressed confidence and wanted to be left alone while others expressed concern and preferred traditional care schedules for guidance and reassurance	Traditional or Flexible Schedules	Patient	Patient	Benefit
4. Beliefs about capabilities	Sanders, 2000, No PMID	"I have had only one doctor 's appointment and one midwife 's appointment since I discovered I was pregnant. I feel that this is not enough. The midwife has said that I can phone at any time regarding any worries etc but having just met the once, I don't feel comfortable about sharing my fears. (Nulliparous woman / Flexible care group)	Women's beliefs about their capabilities varied: some women expressed confidence and wanted to be left alone while others expressed concern and preferred traditional care schedules for guidance and reassurance	Information	Patient	Patient	Barrier
4. Beliefs about capabilities	Sanders, 2000, No PMID	"If this was my first baby, how would I know how good it is for me to have antenatal check-ups and how often?" (Parous women/flexible care group)	Women's beliefs about their capabilities varied: some women expressed confidence and wanted to be left alone while others expressed concern and preferred traditional care schedules for guidance and reassurance	Main Text	Patient	Patient	Barrier
4. Beliefs about capabilities	Sanders, 2000, No PMID	"As this is my first pregnancy, I feel that having antenatal care once a month has been a great reassurance for me" (Nulliparous woman/traditional care group)	Women's beliefs about their capabilities varied: some women expressed confidence and wanted to be left alone while others expressed concern and preferred traditional care schedules for guidance and reassurance	Traditional or Flexible Schedules	Patient	Patient	Benefit

TDF Domain	Study, Year, PMID	Extracted Text[a]	Theme	Location	Perspective	Entity	Barrier/ Facilitator
4. Beliefs about capabilities	Sanders, 2000, No PMID	"Although there were no problems with my previous pregnancy...I did like the reassurance of 4 weekly visits to the midwife as I felt a lot could go wrong with the potentially serious consequences with less frequent visits." (Parous woman/flexible care group)	Women's beliefs about their capabilities varied: some women expressed confidence and wanted to be left alone while others expressed concern and preferred traditional care schedules for guidance and reassurance	Traditional or Flexible Schedules	Patient	Patient	Benefit
6. Beliefs about consequences	Sikorski, 1995, 7616860	If low-risk groups were not seen as often, more time could be directed to the high risk groups."	Belief that seeing low-risk groups less often allows more time to be directed to high-risk groups	Findings	Provider	Provider	Facilitator
6. Beliefs about consequences	Sikorski, 1995, 7616860	However, there was some concern expressed about whether women's psychosocial needs could be met within a reduced schedule of antenatal visits: "At present some women I have spoken to feel they don't get enough time to discuss problems and anxieties they may have, so reducing visits may make this problem worse." (Midwife)	Doubt about whether women's psychosocial needs could be met with reduced care schedule	Findings	Provider	Patient	Barrier
6. Beliefs about consequences	Sanders, 1999, 11216259	Although midwives varied in the degree of flexibility in the care they offered, there was a consensus that both midwives and women felt eight weeks between antenatal attendances to be an unacceptably long gap. Whilst remembering that this represents the views of only a small number of midwives, this point remains worthy of consideration by any provider of maternity care considering a revision of antenatal services. A schedule of attendances which proves unpopular with both midwives and women is not likely to be sustainable. The midwives in this study considered six weeks between antenatal attendances to be the maximum gap with which they felt comfortable. This may be a consequence of midwives viewing any new schedule of attendances in terms of the degree of change from traditional antenatal care. Doubling the length of the gap between visits from four to eight weeks might be a difficult psychological barrier to cross.	Patient and provider [midwife] discomfort with 8-week gap between visits [as indicated by flexible care protocol] citing concerns about missing signs for preeclampsia, fears that physical and psychosocial needs would not be met, and general unease.	Discussion	Provider	Provider	Barrier

TDF Domain	Study, Year, PMID	Extracted Text[a]	Theme	Location	Perspective	Entity	Barrier/ Facilitator
6. Beliefs about consequences	Sanders, 1999, 11216259	All the midwives remained unconvinced by the safety or desirability of any significant reduction in attendances, but equally felt the traditional model of care to be too in flexible to meet the needs of some women. As a result, individual practice reflected personal views and women were offered various degrees of flexibility	Patient and provider [midwife] discomfort with 8-week gap between visits [as indicated by flexible care protocol] citing concerns about missing signs for preeclampsia, fears that physical and psychosocial needs would not be met, and general unease.	Discussion	Provider	Provider	Mixed
6. Beliefs about consequences	Sanders, 1999, 11216259	Although all the midwives expressed support for a reduction in the number of routine attendances for women at low obstetric risk and recognised that some women appreciate being seen less frequently, they also expressed some reservations about this model of care. These reservations centred around a concern that the psychosocial as well as physical needs of women may go unmet if antenatal contact is reduced.	Patient and provider [midwife] discomfort with 8-week gap between visits [as indicated by flexible care protocol] citing concerns about missing signs for preeclampsia, fears that physical and psychosocial needs would not be met, and general unease.	Results	Provider	Provider	Mixed
6. Beliefs about consequences	Sanders, 1999, 11216259	The midwives considered that the majority of women found the maximum gap of eight weeks between visits permitted by the study protocol to be too long. Some women had waited the eight weeks between visits, only to report that they would have preferred to have been seen sooner. Others had phoned to arrange earlier visits; one woman returned after eight weeks only to request that she follow the traditional schedule of visits for the remainder of her pregnancy. None of the midwives felt eight weeks to be an acceptable gap, unless an individual woman specifically requested this: "that extra fortnight seems to make all the difference."	Patient and provider [midwife] discomfort with 8-week gap between visits [as indicated by flexible care protocol] citing concerns about missing signs for preeclampsia, fears that physical and psychosocial needs would not be met, and general unease.	Results	Provider	Patient	Barrier

TDF Domain	Study, Year, PMID	Extracted Text[a]	Theme	Location	Perspective	Entity	Barrier/ Facilitator
6. Beliefs about consequences	Sanders, 1999, 11216259	Their other main concern was the possibility of failing to identify early hypertensive disorders of pregnancy. Although the midwives recognised that pre-eclampsia can develop rapidly, giving first-hand examples of women receiving traditional care who had required delivery between planned attendances at 24 and 28 weeks' gestation, they expressed unease at leaving eight weeks between visits. One midwife said "I just felt eight weeks was quite a long time, whereas six weeks was a better time." Another said "It is hard to put a finger on why I felt six weeks was fine, but eight weeks was a long time." While the threat of pre-eclampsia was viewed as a justification for limiting the gaps between visits, the midwives spoke of occasions when they had used their `gut instinct' to limit the time between visits for an individual woman, only to find a complication requiring referral to hospital. Such events confirmed to the midwives, the need for caution in reducing antenatal attendances, even for the apparently healthy woman	Patient and provider [midwife] discomfort with 8-week gap between visits [as indicated by flexible care protocol] citing concerns about missing signs for preeclampsia, fears that physical and psychosocial needs would not be met, and general unease.	Results	Provider	Provider	Barrier
6. Beliefs about consequences	Sanders, 1999, 11216259	The midwives were concerned that a woman's physical and psychosocial needs may be unmet if there were gaps of eight weeks between attendances. They expressed concern that they would not develop the same depth of relationship with women if they saw them less frequently, particularly during a first pregnancy when relationships with health professionals are being established.	Patient and provider [midwife] discomfort with 8-week gap between visits [as indicated by flexible care protocol] citing concerns about missing signs for preeclampsia, fears that physical and psychosocial needs would not be met, and general unease.	Results	Provider	Provider	Barrier
6. Beliefs about consequences	Sanders, 1999, 11216259	One midwife described a situation which not only demonstrated an individual woman exercising choice over the spacing of her antenatal attendances, but also an acceptance of that choice by the midwife concerned. The midwife stated: “I had one (parous woman) recently, 35 weeks, and I said, well I'll see you at 38. She said, well no, and she went out and booked herself in for 40 weeks. She wasn't coming in 3 weeks; she was going to come in 5 weeks time, which is exactly when she was due. I never got to see her because in fact she delivered actually on her due date.”	Patient and provider [midwife] discomfort with 8-week gap between visits [as indicated by flexible care protocol] citing concerns about missing signs for preeclampsia, fears that physical and psychosocial needs would not be met, and general unease.	Results	Provider	Patient	Facilitator

TDF Domain	Study, Year, PMID	Extracted Text[a]	Theme	Location	Perspective	Entity	Barrier/ Facilitator
11. Environmental context and resources	Sanders, 1999, 11216259	Only one midwife voiced her concern that an adverse outcome combined with anything less than optimum and conventional care would be met by criticism from her managers: "OK you leave this woman for 4 weeks when she should have been 2 weeks, but something happened. Somebody's going to start knocking and say why didn't you see them on the traditional, because if you had, this might not have happened."	Fear of repercussions from management in the event of a rare adverse event; need for supportive management	Results	Provider	Clinic/Office	Barrier
11. Environmental context and resources	Sanders, 1999, 11216259	[T]here is a need for strong and supportive midwifery management if a reduction in antenatal attendances for women at low obstetric risk is to be effectively introduced and maintained. Managers are needed not only to provide strong leadership but also positive support for midwives. Midwives will be reluctant to change their practice unless they believe they will be supported when faced by the sad, but inevitable, occasional adverse outcomes associated with maternity care.	Fear of repercussions from management in the event of a rare adverse event; need for supportive management	Discussion	Provider	Clinic/Office	Barrier
11. Environmental context and resources	Sanders, 1999, 11216259	While all the midwives recognised the importance of women being able to arrange an extra check-up if they had worries or concerns, the level of access women had to midwives varied. One of the midwives wrote her home phone number on each woman's records, and commented that she had "never received an unnecessary phone call." Another group of midwives informed women in their care, that there was a 24 hour on-call system and they should use the number "if they have any problems" whereas other midwives stressed to women that the "on- call number" was for emergency use only	Inconsistent procedures for accessing clinical care (e.g., what phone numbers given and instructions on when to access them)	Results	Provider	Patient	Barrier
11. Environmental context and resources	Sanders, 1999, 11216259	One of the main reasons for midwives supporting a move away from the traditional pattern of antenatal attendances was that they considered that many women perceive too frequent antenatal attendances to be inconvenient. This included both nulliparous and parous women: parous women because they had to drag children to the clinic' with them and nulliparous women because many now continue to work closer to term and difficulty having time off work.	Reduced inconvenience of women needing to attend multiple visits and allowed women to work closer to term	Results	Provider	Patient	Facilitator

TDF Domain	Study, Year, PMID	Extracted Text[a]	Theme	Location	Perspective	Entity	Barrier/ Facilitator
11. Environmental context and resources	Sanders, 1999, 11216259	One midwife described offering a limited flexible service to reduce overcrowding or long waiting times in her clinics: "If you can see on a particular day of the week your clinic is going to be excessively large or it's going to be running on particularly late, or if the ladies are all going to end up having later appointments, you could actually say to them, "Well, it would actually help me out this week if perhaps you could come on a different day, or leave it until next week, or come in a week earlier".	Some providers [midwives] believed that reduced care may help with clinic overcrowding; others believed it would result in the same number of visits dictated by women's needs rather than care provider policies [Sanders 1999]	Results	Provider	Clinic/Office	Faciltator
11. Environmental context and resources	Sanders, 1999, 11216259	Several of the midwives recognised that flexible antenatal care does not necessarily equate with a reduced number of attendances, but rather a similar number of attendances dictated by the woman's need rather than midwifery policy. This view was contradicted by other midwives who considered that providing women with a more flexible schedule of antenatal care was introduced in their own practice, not because it was viewed as best practice or evidence based, but rather in an attempt to reduce overcrowding in antenatal clinics: "The reason we started doing flexible care is simply because our clinics were so big.". One midwife said she used to joke with her colleagues saying: "I've got the most people on traditional care, they're queuing outside my clinic!"	Some providers [midwives] believed that reduced care may help with clinic overcrowding; others believed it would result in the same number of visits dictated by women's needs rather than care provider policies [Sanders 1999]	Results	Provider	Clinic/Office	Mixed
12. Social influences	Sanders, 1999, 11216259	One of the difficulties of moving away from the traditional model of antenatal care is that it has become familiar to generations of British women and as such it is what women expect: "I think there is still this tradition, women know even if they have never had a baby before, they know what everybody else does, their friend or their sister or whoever, comes every month. They come in with this expectation and it is very difficult to get them out of it."	Social familiarity with traditional model of care across generations of families; what women have come to expect with their pregnancy	Results	Provider	Patient	Barrier
13. Emotion	Sikorski, 1995, 7616860	There was also concern about possible staff cutbacks that might result from the introduction of reduced schedules: "If fewer routine antenatal visits were found to be effective for women, this should not be viewed as an exercise to cut the numbers of staff." (Midwife)	Concern that reduced care schedules may result in staff cutbacks	Findings	Provider	Provider	Barrier

TDF Domain	Study, Year, PMID	Extracted Text[a]	Theme	Location	Perspective	Entity	Barrier/ Facilitator
13. Emotion	Meiser, 2021, No PMID	Subjects used the words “anxiety,” “nervous,” and “reassurance” to describe their concerns with a reduced visit schedule	Negative emotion associated with reduced visit schedule (e.g., anxiety, nervousness, need for reassurance)	Results	Patient	Patient	Barrier
13. Emotion	Sanders, 2000, No PMID	The visits, scan etc, are like milestones, each one quite exciting as it brings the big day nearer and makes all seem real! (Parous woman/ Flexible care group)	Positive emotion associated with traditional care schedule (e.g., see visits as important milestones, help reduce worry)	Reassurance	Patient	Patient	Barrier
13. Emotion	Sanders, 2000, No PMID	“I am a bit of a worrier and therefore was glad I was on the traditional half of the study (parous woman/traditional care group)	Positive emotion associated with traditional care schedule (e.g., see visits as important milestones, help reduce worry)	Traditional or Flexible Schedules	Patient	Patient	Barrier

[a] Text was extracted as reported; British spelling was retained where applicable

Table D-3-2. Summary of findings of qualitative evidence on antenatal care visit schedules

Summary of Review Findings	Studies Contributing	Methodological Limitations (CASP Rating)	Coherence	Adequacy	Relevance	CERQual Assessment	Explanation of CERQual Assessment
With respect to knowledge, women value information on how to behave early in pregnancy and want to know the purpose of tests later in pregnancy (regardless of care schedule). Providers think it is important that women have contact information for their providers.	Sanders 1999, Sanders 2000	*Moderate concerns*: Sanders 2000had a high risk to rigor; Sanders 1999 had a low risk to rigor.	*No concerns*: the finding reflects the complexity and variation of data.	*Moderate concern:* Only 2 of the 4 studies addressed the domain. 1 study each provided evidence for the provider perspective (midwife) and the patient perspective. No organizational or partner/support themes were identified.	*Moderate concerns*: The parent study evaluated in both Sanders reports evaluated a flexible vs. traditional care model and the qualitative studies assessed participants perceptions on the schedules. The flexible care protocol (advising maximum of 8 weeks between visits) may not be relevant to an alternative reduced antenatal care schedule. Additionally, the UK-context for both studies may not be relevant to other locations and healthcare contexts	*Moderate concerns*	2 studies with low and high risks to rigor. While the finding was coherent, further evidence is needed to ensure its adequacy and relevance.
With respect to social/professional role and identity, midwife providers value flexible care models as it aligns with their philosophies of practice in which pregnancy is viewed as normal and they embrace sharing responsibility with pregnant women. Pregnant women are hesitant to take on more responsibility	Sanders1999, Sanders 2000, Sikorski 1995	*Minor concerns:* Sanders 1999 had low risk to rigor; Sikorski had moderate risk to rigor; Sanders 2000 had high risk to rigor	*Minor concerns:* the finding reflects the complexity and variation of the data although Sanders also noted midwives (while supportive of flexible care) were reluctant to change their practice.	*Minor concern:* 3 of the 4 studies addressed the domain. 2 studies provided evidence for the provider perspective (midwives; Sanders 1999; diverse disciplines Sikorski 1995) 1 study provided evidence for the patient perspective. No organizational or partner/support themes were identified.	*Moderate concerns:* The parent study evaluated in both Sanders reports evaluated a flexible vs. traditional care model and the qualitative studies assessed participants perceptions on the schedules. The flexible care protocol (advising maximum of 8 weeks between visits) may not be relevant to an alternative reduced antenatal care schedule. Additionally, the UK-context for both studies may not be relevant to other locations and healthcare contexts. Sikorski was also UK-based, and captured data from 1993, primarily through a quantitative survey and was thus not as rich and potentially relevant to contemporary practice in other locations and healthcare contexts.	*Moderate concerns*	3 studies with variable risks to rigor contributed data to this finding. While the finding was coherent, further evidence is needed to ensure its relevance

Summary of Review Findings	Studies Contributing	Methodological Limitations (CASP Rating)	Coherence	Adequacy	Relevance	CERQual Assessment	Explanation of CERQual Assessment
With respect to beliefs about capabilities, women vary in terms of their confidence in managing their pregnancy independently under reduced care models	Sanders 1999, Sanders 2000	*Moderate concerns*: Sanders 2000h ad a high risk to rigor; Sanders 1999 had a low risk to rigor.	*No concerns*: the finding reflects the complexity and variation of data.	*Moderate concern:* Only 2 of the 4 studies addressed the domain. 1 study each provided evidence for the provider perspective (midwife's perceptions of their patients) and the patient perspective. No organizational or partner/support themes were identified.	*Moderate concerns*: The parent study evaluated in both Sanders reports evaluated a flexible vs. traditional care model and the qualitative studies assessed participants perceptions on the schedules. The flexible care protocol (advising maximum of 8 weeks between visits) may not be relevant to an alternative reduced antenatal care schedule. Additionally, the UK-context (and women's confidence in these contexts) for both studies may not be relevant to other locations, cultures, and healthcare contexts.	*Moderate concerns*	2 studies with low and high risks to rigor. While the finding was coherent, further evidence is needed to ensure its adequacy and relevance.
With respect to beliefs about consequences, women and their providers are concerned that reduced visits may compromise antenatal care (i.e., physical and psychosocial needs may not be met) though providers also believe that a reduced care model may allow more time to be directed to high-risk groups	Sanders 1999, Sikorski 1995	*Minor concerns:* Sanders 1999 had low risk to rigor; Sikorski had moderate risk to rigor	*No concerns*: the finding reflects the complexity and variation of data.	*Moderate concern:* Only 2 of the 4 studies addressed the domain and both studies provided data from the provider's perspective (including one study that provided perceptions of patients' perspective). No organizational or partner/support themes were identified.	*Moderate concerns:* The parent study evaluated in the Sanders report evaluated a flexible vs. traditional care model and the qualitative studies assessed participants perceptions on the schedules. The flexible care protocol (advising maximum of 8 weeks between visits) may not be relevant to an alternative reduced antenatal care schedule. Additionally, the UK-context for the Sanders study may not be relevant to other locations and healthcare contexts. Sikorski was also UK-based, and captured data from 1993, primarily through a quantitative survey and was thus not as rich and potentially relevant to contemporary practice in other locations and healthcare contexts.	*Moderate concerns*	2 studies with low and moderate risks to rigor. While the finding was coherent, further evidence is needed to ensure its adequacy and relevance.

Summary of Review Findings	Studies Contributing	Methodological Limitations (CASP Rating)	Coherence	Adequacy	Relevance	CERQual Assessment	Explanation of CERQual Assessment
With respect to environmental context and resources, women may value fewer visits that reduce the inconveniences of attending appointments but may face barriers to contacting care providers if clear and consistent processes are not established. Providers may feel uncomfortable providing fewer visits if they perceive management to be unsupportive in the event of a rare adverse event. Some providers believe reduced care schedules will help with overcrowding while others do not.	Sanders 1999	*No concerns:* Sanders had low risk to rigor	*Minor concerns:* the finding somewhat reflects the complexity and variation of the data, though nuances may be further expressed in the complete data extracted	*Moderate:* Only 1 of the 4 studies addressed the domain and provided data only from the perspective of the provider (midwives). Patient and organizational themes were identified, as perceived by providers. No partner/support themes were identified.	*Moderate concerns:* The parent study evaluated in the Sanders report occurred in the UK. While some factors may be relevant to non-UK context (supports and barriers for patients to attend visits, need for supportive organizational culture) there may be important differences in environmental context and resources in non-UK populations and healthcare settings.	*Moderate*	1 study with low risk to rigor. While the finding was coherent, further evidence is needed to ensure its adequacy and relevance.
With respect to social influences, women's familiarly with traditional model across decades of social networks may be a barrier.	Sanders 1999	*No concerns:* Sanders had low risk to rigor	*No concerns*: the finding reflects the complexity and variation of data.	*Moderate:* Only 1 of the 4 studies addressed the domain and provided data only from the perspective of the provider (midwives). No provider, organizational, or partner/support themes were identified.	*Minor concerns:* The parent study evaluated in the Sanders report occurred in the UK. Traditional care schedules however are similar in the Western cultures and have been consistent for decades. This finding is thus likely relevant to non-UK contexts	Minor	1 study with low risk to rigor. While the finding was coherent and relevant, further evidence is needed to ensure its adequacy.

Summary of Review Findings	Studies Contributing	Methodological Limitations (CASP Rating)	Coherence	Adequacy	Relevance	CERQual Assessment	Explanation of CERQual Assessment
With respect to emotion, women's distress with reduced care (and inversely emotional appreciation for appointments) and providers fears of staff cutbacks may pose psychological barriers to reduced care schedules	Sikorski 1995, Meiser 2021	*Minor concerns:* Sikorski had moderate risks to rigor; Meiser had low risks to rigor	*No concerns*: the finding reflects the complexity and variation of data.	*Moderate concern:* Only 2 of the 4 studies addressed the domain. 1 study each provided evidence for the provider and the patient perspective. No organizational or partner/support themes were identified.	*Minor concerns:* The studies included participants from UK and the US. Regardless of study location however, the themes raised feel reasonably relevant to emotional experiences of women and providers across diverse geographies and healthcare contexts.	Minor	2 studies with low and moderate risks to rigor. While the finding was coherent and relevant, further evidence is needed to ensure its adequacy.

Table D-3-3. Full text coding of extracts for antenatal televisits to Theoretical Domains Framework

TDF Domain	Author, Year, PMID	Extracted Text	Theme	Location	Perspective	Entity	Barrier/ Facilitator
1. Knowledge	Madden, 2020, 32516816	Development of guidelines on which antenatal visits are appropriate for telehealth	Development of guidelines regarding which antenatal visits are appropriate for telehealth	Table 2	Provider	Clinic/Office	Facilitator
1. Knowledge	Madden, 2020, 32516816	Limited data on the use of telehealth in routine obstetrics	Limited evidence on the use of telehealth for routine obstetrics	Table 2	Provider	Provider	Barrier
1. Knowledge	Mary 2021, 34498838	The value of [perinatal telemedicine] services, especially among more senior providers, was reported as not being universally recognized, nor clearly understood/No recognition of [perinatal telemedicine] value.	The value of [perinatal telemedicine] services was not universally recognized	Text-Perceived barriers to PTM adoption/Table II	Provider	Provider	Barrier
2. Skills	Madden, 2020, 32516816	[Clinic has] Online modules for support staff	[Clinic's] online modules for support staff	Table 2	Provider	Clinic/Office	Facilitator
2. Skills	Madden, 2020, 32516816	[Clinic's] Rapidity of integration	[Clinic's] rapid uptake	Table 2	Provider	Clinic/Office	Barrier
2. Skills	Madden, 2020, 32516816	Initial set-up technically difficult	Difficult to initially set up	Table 2	Provider	Patient	Barrier
2. Skills	Peahl, 2021, 33039393	[N]eed for improved preparation for virtual visits, including setting clearer expectations (e.g., visit structure, time).	Need for increased preparation and setting of expectations	Results/ Experience	Patients, Providers	Patients, Providers	Barrier
2. Skills	Madden, 2020, 32516816	[Provider's] Ease of use of telehealth technology	[Provider's] ease of use of telehealth technology	Table 2	Provider	Provider	Facilitator
2. Skills	Madden, 2020, 32516816	Holding regular meetings with a dedicated telehealth leadership team to review progress, troubleshoot problem areas, and review patient enrollment and scheduling.	Regular leadership meetings to learn and refine telehealth processes	Results numbered list	Leadership	Clinic/Office	Facilitator
2. Skills	Madden, 2020, 32516816	Additional training for office staff was required specifically to schedule	Time and training needed to familiarize staff with telehealth technology and guidelines (e.g., which patients to schedule in person vs. telehealth)	Results numbered list	Leadership	Clinic/Office	Barrier

TDF Domain	Author, Year, PMID	Extracted Text	Theme	Location	Perspective	Entity	Barrier/ Facilitator
2. Skills	Madden, 2020, 32516816	[Clinic's] Recent transition to EMR/unfamiliarity with telehealth administration and scheduling	Time and training needed to familiarize staff with telehealth technology and guidelines (e.g., which patients to schedule in person vs. telehealth)	Table 2	Provider	Clinic/Office	Barrier
2. Skills	Madden, 2020, 32516816	Determination of which visits could be performed via telehealth versus which mandated in-person visits was initially a time-intensive process.	Time and training needed to familiarize staff with telehealth technology and guidelines (e.g., which patients to schedule in person vs. telehealth)	Results numbered list	Leadership	Clinic/Office	Barrier
2. Skills	Mary 2021, 34498838	The complexity of downloading smart phone or computer applications to access telemedine consultation, the inability for trouble shoot and use of non-user-friendly patient portal.	Difficult to initially set up	Text-Perceived barriers to PTM adoption	Provider	Patient	Barrier
2. Skills	Mary 2021, 34498838	The onerous[ness] of completing training requirements for telemedicine service provision negatively influence providers' attitudes toward telemedicine/Need for training for using the [perinatal telemedicine] platform and remote communication with patients	Need for onerous training	Text-Perceived barriers to PTM adoption/Table II	Provider	Provider	Barrier
2. Skills	Mary 2021, 34498838	No or limited [information technology] literacy	No or limited IT literacy	Table II	Provider	Patient/Provider	Barrier
4. Beliefs about capabilities	Mary 2021, 34498838	Difficulty in describing or explaining symptoms virtually.	Difficulty in describing symptoms virtually	Text-Perceived barriers to PTM adoption	Provider	Patient	Barrier
4. Beliefs about capabilities	Mary 2021, 34498838	Perceptions of the added complexity telemedicine brings to service delivery, discomfort with new technology/Complexity of [perinatal telemedicine] platform setup	Perception of the added complexity telemedicine brings to service delivery amd discomfort with new technology	Text-Perceived barriers to PTM adoption/Table II	Provider	Provider	Barrier
4. Beliefs about capabilities	Mary 2021, 34498838	Use of complex technology and patient portals	Perception of the added complexity telemedicine brings to service delivery amd discomfort with new technology	Table II	Provider	Health System	Barrier

TDF Domain	Author, Year, PMID	Extracted Text	Theme	Location	Perspective	Entity	Barrier/ Facilitator
5. Optimism	Quinn 2021, 34254940	Initial concern about the concept of a virtual clinic but were happy with the experience once they had tried it.	Initial concern about the concept of a virtual clinic	Text: Summary of Free-Text Responses	Patient	Patient	Barrier
6. Beliefs about consequences	Peahl, 2021, 33039393	[N]ew schedule better fit the needs of low-risk women by eliminating low-value visits	Care can be tailored to the needs of women	Results/ Experience	Patients, Providers	Patients, Providers	Facilitator
6. Beliefs about consequences	Peahl, 2021, 33039393	[C]oncerns about continuity, difficulty maintaining patient-provider relationships in new care models, and the belief that virtual contact is not a perfect substitute for in-person relationship building.	Communication and relationship building can be enhanced/limited	Results/ Experience	Patients, Providers [implied]	Patients, Providers [implied]	Barrier
6. Beliefs about consequences	Peahl, 2021, 33039393	Themes associated with high satisfaction included improved communication and counseling during virtual visits	Communication and relationship building can be enhanced/limited	Results/ Experience	Patients, Providers	Patients, Providers	Facilitator
6. Beliefs about consequences	Peahl, 2021, 33039393	[I]mproved communication and counseling during virtual visits [was] facilitated by the patient's comfort in their own home and the ability to focus on patient questions and concerns.	Communication and relationship building can be enhanced/limited	Results/ Experience	Patients, Providers	Patients, Providers [implied]	Facilitator
6. Beliefs about consequences	Peahl, 2021, 33039393	[C]oncerns [about negative quality and safety] that usual prenatal care measurements, including blood pressure and fetal heart tones, were not incorporated into the model. This contributed to the sense that something could "be missed" leading to delayed diagnosis of pregnancy complications.	Concerns about safety and reduced quality of prenatal care, including less monitoring	Results/ Experience	Patients, Providers	Patients, Providers	Barrier
6. Beliefs about consequences	Madden, 2020, 32516816	Ensures continued access to care	Ensures continuity of care	Table 2	Provider	Patient, Provider	Benefit
6. Beliefs about consequences	Madden, 2020, 32516816	Protection of patients and staff [from COVID-19, implied]	Protection from COVID-19	Table 2	Provider	Clinic/Office	Facilitator

TDF Domain	Author, Year, PMID	Extracted Text	Theme	Location	Perspective	Entity	Barrier/ Facilitator
6. Beliefs about consequences	Peahl, 2021, 33039393	An additional theme associated with positive quality and safety experiences included the new model's reduction of viral exposure during the pandemic.	Protection from COVID-19	Results/Experience	Patients, Providers [implied]	Patients, Providers [implied]	Benefit
6. Beliefs about consequences	Madden, 2020, 32516816	[Patient's] Concerns of COVID-19 exposure	Protection from COVID-19	Table 2	Provider	Patient	Facilitator
6. Beliefs about consequences	Madden, 2020, 32516816	Limits COVID-19 exposure	Protection from COVID-19	Table 2	Provider	Patient, Provider, Office/Clinic	Benefit
6. Beliefs about Consequences	Quinn 2021, 34254940	Virtual clinics...allowed low-risk pregnancies to be managed safely from the patient's own home (provider's perspective)	Allows low-risk pregnancies to be managed safely at home	Text: HCP/Summary of Free-Text Responses	Provider	Patient	Facilitator
6. Beliefs about consequences	Quinn 2021, 34254940	The doctor not knowing them and their history well. (patient's perspective);	Concerns about safety and reduced quality of prenatal care, including less monitoring	Text: Patients/Summary of Free-Text Responses	Patient	Patient	Barrier
6. Beliefs about Consequences	Quinn 2021, 34254940	The clinics were considered to be patient-centered with good continuity of care. (provider's perspective)	Ensures continuity of care	Text: HCP/Summary of Free-Text Responses	Provider	Patient	Facilitator
6. Beliefs about Consequences	Quinn 2021, 34254940	Patient compliance was better and perceived fewer did not attend appointments. (provider's perspective)	Improves patient compliance [with visits] and attendance	Text: HCP/Summary of Free-Text Responses	Provider	Patient	Facilitator
6. Beliefs about consequences	Quinn 2021, 34254940	Team cohesion was better, and they were able to discuss more cases with senior colleagues during the virtual clinics. (provider's perspective)	Improves team cohesion (i.e., discussing cases among senior and junior clinicians)	Text: HCP/Summary of Free-Text Responses	Provider	Provider	Facilitator
6. Beliefs about consequences	Quinn 2021, 34254940	A reduction in the training for junior doctors in virtual clinics compared to face-to-face clinics. (provider's perspective)	Reduces training opportunities for junior doctors	Text: HCP/Summary of Free-Text Responses	Provider	Provider	Barrier

TDF Domain	Author, Year, PMID	Extracted Text	Theme	Location	Perspective	Entity	Barrier/ Facilitator
6. Beliefs about Consequences	Stanhope 2022, 35039177	"Because they do not do nothing [during a televisit]. Like I told you, he just said, 'How are you. How are you feeling?' That's it. And more so when it's in-person you might [get] a fetal checkup, they might measure your stomach, hear the baby's heart."	Concerns about safety and reduced quality of prenatal care, including less monitoring	Text: Participant 13	Patient	Patient	Barrier
11. Environmental context and resources	Peahl, 2021, 33039393	[I]mportance of home device use in conjunction with virtual visits.	[I]mportance of home device use in conjunction with virtual visits.	Results/ Experience	Patients, Providers	Patients, Providers	Barrier
11. Environmental context and resources	Madden, 2020, 32516816	[T]he transition to virtual prenatal care was more challenging for patients with Medicaid insurance receiving care at health clinics than for women with commercial insurance in generalist and maternal fetal medicine faculty practices	[T]he transition to virtual prenatal care was more challenging for patients with Medicaid insurance receiving care at health clinics than for women with commercial insurance in generalist and maternal fetal medicine faculty practices	Discussion	Provider	Patient	Barrier
11. Environmental context and resources	Madden, 2020, 32516816	The Epic MyChart interface did not include an option with Spanish instructions making enrollment more challenging for many patients.	Added potential barriers to patients, particularly those from equity-seeking populations (e.g., increased challenges non-English patients; need for access to devices and stable access to WiFi)	Results numbered list	Leadership	Patient	Barrier
11. Environmental context and resources	Peahl, 2021, 33039393	[C]oncerns that barriers to care might disproportionately affect vulnerable populations—... access to reliable smart devices and internet were seen as important barriers to equity.	Added potential barriers to patients, particularly those from equity-seeking populations (e.g., increased challenges non-English patients; need for access to devices and stable access to WiFi)	Results/Experience	Patients, Providers [implied]	Patient	Barrier
11. Environmental context and resources	Madden, 2020, 32516816	Language barriers/translation services more difficult to use during telehealth visits	Added potential barriers to patients, particularly those from equity-seeking populations (e.g., increased challenges non-English patients; need for access to devices and stable access to WiFi)	Table 2	Provider	Patient	Barrier

TDF Domain	Author, Year, PMID	Extracted Text	Theme	Location	Perspective	Entity	Barrier/ Facilitator
11. Environmental context and resources	Madden, 2020, 32516816	[Patient] Access to required technology and devices (i.e., smart phones, tablet, e-mail)	Added potential barriers to patients, particularly those from equity-seeking populations (e.g., increased challenges non-English patients; need for access to devices and stable access to WiFi)	Table 2	Provider	Patient	Barrier[a]
11. Environmental context and resources	Madden, 2020, 32516816	Need for home monitoring devices (i.e., fetal heart tone Doppler's, blood pressure cuffs)	Added potential barriers to patients, particularly those from equity-seeking populations (e.g., increased challenges non-English patients; need for access to devices and stable access to WiFi)	Table 2	Provider	Patient	Barrier
11. Environmental context and resources	Madden, 2020, 32516816	Phone calls and text reminders within 48 hours of appointment time improved patient attendance for telehealth and in-person visits.	Reminders (text and phone call) increased patient attendance [for in person and telehealth]	Results numbered list	Leadership	Patient	Facilitator
11. Environmental context and resources	Madden, 2020, 32516816	Convenience for patients with increased childcare responsibilities	Removes traditional barriers to accessing care (time, travel, etc.)	Table 2	Provider	Patient	Benefit
11. Environmental context and resources	Peahl, 2021, 33039393	[V]irtual visits removed traditional barriers to care, such as employment, childcare, travel time, and clinic inefficiencies.	Removes traditional barriers to accessing care (time, travel, etc.)	Results/Experience	Patients, Providers	Patient	Facilitator
11. Environmental context and resources	Madden, 2020, 32516816	Assistance for office staff in telehealth scheduling and administration	System supports for office staff (e.g., assistance for telehealth scheduling and administration, continuous IT support)	Table 2	Provider	Clinic/Office	Facilitator
11. Environmental context and resources	Madden, 2020, 32516816	Centralized patient call center to facilitate patient technological troubleshooting and scheduling	System supports for patients (e.g., call center and outreach calls to troubleshoot technological difficulties)	Table 2	Provider	Patient	Facilitator
11. Environmental context and resources	Madden, 2020, 32516816	Patient outreach and phone calls to perform troubleshooting enhanced telehealth use.	System supports for patients (e.g., call center and outreach calls to troubleshoot technological difficulties)	Results numbered list	Leadership	Patient	Facilitator (implied)
11. Environmental context and resources	Madden, 2020, 32516816	Online modules/work-flow documents on how to use telehealth software and interface	System supports for providers (e.g., workflow documents/how-to's for using telehealth system; telehealth-enabled EMR; continuous IT assistance)	Table 2	Provider	Provider	Facilitator

TDF Domain	Author, Year, PMID	Extracted Text	Theme	Location	Perspective	Entity	Barrier/ Facilitator
11. Environmental context and resources	Madden, 2020, 32516816	A telehealth-enabled EMR that allowed simultaneous review of records and documentation during the visit.	System supports for providers (e.g., workflow documents/how-to's for using telehealth system; telehealth-enabled EMR; continuous IT assistance)	Results numbered list	Leadership	Provider	Facilitator
11. Environmental context and resources	Madden, 2020, 32516816	Continuous IT assistance for providers and staff.	System supports for providers (e.g., workflow documents/how-to's for using telehealth system; telehealth-enabled EMR; continuous IT assistance)	Results numbered list	Leadership	Provider; Clinic/Office	Facilitator
11. Environmental context and resources	Madden, 2020, 32516816	Accessible EMR data to plan telehealth care encounters in advance of visit	System supports for providers (e.g., workflow documents/how-to's for using telehealth system; telehealth-enabled EMR; continuous IT assistance)	Table 2	Provider	Provider	Facilitator
11. Environmental context and resources	Madden, 2020, 32516816	[Provider] Technical difficulties with logging on	Technological difficulties with logging on	Table 2	Provider	Provider	Barrier
11. Environmental context and resources	Madden, 2020, 32516816	[Patient] Technical difficulties with logging on and maintaining continuous Wi-Fi or data connection through visit	Technological difficulties with logging on and maintaining continuous Wi-Fi or data connection through visit	Table 2	Provider	Patient	Barrier
11. Environmental context and resources	Madden, 2020, 32516816	Compliance/billing issues [not described]	Telehealth added challenges to clinic operation (billing issues, lack of up-to-date contact information, need for additional support staff, challenges with patient scheduling, reorganization of clinic workflow)	Table 2	Provider	Clinic/Office	Barrier
11. Environmental context and resources	Madden, 2020, 32516816	Provider workflow and scheduling had to be reorganized to facilitate telehealth visits.	Telehealth added challenges to clinic operation (billing issues, lack of up-to-date contact information, need for additional support staff, challenges with patient scheduling, reorganization of clinic workflow)	Results numbered list	Leadership	Clinic/Office	Barrier

TDF Domain	Author, Year, PMID	Extracted Text	Theme	Location	Perspective	Entity	Barrier/ Facilitator
11. Environmental context and resources	Madden, 2020, 32516816	Additional staff supervisors were required to manage these processes.	Telehealth added challenges to clinic operation (billing issues, lack of up-to-date contact information, need for additional support staff, challenges with patient scheduling, reorganization of clinic workflow)	Results numbered list	Leadership	Clinic/Office	Barrier
11. Environmental context and resources	Madden, 2020, 32516816	Lack of up-to-date patient contact information	Telehealth added challenges to clinic operation (billing issues, lack of up-to-date contact information, need for additional support staff, challenges with patient scheduling, reorganization of clinic workflow)	Table 2	Provider	Clinic/Office	Barrier
11. Environmental context and resources	Madden, 2020, 32516816	Additional support staff required numbers	Telehealth added challenges to clinic operation (billing issues, lack of up-to-date contact information, need for additional support staff, challenges with patient scheduling, reorganization of clinic workflow)	Table 2	Provider	Clinic/Office	Barrier
11. Environmental context and resources	Madden, 2020, 32516816	Challenges with patient scheduling	Telehealth added challenges to clinic operation (billing issues, lack of up-to-date contact information, need for additional support staff, challenges with patient scheduling, reorganization of clinic workflow)	Table 2	Provider	Clinic/Office	Barrier
11. Environmental context and resources	Madden, 2020, 32516816	Additional office staff were required to rapidly enroll patients in Epic, so that telehealth visits could be performed.	Telehealth added challenges to clinic operation (billing issues, lack of up-to-date contact information, need for additional support staff, challenges with patient scheduling, reorganization of clinic workflow)	Results numbered list	Leadership	Clinic/Office	Barrier
11. Environmental context and resources	Mary 2021, 34498838	Patient's inequitable access to technology/No or limited access to internet and technology	Added potential barriers to patients, particularly those from equity-seeking populations (e.g., increased challenges non-English patients; need for access to devices and stable access to WiFi)	Text-Perceived barriers to PTM adoption/Table II	Provider	Patient	Barrier

TDF Domain	Author, Year, PMID	Extracted Text	Theme	Location	Perspective	Entity	Barrier/ Facilitator
11. Environmental context and resources	Mary 2021, 34498838	Exacerbated issue for non-native English speakers when patient facing telehealth materials and consultations lack translation/Non-Engish language spoken	Added potential barriers to patients, particularly those from equity-seeking populations (e.g., increased challenges non-English patients; need for access to devices and stable access to WiFi)	Text-Perceived barriers to PTM adoption/Table II	Provider	Patient	Barrier
11. Environmental context and resources	Mary 2021, 34498838	Audio and video translation for all communications...were suggested as means to alleviate inequities in service provision	Audio and visual translation were suggested as a means of alleviating inequities in service provision	Text-Facilitators of PTM services	Provider	Patient	Facilitator
11. Environmental context and resources	Mary 2021, 34498838	Liabilty concerns/Concerns about funding (insurance,[etc.]) and sustainabilty/Potentially unfavorable changes in reimbursement policies for telehealth and [perinatal telemedicine]	Concerns about unfavorable changes in reimbursement policies for telehealth and [perinatal telemedicine] and potential liability issues	Table II	Provider	Provider/Contextual	Barrier
11. Environmental context and resources	Mary 2021, 34498838	No buy-in from hospital/health system leadership	Lack of buy-in from health system leadership	Table II	Provider	Health System	Barrier
11. Environmental context and resources	Mary 2021, 34498838	Need for [perinatal telemedicine] services to be integrated within existing clinical workflows	Need for [perinatal telemedicine] services to be integrated within existing clinical workflows	Text-Facilitators of PTM services	Provider	Provider/Clinic	Barrier
11. Environmental context and resources	Mary 2021, 34498838	Ensuring adequate staffing and support to address technologial issues/Limited technical staff available to troubleshoot problems.	System supports (e.g., assistance for telehealth scheduling and administration, training resources on using the platform, continuous IT support)	Text-Facilitators of PTM services/Table II	Provider	Health System	Facilitator/Barrier
11. Environmental context and resources	Mary 2021, 34498838	Need to develop and pilot-test [training] resources (i.e. guides, instruction sheets) for using the technical [perinatal telemedicine] platform	System supports (e.g., assistance for telehealth scheduling and administration, training resources on using the platform, continuous IT support)	Table II	Provider	Health System	Facilitator
11. Environmental context and resources	Mary 2021, 34498838	Logistics of telemedicine service delivery, such as the complexities of scheduling follow-up appointments after initial telemedicine consults.	Telehealth added challenges to clinic operation (billing issues, lack of up-to-date contact information, need for additional support staff, challenges with patient scheduling, reorganization of clinic workflow)	Text-Perceived barriers to PTM adoption	Provider	Health System	Barrier

TDF Domain	Author, Year, PMID	Extracted Text	Theme	Location	Perspective	Entity	Barrier/ Facilitator
11. Environmental context and resources	Mary 2021, 34498838	Convenience, ...would save time and money, when no transportation is needed, nor childcare or work leave to attend an in-person appointment	Removes traditional barriers to care (time, travel, etc.); increased convenience	Text-Perceived benefits of PTM	Provider	Patient	Benefit
11. Environmental context and resources	Mary 2021, 34498838	Value of user-friendly technology and resources to support and encourage health provider and patient engagement	Value of user-friendly technology and resources to support and encourage health provider and patient engagement	Text-Facilitators of PTM services	Provider	Provider/Patient	Facilitator
11. Environmental context and resources	Quinn 2021, 34254940	Convenience, avoiding travel, being able to stay at home, and staying safe. (patient's perspectives);	Removes traditional barriers to care (time, travel, etc.); increased convenience	Text: Patients/Summary of Free-Text Responses	Patient	Patient	Facilitator
11. Environmental context and resources	Quinn 2021, 34254940	Virtual clinics reduced unnecessary visits to the hospital for patients (provider's perspective)	Removes traditional barriers to care (time, travel, etc.); increased convenience	Text: HCP/Summary of Free-Text Responses	Provider	Patient	Facilitator
11. Environmental context and resources	Stanhope 2022, 35039177	Patients appreciated that the phone visits kept them from having to go into the hospital. "Like the phone visits were more convenient...you should not have to go to the hospital for every visit, for everything.... I do not feel like every visit should be I have to come into the hospital."	Removes traditional barriers to care (time, travel, etc.); increased convenience	Text: Participant 4	Patient	Patient	Facilitator
12. Social influences	Madden, 2020, 32516816	Access to colleagues with prior telehealth experience	Access to colleagues with prior telehealth experience	Table 2	Provider	Provider	Facilitator
12. Social influences	Mary 2021, 34498838	Compared to in-person consultations, ...family could attend and actively participate in telemedicine consultations.	Family could attend and participate	Text-Perceived benefits of PTM	Provider	Patient	Benefit
12. Social influences	Mary 2021, 34498838	Patient's lack of privacy to conduct a telemedicine consultation within their home or work enviroment/Consultation privacy issues at home or work environment	Patients' potential lack of privacy to conduct a telemedicine consultation within their home or work environment	Text-Perceived barriers to PTM adoption/Table II	Provider	Patient	Barrier
13. Emotion	Madden, 2020, 32516816	Appreciation of continued care	Appreciation of continued care	Table 2	Provider	Patient	Facilitator

TDF Domain	Author, Year, PMID	Extracted Text	Theme	Location	Perspective	Entity	Barrier/ Facilitator
13. Emotion	Madden, 2020, 32516816	Many patients were fearful of COVID-19 infection and delayed or abstained from seeking medical attention.	Fear of COVID-19 led patients to delay or avoid care [for in person and telehealth visits]	Results numbered list	Leadership	Patient	Barrier
13. Emotion	Madden, 2020, 32516816	Discomfort/hesitation/anxiety with telehealth visits and technology.	Patients' psychological discomfort with telehealth visits and telehealth technology	Table 2	Provider	Patient	Barrier
13. Emotion	Mary 2021, 34498838	Patient-to-provider interactions were humanized via telemedicine	Appreciation for humanized care delivered via telemedicine	Text-Perceived benefits of PTM	Provider	Provider/Patient	Benefit
13. Emotion	Quinn 2021, 34254940	Wanting a face-to-face appointment because of their individual circumstances (e.g., to physically examine them) (patient's perspective)	Patients' psychological discomfort with telehealth visits and telehealth technology or general desire to be seen in-person	Text: Patients/Summary of Free-Text Responses	Patient	Patient	Barrier
13. Emotion	Quinn 2021, 34254940	Some patients felt they should have been given a choice whether they wanted a face-to-face or virtual appointment. (patient's perspective)	Patients' psychological discomfort with telehealth visits and telehealth technology or general desire to be seen in-person	Text: Patients/Summary of Free-Text Responses	Patient	Patient	Barrier
13. Emotion	Stanhope 2022, 35039177	I was able to just let them know my wellbeing, whether if it was via Zoom [video] or just on the phone, and they would actually call to check up on me. And I actually felt grateful for that.	Appreciation of continuity care	Text: Participant 15	Patient	Patient	Facilitator

[a] Having access was reported by authors as a facilitator; direction flipped to be consistent with other study findings

Table D-3-4. Summary of findings of qualitative evidence on antenatal televisits

Summary of Review Findings	Studies Contributing	Methodological Limitations (CASP Rating)	Coherence	Adequacy	Relevance	CERQual Assessment	Explanation of CERQual Assessment
With respect to knowledge, patients and providers feel that telehealth may be difficult for women who want additional guidance during their pregnancy. Some providers feel there is limited evidence on the use of telehealth in routine obstetrics; others believe the value of perinatatal telemedicine services are not universally recognized. Providers would value guidelines on which types of antenatal visits are appropriate for telehealth versus not.	Madden 2020, Mary 2021	*Minor concerns*: Peahl 2021 had a moderate risk to rigor; Madden 2020 and Mary 2021 had a low risk to rigor.	*No concerns*: the finding reflects the complexity and variation of data.	*Minor concern:* 3 of the 5 studies addressed the domain and provided evidence for the patient, provider, and organizational perspective. No partner/support themes were identified. Additional evidence would be good to ensure richness and saturation of the data.	*Minor concerns*: All 3 studies sampled populations in the US within the past 2 years, including the COVID-19 era and are relevant to the contemporary American obstetric context.	*Minor concerns*	3 studies with low and moderate risks to rigor. While the finding was coherent, further evidence may enhance its adequacy and relevance.
With respect to skills, providers perceived their and their patients' lack of IT literacy to be a barrier, as was onerous provider training and patients' difficulty in initial telehealth. Provider and patients noted the need for increased preparation and setting of expectations among both patients and providers. Ease with technology was a facilitator. Clinics need time to train and incorporate telehealth systems; online training for staff and regular leadership meetings to refine telehealth processes may ease the transition to telehealth.	Peahl 2021, Madden 2020, Mary 2021	*Minor concerns*: Peahl 2021 had a moderate risk to rigor; Madden 2020 and Mary 2021 had a low risk to rigor.	*No concerns*: the finding reflects the complexity and variation of data.	*Minor concern:* 3 of the 5 studies addressed the domain and provided evidence for the patient, provider, and organizational perspective. No partner/support themes were identified. Additional evidence would be good to ensure richness and saturation of the data.	*Minor concerns*: All 3 studies sampled populations in the US within the past 2 years, including the COVID-19 era and are relevant to the contemporary American obstetric context. Additional evidence would be good to ensure saturation in understanding diverse skills of patients and providers in different contexts and variations in organizational support/enhancement of skills.	*Minor concerns*	3 studies with low and moderate risks to rigor. While the finding was coherent, further evidence may enhance its adequacy and relevance.

Summary of Review Findings	Studies Contributing	Methodological Limitations (CASP Rating)	Coherence	Adequacy	Relevance	CERQual Assessment	Explanation of CERQual Assessment
With respect to beliefs about capabilities, providers perceive patients have difficulties descriing their symptoms virtually. Providers also perceive televisits add complexity to service delivery and express discomfort with navigating the technology.	Mary 2021	*No concerns*: Mary 2021 had a low risk to rigor.	*No concerns*: the finding reflects the complexity and variation of data.	*Moderate:* Only 1 of 5 studies addressed the domain and provided data from the perspective of the provider. No organizational, or partner/support themes were identified. One patient-related theme was from the perspective of providers.	*Moderate concerns*: The one study sampled a US-based population within the past 2 years, including the COVID-19 era and is relevant to the contemporary American obstetric context. Additional evidence would be good to ensure saturation in understanding diverse beliefs of patients and providers in additional geographical and healthcare setting contexts.	*Moderate concerns*	1 study with low risks to rigor. While the finding was coherent, further evidence may enhance its adequacy and relevance.
With respect to optimism, patients reported initial scepticism about televisits but these concerns were alleviated once they tried it.	Quinn 2021	*Moderate concerns:* Quinn 2021 had a moderate risk to rigor	*No concerns*: the finding reflects the complexity and variation of data.	*Moderate:* Only 1 of 5 studies addressed the domain and provided data from the perspective of the patient. No provider, organizational, or partner/support themes were identified.	*Moderate concerns*: The one study sampled a UK-based population within the past 2 years, including the COVID-19 era. Additional evidence would be good to ensure saturation of this domain in diverse patient and provider populations in additional geographical and healthcare setting contexts (including the US).	*Moderate concerns*	1 study with moderate risks to rigor. While the finding was coherent, further evidence may enhance its adequacy and relevance.

Summary of Review Findings	Studies Contributing	Methodological Limitations (CASP Rating)	Coherence	Adequacy	Relevance	CERQual Assessment	Explanation of CERQual Assessment
With respect to beliefs about consequences, patients and providers are concerned about safety and reduced quality of care with televisits but also believe it allows care to be tailored to the needs of women and protects women, providers, and clinics from COVID. Providers value how telehealth ensures continued access to care, allows low-risk pregnancies to be managed at home, and improves patient compliance/attendence. While some patients and providers believe televisits enhances communication and relationship building between women and providers, others did not. While some providers believe televisits reduce training opportunities, others believe televisits increase team cohesion between junior and senior clinicians is enhanced	Peahl 2021, Madden 2020, Stanhope 2022, Quinn 2021	*Minor concerns*: Peahl 2021 and Quinn 2021 had a moderate risk to rigor; Madden 2020 and Stanhope had a low risk to rigor.	*No concerns*: the finding reflects the complexity and variation of data.	*Minor concern:* 4 of the 5 studies addressed the domain and provided evidence for the patient, provider, and organizational perspective. No partner/support themes were identified. Additional evidence would be good to ensure richness and saturation of the data.	*Minor concerns*: 3 studies sampled a US-based population and 1 study sampled a UK-based population. All populations were recruited within the past 2 years, including the COVID-19 era and are relevant to the contemporary American (and potentially UK) obstetric context. Additional evidence would be good to ensure saturation in understanding diverse beliefs of patients and providers in additional geographical and healthcare setting contexts.	*Minor concerns*	4 studies with low and moderate risks to rigor. While the finding was coherent, further evidence may enhance its adequacy and relevance.

Summary of Review Findings	Studies Contributing	Methodological Limitations (CASP Rating)	Coherence	Adequacy	Relevance	CERQual Assessment	Explanation of CERQual Assessment
With respect to environmental context and resources, the transition to telehealth is challenging for patients from equity-seeking populations or those with technological difficulties. Patients and providers emphasized the importance of home device use in conjunction with virtual visits and providers valued system supports (e.g., guidance, technology support, translation services). Providers noted concerns about liability issues or changes in reimbursement. Organizations may find telehealth adds challenges to clinic operations but supports for office staff, providers, and patients can ease these barriers. Lack of buy-in by leadership was viewed by providers as a barrier.	Peahl 2021, Madden 2020, Stanhope 2022, Quinn 2021, Mary 2021	*Minor concerns*: Peahl 2021 and Quinn 2021 had a moderate risk to rigor; Madden 2020, Stanhope 2022, and Mary 2021 had a low risk to rigor.	*Minor concerns:* the finding somewhat reflects the complexity and variation of the data, though nuances may be further expressed in the complete data extracted	*Minor concern:* 5 of the 5 studies addressed the domain and provided evidence for the patient, provider, and organizational perspective. No partner/support themes were identified. Additional evidence would be good to ensure richness and saturation of the data.	*Minor concerns*: 4 studies studies sampled a US-based population and 1 study sampled a UK-based population. All populations were recruited within the past 2 years, including the COVID-19 era and are relevant to the contemporary American obstetric context. Additional evidence would be good to ensure saturation in additional geographical and healthcare setting contexts.	*Minor concerns*	5 studies with low and moderate risks to rigor. While the finding was coherent, further evidence may enhance its adequacy and relevance.
With respect to social influences, access to colleagues with prior telehealth experience may help providers in adopting telehealth. While some providers reported patients' lack of privacy as a barrier others noted the attendance and participation of patient's families as a facilitator.	Madden 2020, Mary 2021	*No concerns*: Madden 2020 and Mary 2021 had a low risk to rigor.	*No concerns*: the finding reflects the complexity and variation of data.	*Moderate:* Only 2 of 5 studies addressed the domain and provided data from the perspective of the provider. No organizational, or partner/support themes were identified. Patient-related themes were from the perspective of providers.	*Minor concerns*: The two studies sampled a US-based population within the past 2 years, including the COVID-19 era and is relevant to the contemporary American obstetric context. Additional evidence would be good to ensure saturation in understanding diverse social influences of patients, providers, and organizations in different contexts.	*Minor concerns*	2 studies with low risks to rigor. While the finding was coherent, further evidence may enhance its adequacy and relevance.

Summary of Review Findings	Studies Contributing	Methodological Limitations (CASP Rating)	Coherence	Adequacy	Relevance	CERQual Assessment	Explanation of CERQual Assessment
With respect to emotion, patients had psychological apprehension with telehealth and general wish to be seen in-person may pose a barrier to the uptake of telehealth technology though their appreciation for continuity of care and humanized interaction (as perceived by providers) may be a facilitator.	Madden 2020, Stanhope 2022, Quinn 2021, Mary 2021	*Minor concerns*: Madden 2020, Mary 2021, Stanhope 2022 had a low risk to rigor, Quinn 2021 had moderate risk to rigor.	*No concerns*: the finding reflects the complexity and variation of data.	*Minor concerns:* 4 of the 5 studies addressed the domain and provided data from the perspective of the patient. No provider, organizational, or partner/support themes were identified.	*Minor concerns*: 3 studies sampled a US-based population and 1 study sampled a UK-based population. All populations were recruited within the past 2 years, including the COVID-19 era and is relevant to the contemporary American obstetric context. Additional evidence would be good to ensure saturation in understanding diverse social influences of patients, providers, and even organizations in additional contexts.	*Minor concerns*	1 study with low risks to rigor. While the finding was coherent, further evidence may enhance its adequacy and relevance.