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Synopsis

How to Implement Digital Clinical Consultations in UK Maternity Care: the ARM@DA Realist Review

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Published May 2025
DOI: 10.3310/WQFV7425

Abstract

Background: Digital transformation is a key component within the National Health Service Maternity Transformation Programme. The COVID-19 pandemic led to an acceleration of digital innovation, in particular, the use of digital clinical consultations (telephone/video consultations). The ways in which digital clinical consultations can be optimised and utilised alongside the traditional maternity care pathway remains unclear, however, with particular concerns about the potential for digital care to exacerbate inequalities.

Objective: To explore how digital clinical consultations can be implemented in a clinically safe, appropriate and acceptable way within UK maternity services? For whom? In what settings? And for what purposes?

Design: A realist synthesis combining an evidence review of diverse sources (2010 to the present) from Organisation for Economic Co-operation and Development countries with insights from key stakeholder groups (healthcare professionals, service users and community organisations).

Data sources: There were three main sources: (1) published primary and secondary research; (2) grey literature (such as policy documents and maternity safety reports); and (3) stakeholder insights.

Methods: A realist synthesis adopts a theory-driven approach which seeks to understand how a complex programme works, for whom and under what circumstances. The review had three iterative phases: (1) refining the review focus and developing initial programme theories; (2) retrieval of evidence for data extraction and analysis (using on a realist logic to identify key contexts, mechanisms and outcomes); and (3) testing and refining the programme theories.

Results: The final synthesis included 93 evidence sources (reviews, reports and 77 primary studies), with priority given to UK-focused studies. Study samples included a focus on healthcare professionals (n = 17), women (n = 45, of which 14 focused on vulnerable groups) or both (n = 15). Clinical and safety-related outcomes were reported in 12 studies. Fifteen programme theories were developed. A conceptual framework was produced that illustrates the inter-relationship between key contexts in maternity care through which different interactions activate mechanisms to produce outcomes of interest. The findings suggest that digital clinical consultations can be acceptable and appropriate if implementation includes personalisation and informed choice for women, as well as support and autonomy for staff. The relationship and connection between women and their healthcare professional are proposed as key mechanisms that support safety and engagement in care.

Limitations: Some of the evidence lacked details regarding specific settings, interventions or sample characteristics. This limits the extent to which findings can be applied to micro-level contexts. Stakeholder groups contributed key

This synopsis should be referenced as follows:
Evans C, Clancy G, Evans K, Booth A, Nazmeen B, Sunney C, *et al.* How to Implement Digital Clinical Consultations in UK Maternity Care: the ARM@DA Realist Review [published online ahead of print May 21 2025]. *Health Soc Care Deliv Res* 2025. https://doi.org/10.3310/WQFV7425

insights to the review at all stages. In spite of efforts to achieve diversity within these groups, there may have been experiences or identities that were missed.
Conclusions: Four 'CORE' implementation principles were identified to guide future practice and research: C – Creating the right environment, infrastructure and support for staff; O – Optimising consultations to be responsive, flexible and personalised to different needs and preferences; R – Recognising the importance of access and inclusion; and E – Enabling quality and safety through relationship-focused connections.
Future work: Future research should embed equity considerations and should focus on understanding digital clinical consultation within specific maternity systems (like triage/helplines), services (such as specialist outpatient clinics) or groups of women (e.g. with digital literacy or communication needs).
Funding: This synopsis presents independent research funded by the National Institute for Health and Care Research (NIHR) Health and Social Care Delivery Research as award number NIHR134535.
A plain language summary of this synopsis is available on the NIHR Journals Library Website (https://doi.org/10.3310/WQFV7425).

Introduction

This synopsis presents an overview of the ARM@DA project (A Realist Inquiry into Maternity Care @ a DistAnce).

Maternity care in the UK is undergoing a significant transformation programme, seeking to develop services that are safer, more equitable, more personalised and family friendly.[1,2] The integration of digital technologies forms a key component of this work,[3] one aspect of which includes the utilisation of remote/virtual consultations.[4–7]

Remote care has a very diverse nomenclature.[8] In this paper, we draw on the work of Griffiths *et al.*,[9] and refer to remote care as 'digital clinical consultation' (DC-CON), defined as:

> *[S]ynchronous telephone or video consultations involving direct interaction between a service user and a maternity healthcare professional. It has two-way functionality and can be initiated by either party. It may be linked to, or complemented by, other digital technologies within the maternity care pathways.*

This definition recognises the importance placed on interoperability and system integration within maternity digital transformation initiatives,[3,4] and links the consultation to the systems within which it operates. The emphasis in the definition is on 'consultation'. As such, it refers to situations where dialogue and interaction takes place (rather than, e.g. to a situation where a phone call was made solely to provide an appointment reminder).

Prior to the COVID-19 pandemic, a small evidence base was developing around DC-CON for different aspects of maternity care.[10–12] This included consultations as part of targeted specialist services (e.g. smoking cessation or breastfeeding support),[13–19] triage/helplines,[20] integration within services using remote home-based monitoring (e.g. hypertension or diabetes management)[21–24] and as a replacement for some routine antenatal services as part of new 'hybrid' care pathways.[25–29] Pre-pandemic studies suggest that these innovations can be feasible, safe, effective, and acceptable. However, this pre-COVID-19 evidence consisted of relatively small-scale studies, undertaken with well-resourced interventions and carefully controlled samples in which participants were offered choices and alternatives regarding their participation.

By contrast, the COVID-19 pandemic resulted in an unplanned widespread scale-up of DC-CON across the whole maternity system, supported by guidance produced by professional bodies.[30–33] Evidence from this time period presents a complex mixed picture, with some studies reporting clinical or satisfaction outcomes that are equivalent to in-person care.[34–40] Other studies, however, report highly negative experiences of women and maternity professionals.[41–44] In addition, significant concerns have been articulated about the potential for DC-CON to exacerbate inequalities or other harms, although there is currently little evidence about which groups may be most affected or the specific pathways involved.[35,38,45–53] It is currently unclear therefore how, for whom, or in what contexts, DC-CON should be used as part of routine maternity care.

This review sought to address some of these uncertainties. It drew on an understanding of DC-CON as a complex intervention – defined by the Medical Research Council as: '1) including several interacting components; 2) sensitive to the context in which they are delivered; 3) having a causal chain linking the intervention to outcomes; 4) having a range of possible outcomes'.[54] A large body of implementation science literature demonstrates that adoption of complex technology-based solutions in health care is rarely straightforward, often results in failure, and is best understood using approaches that are able to generate theoretically informed implementation principles, thereby aiding transferability across different settings.[55–58] Taking this complexity into account, we sought to generate an evidence-based, theory-informed understanding of DC-CON implementation in maternity care.[59,60]

For the purposes of this project, 'maternity care' included all stages of the maternity pathway (antenatal, intrapartum and the early postnatal period – up to 14 days). As such, the latter included consultations that may relate to the health of a mother or her baby.

Research question

How can digital clinical consultations be implemented in a clinically safe, appropriate and acceptable way in maternity care in the UK NHS? For whom? In what settings? And for what purposes?

Project structure

The project structure included the main research team, working closely with two knowledge user groups and an advisory group, as outlined below (see *Figure 1*):

1. A multidisciplinary and multiprofessional core research team, *n* = 10, comprising academic midwives, obstetricians, health service researchers, information scientists, methodologists, sociologists, an expert in equity, diversity and inclusion in maternity care, and a public member of the Nottingham Maternity Research Network (a maternity research/public involvement group).
2. A community organisation and service user group, *n* = 13 (consisting of women and maternity advocates who had experience of maternity services). These included representatives from the Nottingham Maternity Research Network, from Sister Circle (a maternity advocacy organisation working to support disadvantaged and vulnerable women from an ethnically diverse area of London), and from the National Autistic Society (representing autistic and neurodivergent women).
3. A healthcare professional knowledge user group (HCP-G), *n* = 26, consisting of midwives and obstetricians working in different roles and areas (e.g. antenatal, postnatal, diabetes clinic, perinatal mental health, safeguarding specialist, digital midwife, breastfeeding specialist, and clinical governance lead).
4. A project advisory group (PAG), *n* = 9 (comprising senior leaders in maternity digital transformation, quality, equity, diversity and inclusion).

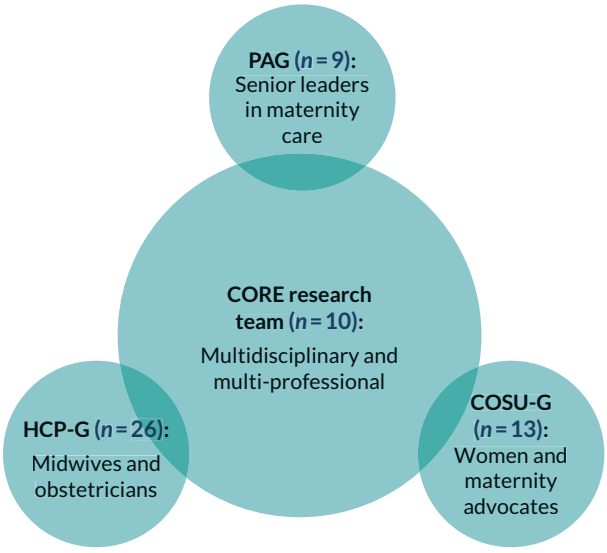

FIGURE 1 Project structure. COSU-G, community organisation and service user group.

Methodology and methods

Full details of the methodology and methods can be found in associated papers (see *Table 1*).[61–63]

The review adopted a realist ontology, drawing on diverse evidence sources and embedding knowledge user involvement to explore complexity and causality in health care.[64–66] In a realist review, the aim is to generate theoretical understandings (referred to as 'programme theories') of how healthcare interventions (such as DC-CON) work and why their outcomes may vary in different contexts.[67,68]

TABLE 1 Research papers synthesised in the synopsis

Type of output	Publication status	Details
Protocol[63]	Published	Evans C, Evans K, Booth A, Timmons S, Jones N, Nazmeen B, *et al.* A realist inquiry into maternity care @ a distance (ARM@DA): realist review protocol. *BMJ Open* 2022;12:e062106
Phase one: Developing initial programme theories[62]	Published	Evans C, Clancy G, Evans K, Booth A, Nazmeen B, Timmons S, *et al.* Developing initial programme theories for a realist synthesis on digital clinical consultations in maternity care: contributions from stakeholder involvement. *Journal of Research in Nursing* 2024;29:127–40. https://doi.org/10.1177/17449871241226911
Main findings[61]	Published	Evans C, Clancy G, Evans K, Booth A, Nazmeen, B, Timmons S, *et al.* Optimising digital clinical consultations in maternity care: a realist review and implementation principles *BMJ Open* 2024;**14**:e079153. https://doi.org/10.1136/bmjopen-2023-079153

Programme theories are expressed utilising a context-mechanism-outcome (CMO) heuristic. The responses of actors to different intervention resources are referred to as 'mechanisms'.[69] Interventions are implemented through a range of different contexts. These differences in context can cause different mechanisms to be activated, and lead to variation in outcomes.[70,71] Within a complex healthcare system such as maternity care, innovations are implemented through many levels of context, involve many groups of actors, and are associated with multiple mechanisms.[72] Hence, programme theories need to be able to incorporate multilevel and intersectional phenomena.[73] See the Glossary for a list of acronyms and terms used in this review.

Overall approach

The review followed established (RAMESES) quality and publication standards (see *Report Supplementary Material 1*)[66,74] and comprised three iterative phases, with each phase incorporating evidence searches (including empirical papers, reviews, reports, and grey literature) and extensive knowledge user consultations.[75] All phases of the review drew on best practice realist search approaches (undertaken by an expert information scientist)[76–79] and were conducted by two or more reviewers (consulting with the larger team through regular meetings). EndNote (Clarivate Analytics, Philadelphia, PA, USA) was used for reference management and Covidence (Melbourne, VIC, Australia) was used for study screening and selection. Excel® (Microsoft Corporation, Redmond, WA, USA) was used for data extraction of study characteristics and for appraisal of relevance and rigour. NVivo (QSR International, Warrington, UK) was used to support data coding and analysis[80,81] (using inductive, abductive, and retroductive analytical approaches).[82–84]

Phase 1: Refining the review scope and developing initial programme theories

Phase 1 is described in detail in an associated paper.[62] It involved a scoping of literature (using established realist search techniques) and consulting with knowledge users to generate 'initial programme theories' (IPTs).[85,86] The knowledge users prioritised equity, diversity, inclusion, safety, personalisation, and choice as key aspects that the review should consider. The scoping searches were undertaken across three bibliographic databases (from 2010 to 2022), alongside a range of supplementary search approaches (see *Appendix 1*). Study screening and selection employed a purposive sampling approach to ensure that literature was included that mapped to stakeholder priorities (see *Appendix 2* for further details).[87] This phase included 49 evidence sources,[3–5,12,13,30–33,39,41,45,46,48,49,58,88–120] and drew on three existing mid-range theories (Candidacy,[89,103] Normalisation Process Theory[107,121] and Burden of Treatment Theory[104,105,109]) and one conceptual framework (PERCS[95] – Planning and Evaluation of Remote Consultation Services) – see *Report Supplementary Material 2* for further details on why these particular theories were identified as being relevant. This phase resulted in 13 IPTs conceptualised within a framework that was a maternity-relevant adaptation of the PERCS[95] model (detailed in *Report Supplementary Material 3*).

Phase 2: Evidence retrieval, review and synthesis

Phase 2 is described in detail in the published protocol[63] and the main findings paper.[61] This phase involved comprehensive searching for evidence and further knowledge user consultations to test and refine the IPTs proposed in phase 1. These searches had a more limited time frame (2016–23) and a focus on research from Organisation for Economic Co-operation and Development (OECD) countries to identify the most contemporary and relevant evidence. Searches were undertaken across six bibliographic databases (undertaken in June 2022 and updated in January 2023). They also included a range of supplementary strategies, including citation and grey literature searching (e.g. searches for unpublished dissertations/theses and searching the websites of 20 maternity-focused organisations). See *Appendix 3* for details of the search strategies.

Studies were screened using agreed inclusion and exclusion criteria. Development of the inclusion criteria took place after phase 1 and addressed several areas where ambiguities in definitions or concepts had been identified. For example, it became clear that the configuration and definitions of 'maternity care' (the pathways and the professionals involved) varied considerably across countries and needed clarification. *Appendix 4*, *Table 14* provides full details.

Study screening an initial 'longlist' of included studies.[67] The longlisted studies were then appraised for rigour, relevance, and richness and prioritised through a traffic light 'banding' system, yielding a final 'shortlist' of included evidence.[122,123] As an example, studies from the UK were weighted more highly for relevance than studies from other contexts. *Appendix 4* provides further details of these processes. Data from the included papers were coded against the IPTs (with new codes created where appropriate), which were continually reviewed and reconfigured during the analytical process.[80]

Phase 3: Test and refine programme theories

Phase 3 is described in detail in the published protocol[63] and the main findings paper.[61] In line with the iterative approach of a realist review, this phase included additional focused searches and consultations to identify further evidence and to sense-check the final programme theories.[65,66,124,125] Consultations with the knowledge user groups continued to emphasise the importance of safety and equity of DC-CON. Although the IPTs included these dimensions, it was considered important to expand the search to try to identify any additional highly relevant evidence that might give additional insights or would serve to validate the IPTs. A focused search was undertaken across four bibliographic databases in March 2023 to find evidence specifically related to DC-CON, equity, and safety (expanded to include non-maternity settings).[65,66,74,76,78,79,124,126] These were supplemented by grey literature searching (searching websites and organisations focused on maternity safety) and other well-established CLUSTER search processes (see *Appendix 5*).[78] As in phase 1, study selection and appraisal were highly purposive, aimed only at finding papers that could offer key additional insights.[127]

In addition, this phase included three further consultation workshops involving women who were pregnant or had recently given birth (n = 22). The groups included women who were refugees, asylum seekers, or from minoritised communities, as these were the groups who had been identified as being particularly vulnerable to negative impacts of DC-CON on risk or equity. The workshops were organised by three community organisations (City of Sanctuary, Centre for Ethnic Health Research, and Sister Circle), respectively in Bradford, Leicester and London. These additional consultations explored the concepts within the IPTs to further test the emerging theories.

This phase also included a workshop (including members of the knowledge user groups) to validate the final programme theories, to develop key implementation principles and recommendations from the review and to co-create an e-learning resource of the review findings. *Figure 2* depicts a flowchart providing an overview of the review methods and processes.

Project outputs

To date, there are five outputs of the project:

(i) A refined set of programme theories
(ii) A refined conceptual model (a maternity-focused adaptation of the PERCS[95] model)
(iii) A set of principles to guide DC-CON implementation
(iv) Implications for decision-makers and recommendations for future research
(v) An e-learning resource.

Outputs (i) and (ii) are summarised in *Results summary*. Output (iii) is presented in *Discussion/interpretation*. Output (iv) is described in *Implications for decision-makers* and *Research recommendations*. Output (v) is presented in *Impact and learning*.

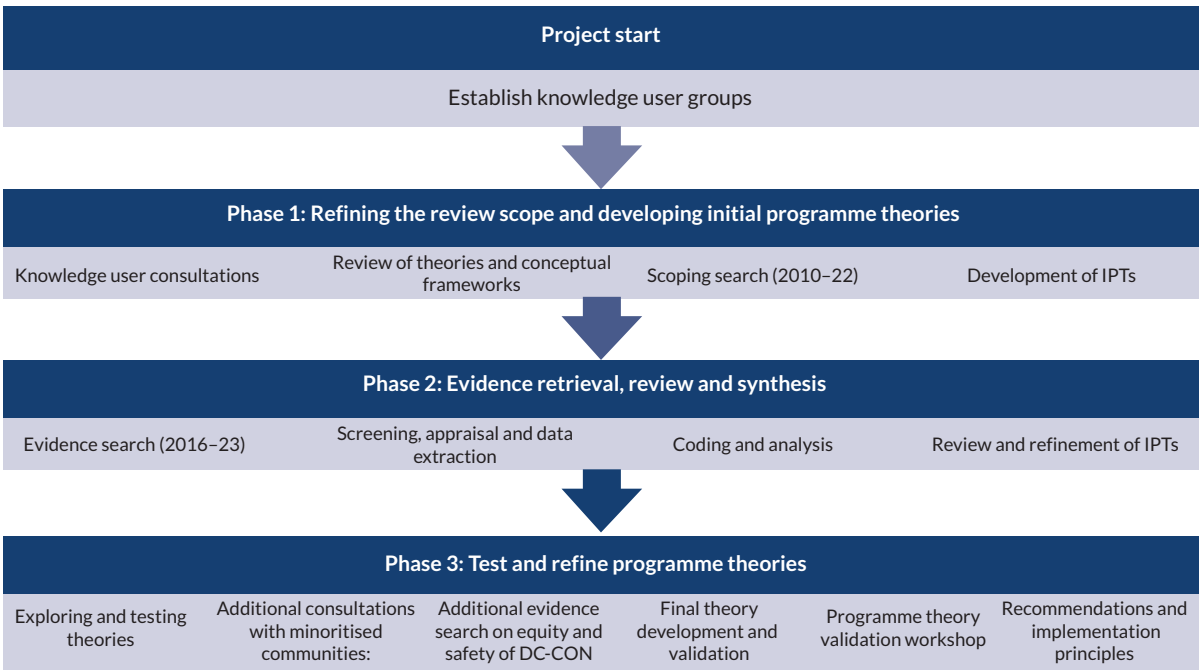

FIGURE 2 Overview of project methods and processes.

Results summary

The review longlist comprised 188 reports, of which 93 were prioritised and included in the review. These included empirical papers (*n* = 77[24,25,27–29,39,41–43,90,100,116,117,119,128–190]), reviews (*n* = 11[12,19,20,35,36,38,44,191–194]) and reports (*n* = 5[50–53,195]). Of the longlist, 95 evidence sources were not prioritised and thus not included in the synthesis (see *Report Supplementary Material 4* for a list of these).

The search, screening, and selection process is summarised in a preferred reporting items for systematic reviews and meta-analyses (PRISMA) flow diagram in *Figure 3*.[196] A fuller, more detailed version of the PRISMA diagram[196] is provided in *Report Supplementary Material 5*.

The characteristics of the included evidence sources are presented in *Appendix 6*, *Tables 25–28*. A more detailed narrative description of the study characteristics is available in *Report Supplementary Material 6*. The majority of the empirical studies utilised cross-sectional observational and descriptive designs. There were just three experimental or quasi-experimental studies (five publications, with one associated qualitative study).[25,27–29,171] A feature of the evidence was a relative lack of specificity of DC-CON modality, with little detail of associated governance processes, support, or infrastructure. Over half the papers (*n* = 41) did not specify the DC-CON modality at all (e.g. phone or video), referring generically to 'remote' or 'virtual' consultations.

Phase 1 had identified 13 IPTs (listed in *Report Supplementary Material 3*). After the analytical processes and evidence syntheses of phases 2 and 3, these were reconfigured to 15 programme theories – see *Report Supplementary Material 7* for a description of the modifications that took place over the course of the project.

The 15 final programme theories are organised into 5 domains, representing sets of CMO propositions for DC-CON implementation. These are presented in *Table 2*. The Table also identifies how each programme theory domain has been influenced by the different mid-range theories. *Appendix 7*, *Tables 29–34*, provides further detail of the underpinning evidence sources for each programme theory, alongside supporting data (quotes) and insights from knowledge users.

The programme theories can be understood in relation to *Figure 4* – a conceptual model (based on the PERCS[95] framework) which depicts the key contexts that interact across different levels of the maternity system during a remote consultation, and through which actors respond, yielding different mechanisms that influence outcomes.

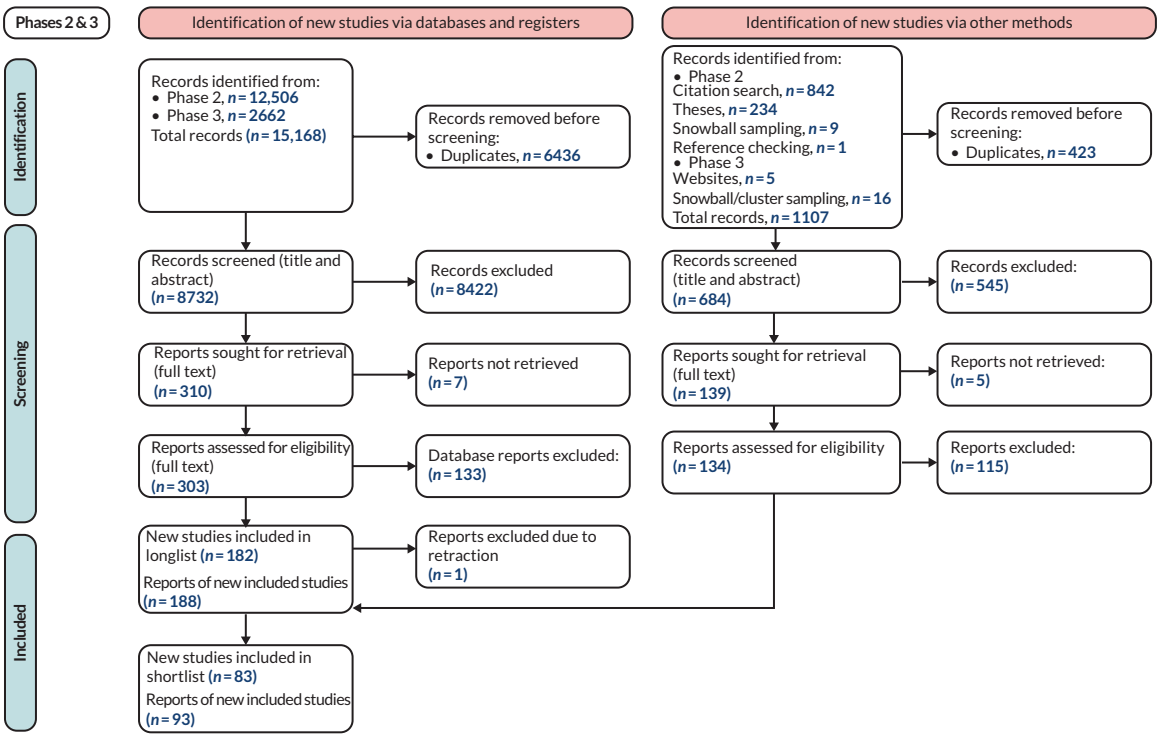

FIGURE 3 Simplified PRISMA flow diagram.

TABLE 2 Refined programme theories

Programme theory domain 1: Infrastructure and resources (links to normalisation process theory)
Programme theory 1.1. Developing infrastructure
If organisations take adequate time to provide a digital infrastructure (including reliable equipment, software, and internet), developed with staff input to make it user-friendly [C], healthcare providers will feel confident [M] that digital consultations [I] are a tool that can 'fit' into existing work practices [C]. Hence, staff will feel motivated [M] to embed it into their practice [O]
Programme theory 1.2. Establishing clinical systems and pathways
If digital consultations [I] are supported by administrative systems and integrated electronic patient record systems that can operate across contexts [C], it will improve the ability of staff to access information, work in multidisciplinary teams and co-ordinate care across the pathway [M]. When systems work well, digital consultations are perceived by staff to improve existing workflows – increasing convenience, efficiency, and reducing workload [O] – for organisations, staff, and service users – as well as maintaining safety [O]
Programme theory 1.3. Appropriate staffing models and conditions
If staffing models for digital consultations include dedicated teams in private spaces with the capacity to provide continuity of carer [C], this type of working environment can enhance staff and women's sense of privacy and comfort [M], facilitating the communication of concerns and treatment [O]. This helps women and staff feel confident and motivated [M] to use digital consultations (and sustain their use) [O]
Programme theory domain 2: Training and support for staff (links to normalisation process theory)
Programme theory 2.1. Providing staff training and ongoing support
If the NHS and professional organisations provide a supportive and enabling workplace culture for digital clinical consultations (including sufficient training, protected time for training, appropriate workspaces and ongoing access to clinical, technical and administrative support) [C], staff will gain relevant knowledge/skills [M] and will feel more motivated, supported, and confident [M], leading to appropriate and sustained uptake of digital consultations [O]
Programme theory 2.2. Ensuring staff motivation and 'buy-in'
If staff are informed about the potential benefits of DC-CON [C], to both healthcare professionals (HCPs) and women, it can promote staff 'buy-in'. In particular, if staff perceive [M] that women accept, are benefiting from, and satisfied [O] with, digital consultations they will be motivated [M] to use it (buy into and sustain its use) [O] and gain job satisfaction from using it [O]
Programme theory 2.3. Providing clinical protocols on consultation mode
If digital consultations are guided by clear clinical protocols [C], staff can feel supported [M] in deciding what type of consultation is appropriate to meet women's varied needs and preferences. When digital consultations are further enhanced with the use of at-home monitoring [C], it can provide additional reassurance to professionals and women [M] of the quality and safety of DC-CON [O]. Combined, this can increase staff ability, acceptance, and confidence in monitoring and treating women at a distance [M], leading to optimal clinical/safety outcomes [O]
Programme theory domain 3: Personalisation and flexibility for women (links to burden of treatment theory)
Programme theory 3.1. Supporting choice and personalisation of care
If digital consultations are clearly presented to women as a choice within a hybrid model of care, [C] then women will be reassured [M] about the option to still have face-to-face appointments when necessary. Furthermore, if the use of digital consultations [I] is personalised [M] to women's needs, preferences and life circumstances [C], women can feel a sense of safety and empowerment [M]. This can help digital consultations to be accepted as a valuable addition to traditional maternity care [O]
Programme theory 3.2. Managing the burden of care
If digital consultations are easy to use and fit flexibly [M] with women's preferences, life circumstances, and clinical needs [C], it gives them more control over the time, money and effort they have to engage with care [M]. This can be a relief and for some women will make it less burdensome [M] for them to engage with services [O]. It can also make it easier [M] for women to access services/specialists in a wider geographical area, potentially improving clinical outcomes [O]
Programme theory domain 4: Women's access and inclusion (links to candidacy theory)
Programme theory 4.1. Supporting women's knowledge and navigation of care
When comprehensive information on digital consultations is provided to women in an easy to understand, accessible format and in a variety of languages, it can facilitate health and digital literacy [C]. If women are made aware of the different types of consultations available to them when they first engage with the maternity services [C], they can be empowered [M] to make informed choices about the mode of care they receive [M]. This will improve the potential for personalisation [M] of care delivery, enable access [O] and help women to play an active role in their maternity care [O]

continued

TABLE 2 Refined programme theories (*continued*)

Programme theory domain 4: Women's access and inclusion (links to candidacy theory)
Programme theory 4.2. Ensuring inclusion and equity
While there can be benefits to using digital clinical consultations [I], for women who face language or other communication barriers [C], digital clinical consultations [I] can present a challenge to the equitable access of care [O]. Experiencing communication barriers can create frustration or anxiety, a lack of motivation or sense of entitlement [M] to engage with care [O]. This can lead to particular groups of women receiving less or inappropriate care relative to their needs [O], important issues being missed and suboptimal clinical outcomes [O]
Programme theory 4.3. Considering access to digital resources
If women do not have access to digital devices, a reliable internet connection or telephone signal [C], it may lead to feelings of dis-empowerment, frustration, and loneliness [M] as women will struggle to engage with digital clinical consultations [O]. This is likely to disproportionately affect already vulnerable women living in poverty or unstable circumstances [C], exacerbating health inequalities through digital exclusion [O]
Programme theory domain 5: Quality care through relationship-focused connections (links to burden of treatment and candidacy theories)
Programme theory 5.1. Considering safety and managing risk
Digital clinical consultations [I] provide staff with additional methods with which to communicate with women [C]. When HCPs are matching the mode of consultation to the reason for consultation [C], understanding [M] women's physical, psychological, or social circumstances and risks [C] can help staff to personalise care and manage uncertainty [M]. This can lead to equivalent clinical outcomes [O], and safety assurances [O]
Programme theory 5.2. Managing relationships and building rapport
If digital consultations are used in place of face-to-face care, it can affect the women–healthcare provider relationship [C]. Since video calls enable the conveyance of non-verbal cues [M], they can be more beneficial in relationship building than telephone calls [O]. If a relationship of trust has already been established and there is sufficient time for the consultation [C], then staff and women can communicate easily and openly [M], improving women's disclosure of sensitive information and feelings of reassurance [M]. For both routine and complex care via digital consultations, continuity of carer can lead to greater satisfaction for women and professionals and is perceived to support optimal clinical outcomes [O]
Programme theory 5.3. Supporting women's empowerment and familial involvement
If women have the ability to use digital consultations [C], it can make it easier to facilitate women's active participation [M] in partnership with their healthcare provider, especially if remote monitoring is utilised [C]. The flexibility and convenience of digital consultations [C] can also help to include women's partners/families [M] in their care. This can empower, motivate, and give women a sense of control over their health and care, [M] improving access and enhancing engagement with services [O]
Programme theory 5.4. Offering connection and support
If digital consultations can provide additional and/or convenient opportunities for women to connect with services and staff [C], it can support women's sense of safety, reassurance, and empowerment [M]. These benefits may be enhanced by a pre-existing healthcare provider–woman relationship, good communication, and sufficient time for the consultation [C]. This leads to increased self-efficacy and motivation [M] contributing to satisfaction, en gagement and access [O]

Discussion/interpretation

Overall, the review found that interactions between the different contextual dimensions (illustrated in *Figure 4*), especially those relating to women's circumstances, needs and preferences will influence DC-CON acceptability and appropriateness, balanced against the reason for the consultation and the nature of the relationship that can be established with clinical staff. These factors are further influenced by the available infrastructure, support and guidance available to staff, which in turn influences their motivations, competence and confidence.

CORE principles

The programme theories are based on a comprehensive synthesis of a large body of evidence, including Healthcare Safety Investigation Branch and Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK reports,[50–53,195,197] alongside insights from mid-range theories and frameworks. They demonstrate that there is no 'one-size-fits-all' approach for the utilisation of DC-CON. Nonetheless, taken together, it is possible to identify a set of implementation principles which can guide service development and future research. We describe these as 'CORE' principles – elaborated in *Figure 5* (and in detail in an associated paper[61]). Recommendations related to the CORE principles are described in *Implications for decision-makers* and *Research recommendations*.

Contribution to existing knowledge

How should digital clinical consultations be implemented?

The review findings are highly consistent with existing literature (from other clinical settings) that emphasises the importance of staff buy-in and staff support,

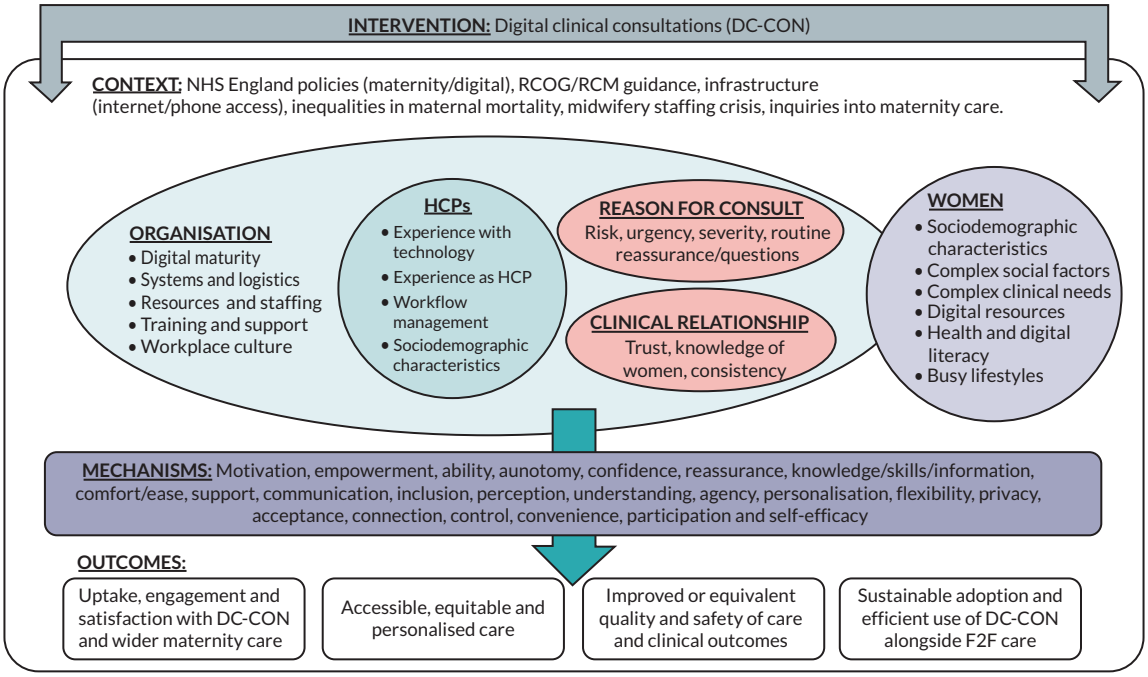

FIGURE 4 Conceptual model.

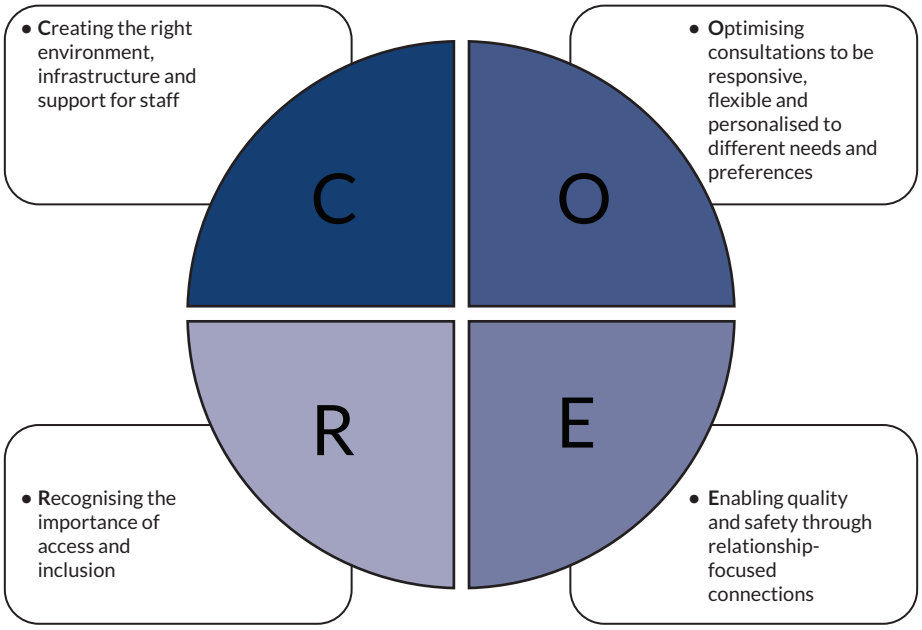

FIGURE 5 CORE DC-CON implementation principles.

through adequate training and appropriate easy to use infrastructure, and by using systems that are 'easy' to slot into daily work routines.[39,56,58,94,110,121,198–200] Women and health professionals emphasised the importance of good communication skills for DC-CON use, reinforcing the need for additional training in this area.[130,173]

For whom should digital clinical consultations be implemented?

The review suggests there is no clear cut or easy way of identifying suitability for DC-CON. In relation to decisions around DC-CON use for service users, we note a tendency in some of the existing literature to try and develop

'typologies of suitability' (based on clinical condition or patient characteristics) by which practitioners can clearly identify which patients are, or are not, suitable candidates for DC-CON.[201,202] The review suggests that this approach has some merit (e.g. taking a cautious approach with women who do not speak English or women/newborns presenting with symptoms where visualisation is important for accurate assessment). However, the findings also suggest a need to resist over-simplification or stereotyping. Rather, the programme theories propose that adjudications about suitability and acceptability need to be made based on a more in-depth assessment (ideally a shared decision) of individual women's preferences, priorities, digital literacy, access to digital resources and life situations.[92,93,102,153] Furthermore, the review highlights that women's choices are dynamic and may change over time or in relation to the reason for consultation.

There was strong evidence to suggest that the convenience of DC-CON is appreciated in terms of reducing the burden of care and may, thereby, potentially reduce 'do not attend' rates.[12,24,25,36,38,39,41,44,117,119,132,138,144,145,150–153,156,157,160,162,164,169,172,173,179,180,183,185,186,188,189,194] DC-CON can be particularly useful for women with complex needs or living in rural areas, whereby DC-CON can replace some consultations thereby reducing the burden of care. Likewise, for these women, the review suggests that complex care planning and support can be facilitated through DC-CON by making it easier to hold meetings requiring input from multiple professionals or across multiple sites.[38,132,140,157,173,203]

When and in what contexts are digital clinical consultations appropriate?

The review found evidence of DC-CON implementation across a wide range of maternity settings (including routine and specialist antenatal and postnatal care and triage), for a wide range of uses and with different groups of women (including higher and lower levels of social vulnerability and health complexity). The review suggests that the potential outcomes of DC-CON across these different services and groups reflect a dynamic interaction across variable contexts (illustrated in *Figure 4*).

The review found that DC-CON has been used both to replace certain consultations (thereby creating 'hybrid' pathways) but also to supplement and enhance face-to-face care. For example, for women with complex social psychological needs, DC-CON can be used to help motivate them to engage with care,[204] and/or to provide additional support and reassurance.[106,175,176,204] The review suggests that DC-CON can potentially be used very flexibly, as long as appropriate safeguards are in place.

The programme theories suggest that adopting a person-centred approach to choice of consultation modality is essential for addressing concerns related to equity, access and inclusion.[106,205,206] To date, there is relatively limited literature on remote consultation and equity.[49,98,207] Hence, the review supports existing calls for caution and for more research to investigate DC-CON impacts on equity.[41,45,205,206] Nonetheless, the review also suggests that it is important to avoid making assumptions about groups of women for whom DC-CON may, or may not, be appropriate. The programme theories demonstrate that in the right circumstances, DC-CON can offer significant benefits to women in terms of convenience, control, cost, and interpersonal support. To deny women these benefits based on assumptions of suitability would be to deny them these benefits.[208]

In line with literature from other settings, the review highlights the relatively limited evidence currently available on the impacts of DC-CON on safety.[209] However, the programme theories delineate a range of contexts and mechanisms that interact to support appropriate risk assessment and clinical management. Consistent with reviews in other clinical settings,[199] key mechanisms are those that relate to the quality of the service user/provider relationship and the quality of communication within a consultation.[210–212]

Strengths, challenges and weaknesses

This was an extremely comprehensive synthesis that adhered closely to the RAMESES quality and reporting standards[66,74] (see *Report Supplementary Material 1*). This section discusses four methodological challenges that were encountered.

Initial programme theory development

The first relates to initial programme theory (IPT) development. There were two main reasons for this. First, in contrast to some realist projects which evaluate a relatively discrete, defined 'intervention' with a set of specified outcomes, DC-CON is an example of an initiative that is better characterised as a complex and 'messy' process of large-scale, whole system transformation.[60,85] Thus, in relation to the development of IPTs for DC-CON, the 'programme' was not a defined intervention, but rather a set of variable practices and processes which are being implemented across a complex system and in a very unsystematic manner. The rapidly changing and variable modality and use of DC-CON in maternity care meant that an important part of the initial process was to understand current systems, and to focus and prioritise the most important questions and outcomes.[60,85,86] Hence, phase 1 comprised extensive engagement with the PAG and the

two knowledge user groups to refine the review questions and to shape the associated search strategies.

Second, because DC-CON implementation is an ongoing organically evolving process (rather than a defined intervention), there was no explicit pre-existing theoretical basis being used to guide implementation. Thus, there was no clear starting point for IPT development. Rather, IPT development required the identification of tacit, implicit theories which needed to be identified, articulated and abstracted using abductive and retroductive reasoning.[74,84] Two main approaches were utilised for this. The first included the identification of tacit theories derived from knowledge user consultations and from existing relevant (maternity-focused) literature, policy documentation, and practice guidance. These are referred to as data-driven approaches. Shearn *et al.*[85] suggest that relying on data-driven approaches alone may have disadvantages, however. For example, there is a risk that the team identifies ideas that are already well established and may miss opportunities to develop new insights. In addition, there is a risk that data-driven approaches can generate a very large number of potential theories which can be difficult to organise and prioritise. Related to this is the potential problem that the plethora of emerging theories may lack a structure, making it conceptually challenging to relate them to the different levels of social strata (micro, meso and macro) through which mechanisms may operate and interact. A lack of analytical structure can lead to a theory that lacks comprehensiveness or coherence. To mitigate this, Shearn *et al.*[85] emphasise the importance of identifying (or building) a more abstract conceptual framework that can incorporate different levels of social structure and thus provide a means for focusing the inquiry. This requires a second approach ('theory-driven'), comprising an analysis of existing relevant theories and conceptual frameworks, acknowledging that these may be found in disciplines and settings outside of the immediate area of enquiry (i.e. outside of maternity care).[66,85] Thus, phase 1 of the review employed both data-driven and theory-driven approaches to the development of the IPTs.[66]

The insights derived from mid-range theory is a significant strength of the review, aiding in retroductive theorising and the construction of programme theories that, (we hope) can be theoretically transferable, and able to be applied across a range of maternity and geographical contexts. Although phase 1 involved a rigorous scoping of evidence for relevant theories, we recognise that the selection of theories was influenced by the team's own *a-priori* knowledge. There are other theories that could have been considered and that would also offer insight. Given the time constraints of the project, we adopted a pragmatic 'best-fit' (rather than exhaustive) approach to theory selection,[213] recognising that other review teams may have made different decisions. The selected theories offered explanatory insights for elements of all of the final programme theories, hence we did not feel the need to search for additional mid-range theories in phase 2 or 3.

Developing suitable appraisal criteria and processes

The second challenge is related to the study screening and selection process in phases 2 and 3. The initial screening based on the inclusion criteria (see *Appendix 4*) yielded 188 reports. This was a potentially unwieldy number, but the studies were all included within an initial 'longlist'.[67] In line with the realist approach, a key criteria for appraisal (and inclusion in the final review) relates to the concepts of 'relevance' and 'rigour', but there is a limited literature regarding how this can best be defined.[122,123,126] In the review, we undertook an extensive search of the related realist literature and developed an approach in which greater weight was given to studies deemed to be highly relevant (e.g. including a UK focus) and highly rigorous (see *Appendix 4* for further details of the criteria and weighting system used).[122] The approach was extensively piloted and discussed within the team. Studies were grouped into nine bands based on aggregate relevance and rigour scores. The team agreed a 'cut-off' point of band six, below which studies would not be taken further for coding and analysis as they were not considered to be contributing new insights. Using this process, 95 papers fell below the cut-off point (see *Report Supplementary Material 4* for details of these), and 93 papers comprised a 'shortlist' which was included within the synthesis (see *Appendix 6*).

Application across a whole complex system

A potential weakness of the review is related to the methodological challenge described for phase 1 above, of analysing DC-CON across the entire maternity system. The review drew on a large evidence base, however many studies lacked precise detail of their clinical setting, service or intervention (DC-CON modality). This has made it challenging to develop programme theories that relate to very specific clinical scenarios. Rather, they propose generic implementation principles (the CORE principles). We are confident that these principles apply across a range of maternity settings and services. Nonetheless, we suggest that future research should be undertaken to explore DC-CON use in specific services or for specific conditions or for specific groups of women – and should provide full details of the systems used [e.g. following the Template for Intervention Description and Replication (TiDIER) intervention reporting guidance].[214]

Understanding the impact of COVID-19

The majority of the empirical studies (52/77), systematic reviews (9/11) and reports (5/5) included in phases 2 and 3 of the review were undertaken during or soon after the COVID-19 pandemic. In terms of data extraction and analysis, we initially grouped the findings (in NVIVO) into 'COVID' and 'pre-COVID' child nodes. This distinction did not prove to be useful, however, as the data did not appear to be showing any clear patterns solely in relation to time frame. Studies from the COVID period among both women and staff variously reported very high as well as very low levels of satisfaction. The programme theories suggest that the variability may lie in the lack of choice and unusually low levels of face-to-face contact experienced by women and staff during this period (particularly at the beginning of the pandemic) as well as anxiety about potential safety impacts and the rapid implementation (particularly for staff) with little training or support. Likewise, during COVID there may have been a tendency to express 'satisfaction' in relation to the extraordinary situation, rather than because it was the best care. This variability in COVID-period study findings, however, can be contrasted with pre-COVID studies in which women were offered choice and where new hybrid pathways (in which face-to-face care was maintained as a key component) were carefully designed and accompanied by training and clinical protocol development.[24,25,27–29,90,100,119,130–132,137,139,141–144,151,160,168,174–176,181,184] These features form key dimensions of the programme theories developed in this review and should be attended to as services recalibrate post the pandemic.

Reflexivity and reflections

We recognise that any research practice is not value-neutral. The review team comprised diverse social, gender, ethnic, disciplinary and professional backgrounds, with each member bringing diverse frames of reference to the project based on our identities and experiences. We engaged in reflexive discussions at regular intervals, seeking to clarify (and challenge) our assumptions and blind spots, as well as to harness the different perspectives within the team.[215–219] This approach impacted the review process in four different ways:

1. Challenging taken for granted assumptions and debating the meaning of key concepts. For example, one team member noted that they had not really considered telephone conversations to be 'consultations' until they were problematised as part of the review.
2. Challenging our thinking on the relevance of key (normative) concepts to maternity care. For example, we reconceptualised 'burden of treatment' theory, referring to this as 'burden of care' which was felt to more appropriately capture its application in a maternity setting.
3. Developing greater analytical sensitivity (and challenging our standpoints) in relation to equity, diversity and inclusion. This led, for example, to a centring of equity as a core focus of the review. It also influenced the decision in phase 3 to widen out knowledge user consultations to a more diverse group of women and to seek further sense-checking in relation to equity and safety.
4. Improving the research practices to enable greater inclusivity. For example, the patient and public involvement (PPI) representative, Candice Sunney (CS) challenged us to think more creatively about the format of the knowledge user consultations, leading to the development of scenarios to bring the realist perspective to life (see *Patient and public involvement*).

There were no alterations to the protocol.[63] Of note, however, is that the protocol had left open the possibility of including empirical data collection (a small number of key informant interviews) in phase 3 if the team felt there was insufficient evidence for programme theory development on particular issues or in order to comprehensively 'test' the programme theories. In this review, it was decided that additional primary data collection (for the purpose of filling evidence gaps) was not required. This was because the final stakeholder workshops (and additional consultations) had revealed strong support for all the programme theories across the different groups. For this reason, we did not feel that a small number of additional interviews would provide significant new insights for programme theory validation. Rather, as suggested above, to test and extend the theories further, we felt that new research would be required that adopted an in-depth whole system case study or a more focused approach (e.g. investigating a particular setting or group). Such an endeavour was not possible within the time and resource constraints of the current project.

Patient and public involvement

Given the focus of the review on the whole maternity system, an ongoing challenge was how to involve knowledge users in a way that would be fully inclusive and adequately acknowledge a diversity of characteristics and experiences.[75,220] As noted in *Project structure*, PPI was primarily operationalised in this review through having a public member (CS) as part of the core project team

and by the ongoing involvement and engagement of two knowledge user groups: the community organisation and service user group and the HCP-G. In addition, PPI was a key agenda item in every team meeting (held monthly).

Community and service user participants were recruited through e-mail invitations to members of the Nottingham Maternity Research Network, and through direct approaches to two third-sector organisations: the National Autistic Society and Sister Circle, which identified key staff members or volunteers ('maternity mates') who had relevant experience and interest. Healthcare professional participants were recruited by e-mail invitations sent out through professional e-mail lists and social media. In both cases, individuals who expressed an interest were contacted by the lead researcher and given further information about the project and about their own potential role. If individuals were happy to take part, they were added to the knowledge user group list.

Due to this recruitment approach, for staff, there was no particular attempt made to specify particular characteristics, roles, or work settings (although we achieved a broad mix). For service users, the team identified a need to ensure that the group should try and represent a broad range of women, including those from different geographic locations, ethnic, or social backgrounds or with particular characteristics (e.g. neurodiversity). While we did not adopt a fully systematic approach to this, the participation of the National Autistic Society and Sister Circle ensured that a wide representation was possible. We requested the members of both knowledge user groups to complete an anonymous survey to better describe their sociodemographic backgrounds. However, in spite of repeated reminders, the information we have is incomplete (see *Report Supplementary Material 8*).

Members of the community and service user group were reimbursed for participation according to the NIHR INVOLVE guidelines.[221] Furthermore, members were offered certificates of participation or references if required. Not all members of both groups attended every meeting, but regular e-mails and simple summary reports were sent to everyone to ensure they were kept up to date with project progress. All meetings (except one) were held online to maximise flexibility and to ensure that knowledge users from across the country could contribute.

A challenge for the project lay in how best to explain and communicate complex realist review principles and methods. Within the team, Helen Spiby (HS) took on the role of supporting the public team member (Candice Sunney - CS) in some of the more technical aspects, through holding regular additional meetings. The public team member (CS) played a key role in co-facilitating the community group consultations. To promote interest and aid communication within the group meetings, the team developed scenarios that were used to exemplify the IPTs, facilitating group discussions based on key questions.

The knowledge user meetings took place four times (twice in separate groups and twice together). There were two meetings during phase 1 and two meetings in phase 3 (one of which was a whole-day face-to-face workshop, designed to generate recommendations and contribute to the development of the e-learning resource). *Report Supplementary Material 9* provides details of the various meetings and their key insights. In addition, the table in *Appendix 7* (detailing the evidence and data underpinning each of the programme theories) has a separate column describing additional insights and comments derived from the knowledge user groups.

As noted above, in addition to the regular knowledge user group meetings, Phase 3 of the review also included three additional PPI consultations with women who had recent or current experience of maternity care (n = 22) from Bradford, Leicester, and London. These were recruited through Bradford City of Sanctuary, the Centre for Ethnic Health Research, and Sister Circle, respectively.

Equality, diversity and inclusion

We recognise that gender is nuanced and not all people who use maternity services are, or identify as, women. To promote readability, however, we have used the word 'woman' or 'service user' throughout this report.

As described above and within the associated papers, equality, diversity and inclusion (EDI) has been a key focus of this review from its inception. We have attempted to foreground and to be sensitive to EDI at every stage of the review process. We draw on insights from Dewidar *et al.*[222] to illustrate our approach to EDI (*Table 3*).

Impact and learning

Website and social media

Information about, and engagement with, the project was facilitated via a website[228] and a project Twitter/X account: @armada_project1. The website provided details about the project and the team.

TABLE 3 EDI considerations within the review

EDI dimension	Action taken and reflections
Research team	
Engaging relevant knowledge users in conducting, designing, and interpreting the review	The review was conceived following a research prioritisation exercise within a local maternity community.[223] From inception, EDI was recognised as a critical issue leading to key decisions around research team composition and knowledge user involvement (see above sections)
Reflecting on equity in team values and composition	One of the core research team members (Benash Nazmeen) had a specific remit to highlight EDI-related issues and to challenge team members to ensure that EDI was integrated within the review. In addition, EDI was an agenda item for every team meeting
Research question	
Explicitly define health equity and develop a hypothesis related to health equity	Health equity was identified as a key outcome and articulated within the IPTs (see *Report Supplementary Material 3* and *Table 2*)
Identifying population(s) experiencing inequities	From the outset, the review team and knowledge users perceived that DC-CON may be experienced differently according to key characteristics (particularly in relation to communication and language challenges, issues relating to digital literacy, and access to digital resources and navigation of maternity services). These were articulated in the IPTs and incorporated in the programme theories
Identification of evidence	
Conducting searches in relevant interdisciplinary databases that may provide evidence of impact on health equity (consider including terms that could capture equity-related content without restricting the search)	In addition to mainstream bibliographic databases, the review sought to identify relevant grey literature and reports (e.g. reports and confidential enquiries) that might include equity-specific insights.[50–53,195] In addition, the focused searches in phase 3 included specific search terms to identify equity-related evidence related to DC-CON (see *Appendix 5*)
Data collection	
Collecting data for equity (collect data on PROGRESS-Plus for study design, sample characteristics, and outcomes)[224–226]	Where available, data on sample characteristics and outcomes in the included studies was extracted in line with the PROGRESS-Plus guidelines (these set out a range of characteristics that can influence health equity. These characteristics can be utilised within systematic review analyses as intersecting axes through which to consider equity outcomes and processes more explicitly. The degree to which these factors are associated with disadvantage depends on time, place, and interaction between the intersectional factors).[227] In addition, the data extraction template included a column for additional comments or reflections on EDI-related insights or conclusions identified within the evidence source
Analysis and critical appraisal	
Analysing evidence on equity	Guidance on analysis for health equity in systematic reviews of interventions has been developed.[224,227] To date, however, there is no guidance on how this can best be done on the context of realist reviews. In this project, we coded and analysed data related to diversity and equity as key contexts and outcomes within the IPTs
Interpretation of findings	
Evaluating the applicability of the findings to populations experiencing inequities or other settings (focus on populations experiencing inequities identified in earlier stages to discuss applicability of findings)	As noted above, phase 3 of the review incorporated additional focused searches for evidence on equity (and safety) and included additional knowledge user consultations (three workshops with different groups of women) to sense-check the programme theories and explore their applicability
Completeness of reporting	
Adhere to equity reporting guidelines to ensure that equity relevant information is appropriately reported	Where appropriate (and as described in this table), all stages of the review have included EDI-related information

In addition, the team published five short blogs about different aspects of the projects which were highlighted through Twitter/X. The blogs covered the following topics:

1. ARM@DA's realist review literature search
2. Literature screening and the ARM@DA reference list
3. How did we agree the boundaries of maternity care for ARM@DA? Considerations for a realist review
4. Equality, diversity and inclusion in ARM@DA
5. Phase 1 summary.

Follow-on research

The review has generated CORE implementation principles for DC-CON. However, during the course of the current project, it became clear that, post COVID-19, practices and policies around DC-CON appear to be extremely variable – both within and between NHS Trusts. This makes it a challenge for digital leaders, managers and policy-makers to issue new guidance related to DC-CON.

To help address this, additional funding has been obtained from the University of Nottingham Institute for Policy and Engagement for a small follow-on study. This is being undertaken with ongoing engagement with system stakeholders and with continued participation of the knowledge user groups. The study comprises an online survey and aims to characterise the extent of DC-CON currently taking place in maternity services in England. The survey is due to be completed in July 2024 and will provide additional information on the ways in which remote consultation is now being practised and will thus help inform further service innovation and future research.

E-learning educational resource

One of the project's key outputs is a short e-learning resource. It is freely available on an Open Access repository.[229] The objective of the resource is to provide guidance to HCPs and students on how to provide safe, appropriate and acceptable digital consultations in maternity care. The content is focused on scenarios and case studies designed to illustrate the CORE principles for DC-CON implementation.

The resource was developed by the University of Nottingham's Centre of Excellence in Health and E-Learning Media. The resource was developed using a well-established participatory co-design process, involving several cycles of piloting and peer review.[230] Members of the knowledge user groups were invited to a one-day, in-person workshop to contribute to the resource conceptualisation and story boarding. It was designed to be highly interactive, using multimedia short chunks of learning based on a limited number of learning objectives.

Dissemination

The project has utilised various strategies for engagement with relevant stakeholders and for dissemination.

Engagement with system stakeholders

The PAG included leaders in digital transformation within maternity services within NHS England (formerly NHS Digital). It also included representatives from the Royal College of Midwives (RCM), the Digital Midwives Network, and the NHS Race and Health Observatory. Through engagement with these groups, we hope to ensure that the review findings are disseminated and influence ongoing service innovations.

Publication of papers, summaries and e-learning resource

Table 1 provides details of the papers published and under review based on the project findings.

In recognition of their contribution and to close the feedback loop, a one-page summary of the project findings has been sent to members of the knowledge user groups, the women participating in the additional consultations and the PAG. In addition, the lead author has held meetings with key groups or individuals to verbally feedback the project findings and to answer any questions.

The e-learning resource has been disseminated through the project's advisory and knowledge user groups, through social media and via professional networks supported by the RCM, the Royal College of Obstetricians and Gynaecologists (RCOG) and NHS England's Digital Maternity Clinical Teams (Transformation Directorate).

Webinar

A nationally advertised online webinar has been held to share the project findings with the wider academic and professional community. All knowledge users and advisory group members were also invited to this. Findings have also been shared during invited presentations to the RCOG (Clinical Quality Projects) and NHS England's Digital Maternity Clinical Team.

Conferences

Abstracts to relevant conferences will be submitted in the forthcoming year.

Implications for decision-makers

The findings of this realist review are 15 programme theories (see *Table 2*), which the research team and knowledge user groups have grouped into a set of CORE

implementation principles (see *Figure 5*). The implications for decision-makers are detailed in *Tables 4–7*. They have been formulated so that they are linked to each CORE principle (described below). The implications are based on the available evidence and have been co-constructed with input from the project's stakeholder groups. As new evidence emerges post the pandemic, it will be important to keep the programme theories and related implications under review, making revisions where required. The implications are oriented to two different groups: (i) practitioners and managers and (ii) policy-makers/commissioners and IT system developers.

C – Creating the right environment, infrastructure and support for staff

The implications in *Table 4* are linked to the need to ensure reliable digital infrastructure so that staff can integrate DC-CON smoothly into existing workflows and practices, and which provide interoperability across systems. In addition, given the emphasis on safety, equity and person-centred care in UK maternity services, processes are needed to develop staff confidence and competence in utilising DC-CON and having strategies to provide feedback on outcomes and performance.

O – Optimising consultations to be responsive, flexible, and personalised to different needs and preferences

The implications in *Table 5* relate to practical considerations of how best to offer women choice and flexibility around consultation modality, based on an assessment and understanding of their needs and life situation. Knowledge users were agreed that individual women's preferences and choices should ideally be explored in the initial antenatal booking appointment (which should ideally be in-person), recorded in the notes and revisited where appropriate.

R – Recognising the importance of access and inclusion

The implications in *Table 6* recognise that DC-CON adds an additional, potentially complex dimension to accessing and navigating maternity services as it requires key capabilities and resources related to digital (as well as health) literacy. In addition, services need to ensure that women's communication needs are understood and able to be addressed (e.g. issues related to language barriers, neuro-diversity, hearing impairments or social anxiety) so that DC-CON is used, not used or adapted appropriately.

TABLE 4 CORE implications [C]

Practitioners/managers	Policy-makers/commissioners
Technology and equipment • Easily available IT support • Good, secure internet connections • Provision of work phones Environment • Enable privacy and a quiet environment Protocols/guidance • Develop protocols to support practice, to set out suitability criteria for DC-CON, to provide clarity around risks/safety/safeguarding issues (and guidance for how to address these) DC-CON modality • Enable/allow staff choice and flexibility to use different DC-CON modalities according to professional judgement Workload • Provide dedicated time for DC-CON (e.g. with appropriate time allocated within workload models and job plans) Training • Provide pre- and post-registration training – for (i) confidence with systems/technology and (ii) on communication (web-side manner) Communication/feedback systems • Undertake audit/patient experience surveys and outcome data to create feedback processes to support staff buy-in and involvement • Consider use of digital champions to promote change and support staff	• Apps and systems for DC-CON to be co-designed with relevant knowledge users • Apps and systems to have templates for recording of preferences and digital access/inclusion needs • Apps and systems to provides users with information of DC-CON times and modality • Interoperability for systems within NHS (e.g. record systems and apps) • Interoperability with mainstream virtual platforms (e.g. WhatsApp, Zoom) • Clarity on GDPR and DC-CON systems

GDPR, General Data Protection Regulation.

TABLE 5 CORE implications [O]

Practitioners/managers	Policy-makers and/or commissioners
Assessment, documentation and evaluation • Assess women's: (i) preferences, (ii) digital literacy/resources, (iii) digital capacity/competency and (iv) bio/psycho/social situation and needs (preferably in-person at the antenatal booking appointment) • Record preferences/situation in notes • Reassess suitability criteria/preferences/needs regularly Informed choice • Produce information resources for women explaining the pros/cons of different DC-CON modalities and explaining how to use these modalities and when (including clarity around phone numbers for different services and who to call when) • Offer women choice around consultation modality DC-CON modality (video/phone) • Utilise DC-CON modality flexibly – as appropriate to women's preferences and situation DC-CON timing • Where possible, offer a time slot so that women are able to engage with the call	N/A

TABLE 6 CORE implications [R]

Practitioners/managers	Policy-makers/commissioners
In line with implications above. Also: pay particular attention to needs associated with: • health literacy and understanding of NHS systems, processes and services associated with maternity care (e.g. which phone numbers to use, who to call and when) • digital literacy • access to digital resources • identification of specific barriers, needs or issues related to: migration status, language, neurodiversity, hearing impairment and other relevant characteristics Interpretation • Ensure there is access to appropriate interpretation services • Ensure that staff are trained to be confident and competent in making full use of virtual interpretation technologies	• Ensure that apps and systems have templates for recording of EDI data, DC-CON preferences and digital access/inclusion needs

TABLE 7 CORE implications [E]

Practitioners/managers	Policy-makers/commissioners
As above. Also: • Ensure there are opportunities for in-person consultations to enable thorough bio-psycho-social assessments (including for safeguarding concerns) and relationship building • Where possible, build in processes for utilisation of DC-CON to support relationship-based reassurance, involvement and engagement in care, including with partners/families • Within protocols and guidance: develop DC-CON suitability criteria – but always ensure that staff have flexibility and autonomy to exercise professional judgment if there are any concerns	• Development of clear and consistent hybrid pathways/protocols (with built-in flexibility options)

E – Enabling quality and safety through relationship-focused connections

These implications (*Table 7*) relate to the programme theories that suggest that safety and clinical appropriateness of DC-CON can be best assured if used in the context of an established relationship. Particularly within continuity of carer models, DC-CON can help to provide additional support and maintain engagement in care. Where a pre-existing relationship is not possible (e.g. in calls to helplines or triage systems), it is important for staff to have excellent communication skills (a good 'web-side manner') and the ability to implement measures to support any communication challenges (as described above). Likewise, it is important for staff to be able to exercise professional judgement (supported by relevant protocols) to request a face-to-face consultation if there are any concerns.

Research recommendations

Recommendations for theory testing and future research fall into two areas: recommendations for research design and recommendations for priority topic areas.

Study design

The review found that many studies failed to provide an in-depth description of the DC-CON modality (simply referring to 'virtual' or 'remote' care as an undifferentiated phenomenon). In addition, even where the DC-CON modality was specified (e.g. phone or video), there was

often relatively little in-depth information on how the system or service actually operated. In addition, in many studies there was a relative lack of detail of the particular service or groups of women involved in DC-CON. This lack of detail makes it challenging to compare the relative merits of one modality against another, or to understand how associated governance, infrastructure or other systems and implementation processes (e.g. staff training and support) directly influence outcomes. These limitations meant that the programme theories that were developed, were oriented in a relatively generic manner. To test and develop these further, we suggest that future research needs to address some of these limitations. Some suggestions are provided below:

- To develop and test the programme theories further, there is a need for in-depth process evaluations or case studies that can provide a richer picture of the systems and processes, training and governance involved in DC-CON in specific settings, and how these influence implementation.
- Future DC-CON maternity research should focus on more tightly specified systems (e.g. triage/helplines), services (e.g. specialist outpatient clinics) or groups of women (e.g. women with particular digital literacy needs or communication challenges). Such greater specificity will produce findings and theories that can be applied more directly to specific service areas.
- Future research needs to provide detailed descriptions of the DC-CON intervention (e.g. using established intervention description templates such as TiDIER[214]).

A key concern of this review related to equity and safety. These dimensions were embedded in the programme theories. It is vital that future research also embeds these issues. For example:

- Future research should address outcomes and processes specifically related to equity and safety (in addition to others as relevant).
- Future research should ensure that equity is addressed through careful selection and reporting of study participants and that analyses are designed to be able to disaggregate and explore findings in relation to key EDI-related characteristics.

Research topic areas

The programme theories from this review provide a comprehensive basis for further evaluation of different aspects of DC-CON implementation. Priority topic areas are described below. These link to the CORE implementation principles and have been co-constructed with input from the knowledge user groups.

1. How best to offer, integrate and record choice and flexibility within services that utilise DC-CON, including:
   - How best to discuss and determine women's preferences, needs, and life situations vis a vis DC-CON suitability.
   - How best to (i) assess and (ii) support women's digital and health literacy in relation to maternity services, including access to requisite technologies and resources.

2. How to define and determine best practice in communication in DC-CON, including:
   - Development and validation of patient-reported outcome and experience measures.
   - Exploration of how safety-netting advice is currently delivered and understood via DC-CON.
   - Evaluation of optimal approaches to address communication challenges (e.g. use of remote interpretation services).

Conclusions

In the UK, maternity and health system reform have digital transformation as a key component.[6,7,231] The programme theories developed in this review offer important new insights that can guide further research and service developments in this area.

The review has illustrated the complexity of maternity care systems and the variety of contexts and stakeholders that need to be considered when interventions are introduced. This review found that the organisational infrastructure and resources available to support DC-CON have a major impact on how they are implemented practically and how staff respond. To help staff feel motivated and confident using DC-CON, the review found that it is important to ensure that staff have access to digital resources as well as clear systems, procedures and pathways to co-ordinate care and facilitate digital connection. In addition, it was highlighted that DC-CON should be recognised as a distinct aspect of maternity care which requires specific training, protocols, workspaces and consideration of staffing allocations to provide the safe and quality care that women sought. Indeed, when DC-CON services worked well and staff heard positive feedback from women, they were increasingly motivated to sustain their use of digital consultations.

The review found that a key consideration in the provision of digital maternity care was supporting women to make informed choices about their consultation modalities to

provide them with a sense of empowerment and control, potentially improving acceptance of DC-CON. In turn, if staff are responsive and considerate of women's individual dispositions, needs and circumstances, it could promote relationship building as well as feelings of safety. Indeed, prioritising meaningful relationships between women and maternity care professionals (midwives and obstetricians) could help to optimise safety and clinical outcomes, as well as avoid fragmentation of care. This is particularly important for women who may face challenges in accessing digital maternity care (due to communication barriers or a lack of reliable access to digital resources), to avoid exacerbating inequalities and to support women's sense of eligibility to use, and engage with, digital care. Indeed, evidence showed that DC-CON had the potential to improve access, satisfaction, and health disparities while delivering clinical outcomes comparable to those achieved with in-person care. Incorporating at-home monitoring and offering women easy, flexible access to care via DC-CON could provide a sense of safety, connection and support as and when it was needed. This could be particularly beneficial for those in remote or rural locations for whom attending face-to-face appointments could be burdensome.

This review embedded knowledge user insights at every stage, ensuring that it focused on issues of most importance to current staff and service users. These groups both prioritised equity, safety, flexibility, and choice around DC-CON use, delivered through inclusive, person-centred, relational care approaches. These principles were not always possible to implement during the rapid changes necessitated by COVID-19 pandemic. Post pandemic, a key challenge for the future lies in how to incorporate these principles into the design of new 'hybrid' models of care, with interoperability across systems, and with support for groups for whom DC-CON may pose material, communication or other kinds of access challenges. In addition, as services move to incorporate more 'hybrid' provision, there will be a need for support, information and training for both staff and service users to become confident and competent in utilising changing technologies as part of maternity care.

Additional information

CRediT contribution statement

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Acknowledgements

We thank all of those who have generously contributed their time and expertise to this project. We are particularly grateful to our Project Advisory Group and to all the participants in our knowledge user groups. We are also grateful to our collaborating

partners: the Nottingham Maternity Research Network, Sister Circle and the National Autistic Society. We also thank the Centre for Ethnic Health Research and the Bradford City of Sanctuary Maternity Stream Research Network for supporting us to undertake additional consultations with women. We are also grateful to Vikki Barrett for helping with the development of the e-learning resource.

Data-sharing statement

All data relevant to this report are included in the Appendices or Supplementary Files or can be obtained on request from the corresponding author.

Ethics statement

The project has been approved by the University of Nottingham Faculty of Medicine and Health Sciences Research Ethics Committee: reference no. FMHS 426-1221.

Information governance statement

The University of Nottingham is committed to handling all personal information in line with the UK Data Protection Act (2018) and the General Data Protection Regulation (EU GDPR) 2016/679. Under the Data Protection legislation, the University of Nottingham is the Data Controller, and you can find out more about how we handle personal data, including how to exercise your individual rights and the contact details for our Data Protection Officer here: https://www.nottingham.ac.uk/utilities/privacy.aspx/.

Disclosure of interests

Full disclosure of interests: Completed ICMJE forms for all authors, including all related interests, are available in the toolkit on the NIHR Journals Library report publication page at https://doi.org/10.3310/WQFV7425.

Primary conflicts of interest: Catrin Evans: None declared.

Georgia Clancy: None declared.

Kerry Evans: None declared.

Andrew Booth is Joint Principal Investigator – NIHR HS&DR Evidence Synthesis Centre, NIHR Public Health Evidence Synthesis Team; NIHR Evidence Synthesis Programme Evidence Synthesis Group (Sheffield EnSygN). He is also Co-Convenor of Cochrane Qualitative and Implementation Methods Group and author on the *Cochrane-Campbell Handbook for Qualitative Evidence Synthesis* chapter on Realist Synthesis. Andrew Booth is a former member of the National Institute for Health and Care Research (NIHR) Health and Social Care Delivery Research (HSDR) Funding Board (2019–22) and the NIHR Evidence Synthesis Advisory Group (2019–22). In 23 he served on the NIHR SEISMIC Funding Board.

Benash Nazmeen has received fees for consultancy, projects, participation or travel from University of Bradford, Florence Nightingale Foundation, Baby Lifeline, Association of South Asian Midwives, Care Quality Commission, Reproductive Justice Network, Royal College of Midwives, Birthrights, National Perinatal Epidemiology Unit (MBRACE), NHS Race and Health Observatory, Nursing and Midwifery Council, Birth Plus and Iolanthe Midwifery Trust.

Candice Sunney: None declared.

Mark Clowes: None declared.

Nia Wyn Jones: None declared.

Stephen Timmons: Stephen Timmons has received fees/funding from Taipei Medical University, NIHR, MRC, NHS ACCIA.

Helen Spiby: None declared.

Department of Health and Social Care disclaimer

This publication presents independent research commissioned by the National Institute for Health and Care Research (NIHR). The views and opinions expressed by authors in this publication are those of the authors and do not necessarily reflect those of the NHS, the NIHR, MRC, NIHR Coordinating Centre, the Health and Social Care Delivery Research programme or the Department of Health and Social Care.

This synopsis was published based on current knowledge at the time and date of publication. NIHR is committed to being inclusive and will continually monitor best practice and guidance in relation to terminology and language to ensure that we remain relevant to our stakeholders.

Publications

Protocol Evans C, Evans K, Booth A, Timmons S, Jones N, Nazmeen B, *et al.* A Realist Inquiry into Maternity Care @ a Distance (ARM@DA): Realist Review Protocol. *BMJ Open* 2022;**12**:e062106. https://doi.org/10.1136/bmjopen-2022-062106

Phase 1: Developing initial programme theories – published Evans C, Clancy G, Evans K, Booth A, Nazmeen B, Timmons S, *et al.* Developing initial programme theories for a realist synthesis on digital clinical consultations in maternity care: contributions from stakeholder involvement. *J Res Nurs* 2024;**29**:127–40. https://doi.org/10.1177/17449871241226911

Main findings Evans C, Clancy G, Evans K, Booth A, Nazmeen, B, Timmons S, *et al.* Optimising digital clinical consultations in maternity care: a realist review and implementation principles *BMJ Open* 2024;**14**:e079153. https://doi.org/10.1136/bmjopen-2023-079153

Seminars/webinars

6 September 2024 National online dissemination webinar.

26 October 2023 Seminar for Royal College of Obstetricians and Gynaecologists (RCOG) Clinical Quality Group.

29 November 2023 Seminar for the School of Health Sciences, Research Community of Practice, University of Nottingham.

1 February 2024 Seminar for NHS England's Maternity Digital Transformation Leaders Group.

Study registration

This study is registered as PROSPERO CRD42021288702.

Funding

This synopsis presents independent research funded by the National Institute for Health and Care Research (NIHR) Health and Social Care Delivery Research programme as award number NIHR134535.

This synopsis provided an overview of the research award ARM@DA: A Realist Inquiry into Maternity Care @ a DistAnce. For more information about this research please view the award page https://www.fundingawards.nihr.ac.uk/award/NIHR134535.

About this synopsis

The contractual start date for this research was in February 2022. This article began editorial review in October 2023 and was accepted for publication in July 2024. The authors have been wholly responsible for all data collection, analysis and interpretation, and for writing up their work. The Health and Social Care Delivery Research editors and publisher have tried to ensure the accuracy of the authors' article and would like to thank the reviewers for their constructive comments on the draft document. However, they do not accept liability for damages or losses arising from material published in this article.

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Glossary

Abductive theorising Making simple and logical assumptions to explain a set of observations.

CLUSTER search strategy Citations, Lead authors, Unpublished materials, Scholar searches, Theories, Early examples and Related projects.

Context-mechanism-outcome A heuristic used in realist research to set out the relationship between a specific context, the mechanisms generated and outcomes produced.

Context The environment of a programme which determines whether or not mechanism(s) are activated.

CORE implementation principles **C** – Creating the right environment, infrastructure and support for staff; **O** – Optimising consultations to be responsive, flexible, and personalised to different needs and preferences; **R** – Recognising the importance of access and inclusion; and **E** – Enabling quality and safety through relationship-focused connections.

Digital clinical consultation Synchronous telephone or video consultations involving direct interaction between a service user and a maternity healthcare professional. It has two-way functionality and can be initiated by either party. It may be linked to, or complemented by, other digital technologies within the maternity care pathways.

Inductive theorising Drawing conclusions by observing behaviours/events.

Initial programme theory/ies Early attempts to explain how and why programmes work, often using the CMO heuristic.

Intersectionality Coined by Crenshaw in 1989 to describes the ways in which systems of inequality based on race, class, gender, sexuality, religion, disability, and other individual characteristics combine and overlap to create unique experiences and dynamics.

Mechanism Causal forces (reactions people have to the resources offered) that determine whether or not a programme works.

Outcome Intended or unintended consequences of a programme due to mechanisms being activated within specific contexts.

Planning and Evaluation of Remote Consultation Services A conceptual framework highlighting underpinning principles of healthcare quality and ethics (Greenhalgh T, Rosen R, Shaw SE, Byng R, Faulkner S, Finlay T, *et al.* Planning and evaluating remote consultation services: a new conceptual framework incorporating complexity and practical ethics. *Front Digit Health* 2021;**3**:726095. https://doi.org/10.3389/fdgth.2021.726095).

Programme theory/ies Ideas and assumptions about how a programme works to produce outcomes.

PROGRESS-Plus Place of residence, Race/ethnicity/culture/language, Occupation, Gender/sex, Religion, Education, Socioeconomic status, Social capital: an acronym that seta out a range of characteristics that can influence health equity.

Realist And MEta-narrative Evidence Syntheses: Evolving Standards Quality and reporting standards and resources and training materials for realist research.

Retroductive theorising Finding hidden causal mechanisms that explain observed patterns/behaviours.

List of abbreviations

ARM@DA	A Realist inquiry into Maternity care @ a DistAnce
CMO	context-mechanism-outcome
DC-CON	digital clinical consultation
COSU-G	community organisation and service user group
EDI	equality, diversity, and inclusion
HCP	healthcare professional
HCP-G	Healthcare Professional Group
IPT	initial programme theory
NIHR	National Institute for Health and Care Research
PAG	Project Advisory Group
PERCS	Planning and Evaluation of Remote Consultation Services
PPI	patient and public involvement
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PT	programme theory
RAMESES	Realist And MEta-narrative Evidence Syntheses: Evolving Standards
RCOG	Royal College of Obstetricians and Gynaecologists
RCM	Royal College of Midwives
TIDIER	Template for Intervention Description and Replication

List of supplementary material

Report Supplementary Material 1
RAMESES publication standards checklist.

Report Supplementary Material 2
Selection of theories and model

Report Supplementary Material 3 Phase 1 initial programme theories (IPTs) and model

Report Supplementary Material 4
Evidence sources in longlist (not prioritised for synthesis)

Report Supplementary Material 5
Detailed PRISMA flow diagram

Report Supplementary Material 6
Narrative description of characteristics of evidence sources

Report Supplementary Material 7
Narrative of programme theory development

Report Supplementary Material 8
Knowledge user groups information

Report Supplementary Material 9
Details of knowledge user group meetings

Supplementary material can be found on the NIHR Journals Library report page (https://doi.org/10.3310/WQFV7425).

Supplementary material has been provided by the authors to support the report and any files provided at submission will have been seen by peer reviewers, but not extensively reviewed. Any supplementary material provided at a later stage in the process may not have been peer reviewed.

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UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2016-18; 2021. URL: https://www.npeu.ox.ac.uk/assets/downloads/mbrrace-uk/reports/maternal-report-2020/MBRRACE-UK_Maternal_Report_Dec_2020_v10.pdf (accessed 9 February 2021).

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Appendix 1 Phase 1 search strategies

PRIORITY STUDIES Study:	Appraiser initials	RELEVANCE: High = 5 pts, Moderate = 3 pts, Low = 1 pt				RIGOUR: High = 5 pts, Moderate = 3 pts, Low = 1 pt				PRIORITY SCORE	RICHNESS: High = 5 pts, Moderate = 3 pts, Low = 1 pt
		Does the text focus on DC-CON in UK maternity care? (Yes = 5 pts, No = 0pt)	Is the text a high, moderate or low match to the ARM@DA review questions/IPTs?	Does the text provide a high, moderate or low number of 'nuggets' of information?	Total	Does the text provide a clear account of processes – ethics, sample, selection, limitations and biases noted?	Does the text include a clear description of analytical processes?	Does the text present a developed and plausible explanation?	Total		Does the text offer a rich description, grounded in the data, of the process and context that can lead to explanatory insights?
Appelman, I. F., Thompson, S. M., van den Berg, L. M. M., Gitsels van der Wal, J. T., de Jonge, A. & Hollander, M. H. (2022) It was tough, but necessary. Organizational changes in a community based maternity care system during the first wave of the COVID-19 pandemic: A qualitative analysis in the Netherlands. PloS one, 17 (3 March): e0264311	HS	0	5	3	8	5	5	5	15	3rd	3
Aydin, E., Glasgow, K. A., Weiss, S. M., Austin, T., Johnson, M., Barlow, J. & Lloyd-Fox, S. (2021) Expectant parents' perceptions of healthcare and support during COVID-19 in the UK: A thematic analysis. medRxiv, 2021.2004.2014.21255490	GC	5	5	3	13	3	5	3	11	2nd	3
Bailey, C. M., Newton, J. M. & Hall, H. G. (2019) Telephone triage in midwifery practice: A cross-sectional survey. International journal of nursing studies, 91 110-118	GC	0	3	5	8	5	5	5	15	3rd	5

Searches for this phase were run in January 2022 on three databases: MEDLINE (including in-process citations and e-pub ahead of print); CINAHL, and – for a broad, multidisciplinary perspective – Scopus. An example search strategy (from MEDLINE) is reproduced in full in the project's published protocol (within its associated *Supplemental File No.2: Initial Search Strategy*).[63]

Appendix 2 Phase 1 study screening, appraisal, sampling and selection

Full details of phase 1 can be found in an associated publication.[62] This phase sought to identify what Jagosh has referred to as 'key informant' papers (rather than to undertake a comprehensive search of empirical evidence which occurs in phase 2). Using definitions of relevance and richness outlined by Jagosh,[127] a key informant paper was defined as:

> *[P]apers that have high relevance to the realist synthesis. This means that the framing of the research and the research questions are highly matched to the review questions, the empirical findings are clearly described and there is a rich description of the process and context that can greatly advance the theoretical output of the review. The paper is a 'key informant'.*[127]

The phase 1 records were screened to identify theory-rich and theoretically informed papers and other relevant sources of evidence from which tacit theories could be abstracted (expressed as CMO configurations). *Table 8* summarises the initial inclusion criteria used in phase 1.

TABLE 8 Phase 1 inclusion/exclusion criteria

Concept	Criteria
Date	2010 onwards
Study design	Any study design including primary research, reviews, service evaluations, quality improvement projects, audits, policy documents, practice guidance, opinion/discussion pieces, theory papers
Geographical context	UK and OECD countries
Language	English language only
Clinical context	Maternity (any setting) Non-Maternity (primary care and select secondary care sources)
Focus/relevance	**Maternity care** Directly related to any aspect of maternity care at any stage of the care pathway and including any actor Includes reports empirical data, theories, frameworks, models or theoretical ideas linked to the implementation or views and experiences of remote care/digital clinical consultations **Non-maternity care** Direct and specific focus on implementation issues, theories, models and frameworks around digital clinical consultation (i.e. this is the main focus of the paper – not just where views/experiences of remote care are reported as a single theme within a broader focus) Likely to be qualitative/mixed method or realist reviews of implementation of digital clinical consultations **Theory** Theory papers that focus on theories of implementation of remote consultations/digital clinical consultations

In addition to using criteria of relevance and richness, a purposive sampling approach to study selection was adopted. Purposive sampling helped to keep this phase of the review manageable, but more importantly, it provided a way of addressing the priorities identified in the stakeholder workshops and PAG. The initial tabulated list of CMOs was modified into a sampling framework based on maximum variation sampling in terms of potential groups of women and settings, taking care to ensure that all areas identified as stakeholder priorities were included. These included:

- Empirical papers and reviews: Maternity context
- Empirical papers and reviews: Non-maternity context
- Frameworks and theories (and select associated exemplar papers)
- Policy, guidance and opinion.

The records were screened in three stages: (1) initial screening of bibliographic database records by two members of the project team; (2) screening of records from other evidence sources; and (3) further screening of (1) and (2) using the purposive sampling criteria. Overall, 49 diverse sources of evidence were used to inform phase 1.[3–5,12,13,30–33,39,45,46,48,49,58,88–120,203]

Appendix 3 Phase 2 comprehensive search strategies

TABLE 9 Phase 2 MEDLINE search strategy

Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations, Daily and Versions < 1946 to June 29, 2022 >		
#	**Query**	**Results**
1	exp Telemedicine/	40,937
2	remote consultation/ or videoconferencing/	7451
3	(telemedicine or tele-medicine or telecare or tele-care or telehealth or tele-health or telemonitoring or tele-monitoring or remote monitoring).mp.	50,441
4	((remote* or virtual* or online or on-line or digital*) adj3 (consultation* or appointment* or meet*)).mp.	9066

TABLE 9 Phase 2 MEDLINE search strategy (*continued*)

Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations, Daily and Versions < 1946 to June 29, 2022 >		
#	**Query**	**Results**
5	(videoconferenc* or video-conferenc* or teleconferenc* or tele-conferenc* or zoom or facetime or face-time or badge?net or medway or system C or systemC or K2* or athena or attendanywhere or attend anywhere or dr doctor or doctor doctor or PKB or patient knows best or PAS or patient administration system* or near me).mp.	74,138
6	1 or 2 or 3 or 4 or 5	128,601
7	exp Maternal Health Services/	55,880
8	exp Prenatal Care/ or exp Midwifery/ or exp Pregnancy/ or exp Obstetrics/	991,039
9	(matern* or pregnan* or prenatal or pre-natal or antenatal or ante-natal or perinatal or peri-natal or postnatal or post-natal or postpartum or post-partum or breastfeed* or breast feed* or infant feeding or lactati* or midwi* or obstetric* or gestation*).mp.	1,506,581
10	7 or 8 or 9	1,517,372
11	6 and 10	4898
12	limit 11 to yr="2016 -Current"	2812
13	meta analysis.mp,pt. or review.pt. or search:.tw.	3,449,244
14	12 and 13	462
15	12 not 13	2350
16	exp Great Britain/	385,304
17	(national health service* or nhs*).ti,ab,in.	247,302
18	(english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) adj5 english)).ti,ab.	45,087
19	(gb or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united kingdom* or (england* not "new england") or northern ireland* or northern irish* or scotland* or scottish* or ((wales or "south wales") not "new south wales") or welsh*).ti,ab,jw,in.	2,322,787
20	(bath or "bath's" or ((birmingham not alabama*) or ("birmingham's" not alabama*) or bradford or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or "carlisle's" or (cambridge not (massachusetts* or boston* or harvard*)) or ("cambridge's" not (massachusetts* or boston* or harvard*)) or (canterbury not zealand*) or ("canterbury's" not zealand*) or chelmsford or "chelmsford's" or chester or "chester's" or chichester or "chichester's" or coventry or "coventry's" or derby or "derby's" or (durham not (carolina* or nc)) or ("durham's" not (carolina* or nc)) or ely or "ely's" or exeter or "exeter's" or gloucester or "gloucester's" or hereford or "hereford's" or hull or "hull's" or lancaster or "lancaster's" or leeds* or leicester or "leicester's" or (lincoln not nebraska*) or ("lincoln's" not nebraska*) or (liverpool not (new south wales* or nsw)) or ("liverpool's" not (new south wales* or nsw)) or ((london not (ontario* or ont or toronto*)) or ("london's" not (ontario* or ont or toronto*)) or manchester or "manchester's" or (newcastle not (new south wales* or nsw)) or ("newcastle's" not (new south wales* or nsw)) or norwich or "norwich's" or nottingham or "nottingham's" or oxford or "oxford's" or peterborough or "peterborough's" or plymouth or "plymouth's" or portsmouth or "portsmouth's" or preston or "preston's" or ripon or "ripon's" or salford or "salford's" or salisbury or "salisbury's" or sheffield or "sheffield's" or southampton or "southampton's" or st albans or stoke or "stoke's" or sunderland or "sunderland's" or truro or "truro's" or wakefield or "wakefield's" or wells or westminster or "westminster's" or winchester or "winchester's" or wolverhampton or "wolverhampton's" or (worcester not (massachusetts* or boston* or harvard*)) or ("worcester's" not (massachusetts* or boston* or harvard*)) or (york not ("new york*" or ny or ontario* or ont or toronto*)) or ("york's" not ("new york*" or ny or ontario* or ont or toronto*))))).ti,ab,in.	1,633,647
21	(bangor or "bangor's" or cardiff or "cardiff's" or newport or "newport's" or st asaph or "st asaph's" or st davids or swansea or "swansea's").ti,ab,in.	65,320
22	(aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or stirling or "stirling's").ti,ab,in.	240,883
23	(armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or "londonderry's" or derry or "derry's" or newry or "newry's").ti,ab,in.	31,250

continued

TABLE 9 Phase 2 MEDLINE search strategy (*continued*)

Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations, Daily and Versions < 1946 to June 29, 2022 >		
#	**Query**	**Results**
24	or/16-23	2,915,825
25	(exp africa/ or exp americas/ or exp antarctic regions/ or exp arctic regions/ or exp asia/ or expoceania/) not (exp great britain/ or europe/)	3,033,847
26	24 not 25	2,777,210
27	14 and 26	101
28	14 not 26	361
29	15 and 26	225
30	15 not 26	2125

TABLE 10 Phase 2 EMBASE search strategy

EMBASE < 1974 to 2022 June 29 >		
#	**Query**	**Results**
1	exp Telemedicine/	60,758
2	teleconsultation/ or videoconferencing/	19,979
3	(telemedicine or tele-medicine or telecare or tele-care or teleconsultation* or tele-consultation* or telehealth or tele-health or telemonitoring or tele-monitoring or remote monitoring).mp.	77,484
4	((remote* or virtual* or online or on-line or digital*) adj3 (consultation* or appointment* or meet*)).mp.	5895
5	(videoconferenc* or video-conferenc* or teleconferenc* or tele-conferenc* or zoom or facetime or face-time or badge?net or medway or system C or systemC or K2* or athena or attendanywhere or attend anywhere or dr doctor or doctor doctor or PKB or patient knows best or PAS or patient administration system* or near me).mp.	111,335
6	1 or 2 or 3 or 4 or 5	192,510
7	exp Maternal Health Services/	2468
8	exp Prenatal Care/ or exp Midwifery/ or exp Pregnancy/ or exp Obstetrics/	857,303
9	(matern* or pregnan* or prenatal or pre-natal or antenatal or ante-natal or perinatal or peri-natal or postnatal or post-natal or postpartum or post-partum or breastfeed* or breast feed* or infant feeding or lactati* or midwi* or obstetric* or gestation*).mp.	1,707,141
10	7 or 8 or 9	1,715,189
11	6 and 10	6923
12	limit 11 to yr="2016 -Current"	4195
13	meta-analys:.mp. or search:.tw. or review.pt.	3,577,645
14	exp United Kingdom/	445,209
15	(national health service* or nhs*).ti,ab,in,ad.	424,909
16	(english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) adj5 english)).ti,ab.	53,436
17	(gb or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united kingdom* or (england* not "new england") or northern ireland* or northern irish* or scotland* or scottish* or ((wales or "south wales") not "new south wales") or welsh*).ti,ab,jx,in,ad.	3,507,772

TABLE 10 Phase 2 EMBASE search strategy (*continued*)

EMBASE < 1974 to 2022 June 29 >		
#	**Query**	**Results**
18	(bath or "bath's" or ((birmingham not alabama*) or ("birmingham's" not alabama*) or bradford or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or "carlisle's" or (cambridge not (massachusetts* or boston* or harvard*)) or ("cambridge's" not (massachusetts* or boston* or harvard*)) or (canterbury not zealand*) or ("canterbury's" not zealand*) or chelmsford or "chelmsford's" or chester or "chester's" or chichester or "chichester's" or coventry or "coventry's" or derby or "derby's" or (durham not (carolina* or nc)) or ("durham's" not (carolina* or nc)) or ely or "ely's" or exeter or "exeter's" or gloucester or "gloucester's" or hereford or "hereford's" or hull or "hull's" or lancaster or "lancaster's" or leeds* or leicester or "leicester's" or (lincoln not nebraska*) or ("lincoln's" not nebraska*) or (liverpool not (new south wales* or nsw)) or ("liverpool's" not (new south wales* or nsw)) or ((london not (ontario* or ont or toronto*)) or ("london's" not (ontario* or ont or toronto*)) or manchester or "manchester's" or (newcastle not (new south wales* or nsw)) or ("newcastle's" not (new south wales* or nsw)) or norwich or "norwich's" or nottingham or "nottingham's" or oxford or "oxford's" or peterborough or "peterborough's" or plymouth or "plymouth's" or portsmouth or "portsmouth's" or preston or "preston's" or ripon or "ripon's" or salford or "salford's" or salisbury or "salisbury's" or sheffield or "sheffield's" or southampton or "southampton's" or st albans or stoke or "stoke's" or sunderland or "sunderland's" or truro or "truro's" or wakefield or "wakefield's" or wells or westminster or "westminster's" or winchester or "winchester's" or wolverhampton or "wolverhampton's" or (worcester not (massachusetts* or boston* or harvard*)) or ("worcester's" not (massachusetts* or boston* or harvard*)) or (york not ("new york*" or ny or ontario* or ont or toronto*)) or ("york's" not ("new york*" or ny or ontario* or ont or toronto*))))).ti,ab,in,ad.	2,731,888
19	(bangor or "bangor's" or cardiff or "cardiff's" or newport or "newport's" or st asaph or "st asaph's" or st davids or swansea or "swansea's").ti,ab,in,ad.	112,122
20	(aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or stirling or "stirling's").ti,ab,in,ad.	375,775
21	(armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or "londonderry's" or derry or "derry's" or newry or "newry's").ti,ab,in,ad.	51,742
22	14 or 15 or 16 or 17 or 18 or 19 or 20 or 21	4,284,822
23	(exp "arctic and antarctic"/ or exp oceanic regions/ or exp western hemisphere/ or exp africa/ or exp asia/ or exp "australia and new zealand"/) not (exp united kingdom/ or europe/)	3,506,781
24	22 not 23	4,027,067
25	12 and 13	607
26	12 not 13	3588
27	24 and 25	114
28	25 not 24	493
29	26 and 24	500
30	26 not 24	3088
31	limit 30 to conference abstract status	933
32	30 not 31	2155

TABLE 11 Phase 2 PsychInfo search strategy

APA PsycInfo < 2002 to June Week 3 2022 >		
#	**Query**	**Results**
1	exp Telemedicine/	10,965
2	videoconferencing/	719
3	(telemedicine or tele-medicine or teleconsultation or tele-consultation or telecare or tele-care or telehealth or tele-health or telemonitoring or tele-monitoring or remote monitoring).mp.	9851

continued

TABLE 11 Phase 2 PsychInfo search strategy (*continued*)

APA PsycInfo < 2002 to June Week 3 2022 >		
#	**Query**	**Results**
4	((remote* or virtual* or online or on-line or digital*) adj3 (consultation* or appointment* or meet*)).mp.	1509
5	(videoconferenc* or video-conferenc* or teleconferenc* or tele-conferenc* or zoom or facetime or face-time or badge?net or medway or system C or systemC or K2* or athena or attendanywhere or attend anywhere or dr doctor or doctor doctor or PKB or patient knows best or PAS or patient administration system* or near me).mp.	10,774
6	1 or 2 or 3 or 4 or 5	23,210
7	exp Prenatal Care/ or exp Midwifery/ or exp Pregnancy/ or exp Obstetrics/	35,626
8	(matern* or pregnan* or prenatal or pre-natal or antenatal or ante-natal or perinatal or peri-natal or postnatal or post-natal or postpartum or post-partum or breastfeed* or breast feed* or infant feeding or lactati* or midwi* or obstetric* or gestation*).mp.	113,676
9	7 or 8	117,406
10	6 and 9	663
11	limit 10 to yr="2016 -Current"	438
12	limit 11 to "reviews (maximizes sensitivity)"	297
13	11 not 12	141

ASSIA via ProQuest (searched 7/7/22)

(noft(telemedicine OR tele-medicine OR telecare OR tele-care OR telehealth OR tele-health OR telemonitoring OR tele-monitoring OR "remote monitoring") OR noft(remote NEAR/3 care) OR noft("remote consultation" OR videoconferencing OR video-conferenc* OR facetime OR zoom OR face-time OR medway OR "system C" OR systemC OR K2* OR athena OR attendanywhere OR "attend anywhere" OR "dr doctor" OR "doctor doctor" OR PKB OR "patient knows best" OR PAS OR "patient administration system*" OR "near me")) AND noft(matern* OR pregnan* OR prenatal OR pre-natal OR antenatal OR ante-natal OR perinatal OR peri-natal OR postnatal OR post-natal OR postpartum OR post-partum OR breastfeed* OR "breast feed*" OR "infant feeding" OR lactati* OR midwi* OR obstetric* OR gestation*) AND yr(2016-2022)

TABLE 12 Phase 2 CINAHL search strategy

CINAHL (searched 1/7/22)			
#	**Query**	**Limiters/expanders**	**Results**
S23	S17 not S18	Limiters – Published Date: 20160101-20221231 Expanders – Apply equivalent subjects Search modes –- Boolean/Phrase	163
S22	S16 not S18	Limiters – Published Date: 20160101-20221231 Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	546
S21	S14 not S15	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	699
S20	S15 not S19	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	1210
S19	S16 OR S17	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	757
S18	S16 AND S17	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	48

TABLE 12 Phase 2 CINAHL search strategy (*continued*)

CINAHL (searched 1/7/22)			
#	**Query**	**Limiters/expanders**	**Results**
S17	S5 AND S12	Limiters – Published Date: 20160101-20221231; Clinical Queries: Review – Best Balance Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	211
S16	S5 AND S12	Limiters – Published Date: 20160101-20221231 Expanders – Apply equivalent subjects Narrow by SubjectGeographic: - uk and ireland Search modes – Boolean/Phrase	594
S15	S5 AND S12	Limiters – Published Date: 20160101-20221231 Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	1967
S14	S5 AND S12	Limiters – Published Date: 20100101-20221231 Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	2666
S13	S5 AND S12	Expanders – Apply equivalent subjects Search modes– Boolean/Phrase	2988
S12	S6 OR S7 OR S8 OR S9 OR S10 OR S11	Expanders– Apply equivalent subjects Search modes – Boolean/Phrase	455,994
S11	matern* or pregnan* or prenatal or pre-natal or antenatal or ante-natal or perinatal or peri-natal or postnatal or post-natal or postpartum or post-partum or breastfeed* or "breast feed*" or "infant feeding" or lactati* or midwi* or obstetric* or gestation*	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	451,291
S10	(MH "Obstetrics") OR (MH "Diagnosis, Obstetric+") OR (MH "Obstetric Service")	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	33,685
S9	(MH "Pregnancy+")	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	236,550
S8	(MH "Midwifery+")	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	21,780
S7	(MH "Prenatal Care") OR (MH "Prenatal Care (Iowa NIC)")	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	19,037
S6	(MH "Maternal Health Services+")	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	35,082
S5	S1 OR S2 OR S3 OR S4	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	56,506
S4	(telemedicine or tele-medicine or telecare or tele-care or telehealth or tele-health) OR (teleconsultation or tele-consultation or "video consultation*" or videoconsultation*) OR (videoconferenc* or video-conferenc* or teleconferenc* or tele-conferenc* or zoom or facetime or face-time or badgenet or "badge net" or medway or "system C" or systemC or K2* or athena or attendanywhere or "attend anywhere" or "dr doctor" or "doctor doctor" or PKB or "patient knows best" or PAS or "patient administration system*" or "near me")	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	49,775
S3	(MH "Videoconferencing+")	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	5086
S2	(MH "Remote Consultation")	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	2870
S1	(MH "Telemedicine+") OR (MH "Telehealth+")	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	32,293

TABLE 13 Phase 2 Cochrane library search strategy

Cochrane Library (searched 3/7/22)	
#1	MeSH descriptor: [Telemedicine] explode all trees
#2	MeSH descriptor: [Remote Consultation] explode all trees
#3	MeSH descriptor: [Videoconferencing] explode all trees
#4	(telemedicine or tele-medicine or telecare or tele-care or telehealth or tele-health or telemonitoring or tele-monitoring or "remote monitoring"):ti,ab,kw (Word variations have been searched)
#5	((remote* or virtual* or online or on-line or digital*) near/3 (consultation* or appointment* or meet*)):ti,ab,kw (Word variations have been searched)
#6	(videoconferenc* or video-conferenc* or teleconferenc* or tele-conferenc* or zoom or facetime or face-time or badgenet or "badge net" or medway or "system C" or systemC or K2* or athena or attendanywhere or "attend anywhere" or "dr doctor" or "doctor doctor" or PKB or "patient knows best" or PAS or "patient administration system*" or "near me"):ti,ab,kw (Word variations have been searched)
#7	#1 or #2 or #3 or #4 or #5 or #6
#8	MeSH descriptor: [Maternal Health Services] explode all trees
#9	MeSH descriptor: [Prenatal Care] explode all trees
#10	MeSH descriptor: [Midwifery] explode all trees
#11	MeSH descriptor: [Pregnancy] explode all trees
#12	MeSH descriptor: [Obstetrics] explode all trees
#13	(matern* or pregnan* or prenatal or pre-natal or antenatal or ante-natal or perinatal or peri-natal or postnatal or post-natal or postpartum or post-partum or breastfeed* or "breast feed*" or "infant feeding" or lactati* or midwi* or obstetric* or gestation*):ti,ab,kw (Word variations have been searched)
#14	#8 or #9 or #10 or #11 or #12 or #13

Grey literature searches

Searches to identify relevant unpublished evidence were conducted, including searching for theses via ProQuest Dissertations and Theses and ETHOS, and the DANS-Easy archive of European research data.

Dissertations and theses was searched using a simple Boolean strategy:

(remote or virtual or online or telehealth) and (matern* or pregnan* or midwi*)
retrieving 227 results which were imported to EndNote for screening.

ETHOS functionality is more limited so searches were restricted to various pairings of words (e.g. pregnant and online; telemedicine and pregnancy; virtual and obstetrics) and a total of six records of possible interest were selected. DANS-Easy yielded only one result not found via the previous searches.

In total, these resources retrieved 234 results for screening.

Other grey literature search strategies

A list of 20 grey literature websites was compiled by the core research team and searched for relevant written content on digital consultations in maternity care (see below). These websites typically just had single-line search boxes and as such a very simple search strategy was used: (remote or virtual or online or telehealth) and (maternity or pregnancy). For thoroughness, these searches were also repeated on the search engine Google with the addition of each individual website's name in turn. This identified a number of results that were not found through the websites' own search facilities. The results of these grey literature searches were screened by two team members following the same inclusion criteria used in phase 2 (see *Appendix 4*). Overall, 28 texts were found and all were excluded; 17 texts were considered to have 'no relevant data', 4 texts could not be accessed, 2 reports and 2 guidance documents were already in the sample, 2 were non-UK discussion/opinion pieces and 1 was published pre-2016.

1. RCM
2. RCOG

3. NHSx
4. NCT
5. All4Maternity
6. MVP/National Maternity Voices
7. Maternity and Midwifery Forum
8. AIMS
9. Association of Radical Midwives
10. BirthRights
11. The Health Foundation
12. The King's Fund.
13. WHO
14. International Confederation of Midwives
15. European Midwives Association
16. British Association Perinatal Medicine (BAPM) and the Intrapartum Care group
17. Positive Birth Movement
18. Health Education England
19. Make Birth Better
20. Birth Trauma Association.

Appendix 4 Phase 2 study screening, appraisal and selection

Phase 2

In phase 2, study selection comprised two stages. Initially, studies were screened against the inclusion/exclusion criteria (see *Table 14*) to produce a 'longlist' of included studies.[67]

TABLE 14 Phase 2 inclusion criteria

Inclusion criteria
Participants
• Women and birthing people accessing maternity care
• Maternity care professionals and healthcare management
Interventions
• Studies looking at the implementation, evaluation, views and experiences of DC-CON (as defined in the protocol)
Comparator
• The most implicit or explicit comparator is face-to-face consultations; however, studies without a comparator will be included if they meet the other criteria
Outcomes
• Uptake, utilisation, engagement, satisfaction, access, equity, personalisation, quality/safety, clinical, harms, sustainable adoption, efficiency and cost
Study designs
• Primary and secondary research of any study design, reporting empirical research, audit, evaluation and quality improvement data
• UK-focused grey literature (UK-specific reports, guidelines, policy documents, websites, conference proceedings and theses/dissertations if they are reporting primary data)
Context/setting
• Studies within various maternity care contexts/settings and models (e.g. midwife/obstetric-led care) and including different stages of the maternity care pathway (e.g. antenatal, intrapartum and early postnatal period – 10 to 14 days)
• OECD countries
Other criteria
• Date: 2016 – present. The initial focus in phase 2 is on texts published from 2016 onwards, but studies from 2010 will be considered (in phase 3) to address gaps in the evidence base
• Studies about maternity care during COVID-19 will be included for full-text screening on the assumption that DC-CON is likely to have occurred, even if this is not explicitly clear from title and abstract screening

continued

TABLE 14 Phase 2 inclusion criteria (*continued*)

Inclusion criteria
Exclusion criteria
• Studies not in English; studies where the full text is unavailable, protocols; and non-UK-focused opinion pieces/editorials
• Studies not explicitly focused on service user-healthcare provider consultations, for example online antenatal classes
• Studies not explicitly focused on maternity care, but other areas of reproductive health, for example abortion, fertility or contraceptive care
• Studies focused on services/interventions provided by non-maternity care professionals/providers (e.g. drug and alcohol services, specialist mental health services, stopping smoking services, and weight management services). We recognise that there may be regional and national variation in the delivery and commissioning of maternity supportive services and therefore such studies will be discussed on a case-by-case basis within the research team and assessed for inclusion in consideration of the role and involvement of the maternity care professional. As a general rule for overseas studies, these will be included if they describe a service which, in the UK, would typically be provided by maternity professionals within commissioned maternity services

In the next stage, the longlist of studies was appraised against operationalised concepts of relevance and rigour (informed by various sources of literature).[122,123,125,127,232]

Relevance and rigour were assessed as high/moderate/low based on aggregate scores for three different criteria (see *Tables 15–17*). The appraisal process also included an assessment of 'richness' (as a key realist concept) based on one criterion, to determine the extent to which a text could provide a detailed explanation of how and why an intervention worked (see *Table 18*).

Based on the appraisal process, studies were grouped into 'bands' depending on the aggregate scores. Studies in bands 1–6 were included. The remaining studies were judged to have very 'thin', poor quality or poorly relevant data that would not contribute to the synthesis. *Table 19* provides a visual of the spreadsheet Study appraisal form – undertaken in Excel.

TABLE 15 Criteria for appraising relevance and rigour

Appraisal domain	Criteria		
Relevance • High = 5 pts • Moderate = 3 pts • Low = 1 pt	Does the text focus on DC-CON in UK maternity care? (Yes = 5 pts, No = 0pt)	Is the text a high, moderate or low match to the ARM@DA review questions/IPTs?	Does the text provide a high, moderate, or low number of 'nuggets' of information?
Rigour • High = 5 pts • Moderate = 3 pts • Low = 1 pt	Does the text provide a clear account of processes – ethics, sample, selection, limitations and biases noted?	Does the text include a clear description of analytical processes?	Does the text present a developed and plausible explanation?
Richness • High = 5 pts • Moderate = 3 pts • Low = 1 pt	Does the text offer a rich description, grounded in the data, of the process and context that can lead to explanatory insights?		

TABLE 16 Scoring criteria for relevance

Relevance	Scoring explanations
High – 5	The text is focused on DC-CON in UK maternity care and has a high amount of 'nuggets'
Moderate – 3	The text is either focused on DC-CON in UK maternity care with a moderate amount of 'nuggets' or is focused on DC-CON in an OECD country's maternity care system and has a high amount of 'nuggets'
Low – 1	The text may be focused on DC-CON in the UK or an OECD country and has a low number of 'nuggets'

TABLE 17 Scoring criteria for rigour

Rigor	Scoring explanations
High – 5	The text contains a great amount of methodological details, and logical and appropriate explanations for support the conclusions
Moderate – 3	The text contains some methodological details and reasonable explanations to support the conclusions
Low – 1	The text contains a limited or insufficient amount of methodological details and it is unclear how the conclusions were reached

TABLE 18 Scoring criteria for richness

Richness	Scoring explanations
High – 5	The text contains a good or great amount of details and depth to explain how and why an intervention does, or is expected to, work. That is there is a description of the theoretical underpinning/programme theory which allows the findings to be transferred to other settings
Moderate – 3	The text contains a reasonable amount of detail and depth to explain how and why an intervention does, or is expected to, work
Low – 1	The text contains a limited or insufficient amount of detail and depth to explain how and why an intervention does, or is expected to, work

TABLE 19 Example of appraisal and prioritisation form

		RELEVANCE: High = 5 pts, moderate = 3 pts, low = 1 pt				RIGOUR: High = 5 pts, moderate = 3 pts, low = 1 pt					RICHNESS: High = 5 pts, moderate = 3 pts, low = 1 pt
PRIORITY STUDIES Study:	Appraiser initials	Does the text focus on DC-CON in UK maternity care? (yes = 5 pts, no = 0 pts)	Is the text a high, moderate or low match to the ARM@DA revlew questions/ IPTs?	Does the text provide a high, moderate or low number of 'nuggets' of information?	Total	Does the text provide a clear account of processes – ethics, sample, selection, limitations and biases noted?	Does the text include a clear description of analytical processes?	Does the text present a developed and plausible explanation?	Total	PRIORITTY SCORE	Does the text offer a rich description, grounded in the data, of the process and context that can lead to explanatory insights
Appelman *et al.* 2022[128]	HS	0	5	3	8	5	5	5	15	3rd	3
Aydin *et al.* 2021[129]	GC	5	5	3	13	3	5	3	11	2nd	3
Bailey *et al.* 2019[130]	GC	0	3	5	8	5	5	5	15	3rd	5

This synopsis should be referenced as follows: Evans C, Clancy G, Evans K, Booth A, Nazmeen B, Sunney C, *et al.* How to Implement Digital Clinical Consultations in UK Maternity Care: the ARM@DA Realist Review [published online ahead of print May 21 2025]. *Health Soc Care Deliv Res* 2025. https://doi.org/10.3310/WQFV7425

Appendix 5 Phase 3 focused additional search strategies

Database search strategies are listed in *Tables 20–23*.

TABLE 20 Phase 3 EMBASE search strategy

EMBASE < 1974 to 2023 Week 13 >		
#	Query	Results
1	(realist or (theory adj3 change) or logic model* or program logic or programme logic or causal model* or results chain* or intervention logic).mp.	11,318
2	(safety or safetynet* or safeguard* or safe-guard* or near miss* or never event* or adverse event* or adverse outcome*).mp.	1,780,103
3	((risk* or harm*) adj3 (prevent* or reduc*)).mp.	399,867
4	2 or 3	2,119,026
5	1 and 4	766
6	remove duplicates from 5	742
7	limit 6 to EMBASE	361

TABLE 21 Phase 3 MEDLINE search strategy

Ovid MEDLINE(R) ALL < 1946 to April 03, 2023 >		
#	Query	Results
1	(realist or (theory adj3 change) or logic model* or program logic or programme logic or causal model* or results chain* or intervention logic).mp.	9214
2	(safety or safetynet* or safeguard* or safe-guard* or near miss* or never event* or adverse event* or adverse outcome*).mp.	904,994
3	((risk* or harm*) adj3 (prevent* or reduc*)).mp.	235,815
4	2 or 3	1,115,450
5	1 and 4	584
6	remove duplicates from 5	580

TABLE 22 Phase 3 PsychInfo search strategy

APA PsycInfo < 1806 to March Week 4 2023 >		
#	Query	Results
1	(realist or (theory adj3 change) or logic model* or program logic or programme logic or causal model* or results chain* or intervention logic).mp.	10,413
2	(safety or safetynet* or safeguard* or safe-guard* or near miss* or never event* or adverse event* or adverse outcome*).mp.	104,683
3	((risk* or harm*) adj3 (prevent* or reduc*)).mp.	44,045
4	2 or 3	145,102
5	1 and 4	329
6	remove duplicates from 5	329

TABLE 23 Phase 3 CINAHL search strategy

CINAHL search (via EBSCO host)				
#	**Query**	**Limiters/expanders**	**Last run via**	**Results**
S3	S1 AND S2	Expanders – Apply equivalent subjects Search modes – Boolean/Phrase	Interface – EBSCOhost Research Databases Search Screen – Advanced Search Database – CINAHL	1395
S2	((safety or safetynet* or safeguard* or safe-guard*)) OR ("near miss*" or "never event*" or "adverse event*" or "adverse outcome*") OR ((risk or harm) n3 (prevent* or reduc*))	Search modes – Boolean/Phrase	Interface – EBSCOhost Research Databases Search Screen – Advanced Search Database – CINAHL	467,712
S1	realist* OR theory n3 change OR ("logic model*" or "program logic" or "programme logic" or "causal model*" or "results chain*" or "intervention logic")	Search modes – Boolean/Phrase	Interface – EBSCOhost Research Databases Search Screen – Advanced Search Database – CINAHL	17,999

Additional 'CLUSTER' approaches

Additional search approaches are shown in *Table 24*.

TABLE 24 Phase 3 CLUSTER search approaches

Topic focus/search approach	Date	Records found for screening • Reports from websites *n* = 5 • Snowball/CLUSTER *n* = 16
Safety/risk in remote maternity care		
Keyword searches in Google and Google Scholar (combinations of safety/safety-netting/safe-guarding/risk and remote/virtual/telehealth/triage and maternity/midwifery/obstetrics) – in incognito mode, scrutinising the first 100 records Reference list searching of identified records and citation searching	15/02/23	*n* = 5
Keyword searches of records in existing reference management system Reference list searching of records and citation searching	20/02/23	*n* = 1
Inequality/access/inclusion in remote maternity care		
Keyword searches in Google and Google Scholar (combinations of inequality/inclusion/access and remote/virtual/telehealth/triage and maternity/midwifery/obstetrics) – in incognito mode, scrutinising the first 100 records Reference list searching of records and citation searching	16/02/23	*n* = 1
Keyword searches of records in existing reference management system	20/02/23	No relevant records
Both maternity IPT areas		
Key author – Lisa Hinton • Citation alerts • New publication alerts • Webpage search Reference list searching of records and citation searching	Cut-off 30 April 2023	No relevant records

continued

TABLE 24 Phase 3 CLUSTER search approaches (*continued*)

Topic focus/search approach	Date	Records found for screening • Reports from websites *n* = 5 • Snowball/CLUSTER *n* = 16
Key/pearl paper citation alerts Hinton, L., Dakin, F. H., Kuberska, K., Boydell, *N*., Willars, J., Draycott, T., Winter, C., Mcmanus, R. J., Chappell, L. C., Chakrabarti, S., Howland, E., George, J., Leach, B. & Dixon-Woods, M. 2022. Quality framework for remote antenatal care: qualitative study with women, healthcare professionals and system-level stakeholders. *BMJ Quality & Safety*, 12, 12[153]	Cut-off 30 April 2023	*n* = 1
Related (non-maternity) evidence on safety/risk/inequality in remote consultations		
Key paper citation alerts Greenhalgh, T., Rosen, R., Shaw, S. E., Byng, R., Faulkner, S., Finlay, T., Grundy, E., Husain, L., Hughes, G., Leone, C., Moore, L., Papoutsi, C., Pope, C., Rybczynska-Bunt, S., Rushforth, A., Wherton, J., Wieringa, S. & Wood, G. W. 2021. Planning and Evaluating Remote consultation services: A New Conceptual Framework Incorporating Complexity and Practical Ethics. *Front Digit Health*, 3, 726095.[95]	Cut-off 30 April 2023	**Inequality/access/inclusion** *n* = 5 **Safety/risk** *n* = 5
Key author – Tricia Greenhalgh • Citation alerts • New publication alerts • Webpage search	Cut-off 30 April 2023	
Reference list searching of records and citation searching		
Keyword searching in existing reference management programme Reference list searching of records and citation searching		*n* = 3

Appendix 6 Characteristics of included evidence sources

The key for abbreviations in the study characteristics tables is found in *Table 25*. The study characteristics are shown in *Tables 26–28*.

TABLE 25 Study characteristics: table key

Key
Pandemic timing:
During pandemic = DP, Pre-pandemic = PP
Country:
AUS = Australia, CAN: Canada, ESP = Spain, FRA = France, GER = Germany, IT = Italy, NLD = Netherlands, NZL = New Zealand, SUI = Switzerland, UK = United Kingdom, USA = United States of America
Population:
HCP = Healthcare professionals, MW = Midwives, RN = Registered nurses, OB = Obstetricians, SU = Service users, ADMIN = Administrative staff
Stage of pregnancy:
AN = Antenatal, PN = Postnatal, IP = Intrapartum, T = Triage, *n*/a = not applicable

TABLE 26 Study characteristics: empirical papers

Reference	Pandemic timing	Geographical focus	Population	Stage of pregnancy	Tech modality	Study aim	Study design	Outcomes
Appelman *et al.* 2022[128]	DP	NLD	HCP	*n*/a	Telephone and video calls	To investigate which policy changes in maternity care during the first COVID-19 wave were perceived as positive or unfavourable by care providers and that could offer future improvements	Qualitative	Experiences of HCPs, policy changes, cooperation between HCPs, practices and hospitals
Aydin *et al.* 2021[129]	DP	UK	SU	AN	Telephone and video calls	To examine how COVID-19 and its societal related restrictions have impacted the provision of healthcare support for pregnant women during the COVID-19 pandemic	Quantitative; cross-sectional	Changes to service provision linked to SU anxiety levels
Bailey *et al.* 2019[130]	PP	AUS	MW	T	Telephone calls	To explore the experiences and practices of midwives regarding their management of telephone triage	Quantitative; cross-sectional	MW experiences and practices
Baron *et al.* 2018[131]	PP	USA	SU, HCP	AN	Telephone and video calls	To explore the perspectives of patients, RNs, and other providers regarding a new prenatal connected care model for low-risk patients aimed at reducing in-office visits and creating virtual patient–RN connections	Qualitative	Satisfaction, appointment type/number
Bidmead *et al.* 2020[132]	PP	UK	SU, HCP	AN	Video calls	For women, to directly assess experiences and acceptance of fetal telemedicine. For HCPs, to identify the barriers and enablers of adoption of fetal telemedicine	Mixed methods	SU and HCP acceptance and satisfaction with fetal ultrasound telemedicine
Borrelli *et al.* 2023[133]	DP	UK/IT	SU	IP; T	Video calls	To report on mothers' perspectives on the potential use of video calls during early labour in England and Italy	Qualitative	Implementation benefits and barriers to video calling in early labour
Borrelli *et al.* 2023[134]	DP	UK/IT	MW	IP; T	Video calls	To explore midwives' perspectives on potential use of video calls during early labour	Qualitative	MW perspectives, satisfaction, challenges, best practice

continued

TABLE 26 Study characteristics: empirical papers (*continued*)

Reference	Pandemic timing	Geographical focus	Population	Stage of pregnancy	Tech modality	Study aim	Study design	Outcomes
Branwer *et al.* 2021[135]	DP	UK	SU	AN; PN	Telephone calls	To rapidly gather data on the health, social, education and economic impacts of the COVID-19 pandemic on families in Bradford, UK	Qualitative	SU experiences. Recommendations for service providers
Butler Tobah *et al.* 2019[25]	PP	USA	SU	AN	Multiple technol-ogies, including telephone calls, video calls, and remote monitoring	To evaluate the acceptability and effectiveness of OB Nest, a reduced-frequency prenatal care model enhanced with remote home monitoring devices and nursing support	RCT	Acceptability, satisfaction, effectiveness prenatal maternal stress
Cordasco *et al.* 2018[137]	PP	USA	SU	AN; PN	Telephone calls	To develop and assess feasibility, as well as facilitators and barri-ers, of implementing the VA Maternity Care Coordinator Telephone Care Program	Mixed methods	Feasibility of telephone care
Craighead *et al.* 2022[138]	DP	USA	SU	AN	Not specified	To understand the impact of telehealth on healthcare communication and quality, and patient satisfaction	Mixed methods	Understanding the challenges of implementing telehealth for prenatal care delivery during the pandemic
Demirci *et al.* 2019[139]	PP	USA	SU	PN	Video calls via an app	To describes the feasi-bility and acceptability of direct to consumer tele-lactation for rural mothers	Qualitative	Feasibility of tele-lactation
Duryea *et al.* 2021[140]	DP	USA	SU	AN	Telephone calls	To explore the association of audio-only virtual prenatal care with perinatal outcomes	Quantitative; cohort study	Clinical outcomes
Engeltjes *et al.* 2022[141]	PP	NLD	HCP	Unclear	Telephone calls	To evaluate the degree of implementation (i.e. normalisation) of the Dutch Obstetric Telephone Triage System (DOTTS) and evaluate which lessons can be learned from its current implementation in Dutch hospitals	Mixed methods	Implementation (i.e. normalisa-tion) of DOTTS
Engeltjes *et al.* 2023[142]	PP	NLD	SUs	AN; T	Telephone calls	To explore how care is experienced by pregnant women when using a telephone obstetric triage system	Qualitative	SU experiences, satisfaction

TABLE 26 Study characteristics: empirical papers (*continued*)

Reference	Pandemic timing	Geographical focus	Population	Stage of pregnancy	Tech modality	Study aim	Study design	Outcomes
Engeltjes *et al.* 2020[143]	PP	NLD	HCPs	AN; T	Telephone calls	To develop obstetric guidelines for telephonic triage	Mixed methods	HCPs' views on guidelines
Evans *et al.* 2017[144]	PP	USA	SU, RN	AN; PN	Telephone calls	To characterise nursing care delivered via telephone social support intervention to low-income, pregnant women in the Midwestern USA	Qualitative	Feasibility of 'tele-nursing', improvement of clinical and psychosocial outcomes
Farrell *et al.* 2022[145]	DP	USA	SU	AN	Unclear	To examine patients' prenatal care needs, preferences, and experiences during the COVID-19 pandemic; to develop models to serve the needs of pregnant patients, providers, and healthcare systems	Qualitative	SU satisfaction and care preferences during COVID-19
Faucher and Kennedy. 2020[90]	PP	USA	SU	IP; T	Video calls	To examine women's perspectives on the potential use of video technology for early labour support	Qualitative	SU satisfaction
Fernandez Lopez *et al.* 2022[146]	DP	ESP	SU	AN	Video calls	To identify the needs, concerns and preferences of survivors about the use of eHealth strategies to counsel and empower pregnant victims of intimate partner violence in antenatal care	Qualitative	Suitability of eHealth for pregnant survivors of intimate partner violence
Foster *et al.* 2022[147]	DP	USA	HCP	AN	Unclear	To identify mean differences in telehealth maternity care; perceived patient acceptability; clinician satisfaction; and the perceived anticipation of long-term telehealth utilisation in family medicine maternity care	Quantitative; cross-sectional	Acceptability and satisfaction
Galle *et al.* 2021[148]	DP	Global	HCP	AN; IP; PN	Telephone and video, SMS	To document the experiences with providing telemedicine for maternal and newborn health care during the pandemic among health professionals globally	Quantitative; cross-sectional	Implementation of telemedicine, barriers to effectiveness, HCP perceptions and experiences

continued

TABLE 26 Study characteristics: empirical papers (*continued*)

Reference	Pandemic timing	Geographical focus	Population	Stage of pregnancy	Tech modality	Study aim	Study design	Outcomes
Gao *et al.* 2022[136]	DP	USA	SU	AN	Not specified	To investigate which prenatal visits are appropriate to be replaced with telehealth, access barriers and how telehealth impacts maternal outcomes	Quantitative; observational	Telehealth use, disparities in SU using telehealth, clinical outcomes
Gemperle *et al.* 2022[149]	DP	SUI	MW	AN; PN	Multiple technologies	To explore midwives' perceptions of the advantages of telemedicine during the COVID-19 pandemic in Switzerland	Quantitative; cross-sectional	Perceptions of telemedicine
Gomez-Roas *et al.* 2022[150]	DP	USA	SU	PN	Telephone and video calls	To identify additional challenges to healthcare interactions that emerged for low-income postpartum individuals during the pandemic	Qualitative	Equity and access to care
Harrison *et al.* 2017.[151]	PP	USA	SU	AN	Telephone and video calls	To assess the acceptability of a telemedicine-augmented gestational diabetes mellitus management protocol, which alternates 'virtual office visits' and standard office-based prenatal visits	Mixed methods	Acceptability of telemedicine for gestational diabetes mellitus care
Henry *et al.* 2022[152]	DP	AUS	HCP	AN; PN	Telephone and video calls	To assess COVID-19 effects on domestic and family violence and mental health screening, as well as broader service provision from the perspective of local maternity service providers	Mixed methods	Suitability of telehealth for assessing domestic and family violence and mental health. Broader advantages and disadvantages of telehealth
Hinton *et al.* 2022[41]	DP	UK	SU, HCP	AN	Telephone and video calls	To characterise what quality remote antenatal care looks like from the perspectives of those who use, provide and organise it	Mixed methods	Service improvement, quality
Hinton *et al.* 2023[153]	DP	UK	SU, HCP	AN	Telephone and video calls	To explore the experiences and perspectives of pregnant women, antenatal HCPs, and system leaders to understand the impact of implementing remote antenatal care during COVID-19 and beyond	Qualitative	Access, equity, experiences, use of 'candidacy' to understand access to remote antenatal care

TABLE 26 Study characteristics: empirical papers (*continued*)

Reference	Pandemic timing	Geographical focus	Population	Stage of pregnancy	Tech modality	Study aim	Study design	Outcomes
Jeganathan *et al.* 2020[42]	DP	USA	SU, HCP	AN	Telephone and video calls	To describe patient and provider attitudes toward telehealth for the delivery of high-risk obstetrical care and to determine whether the implementation of a telehealth model improves patient adherence to scheduled appointments	Quantitative; cross-sectional	Attitudes and feasibility; reduction in no-show rates and cancellations
Karavadra *et al.* 2020[43]	DP	UK	SU	All	Not specified	To explore pregnant women's' perceptions of COVID-19 and their healthcare experiences. To obtain insight into any barriers to health care during this pandemic and any concerns women have about their pregnancy	Quantitative; cross-sectional	Attitudes and feasibility
Khalil. 2019[100]	PP	FRA	SU, HCP	AN	Remote monitoring (myDiabby app) and telephone calls	To understand, from patients' and HCPs' perspective, what drives the adoption and diffusion of myDiabby (telemonitoring platform) in healthcare centres where telemonitoring of women with gestational diabetes mellitus is not compensated	Qualitative	Satisfaction with care and understanding of factors that influence diffusion and adoption
Khosla *et al.* 2022[154]	DP	USA	SU	PN	Telephone calls	To investigate whether rapid switch to telehealth with audio-based visits during the COVID-19 pandemic decreased racial disparities in postpartum hypertension follow-up adherence	Quantitative; retrospective cohort study	Adherence to postpartumhypertension follow-up. Readmission rates
Klamroth-Marganska *et al.* 2021[155]	DP	SUI	HCP	*N*/A	Telephone and video calls	To identify the use of services and to appraise the experiences of HCPs regarding the provision of health care at a distance during lockdown. To understand facilitators and barriers for successful implementation of telehealth applications	Quantitative; cross-sectional	Usage, satisfaction, concerns, support needs

continued

TABLE 26 Study characteristics: empirical papers (*continued*)

Reference	Pandemic timing	Geographical focus	Population	Stage of pregnancy	Tech modality	Study aim	Study design	Outcomes
Kluwgant *et al.* 2022[156]	DP	AUS	SU	AN; PN	Not specified	To understand the positive aspects of the changes to antenatal and childbirth care from COVID-19 from the perspectives of both pregnant women and midwives	Quantitative; cross-sectional	Positive impacts, care-related factors and contextual factors
Kozica-Olenski *et al.* 2022[157]	DP	AUS	SU, HCP	AN	Telephone and video calls	To explore the experiences and acceptability of telehealth for general maternity care and in diabetes pregnancy care during the COVID-19 pandemic, from the perspectives of pregnant women and their clinicians	Qualitative	Satisfaction, benefits, barriers, evaluation against the Nonadoption, Abandonment, Scale-Up, Spread and Sustainability (NASSS) framework
Krenitsky *et al.* 2020[158]	DP	USA	SU	AN; PN	Telephone and video calls (integrated with remote monitoring)	To describe the experience of an academic institution and its community hospital partner in establishing a virtual clinic for obstetric patients with mild or resolving acute COVID-19 infections, including the process, challenges, outcomes and lessons	Quantitative; observational	Clinical outcomes, rates of follow-up
Lapadula *et al.* 2021[159]	DP	USA	SU, HCP	AN	Video calls (Zoom)	To evaluate patients' and neonatologists' satisfaction with virtual prenatal consultations and to compare satisfaction levels of patients receiving virtual consultation with those receiving in-person care	Quantitative; cross-sectional	Satisfaction
Leighton *et al.* 2019[160]	PP	USA	SU	AN; PN	Video calls (supported by tele-ultrasound)	To compare maternal and child health outcomes between telemedicine care and traditional in-person care. To calculate the time and resources saved by using a telemedicine approach	Quantitative; observational	Satisfaction, patient and service-related cost-savings, clinical outcomes
Liu *et al.* 2021[161]	DP	USA	SU	AN	Not specified	To identify factors related to satisfaction with virtual visits during pregnancy in an effort to prioritise intervention targets for pregnant women during the COVID-19 pandemic	Quantitative; cross-sectional	Satisfaction and preferences

TABLE 26 Study characteristics: empirical papers (*continued*)

Reference	Pandemic timing	Geographical focus	Population	Stage of pregnancy	Tech modality	Study aim	Study design	Outcomes
Madden *et al.* 2020[162]	DP	USA	HCP	AN; PN	Video calls	To determine to what degree prenatal care was able to be transitioned to telehealth at prenatal practices associated with two affiliated hospitals in New York City, USA, during the COVID-19 pandemic and describe providers' experiences	Mixed methods	Satisfaction, barriers, facilitators
Mann *et al.* 2021[163]	DP	USA	SU	AN	Not specified	To increase knowledge and understanding of telehealth for reproductive genetic counselling services	Quantitative; observational	SU access to genetic counselling and services
Mehl *et al.* 2022[164]	DP	USA	SU	AN; PN	Video calls	To explore differences in demographics of expectant mothers evaluated pre- and post-telemedicine implementation, and the patient experience with telemedicine	Mixed methods	Distance and travel time, patient demographics
Moltrecht *et al.* 2022[165]	DP	UK	SU	AN; PN	Not specified	To explore young parents' experiences and perceptions of becoming and being parents during the COVID-19 pandemic	Qualitative	Experiences of care
Moltrecht *et al.* 2022[166]	DP	UK	HCP	AN; PN	Not specified (various modalities)	To explore HCP experiences of providing care to young parents during the COVID-19 pandemic	Qualitative	Pandemic-related changes to services
Morgan *et al.* 2022[167]	DP	USA	SU	AN	Telephone and video calls	To evaluate patient experience with a prenatal telemedicine visit and identify barriers to accessing telemedicine among rural pregnant people in New England, USA, during COVID-19	Quantitative; cross-sectional	Satisfaction
Nelson and Holschuh. 2021[168]	PP	USA	SU, HCP	AN	Not specified	To evaluate a new hybrid antenatal model of care in which some in-person visits were replaced by teleconsults	Quantitative; cross-sectional	Satisfaction
Oelmeier *et al.* 2022[169]	DP	GER	SU, HCP	AN; PN	Video calls	To evaluate the technical feasibility and patient satisfaction with video consultations in a tertiary centre for obstetric care	Quantitative; cross-sectional	Satisfaction, acceptability

continued

TABLE 26 Study characteristics: empirical papers (*continued*)

Reference	Pandemic timing	Geographical focus	Population	Stage of pregnancy	Tech modality	Study aim	Study design	Outcomes
Osarhiemen *et al.* 2022[170]	DP	USA	SU	AN; PN	Unclear	To define vulnerable obstetrical populations that were more likely to miss scheduled visits before the COVID-19 pandemic and to quantify the impact of telehealth on the odds of no-shows in vulnerable obstetrical populations	Quantitative; observational	No-show rate, access to care
Palmer *et al.* 2021[37]	DP	AUS	SU	AN	Video calls (95%) and telephone calls (5%)	To assess the impact of telehealth integration into antenatal care across low-risk and high-risk care models	Quantitative; interrupted time series analysis	Safety, efficacy, clinical outcomes
Peahl *et al.* 2021[172]	DP	USA	SU, HCP	AN	Telephone and video calls	To evaluate initial adoption and patient and provider care experience of a hybrid (integrated antenatal care model)	Quantitative service evaluation; observational	Adoption, adherence, satisfaction
Pflugeisen *et al.* 2016[27]	PP	USA	SU	AN; PN	Video calls (and digital BP machine and fetal Doppler monitor)	To evaluate a new hybrid model of pre- and post-natal care in which women are offered a choice of in-person consultations or a hybrid programme with some video consultations	Quasi-experimental	Safety, clinical outcomes, health service outcomes, hospital admissions, emergency department attendance rates
Pflugeisen and Mou. 2017[28]	PP	USA	SU	AN; PN	Video calls (and digital BP machine and fetal Doppler monitor)	To compare the satisfaction of obstetric patients who received one-third of their antenatal visits in videoconference compared to those who received 12–14 face-to-face visits in clinic with their physician/midwife	Quasi-experimental	Satisfaction
Quinn *et al.* 2021[173]	DP	UK	SU, HCP, ADMIN,	AN	Telephone calls	To evaluate patient and HCP satisfaction, preferences, and experiences of a virtual antenatal clinic during the COVID-19 pandemic from a tertiary obstetric hospital	Quantitative; cross-sectional; service evaluation	Satisfaction

TABLE 26 Study characteristics: empirical papers (*continued*)

Reference	Pandemic timing	Geographical focus	Population	Stage of pregnancy	Tech modality	Study aim	Study design	Outcomes
Rasekaba *et al.* 2021[174]	PP	AUS	SU, HCP, ADMIN,	AN	Not specified	To identify the profiles of women accessing care for gestational diabetes mellitus in a large regional hospital with a rural catchment and the views of women, clinicians and IT staff on the acceptability and feasibility of telehealth in this context	Mixed methods	Feasibility, satisfaction, burden of treatment
Rayment-Jones *et al.* 2023[175]	PP	UK	SU	AN	Telephone call, text message or free technology (freephone number, WhatsApp, etc.)	To evaluate how women access and engage with different models of maternity care, whether specialist models improve access and engagement for women with social risk factors, and if so, how?	Quantitative; observational (with mixed methods)	Access, engagement, equity
Rayment-Jones *et al.* 2022[176]	PP	UK	SU	AN	Telephone call, text message or free technology (freephone number, WhatsApp, etc.)	To evaluate two specialist models of care that provide continuity to women with social risk factors and identify mechanisms that reduce or exacerbate health inequalities	Qualitative	Service evaluation, access, engagement, equity
Reid *et al.* 2021[116]	DP	USA	OB	AN; PN	Telephone and video calls	To assess the rapid implementation of obstetric telemedicine during the COVID-19 pandemic	Mixed methods	Feasibility, satisfaction
Rousseau *et al.* 2022.[177]	DP	FRA	MW	*n*/a	Telephone and video calls	To measure and understand the determinants of independent midwives' implementation of teleconsultations and their intention to continue these in the future	Mixed methods	Implementation of telehealth, intention to continue telehealth, and explanation of these two variables
Saad *et al.* 2021.[117]	DP	CAN	SU	PN	Video calls	To understand the perspectives of new mothers using virtual visits. To understand the barriers and facilitators	Qualitative	Access, satisfaction, financial benefits

continued

TABLE 26 Study characteristics: empirical papers (*continued*)

Reference	Pandemic timing	Geographical focus	Population	Stage of pregnancy	Tech modality	Study aim	Study design	Outcomes
Sanders and Blaylock. 2021[178]	DP	UK	SU	AN; PN	Telephone and video calls	To understand the impact of COVID-19 public health messaging and pandemic-related service changes on users of maternity care in the UK during the pandemic	Mixed methods	Messaging, access, satisfaction
Sarre *et al.* 2021[179]	DP	UK	SU	AN	Telephone and video calls	To explore patients' experience of antenatal diabetic maternity services during the current COVID-19 pandemic	Mixed methods	Satisfaction
Shashikumar *et al.* 2022[180]	DP	NZL	SU	AN	Telephone calls	To determine satisfaction of pregnant people with teleclinics for diabetes in pregnancy; compare clinical outcomes and attendance for those receiving care through teleclinics vs. standard care	Quantitative; cross-sectional	Satisfaction and future use of telehealth, clinical outcomes, number of appointments
Shaw *et al.* 2018[181]	PP	UK	SU	AN	Video calls	To define good practice and inform digital technology implementation in relation to remote consultations via Skype and similar technologies	Mixed methods	Satisfaction, efficiency, best practice
Silverio *et al.* 2021[182]	DP	UK	SU	AN; PN	Telephone and video calls	To explore women's experiences of maternity service reconfiguration during the first wave of the COVID-19 pandemic	Qualitative	Women's experiences, satisfaction
Smith *et al.* 2020[183]	DP	UK	SU	AN; PN	Telephone and video calls	To understand the impact of the changes that were introduced in the first period of lockdown and local restrictions (March 2020–August 2020) on expectant and new parents and families	Mixed methods	Satisfaction
Smith *et al.* 2021[184]	PP	UK	SU	AN	Video calls	To report the successful introduction of a fetal ultrasound telemedicine service linking a specialist fetal medicine centre and a remote obstetric unit	Mixed methods	Satisfaction, clinical, time/cost-savings for women

TABLE 26 Study characteristics: empirical papers (*continued*)

Reference	Pandemic timing	Geographical focus	Population	Stage of pregnancy	Tech modality	Study aim	Study design	Outcomes
Spiby *et al.* 2019[119]	PP	UK/USA	MW	IP	Video calls	To explore midwives' views on the potential of video calling as a method for assessing women in early labour	Qualitative	Midwives views
Stacey *et al.* 2021[185]	DP	UK	SU	AN; PN	Telephone and video calls	To explore service users' and their partners' experiences of maternity services in the North of England during the COVID-19 pandemic	Mixed methods	Experiences of care during COVID-19
Sullivan *et al.* 2021[186]	DP	USA	SU	AN	Telephone and video calls	To determine acceptability of virtual prenatal care and preferences for future pregnancies among our patient population	Quantitative; cross-sectional	SU acceptability and preferences of virtual prenatal care
Sung *et al.* 2021[187]	DP	USA	SU	AN; PN	Unclear	To evaluate the effects of the High-Risk Pregnancy Program (using telemedicine) at the University of Arkansas, USA, on health services utilisation and medical expenditures among pregnant women with pre-existing diabetes and their newborns	Quantitative; observational	Admissions, insulin usage, cost/expenditure, clinical outcomes, number of visits
Talmont *et al.* 2022[188]	DP	USA	RN	AN; PN	Telephone and video calls	To assess telehealth readiness among perinatal nurses in New Jersey, USA	Quantitative; cross-sectional	Telehealth readiness, usage, and acceptability
Tavener *et al.* 2022.[39]	DP	UK	SU, OB, MW	AN	Telephone and video calls	To introduce telephone consultations to reduce need to attend the clinic and to reduce waiting times for those women needing to be seen face to face	Quality Improvement Initiative	Waiting times in clinic; patient and staff satisfaction
Theiler *et al.* 2021.[29]	PP	USA	SU	AN	Multiple technologies, including telephone calls, video calls, and remote monitoring	To explore the cost implications of telemedicine-enhanced programmes added to prenatal care packages	RCT	Appointment time; cost

continued

TABLE 26 Study characteristics: empirical papers (*continued*)

Reference	Pandemic timing	Geographical focus	Population	Stage of pregnancy	Tech modality	Study aim	Study design	Outcomes
Tozour *et al.* 2021[189]	DP	USA	SU	Unclear	Telephone and video calls	To evaluate both patient and provider satisfaction with maternal-fetal medicine services through telemedicine and to identify the factors that drive the patient desire for future obstetrical telemedicine	Quantitative; cross-sectional	Satisfaction
van den Heuvel *et al.* 2020[24]	PP	NLD	SU	AN	Remote monitoring and telephone calls	To explore the usability and acceptability of telemonitoring and gain insight into the experiences and preferences of high-risk pregnant women concerning telemonitoring, opposed to women who were hospitalised in pregnancy	Qualitative	Feasibility, usability, acceptability, experiences, preferences
Zulifqar. 2021[190]	DP	USA	HCP	AN	Telephone and video calls	To understand provider satisfaction with providing prenatal care in various formats	Quantitative; cross-sectional	Provider satisfaction

TABLE 27 Study characteristics: reviews

Reference	Geographical focus	Stage of pathway	Tech modality	Study aim	Review methodology	Number of studies included	Range of studies included
Almuslim *et al.* 2022[191]	Not stated (appears global)	AN; PN	Not stated	To determine how healthcare organisations are responding to the COVID-19 pandemic by incorporating telehealth visits into their protocols for obstetric care, what services were converted to telehealth, and its benefits and barriers	Scoping review	15 clinical practice protocols; 10 studies	All 2020
Bailey *et al.* 2018[20]	Global (all USA or UK)	T	Telephone calls	To identify and determine the nature and degree of literature on midwives' practice of telephone triage to inform future educational strategies and practice, and to identify gaps in the literature to guide future research	Scoping review	11	1999–2014
Cantor *et al.* 2022[35]	High-income countries	AN; PN	Multiple modalities including telephone calls, video calls and apps	To conduct a rapid review of the effectiveness and harms of telehealth strategies for maternal health care given the recent expansion of telehealth from the COVID-19 pandemic; produce an evidence map	Rapid systematic review with narrative summary	42 studies (45 publications)	2015–22

TABLE 27 Study characteristics: reviews (*continued*)

Reference	Geographical focus	Stage of pathway	Tech modality	Study aim	Review methodology	Number of studies included	Range of studies included
Chua *et al.* 2022[19]	High-income countries	PN	Video calls	To consolidate and synthesise findings on the available evidence of tele-lactation interventions on breastfeeding outcomes, uptake of interventions, and recommendations for future lactation interventions	Mixed-studies systematic review	13	2007–21
Fernandez Turienzo *et al.* 2021[192]	High-income countries (all AUS, UK, USA)	AN	Telephone calls	To uncover theories of change by which we can postulate how and why continuity of midwifery care models might affect preterm birth	Realist review	11	1996–2017
Flaherty *et al.* 2022[44]	Global	AN; PN	Not stated	To gain insight and understanding of the experience of maternity care during COVID-19, from the perspectives of women and maternity care providers	Qualitative systematic review using thematic synthesis	48 studies (50 papers)	2020–1
Friedemann Smith *et al.* 2022[193]	Global	N/A	Telephone calls	To produce a programme theory of safety-netting, that is, advice and support provided to patients when diagnosis or prognosis is uncertain, in primary care	Realist review	95	1996–2021
Ghimire *et al.* 2023[194]	High-income countries	AN	Telephone and video calls	To assess the practical implications of virtual prenatal care and identify the needs and experiences associated with it	Systematic review (mixed methods) using integrative analysis	23	2011–21
Konnyu *et al.* 2023[36]	High-income countries	AN	Telephone and video calls	To systematically review patient, partner or family, and clinician perspectives, preferences, and experiences related to: (i) prenatal care visit schedules; and (ii) televisits for routine prenatal care	Qualitative systematic review using framework analysis approach	9 (only 5 of which looked at telehealth)	1995–2022
Society for Maternal-Fetal Medicine. 2022[38]	Not stated	Any	Multiply modalities including telephone and video calls	To summarise the literature regarding the safety and quality of telemedicine for pregnancy-related services, including prenatal care, postpartum care, diabetes mellitus management, medical abortion, lactation support, hypertension management, genetic counselling, ultrasound examination, contraception, and mental health	Narrative review	Not stated	Not stated
Wu *et al.* 2021[12]	High-income countries	AN	Telephone and video calls	To gain a deeper understanding of (1) how virtual visits have been integrated with in-person visits during routine prenatal care and (2) how patients and healthcare providers have experienced combined virtual and in-person visits	Systematic review (integrative approach)	13	2013–20

TABLE 28 Study characteristics: reports

Reference	Geographical focus	Report aim	Methodology	Reporting period
Healthcare Safety Investigation Branch. 2021[51]	England	To inform understanding about the range of factors that may have contributed to the increased referral rate to Healthcare Safety Investigation Branch (HSIB) of incidences of intrapartum stillbirth; promote and support learning discussions within organisations; influence the development of systems and processes to optimise patient safety; identify potential safety risks that merit further HSIB investigation	Review of 37 reports concerning cares of intrapartum still birth that occurred during the time period	1 April 2020–30 June 2020
Healthcare Safety Investigation Branch. 2021[50]	England	To investigate maternal deaths during the first peak of the COVID-19 pandemic; inform understanding about the range of factors that contributed to harm at a local, regional, and national level; support learning discussions within organisations; influence the development of systems and processes to optimise patient safety; and identify potential safety risks that merit further HSIB investigation	Review of 19 maternal deaths that happened in England during the time period (out of 20)	1 March 2020–31 May 2020
Healthcare Safety Investigation Branch. 2023[195]	England	This national learning report analyses themes from HSIB's maternity investigation programme in relation to the risk assessment of pregnant women/people, with the aim of identifying key learnings about risk assessment	Thematic review of 208 reports of maternity investigations that had made a total of 271 findings and recommendations to NHS Trusts about risk assessment across the entire maternity pathway, including the antenatal and intrapartum periods	April 2019–January 2022
Knight *et al.* 2021[52]	UK	To respond to the second wave of COVID-19 in the UK which brought further challenges to maternity services and a higher burden of infection, together with new variants of concern. The aim was to ensure any new messages for care and services were identified in a timely manner to implement rapid change	The care of 17 women was assessed by 5–7 multidisciplinary review experts	June 2020–March 2021
Knight *et al.* 2022[53]	UK (some data included from Ireland)	Confidential enquiry into maternal deaths and morbidity for women who died during or up to one year after pregnancy (and focus on morbidity in relation to diabetic ketoacidosis). Focus on women who died from cardiovascular causes, hypertensive disorders, early pregnancy disorders and accidents, and mental-health-related causes	Epidemiological surveillance information for 536 women who died and 61 women who suffered with diabetic ketoacidosis. For each death, care was examined by 10–15 multidisciplinary review experts and assessed against current guidelines and standards	2018–2020

Appendix 7 Evidence underpinning the programme theories

A key to abbreviations used in the programme theory evidence tables is found in *Table 29*.

Details for each of the five programme theory domains are presented in *Tables 30–34*.

TABLE 29 Abbreviations key: programme theory tables

Key for programme theory tables
Participant type:
HCP = Healthcare professionals, MW = Midwives, RN = Registered nurses, SU = Service users
Country:
AUS = Australia, CAN = Canada, IT = Italy, NLD = Netherlands, SUI = Switzerland, UK = United Kingdom, USA = United States of America

TABLE 30 Programme theory domain 1: infrastructure and resources

Programme theories: infrastructure and resources	References	Key contexts	Examples of supporting data	Additional insights from stakeholders
1.1. Developing infrastructure *If organisations take adequate time to provide a digital infrastructure (including reliable equipment, software, internet), developed with staff input to make it user-friendly [**C**], healthcare providers will feel confident [**M**] that digital consultations [I] are a tool that can 'fit' into existing work practices [**C**]. Hence, staff will feel motivated [**M**] to embed it into their practice [O]*	*n* = 34 19,29,36,38,39,41,51,90,116,119,132–134,137,138,141,143,145,148,152,153,155,157,158,164,173,174,177,180,189–191,194,195	• The digital maturity of healthcare facilities and, in the UK, local NHS Trusts • HCPs working in the community or at home with poor internet connection, limited or outdated devices, with which to conduct digital consultations • IT support • National-level digital infrastructure for example superfast broadband mobile phone network coverage	• 'I think it could have been good, if this organization was invested in the equipment… It took me four months to get a computer that was a laptop, and I still haven't been able to crack how to get those two apps on my desktop. so I still cannot work remotely'. [152] HCP, AUS • 'I think that our facility underestimated the time commitment that putting a program like this [telehealth] in place requires'. [137] HCP, USA • 'There's constantly a push for things to be digital; and there are huge advantages of that, but, until you make internet free for everyone and give everyone a smart phone, then, you know, the people that really need us are the ones that get left behind'.[41] HCP, UK • 'WhatsApp would be very accessible because every woman has WhatsApp on their phone. Everybody knows how to use it'.[133] MW, UK/IT	• UK staff often use mainstream software and applications to facilitate women's engagement and access to DC-CON, even though these technologies are not approved by the NHS • Poor resourcing from employers cause many HCPs to rely on their personal devices and internet allowances to conduct DC-CONs • The poor quality and inaccessibility of NHS DC-CON software, which often lacks interoperability with other systems (e.g. medical records), makes digital consultations challenging

continued

TABLE 30 Programme theory domain 1: infrastructure and resources (*continued*)

Programme theories: infrastructure and resources	References	Key contexts	Examples of supporting data	Additional insights from stakeholders
1.2. Establishing clinical systems and pathways *If digital consultations [**I**] are supported by administrative systems and integrated electronic patient record systems that can operate across contexts [**C**], it will improve the ability of staff to access information, work in multi-disciplinary teams and co-ordinate care across the pathway [**M**]. When systems work well, digital consultations are perceived by staff to improve existing workflows – increasing convenience, efficiency, and reducing workload [**O**] – for organisations, staff and service users – as well as maintaining safety [**O**]*	*n* = 33 12,25,29,39,41,50,51,100,116,119,128,131,132,134,137,148,150,152,153,157,160,162,173,174,176,179–181,183,190,191,195	• HCPs offsite in the community or at-home who need access to medical systems and records • Multidisciplinary teams with HCPs working in different locations but who need to make joint decisions about care plans • Women trying to contact and access maternity care services	• 'You have a lot more leg work to make the two (Attend Anywhere and hospital appointment system) combine…well, they don't. I've got this form […] to fill in and then save it in their file and retrieve it when I need it […] that's a bit of a hassle'.[41] HCP, UK • '[…] in the video clinics they will have a regular appointment with the diabetes specialist nurse and the diabetes specialist dietician, and […] with the consultant as well. So, we can all still have that joint decision-making but just on a video, virtual clinic rather than a face-to-face clinic'.[41] HCP, UK • 'The fact that the link is there you can talk directly to [specialists] about other service users. Just little worries… that you've no idea what it is; it's worth saying can you just cast your eye over these pictures?' [132] HCP, UK • '[T]hey [administrative teams] did the heavy lifting that made this [telehealth delivery] possible'.[157] HCP, AUS	• The HP-SG considered access to women's current and previous records, referrals, and notes (including safeguarding concerns) as key to delivering safe digital care

TABLE 30 Programme theory domain 1: infrastructure and resources (*continued*)

Programme theories: infrastructure and resources	References	Key contexts	Examples of supporting data	Additional insights from stakeholders
1.3. Appropriate staffing models and conditions *If staffing models for digital consultations include dedicated teams in private spaces with the capacity to provide continuity of carer [**C**], this type of working environment can enhance staff and women's sense of privacy and comfort [**M**] facilitating the communication of concerns and treatment [**O**]. This helps women and staff feel confident and motivated [**M**] to use digital consultations (and sustain their use) [**O**]*	*n* = 15 [12,20,29,41,51,119,130,132–134,157,158,162,174,195]	• All HCPs providing DC-CONs • Management/senior staff responsible for allocating staff to teams and providing appropriate workspaces • Staff currently providing digital care in silos, onsite or offsite (perhaps working from home) who lack communicative spaces	• 'The designated midwife should have a dedicated space so that she can fully focus on what she is doing'.[133] MW, UK/IT • 'We'd need a private space in the hospital, and what comes to my mind are those old- fashioned telephone booths, you know, [laughs] where you go in and you close the door'.[119] MW, UK/USA • 'I think there's less of the kind of corridor conversations that were really good with colleagues both in terms of advancing clinical knowledge, working out management plans for patients, but also just making sure that your colleagues are okay'.[157] HCP, AUS • [Some] maternity providers were found to not have dedicated telephone triage lines. This meant that calls were taken in a variety of locations by differing HCPs. In some cases, calls were answered by non-registered staff. This led to variable information and advice being given.[195] UK	• In practice, it is often difficult for staff to find private spaces at work and that women felt uncomfortable if, for example, they saw other HCPs in the background of a video call • One driver for implementing DC-CON in UK maternity care was to help services cope with reduced workforces, or similarly, to help services retain staff by offering them more flexible working patterns

TABLE 31 Programme theory domain 2: training and support for staff

Programme theories: training and support for staff	References	Key contexts	Examples of supporting data	Additional insights from stakeholders
2.1. Providing staff training and ongoing support *If* NHS *and professional organisations provide a supportive and enabling workplace culture for digital clinical consultations (including sufficient training, protected time for training, appropriate workspaces and ongoing access to clinical, technical and administrative support) [**C**], staff will gain relevant knowledge/skills [**M**] and will feel more motivated, supported and confident [**M**], leading to appropriate and sustained uptake of digital consultations [**O**]*	*n* = 23 20,36,38,51,90,116,119,130,132–134,137,138,141,143,148,155,157,158,162,173,193,195	• Staff who are unfamiliar with digital technology • Staff who are new to providing maternity care digitally or who are unfamiliar with the systems, software and procedures used to deliver DC-CON locally	• 'Comprehensive training on empathic communication and on all the abilities necessary to help the woman gain confidence already at your first contact'. [133] MW, UK/IT • The majority of staff surveyed were in support of training for virtual clinics, which is not routinely part of the curriculum, and we anticipate this would further improve efficiency, satisfaction, and ease of adaptation to virtual clinics.[173] UK • Participants stated that ongoing training is a facilitating factor in continuous stimulation of daily use. In addition, nurses who work as triage staff need to be well supported in their new task. In addition to performing obstetric triage, appropriate support services, such as administration and equipment, must be facilitated.[141] NLD • Telephone triage services should be operated by appropriately trained and competent clinicians who are skilled in the specific needs required for effective telephone triage.[195] UK	• Training and support were presented as an essential feature that influenced a HCP's cognitive participation and collective action in implementing DC-CON • It was also acknowledged that staff already have a lot of training to complete and ideally need protected time to complete additional comprehensive DC-CON training

TABLE 31 Programme theory domain 2: training and support for staff (*continued*)

Programme theories: training and support for staff	References	Key contexts	Examples of supporting data	Additional insights from stakeholders
2.2. Ensuring staff motivation and 'buy-in' *If staff are informed about the potential benefits of DC-CON [**C**], to both HCPs and women, it can promote staff 'buy-in'. In particular, if staff perceive [**M**] that women accept, are benefitting from, and are satisfied [**O**] with, digital consultations they will be motivated [**M**] to use it (buy into and sustain its use) [**O**] and gain job satisfaction from using it [**O**]*	*n* = 21 12,36,41,116,119, 131–133,137,147,149,155,157, 162,165,173,177, 188,189,191,194	• Staff who do not understand why DC-CON is being offered and/or the potential benefits for women and staff • Older staff who may be unfamiliar and/or unmotivated to use DC-CON	• 'I don't yet have the evidence I would like about the impact on women, about the acceptability from women, about whether women prefer this style'.[41] HCP, UK • '[…] there are a number of midwives that are approaching retirement age that would say they are not very digitally savvy, so it's been difficult for them. And they have probably used the telephone more than video appointments. So, that has certainly been a problem for people'.[41] HCP, UK • 'I love connecting with these women [via telephone] and providing them the resources they need. They are truly appreciative of all we are able to do for them'.[137] HCP, USA • 'Saving time', 'Saving travel time', 'The appointment is done effciently', 'Working more effciently'.[149] HCPs, SUI	• Knowing women's thoughts on DC-CON helped staff make sense of why they were offering DC-CON and its coherence with the wider maternity service • While DC-CON can reduce workloads in some settings, by enabling staff to focus on those most in need, it can increase workloads due to the increased flexibility, 'unseen' administration and pressure to fill the day with appointments and meetings • A shared commitment to DC-CON from staff at all levels was considered necessary for sustained use • 'Digital champions' were suggested to support and motivate staff with DC-CON • DC-CONs can benefit staff with health conditions that make in-person appointments difficult and/or risky

continued

TABLE 31 Programme theory domain 2: training and support for staff (*continued*)

Programme theories: training and support for staff	References	Key contexts	Examples of supporting data	Additional insights from stakeholders
2.3. Providing clinical protocols on consultation mode *If digital consultations are guided by clear clinical protocols [**C**], staff can feel supported [**M**] in deciding what type of consultation is appropriate to meet women's varied needs and preferences. When digital consultations are further enhanced with the use of at-home monitoring [**C**], it can provide additional reassurance to professionals and women [**M**] of the quality and safety of DC-CON [**O**]. Combined, this can increase staff ability, acceptance and confidence in monitoring and treating women at a distance [**M**], leading to optimal clinical/safety outcomes [**O**]*	*n* = 23 20,38,39,41,51,116,119,128,133,143,146,148,152,153,157,158,162,163,172,174,189,193,195	• Staff who are new or unfamiliar with digital consultations or local procedures • Staff supporting women with complex pregnancies who may be receiving DC-CON and/or remote monitoring • Staff who are worried about safety and safeguarding via DC-CON	• 'If you're on a videoconference with somebody and you potentially see something in the background that is either, you're not comfortable with, or is potentially illegal then how do you respond to that new information […] what do you do with it?'[119] MW, UK/USA. • Home devices were seen as important for patient and provider comfort—92.2% of patients […] 95.5% of providers […] believed that a home blood pressure cuff was important for virtual prenatal visits, and 84.8% of patients […] 71.2% of providers […] believed that a home fetal Doppler was important.[172] USA • Protocols should be developed for virtual care that seek to reduce variation between providers and specialties and that outline standards by which symptoms and conditions can be managed virtually […] Clinicians should have access to real-time patient data; therefore, remote patient monitoring data, such as blood pressure and glucose, should be reliably collected into the electronic health record.[38] Global • 'Triage proformas may be used to conduct a structured assessment […] over the telephone. These may contain parameters that specify what actions should be taken and the urgency of those actions. Some systems use colour-coded visual cues to aid the assessment. These may be electronic, paper-based or a combination'. [195] UK	• Clear evidence-based protocols and guidelines are essential for safe use of DC-CON

TABLE 32 Programme theory domain 3: personalisation and flexibility for women

Programme theories: personalisation and flexibility for women	References	Key contexts	Examples of supporting data	Additional insights from stakeholders
3.1. Supporting choice and personalisation of care *If digital consultations are clearly presented to women as a choice within a hybrid model of care, [**C**] then women will be reassured [**M**] about the option to still have face-to-face appointments when necessary. Furthermore, if the use of digital consultations [**I**] is personalised [**M**] to women's needs, preferences, and life circumstances [**C**], women can feel a sense of safety and empowerment [**M**]. This can help digital consultations to be accepted as a valuable addition to traditional maternity care [**O**]*	*n* = 36 27,41,43,90,128,129,134,135,138,139,144,145,150,151,156,157,161,164,167,172–174,178–180,182,183,185,186,189	• All women require support with choice and personalisation, however those who are first-time mothers, have mental health conditions, come from marginalised backgrounds, had previously complicated pregnancies/births, are high risk, face language barriers or have low levels of health literacy may be less suitable for DC-CON and need extra support • Women's willingness to use DC-CON may depend on whether they have a straightforward or complicated pregnancy, feel uncomfortable on video or prefer telephone calls, and whether they find DC-CON easy to use • A few studies identified that those most receptive to DC-CON were often white, young, married and multiparous due to health disparities, language and access barriers, as well as multiparous women potentially having fewer concerns to discuss or greater inconvenience attending face-to-face appointments	• '[T]he Asian women… told us they didn't need our support during lockdown. And the only reason […] was just because they didn't have space to talk […] …They wanted to come back when we do face to face again, but they didn't want support via telephone, video or any online activity'.[41] MW, UK • Some identified their experiences of care as having an impact on their emotional and psychological well-being […]'I have been suffering from postnatal depression and have felt that phone calls have simply not been sufficient to support me during this time'.[183] SU, UK • 'I feel nervous about lack of face-to-face appointments. I have been having at home visits from an independent Midwife. Our first son was stillborn at 22 weeks, so I feel I need face to face appointments to check the baby and me'. [129] SU, UK • 'I think there could be benefits for the right people who are comfortable enough and confident enough and asking the right questions over, over video and things like that'. [138] SU, USA	• DC-CONs should be presented as a choice for women, never mandatory, and based on an assessment of individual women's needs, preferences and circumstances • Women's consultation preferences and digital resources should be discussed and recorded early on in the pregnancy, including any adjustments they might need to make the most of DC-CONs • At present, in the NHS, some antenatal 'booking' appointments are conducted via telephone and women are not routinely asked about their consultation mode preferences or digital capacity. If this appointment is in-person, the HCP can better assess preferences, suitability and needs for DC-CONs • Some women might actively choose DC-CON over in-person care, because they have mental health conditions that make it difficult to leave the house, feel stigmatised (e.g. around smoking), or are uncomfortable in clinical settings. For some women, DC-CON may improve engagement

continued

TABLE 32 Programme theory domain 3: personalisation and flexibility for women (*continued*)

Programme theories: personalisation and flexibility for women	References	Key contexts	Examples of supporting data	Additional insights from stakeholders
3.2. Managing the burden of care *If digital consultations are easy to use and fit flexibly [**M**] with women's preferences, life circumstances, and clinical needs [**C**], it gives them more control over the time, money, and effort they have to engage with care [**M**]. This can be a relief and for some women will make it less burdensome [**M**] for them to engage with services [**O**]. It can also make it easier [**M**] for women to access services/specialists in a wider geographical area, potentially improving clinical outcomes [**O**]*	*n* = 43 12,19,24,25,28,36,38,39,41,44,100,117, 119,132,139,140,144,145,151–153, 156,157,160,162,164,167,169, 172–174,179,180,183–191,194	• Women in remote/ rural locations without local access to care – particularly specialist care – who would otherwise incur time and financial costs to be seen in-person, or potentially forgo care all together • Women with co-morbidities that made travelling difficult, women who needed frequent monitoring (e.g. for Gestational Diabetes Mellitus), women juggling other responsibilities (e.g. childcare or work) and potentially women in early labour who could be supported remotely to stay at home longer	• 'It's [remote care] flexible, so if I'm, like, feeling tired or unwell, I can just stay at home and still get the same level of care'. [41] SU, UK • 'The expertise is there because the doctor's there on screen. You can ask a question without having to think well is he going to be able to answer this, is he not going to be able to answer it. You know the right professional's there'. [132] SU, UK • Some clinicians reported that telehealth utilisation reduced the number of women who failed to attend appointments and improved their ability to engage with 'harder to reach' women who 'often fall through the cracks'. Their rationale was that telehealth is more convenient and minimises barriers to attending appointments such as effort, costs and time.[157] AUS • 'I found it much easier to just be able to be at home, not have to worry about getting the kids ready and long care rides or have to worry about findings someone to watch them. They were very good if I needed to take care of the baby for a second or breastfeed'. [117] SU, CAN	• The potential for DC-CON to reduce 'did not attend' rates was considered especially important for vulnerable women with complex social risk factors

TABLE 33 Programme theory domain 4: women's access and inclusion

Programme theories: women's access and inclusion	References	Key contexts	Examples of supporting data	Additional insights from stakeholders
4.1. Supporting women's knowledge and navigation of care *When comprehensive information on digital consultations is provided to women in an easy to understand, accessible format and in a variety of languages, it can facilitate health and digital literacy [**C**]. If women are made aware of the different types of consultations available to them when they first engage with the maternity services [**C**], they can be empowered [**M**] to make informed choices about the mode of care they receive [**M**]. This will improve the potential for personalisation [**M**] of care delivery, enable access [**O**], and help women to play an active role in their maternity care [**O**]*	*n* = 31 12,36,39,41,42,90,119,132–134,138,139,142,148,150,153,155,157,162,164,166,170,172,178,179,183,188,191,194,195	• Women who are unaware of DC-CON as a potential option in their maternity care, and the advantages/disadvantages of DC-CON compared to in-person care • Women who have not used DC-CON before or who are anxious about using DC-CON. In particular, women with mental health problems, lacking digital literacy, facing communication barriers or a shy/inhibited disposition • Women unfamiliar with NHS maternity care and/or low health literacy in general	• 'That these women are informed thoroughly about the service [early labour calls] […] there should be a privacy consent form, information on how the service is managed, who makes the phone calls and from where. They have to be fully aware of what they are going to do'.[133] MW, UK/IT • 'If it [DC-CON] was a longer term thing where we were talking about bringing in remote care as part of standard maternity then that should be communicated to you right at the beginning as part of your package of care'. [41] HCP, UK • 'I mean I would think a dry run with your patient would be necessary… "let's practice this; I want you to go into another room and I want you to video me. You know, so that way you know it works". Every technology there's always hiccups'.[119] MW, UK/USA • 'I mean these days we Skype or Facetime, you know, within your personal life so why, why shouldn't it be used for like you know, something medical?'[132] SU, UK	• Since DC-CON is normalised in other areas of health care, such as primary care, some felt it made sense to offer DC-CON in maternity care too • Others noted that just because women use telephone and video calls in their personal life, it does not necessarily mean that they are comfortable having medical appointments this way • A personalised approach to DC-CON based on women's individual needs and preferences is key • When women are confused about who to call for help they might contact their GP surgery who then becomes the 'gatekeepers' to maternity care. However, stakeholders stressed that going through busy GP surgeries was often time-consuming and complicated, potentially delaying access to care

continued

TABLE 33 Programme theory domain 4: women's access and inclusion (*continued*)

Programme theories: women's access and inclusion	References	Key contexts	Examples of supporting data	Additional insights from stakeholders
4.2. Ensuring inclusion and equity *While there can be benefits to using digital clinical consultations [I], for women who face language or other communication barriers [C], digital clinical consultations [I] can present a challenge to the equitable access of care [O]. Experiencing communication barriers can create frustration or anxiety, a lack of motivation, or sense of entitlement [M] to engage with care [O]. This can lead to particular groups of women receiving less or inappropriate care relative to their needs [O], important issues being missed, and suboptimal clinical outcomes [O]*	*n* = 32 12,19,38,39,41,43,44,50,51,119,129,130,133,134,136,148,150,152,154,155,157,162–164,172,176,179,183,188,191,194,233	• Women for whom English is not their first language, have disabilities (including learning disabilities, hearing or visual impairments), or who are neurodiverse and may at times struggle to communicate • Healthcare professionals who care for the women above, and their access to resources to overcome barriers, for example, interpretation services	• 'Women that don't necessarily speak good English or limited English, it [video] would maybe be a little bit better for them as well. Because at least then they could physically see you and then maybe you could use hand gestures to kind of help'. [133] MW, UK/IT • 'I find it hard sometimes depending on the accent to follow through, so I felt like it was really…she was talking really fast, and maybe I could have said, like, for…ask for her to slow down a little bit. But, yeah, I think that the main barrier was actually getting a bit lost in translation, 'cause at the end of the call, for example, I didn't even realise the call was about to end (laugh) […] And then I realised I hadn't asked any of my questions'.[41] SU, UK • One woman was deaf and relied on lip reading. While she was engaged in the video consultation, she gave up halfway and became upset as the lag time made it impossible for her to lip read.[39] UK • It was evident that virtual consultations, either by video or telephone, meant that staff were not aware of the lack of understanding. An inability to speak English as a first language may be a contraindication to remote consultations and guidance reflects this […] stat[ing] that face to face treatment may be preferable when it is hard to ensure, by remote means, that people have all the information they want and need about treatment options.[52] UK	• Staff do not always know an interpreter is needed until the women arrives for her appointment, by which time it is often too late to arrange; highlighting the importance of effective administrative systems • Involving family members in interpretation may not be appropriate depending on the topic of conversation, especially safeguarding concerns • Real-time digital translation could be a useful back-up option when interpreters are not available • Even where a woman speaks an understandable level of English as a second language, DC-CON could create anxiety and worries about either not understanding the HCP or not being understood by the HCP; this could be especially troublesome if the staff member had a strong regional UK accent • Neurodiverse women could also experience anxiety and potentially a lack of engagement with care (e.g. not answering the phone) or reliance on partners/family to communicate on their behalf if the consultation modality was not suited to their communication needs

TABLE 33 Programme theory domain 4: women's access and inclusion (*continued*)

Programme theories: women's access and inclusion	References	Key contexts	Examples of supporting data	Additional insights from stakeholders
4.3. Considering access to digital resources *If women do not have access to digital devices, a reliable internet connection, or telephone signal [**C**], it may lead to feelings of disempowerment, frustration and loneliness [**M**] as women will struggle to engage with digital clinical consultations [**O**]. This is likely to disproportionately affect already vulnerable women living in poverty or unstable circumstances [**C**], exacerbating health inequalities through digital exclusion [**O**]*	*n* = 26 12,28,38,39,41,116,117,119,134,136,148,150,151,153,157,162,164–167,172,174,182,188,191,194	• Women of low socioeconomic status without consistent access to digital devices, WiFi, phone signal, credit/data, charging facilities and remote monitoring equipment (if necessary). • Women in remote/rural areas with poor connectively, those experiencing poverty (including digital poverty) and those in unstable housing such as migrants, refugees and asylum seekers	• 'I mean, the video calls are a bit of an issue, just because of the internet connection, and I think…I mean, I'm not 100 per cent sure but I…so I…I'm in a very rural area, I don't have broadband, I'm relying on my 4G hotspot, so that is a bit of a problem'.[41] SU, UK • 'There's constantly a push for things to be digital; and there are huge advantages of that, but, until you make internet free for everyone and give everyone a smart phone, then, you know, the people that really need us are the ones that get left behind'. [41] HCP, UK • 'My cell phone, it has limited data, so I'm not really able to video chat […] it'll start like freezing or coming on saying low data. So just not being able to have like the actual access to kind [of] do it and video chat. it's hard'.[150] SU, USA • Ninety-three survey respondents answered the survey question '[A]re there things that make telemedicine visits hard?' […] Of these, 39.8% cited poor internet or phone connectivity and 10.8% reported not having the right equipment.[167] USA	• For very vulnerable women, even accessing a phone, purchasing credit, and having a consistent phone number can be difficult, posing barriers to contact

TABLE 34 Programme theory domain 5: quality care through relationship-focused connections

Programme theories: quality care through relationship-focused connections	References	Key contexts	Examples of supporting data	Additional insights from stakeholders
5.1. Promoting safety and managing risk *Digital clinical consultations [I] provide staff with additional methods with which to communicate with women [C]. When HCPs are matching the mode of consultation to the reason for consultation [C], understanding [M] women's physical, psychological, or social circumstances and risks [C] can help staff to personalise care and manage uncertainty [M]. This can lead to equivalent clinical outcomes [O], and safety assurances [O]*	*n* = 51 12,20,27,35–39,41,44,51,90,116,119,129,130,133,134,136,138,146,148,150–153,155,157–159,162,164–166,168,169,172–174,178,182,183,188–191,193,194,233,234	• When there is a lack of physical examination and non-verbal communication in a consultation (such as via DC-CON), it can affect women and staff's confidence levels • DC-CON was perceived to suit low-risk women, multiparous women, those not requiring examination, and those living far from hospital. Those not suited included high-risk women, those facing communication barriers, those at risk of social isolation (including asylum seekers, refugees and young mothers) and those with mental health considerations, safeguarding concerns or other psychosocial issues • Women and staff considered that DC-CONs could be well suited to 'transactional' care where physical examination was not needed (e.g. form filling, test results, regular monitoring, review appointments) and less suited to discussion of sensitive issues • Telephone triage could play a vital role in promoting safety and managing risk so long as those answering the phone were appropriately qualified and experienced	• 'Video calls definitely have the advantage of letting you see the woman, how she moves, how she acts, where and who she is. There are a lot of visual elements we can use to make an assessment, whereas on the phone, you can only rely on the voice for clues: when the woman is quiet, there is a contraction but […] you can't see how her body is reacting'.[133] MW, UK/IT • 'More often than not their partner didn't come, and so it provided a safe space for women to talk about their issues at home. And enabled us to pick on subtleties in terms of any domestic abuse, any physical abuse; you know, you'd sometimes be able to see that physically on their body. So, you don't necessarily see that remotely'.[41] HCP, UK • 'It is hard to make contact on the telephone, you cannot communicate fully if you can't use body language as well. Also, the midwife cannot see you so cannot examine you properly'.[129] SU, UK • A total of 75% agreed that the lack of physical examination was not a problem. Thus, 67% of providers agreed that telemedicine visits are an adequate replacement to in-person visits and 83% agreed they would like telehealth to be an option for future obstetrical visits.[189] USA • […] recognising situations in which remote consultations are inadequate. This may be for several reasons including language difficulties, lack of access to appropriate technology, repeated presentation, clinical complexity or potentially severe/high risk conditions.[51] UK	• Some obstetrician stakeholders commented that they felt the clinical risk of missing something via DC-CON was probably not any more likely than in-person care • For women in difficult home situations, including domestic violence, in-person appointments were an important opportunity to create a safe, private space in which women could talk openly and seek help • For DC-CON a cautious approach should be taken centring on women's own preferences, comprehensive safety-netting and clear clinical guidance and protocols to make sure no-one falls through the cracks

TABLE 34 Programme theory domain 5: quality care through relationship-focused connections (*continued*)

Programme theories: quality care through relationship-focused connections	References	Key contexts	Examples of supporting data	Additional insights from stakeholders
5.2. Managing relationships and building rapport *If digital consultations are used in place of face-to-face care, it can affect the women-healthcare provider relationship [**C**]. Since video calls enable the conveyance of non-verbal cues [**M**], they can be more beneficial in relationship building than telephone calls [**O**]. If a relationship of trust has already been established and there is sufficient time for the consultation [**C**], then staff and women can communicate easily and openly [**M**], improving women's disclosure of sensitive information and feelings of reassurance [**M**]. For both routine and complex care via digital consultations, continuity of carer can lead to greater satisfaction for women and professionals and is perceived to support optimal clinical outcomes [**O**]*	*n* = 46 12,19,28,36,38,39,41,43,44,90,116,119,129,131–134,138,139,142,144–146,148,150–153,155,157,159,164,166,167,172–174,177,179,182,183,185,186,190,192,194	• Continuity of carer was considered particularly important because it was thought to be more difficult to assess women online and to build rapport remotely, particularly because of the more transactional, rather than therapeutic, nature of DC-CON • It could be particularly beneficial for women and providers to establish a relationship in-person before starting virtual care • Establishing a relationship between a women and HCP can be particularly important when delivering of bad news and emotionally supporting women via DC-CON	• 'If you're seeing the same midwife, even on a video call, it makes you feel even more reassured. […] I do think that implementing this with the continuity teams and see how that works with them, I think that would be good'. [133] MW, UK/IT • 'You know, midwifery is a science, but it is also an art, and it relies on our being together and picking up on people's communication skills, their … you know, their social situations, their body language, the relationships they have, you can't pick that up on a video'. [153] HCP, UK • '[If] I'd had a video call with a lady and then I saw her come into the door … I'd feel like I knew her already … and I'd already started to build up that relationship…'[119] MW, UK/USA • ' […] it might be challenging if there was an intimate something that we would need to converse with via Facetime […] But I think if you already had a relationship with the midwife you were working with, that level of comfortability and privacy would have hopefully already been there'.[90] SU, USA • 'I feel like maybe it's better in person because when you can see somebody's facial expression or how they react to a certain question or comment, that probably tells you more about the question you're asking than someone's actual answer'.[150] SU, USA	• It is more comfortable being seen by and showing a known HCP what was wrong online, highlighting how the sometimes-awkward nature of video calls could pose a barrier to women appearing for appointments (a core feature of candidacy) • Particularly vulnerable women, the midwife-women relationship could be a significant source of support, sometimes viewed by the women more like a friendship than a professional relationship • Stakeholders added that a DC-CON with an HCP who was engaged and made a connection with the women could be more beneficial than an in-person appointment where the professional seemed disengaged and was looking at their computer more than the women next to them

continued

TABLE 34 Programme theory domain 5: quality care through relationship-focused connections (*continued*)

Programme theories: quality care through relationship-focused connections	References	Key contexts	Examples of supporting data	Additional insights from stakeholders
5.3. Supporting women's empowerment and familial involvement *If women have the ability to use digital consultations [C], it can make it easier to facilitate women's active participation [M] in partnership with their healthcare provider, especially if remote monitoring is utilised [C]. The flexibility and convenience of digital consultations [C] can also help to include women's partners/families [M] in their care. This can empower, motivate, and give women a sense of control over their health and care, [M] improving access and enhancing engagement with services [O].*	*n* = 27 12,24,36,38,41,51,117,131,133,134,138,145, 149–151,157,160,165,166,168,172,179,182,184,188,191,194	• Women who need regular monitoring for example for GDM or high blood pressure, and are able to conduct this themselves at-home • Women who have the resources and are confident and comfortable using at-home monitoring equipment • Partners and family members whose involvement in the women's maternity care would benefit from the flexibility of DC-CON. This was particularly true during COVID-19 when restrictions meant that women may have to attend appointments or give birth alone	• 'We have that battle calls where the partner calls and we're like, "But we want to speak to the woman" and actually, the woman don't always want to speak to you, they've asked their partner to call on their behalf. So, it actually would make it a bit more family centred if you're having a video call with the woman and the partner'.[133] MW, UK/IT • 'She [HCP] said she'd send us home with Dopplers to listen to the baby's heart at home, which is like, "Woah. I'm supposed to sit there and try to find it?" […] It makes me nervous that the doctor won't be right there to do it for me'.[145] SU, USA • '… [the midwife] explained the use of the equipment and took us through all the steps of the entire process. For me it was really nice to speak to somebody on the phone every single day. In my experience they would call quickly after sending the CTG [cardiotocography]'. [24] SU, NLD • 'Telehealth in pregnancy can be tricky. We have to trust the patient to tell us exactly what is going on and trust in their BP [blood pressure] cuffs at home. Things can easily be missed in pregnancy with telehealth visits'.[188] RN, USA	• Despite the convenience of at-home monitoring, some women may still feel more reassured if this is done by a professional and therefore prefer to visit the maternity unit in-person

TABLE 34 Programme theory domain 5: quality care through relationship-focused connections (*continued*)

Programme theories: quality care through relationship-focused connections	References	Key contexts	Examples of supporting data	Additional insights from stakeholders
5.4. Offering connection and support *If digital consultations can provide additional and/or convenient opportunities for women to connect with services and staff [**C**], it can support women's sense of safety, reassurance, and empowerment [**M**]. These benefits may be enhanced by a pre-existing healthcare provider-woman relationship, good communication and sufficient time for the consultation [**C**]. This leads to increased self-efficacy and motivation [**M**], contributing to satisfaction, engagement and access [**O**]*	*n* = 18 24,39,41,51,90,117,119,131,133,134,139,142,144,157,176,179,180,183	• Women who might need out-of-hours care as DC-CON can offer staff more flexible working patterns and therefore increase access • For women who worry about burdening or bothering healthcare services, DC-CON can help them to feel more entitled to care – this can be particularly important for vulnerable women in difficult personal situations (Evans, 2017; Rayment-Jones, 2022; Baron, 2018) • Healthcare professionals delivering DC-CON who have expectations about the appropriate environment in which women should receive DC-CONs	• 'So we can be a lot more responsive to these women, by literally just picking up the phone and having that chat with them. You don't have the practical issues, is there a clinic room available, how long is it going to take her to come in, I haven't got a clinic slot for 3 weeks'.[41] MW, UK • ' [...] Whoever would answer the phone was reassuring, they were able to talk me through things ... if we didn't have the like phone number that we could call the first few weeks it would have been a lot worse, a lot more difficult. We would have ended up in A&E [accident and emergency] a lot more often than we did'.[176] SU, UK • 'As a mom, you have so many questions about is this normal [...] It's just nice to have that. It's a little less formal. You don't feel like you're taking up a lot of time. You don't have to book an appointment just to get one quick question answered'.[117] SU, CAN • Pre-admission telephone triage provides the gateway for women and pregnant people to raise concerns and allows healthcare staff to identify whether there is a need for a person to attend the maternity unit [...] The variability in how information is conveyed over the telephone is influenced by the style of communication. How the clinician receives the information is influenced by their knowledge of the subject in the context of the healthcare environment.[51]	• When women do not seem ready or focused on the DC-CON, HCPs worry about how engaged they are in the appointment, their ability to take in information and ask questions • Women could become frustrated if their HCP did not call at the expected time