

**Title page:**

**Title: Patient and professional experiences of virtual antenatal clinics during the COVID-19 pandemic in a UK tertiary obstetric hospital: a questionnaire study**

**Authors:**

LM Quinn<sup>1</sup>, O Olajide<sup>1</sup>, H Sayed<sup>1</sup>, M Green<sup>1</sup>, H Ansar<sup>1</sup>

**Affiliations:**

<sup>1</sup>Department of obstetrics, University Hospitals of Leicester, UK

**Corresponding author:** [lauren.quinn6@nhs.net](mailto:lauren.quinn6@nhs.net)

University Hospitals of Leicester, Leicester, UK

**Short-running title:**

**Patient and professional satisfaction with virtual clinics [58]**

**Abstract:**

**Objective**

We evaluated patient and professional's experience with virtual antenatal clinic appointments during the COVID-19 pandemic, to determine satisfaction and enquire into the safety and quality of care received.

**Design, Setting, Population and Methods**

A total of 148 women who attended a virtual antenatal clinic appointment at our UK tertiary obstetric care centre over a two-week period provided feedback (62% response rate). A further 37 health care professionals (HCP) delivering care in the virtual antenatal clinics participated in another questionnaire study (82% response rate).

**Main Outcome Measures and Results**

We showed that women were highly satisfied with the virtual clinics, with 86% rating their experience as good/very good, and this was not associated with any statistically significant differences in age, ethnicity, number of previous births or pregnancy loss(es) ( $p>0.05$ ). Even though, 56% preferred face-to-face appointments, 44% either expressed no preference or preferred virtual, and these preferences were not associated with significant differences in patient demographics ( $p>0.05$ ). For HCP, 67% rated their experience of virtual clinics as good/very good; 78% described their experience as the same or better than face-to-face clinics; 15% preferred virtual clinics and 44% had no preference. Importantly, 67% found it easy/very easy to adapt to virtual clinics. Over 90% of HCP agreed virtual clinics should be implemented long-term.

**Conclusions**

Our study demonstrates high satisfaction with telephone, antenatal clinics during the pandemic, which supports the transition towards widespread digitalisation of antenatal care, suited to twenty first century patients and professionals.

**Funding**

None

38 **Keywords**

39 COVID-19, Virtual clinic, antenatal, satisfaction

40 **Tweetable abstract:**

41 Virtual antenatal clinics from the UK were highly acceptable to pregnant women and health care  
42 professionals. [110]

## 43 Main body of text:

### 44 Introduction

45 The COVID-19 pandemic presented immense challenges to obstetric departments around the world  
46 and has resulted in increased pressures on the delivery of routine antenatal care. It was  
47 recommended by consensus guidelines that pregnant women should self-isolate and avoid coming  
48 into hospital unless necessary, to avoid contracting COVID-19 [1-3]. Following the pandemic, the  
49 Royal College of Obstetricians and Gynaecologists (RCOG) recommended a minimum of six antenatal  
50 appointments, which was a reduction from the usual eight face-to-face visits. However, this only  
51 accounted for low risk pregnancies, as women at higher risk still required specialist antenatal clinic  
52 appointments. RCOG therefore also advised that telephone or video consultations were safe and  
53 their adoption should be maximised in order to minimise unnecessary contact between patients and  
54 care-providers [4, 5].

55 Face-to-face antenatal care has long been recognised as the standard of care, because of the  
56 importance of routine screening for blood pressure, and urine assessment, but also to provide  
57 personalised support. However, telemedicine approaches in perinatal care have been implemented  
58 with success [6] and the NHS England's long-term plan is a digital agenda, aiming to reduce face-to-  
59 face appointments by a third over the next five years [7]. Pflugieson *et al.* compared virtual and  
60 traditional antenatal appointments and showed that patient satisfaction was significantly higher in  
61 women who received virtual care compared to face-to-face appointments and there was no  
62 difference in preference between telephone or video calls for the virtual clinics [8]. However, during  
63 the COVID-19 pandemic, when the majority of antenatal care was rapidly transformed to virtual care  
64 in the UK, it was unclear how pregnant women felt about this shift in culture.

65 In addition to the patient experience of virtual clinics, it is also important to consider the clinicians'  
66 perspective. A mixed-methods acceptability study evaluating virtual clinics at the micro, meso and  
67 macro levels found that technical challenges could be prohibitive to staff running virtual clinics [9].  
68 However, when clinical, technical and practical requirements were achieved, staff were satisfied and  
69 felt virtual clinics were safe [9]. Nevertheless, in the setting of a global pandemic, virtual clinics had  
70 to become the new normality for antenatal care, providing the advantage of instilling digitalised  
71 antenatal care into obstetric care systems around the world [10].

72 The aim of this study was to evaluate patient and health care professional (HCP) satisfaction,  
73 preferences and experiences of virtual antenatal clinic during the COVID-19 pandemic, from a  
74 tertiary obstetric hospital in the UK. [400]

## 75 **Methods**

76 In March 2020, the majority of antenatal face-to-face clinic appointments in our regional tertiary  
77 obstetric unit, were transformed to virtual telephone clinic appointments. This included both  
78 general and subspecialist obstetric clinics (maternal medicine, prematurity prevention, diabetes,  
79 hypertension, renal, perinatal mental health, and substance misuse). Telephone consultations were  
80 conducted by either consultants, registrars/junior obstetric doctors, or midwives, and a named  
81 consultant led each clinic. Virtual clinics were performed with access to the electronic medical  
82 records and hospital notes, however patient's handheld notes were not available. A virtual clinic  
83 proforma was completed for each patient, which outlined the obstetric history, risk factors,  
84 management plan and follow-up. This virtual clinic proforma was included in the hospital notes and  
85 a copy was posted to the women to be included in their handheld notes. The process of setting up  
86 the virtual antenatal clinic at our centre is reported on elsewhere [11].

## 87 **Patient experience**

88 An anonymised questionnaire was used to evaluate satisfaction with the virtual clinic experience.  
89 The questionnaire was adapted, with consent, from the questionnaire previously validated by  
90 Pflugieson *et al.* [8]. The full questionnaire can be found in appendix 1. The questionnaire asked  
91 women to rate each question on a Likert scale, from very poor to very good, in relation to the  
92 following domains: scheduling, technology, health care professional rating, patient-orientated  
93 nature, overall rating and preferences. There were 16 Likert scale questions. The questionnaire also  
94 inquired if the women had been asked COVID-19 screening questions during the virtual consultation,  
95 and to denote their preference for either virtual or traditional (In-person) clinic appointments, or if  
96 there was no preference. Study participants were finally asked to outline the benefits of the virtual  
97 clinic and areas of improvement, by free text. The following demographic variables were collected:  
98 age, ethnicity, number of previous births and number of pregnancy losses. See Appendix S2 for the  
99 patient questionnaire.

100 The questionnaires were collected from women who had a virtual clinic consultation over a two-  
101 week period between Monday 4<sup>th</sup> May and Friday 15<sup>th</sup> May 2020. Prior to this, the virtual clinics had  
102 been well established, having run for a period of one month and there had been multiple quality  
103 improvement cycles to optimise the virtual clinics. Women who attended the following virtual  
104 antenatal clinics were invited to participate in the questionnaire study: General Obstetric, Maternal  
105 Medicine, Prematurity Prevention, and Perinatal Mental Health.

106 Women were verbally consented to participate in the questionnaire study during the telephone  
107 consultation, and the response was documented on the virtual clinic proforma. Women were given

the choice of providing feedback by telephone or by returning the questionnaire by email. Following the consultation, an independent staff member who had not conducted the virtual clinic for that patient sought feedback via email or telephone. Women were assured that participation in this study was voluntary and would not affect their care. All questionnaire responses were anonymised. Feedback was collected up to 2 weeks after the consultation had occurred. For non-English speaking women, a staff member who could speak the required language, mainly Gujarati, Hindi and Urdu, obtained feedback by translating over the telephone. Given the anonymous nature of the questionnaire study, it was possible that the same patient who attended two clinics in the two-week study period could have provided feedback more than once. However, this would reflect a small minority of the cohort and patients were asked to provide feedback on only one clinic at a time.

A pilot study was performed to test the questionnaire and acceptability of the study design, and the questions were modified as a result, to aid understanding. The pilot questionnaire was completed by four patients but this feedback was not included in the analysis.

#### **Health care professional experience**

Two questionnaires for HCP were designed and trialled, with the first aimed at clinical staff conducting the virtual antenatal clinics, including doctors, and midwives (HCP survey), and the second aimed at administrative and clerical staff who were organising the virtual clinics (administrator survey). The HCP survey included 46 questions evaluating experiences with the virtual clinics. HCP were asked to rate on a Likert scale how safe, effective, efficient and satisfied they were with the virtual clinics and how this compared to their experience of face-to-face clinics. There were also questions enquiring into the benefits and consequences of virtual clinics, and their opinions on how well the virtual clinics had been implemented at this centre. Finally, HCP were asked to give their preference for virtual or face-to-face appointments. Health care professionals were surveyed over a 2-week period in July 2020 and were asked to comment on their experiences from the preceding two months.

The administrator survey consisted of 26 questions which enquired into their experiences of running and coordinating the virtual clinics, how this compared to face-to-face clinics and whether they felt the virtual clinic system was effective.

The two surveys were tested on a pilot population of 4 individuals and the questionnaires were adapted accordingly. A list of health care professionals and administrators who had undertaken virtual clinics in the preceding four weeks was compiled by the study team. The questionnaire was

139 sent out via email using Survey monkey. All questionnaire responses were anonymous. See Appendix  
140 S3 for the HCP questionnaire.

#### 141 **Ethics**

142 This study was registered as a service evaluation and quality improvement project with the local  
143 audit department (Reference number: 10560a).

#### 144 **Statistical analysis**

145 Descriptive statistics were performed for each question in excel. The Mann Whitney U and ANOVA  
146 tests were used to compare demographics between responses to the virtual clinic experience. Data  
147 was inputted into excel and statistical analysis was performed in Graphpad Prism. Level of statistical  
148 significance was set at  $p < 0.05$ .

## 149 Results

### 150 Patient experience of virtual antenatal clinics

151 In the two-week period evaluated, 268 women had a virtual consultation and a further 45 women  
152 did not attend or cancelled their virtual clinic appointment. Of the 268, 28 women did not consent to  
153 participate in the study. Of the 240 women who were seen in virtual clinic and consented to  
154 providing feedback, 148 completed and returned the questionnaire, resulting in a 62% response rate  
155 (see flowchart in Appendix S1).

### 156 Demographics

157 Of those women who completed the questionnaire, mean age was 31 years (SD 5.829). The majority  
158 of women were Caucasian (78.5%), 20% were South Asian and 1.5% were other ethnic group. The  
159 majority of women were multipara (89.5) and 10.5% of women were primipara. Also, the majority of  
160 women had no previous pregnancy loss (67%) and 33% had one or more self-reported previous  
161 pregnancy loss (miscarriage, ectopic or molar pregnancy).

### 162 Quantitative analysis-Descriptive

163 Satisfaction with the virtual clinic appointment was rated as good/very good by 86% of women  
164 (Figure 1) and 82% were very likely/likely to recommend a virtual clinic appointment based on their  
165 experience (Figure 1a). Also, 96% of women rated the overall quality of the virtual clinic  
166 appointment, excluding the technology component as 6 out of 10 or more (Figure 1b).

167 Table 1 shows the questions asked in the study questionnaire about their experience of virtual clinic  
168 (adapted from Pflugieson *et al.* [8]) and the mean score out of five with the standard deviation  
169 provided.

170 Of those surveyed, 38% remembered being asked COVID-19 screening questions, and 12% could not  
171 remember being asked, leaving 50% who were not asked COVID-19 screening questions during the  
172 virtual clinic appointment. Fortunately, almost all women (97%) said the consultation felt private to  
173 them. When participants were asked to select between virtual and face-to-face appointments, 25%  
174 preferred virtual, 10% had no preference while 9% said it was dependent on other factors such as  
175 the ongoing pandemic, giving a total of 44% of women who would be happy with virtual  
176 appointments. However, 56% of respondents still preferred face-to-face appointments.

### 177 Statistical analysis

178 There were no statistically significant differences between virtual clinic satisfaction rating and age,  
179 ethnicity, number of previous births, or number of previous pregnancy losses ( $p>0.05$ ). There were  
180 also no statistically significant differences between preference for clinic type i.e. virtual or face-to-  
181 face with age, ethnicity, number of previous births, or number of previous pregnancy losses  
182 ( $p>0.05$ ).

### 183 *Summary of free text responses*

184 Women were asked to denote the best parts of the virtual clinic experience. The key benefits  
185 highlighted were convenience, avoiding travel, being able to stay at home and stay safe. Patients  
186 also said that the communication from their doctor was good and the doctors took time to listen to  
187 them, were friendly and gave good explanations. A few women expressed initial concern about the  
188 concept of a virtual clinic but were happy with the experience once they had tried it.

189 In terms of areas for improvement, a lot of women said they would not change anything. However,  
190 the main improvement suggested was that the virtual clinic consultations should be at the specific  
191 time given. Some women felt they should have been given a choice whether they wanted a face-to-  
192 face or virtual appointment.

193 Of the minority of women who were dissatisfied with their virtual clinic consultation, rating the  
194 consultation as very poor or poor, the main issues raised were around the doctor not knowing them  
195 and their history well, and wanting a face-to-face appointment because of their individual  
196 circumstances, for example in order to physically examine them. Timing of the clinic appointment  
197 was also a common issue, in terms of having their telephone consultation later than the expected  
198 time.

## 199 **Health care professional's experience of virtual antenatal clinics**

### 200 *Demographics*

201 A total of 37 staff members completed the questionnaires, of which 27 completed the HCP survey  
202 and 10 completed the administrators survey; this was an 82% response rate overall.

203 Of the 27 HCP who completed the HCP survey, 38% were consultants, 38% were registrars, 16%  
204 were junior doctors, and 4% were midwives. In terms of obstetric experience, 33% had more than 21  
205 years, 19% had 11-20 years' experience and 26% had less than 10 years obstetric experience. Among  
206 these HCP, 11% were undertaking virtual clinics remotely (from home), 33% were non-patient facing  
207 (undertaking virtual clinics full-time in the hospital) and 56% were undertaking both virtual clinics  
208 and patient facing roles. Over half of the HCP (54%) had done more than 30 virtual consultations in



209 the study period, 11% had done 11-30 virtual consultations while 23% had done fewer than 10  
210 consultations.

#### 211 *Quantitative analysis-descriptive*

212 In terms of health care professional's experience of the virtual antenatal clinics, 67% had a  
213 good/very good experience of virtual clinics and 78% described their experience as the same or  
214 better than face-to-face clinics. Although 74% of clinicians received no training, 67% felt it was very  
215 easy/easy to adapt to the virtual clinics. Nonetheless, 56% felt training would have been helpful/very  
216 helpful. Seventy-eight percent felt the quality of connection was good/very good during the virtual  
217 clinics.

218 Health care professionals were also asked to rate how safe and effective they found the virtual  
219 antenatal clinics for patients. The majority felt virtual clinics were safe (82%), 100% felt virtual clinics  
220 were effective at delivering on high quality patient care, and 89% perceived the care received by  
221 patients to be better or comparable to face-to-face appointments, in spite of the COVID-19  
222 pandemic. Furthermore, the majority felt it was easy to generate a management plan for patients  
223 from virtual clinics (67%), and this was the same or better compared to face-to-face clinics (70%).  
224 Finally, 56% felt it was easier or just as easy to seek advice or a second opinion in virtual clinics.

225 Although 74% perceived virtual clinics took longer than face-to-face appointments, 63% felt virtual  
226 clinics were as or more efficient than face-to-face clinics overall. Within each 4 to 4.5-hour clinic  
227 period, 70% of HCP could review on average 5-8 patients in a virtual clinic while 22% could consult  
228 with more than 9 patients. Importantly, 93% felt virtual clinics should be implemented in the long-  
229 term. In terms of whether clinicians would rather conduct virtual or face-to-face appointment, 44%  
230 gave no preference, 15% preferred virtual clinics and 27% preferred face-to-face appointments.

231 HCPs were asked to rate the most important benefits of virtual antenatal clinics and they ranked  
232 highly patient convenience, environmentally friendly and perceived cost-effectiveness. Further  
233 benefits, which ranked highly include the improved efficiency of virtual clinics, the staff convenience  
234 and the patient centred approach (Figure 2).

235 The principal barriers ranked highly by HCP which would limit the implementation of virtual clinics  
236 included the unavoidable need for face-to-face appointments in certain cases, limitations with  
237 technology, difficulties embedding the virtual clinics into the systems and process, and the  
238 adaptation required by clerical and clinical teams alike (Figure 3).

#### 239 *Summary of free text responses*

240 In the free test responses, key themes from the HCP that arose were that the virtual clinics reduced  
241 unnecessary visits to the hospital for patients and allowed low-risk pregnancies to be managed  
242 safely from the patient's own home. Many felt patient compliance was better with fewer 'did not  
243 attend' appointments, and the clinics were considered to be patient-centred, with good continuity of  
244 care. A concern raised was around a reduction in the training for junior doctors in virtual clinics  
245 compared to face-to-face clinics, however others felt team cohesion was better and they were able  
246 to discuss more cases with senior colleagues during the virtual clinics, so the experiences were  
247 varied.

#### 248 **Administrators experience of virtual antenatal clinics**

249 Of the clerical staff who submitted a questionnaire response regarding their experience of  
250 coordinating the virtual antenatal clinics, 70% found it easy/very easy to schedule the virtual clinic  
251 appointments for patients. Although 50% felt the virtual clinics took more time to complete the  
252 clinic outcomes for patients, a further 20% felt the time spent was comparable to face-to-face clinics.  
253 All (100%) felt the care received by patients was the same or better with the virtual clinics compared  
254 to the face-to-face appointments and 80% felt virtual clinics were safe for patients. Of these, 80%  
255 rated their experience of virtual clinics as good/very good, and 80% said the virtual clinics in their  
256 current format would be feasible for the future, and should be implemented long-term. Finally, 60%  
257 had no preference for virtual or face-to-face clinics and 90% found it easy or very easy to adapt to  
258 the virtual clinics.

259 Administrators ranked highly the same benefits and barriers to virtual antenatal clinics as the HCPs;  
260 convenience, efficiency, environmentally friendly nature, and cost-effectiveness were ranked highly  
261 as benefits of virtual clinics. The largest denoted barriers included difficulties with the technology,  
262 adaptation for clerical and clinical staff, and the inevitable need for some patients to have face-to-  
263 face appointments.

## 264 Discussion

### 265 Main findings

266 We demonstrated that women were highly satisfied with all aspects of their virtual clinic experience  
267 and that this did not differ with age, ethnicity, previous pregnancies or previous pregnancy losses.  
268 Although 56% of women in our study would prefer a face-to-face clinic appointment, it is positive  
269 that 44% preferred virtual clinics or had no preference. We also showed that HCP and administrative  
270 staff were highly satisfied with virtual antenatal clinics, and felt they were at least comparable to  
271 face-to-face appointments, in terms of safety, care received, efficiency and experience.

### 272 Interpretation

273 The COVID-19 pandemic has provided a much-needed opportunity to digitalise antenatal care; over  
274 88% of pregnant women own a smart phone [12] and commonly seek knowledge from online  
275 sources [13]. E-Health has been shown to confer benefits to lifestyle and mental health outcomes for  
276 pregnant women, who report that e-health interventions are convenient and acceptable [14].  
277 Hence, there is scope to increasingly integrate virtual and telemedicine approaches, to bring  
278 antenatal care into the twenty first century [15].

279 Our finding that virtual antenatal clinics were acceptable to patients is supported by Pflugieson *et al.*  
280 [8] who showed high satisfaction with virtual care but acknowledged that women should ideally be  
281 offered a choice in their antenatal care modality because of the unique benefits received from  
282 patient-centred, face-to-face contact with a health care professional. During the COVID-19  
283 pandemic, Aziz *et al.*, similarly reported on the importance of combining face-to-face and  
284 telemedicine approaches, for high risk pregnancies [6]. Holcomb *et al.* showed similarly high patient  
285 satisfaction with audio only virtual antenatal care during the COVID-19 pandemic [16]. They  
286 demonstrated that 99% of women felt their needs were met with virtual care, and compliance with  
287 virtual clinics was significantly higher than in-person appointments; 88% compared to 82% attended  
288 their appointment ( $p<0.001$ ). Overall, women in this study preferred a combination of virtual and  
289 face-to-face antenatal care which supports the findings from our study.

290 Similarly, the high professional satisfaction with virtual care reported in our study, can be explained  
291 by the minimal technical issues experienced, because telephone rather than video consultations  
292 were implemented in our centre. Additionally, there was good integration between clinical and  
293 administrative teams to ensure the clinics ran efficiently and meant satisfaction from both teams  
294 was high. The finding that our virtual clinics were perceived to take longer is not supported by other  
295 studies (9, 16) and may be explained by inexperience or apprehension around needing to adapt to  
296 the new clinic experience, which is recognised as a significant challenge for health care

professionals; staff were asked to transition to a completely new way of working without training beforehand [9]. However, given virtual clinics were considered to be more efficient than face-to-face appointments, this would suggest time was saved elsewhere. 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.

The benefits of virtual clinics are widely reported to include the environmentally friendly nature, patient-centred approach and opportunity to build better rapport between patient and professionals. Furthermore, the challenges presented, such as inability to examine, can be overcome with video consultations [17]. Therefore, the benefits, combined with the high satisfaction reported here demonstrate the importance of integrating virtual clinics into obstetric care services in the longer-term, to align with the NHS digital long-term plan [7].

#### Strengths and limitations

We achieved a 62% questionnaire response rate for women who received a virtual clinic consultation and 82% response rate for the professionals surveyed in a large UK tertiary obstetric care centre during the study period. Limitations of the study include its cross-sectional nature, as we only evaluated satisfaction over a two-week period and collection of the feedback was retrospective. There was also risk of selection bias in terms of the population of women who chose to complete the study questionnaire. We were unable to compare virtual clinic experiences directly with face-to-face care because of the pandemic, but as the lockdown restrictions ease, this is an area we will be evaluating moving forward to assess the long-term feasibility of virtual antenatal clinics. It is important to note that a minority of our cohort were primipara women, and the majority had no previous pregnancy loss, which reflects a lower risk population and may partly account for the high satisfaction with virtual compared to face-to-face consultations. Furthermore, this questionnaire was only designed to evaluate preferences and further work needs to focus on safety, cost-effectiveness, maternal and fetal outcomes of virtual care compared to face-to-face antenatal clinics. Finally, it must be acknowledged that satisfaction was not one hundred per cent and for a minority of patients and professionals, virtual care and clinics were not acceptable. In these instances, a combination of virtual and face-to-face care would be a necessary approach, which aligns with the consensus viewpoint for antenatal care services.

#### Conclusion

We have shown that despite rapid transformation and implementation of virtual antenatal clinics during the COVID-9 pandemic, patient and professional satisfaction with this service was very high.

329 The virtual antenatal clinics have been widely accepted by women regardless of sociodemographic  
330 differences, which supports feasibility of the virtual clinics moving forward. Our study supports  
331 integration of virtual antenatal clinics alongside face-to-face delivery of care as and where  
332 appropriate, to ensure delivery of patient-centred care. Further telemedicine strategies which aim to  
333 personalise care for pregnant women warrant further exploration.

334 Acknowledgements:

335 Ms Penelope McParland, Ms Helena Maybury, Mr Eamonn Breslin (Consultant obstetricians) and Ms  
336 Nicola Hooson (Obstetric clinical secretary).

337

338 Disclosure of interests:

339 None to declare

340

341 Contribution of authorship:

342 LQ, OO, HS, MG and HA performed the data collection. LQ, OO and HA performed the data analysis.  
343 LQ, OO, HS, MG and HA wrote the paper and all authors reviewed the manuscript.

344

345 Details of ethics approval:

346 This service evaluation was registered and approved by the University Hospitals of Leicester  
347 Obstetric audit department, service evaluation reference number: 10560a. Date of approval:  
348 01/05/2020.

349

350 Funding:

351 None to declare.

352

353

## References

1. Royal College of Obstetricians and Gynaecologists. Guidance for antenatal and postnatal services in the evolving coronavirus ( COVID-19 ) pandemic [Internet]. UK; 2020 [cited 2020 Jun 26]. Available from: <https://www.rcog.org.uk/globalassets/documents/guidelines/2020-04-09-coronavirus-COVID-19-infection-in-pregnancy.pdf>.
2. World Health Organisation. Pregnancy, childbirth and COVID-19 [Internet]. UK; 2020 [cited 2020 Jun 26]. Available from: <https://www.who.int/news-room/q-a-detail/q-a-on-COVID-19-pregnancy-childbirth-and-breastfeeding>
3. Poon LC, Yang H, Kapur A, Melamed N, Dao B, Divakar H, et al. Global interim guidance on coronavirus disease 2019 (COVID-19) during pregnancy and puerperium from FIGO and allied partners: Information for healthcare professionals. *Int J Gynecol Obstet*. 2020;149(3):273-286.
4. Royal College of Obstetricians and Gynaecologists. Guidance for antenatal and postnatal services in the evolving coronavirus ( COVID-19 ) pandemic [Internet]. UK; 2020 [cited 2020 Jun 26]. Available from: <https://www.rcog.org.uk/globalassets/documents/guidelines/2020-03-30-guidance-for-antenatal-and-postnatal-services-in-the-evolving-coronavirus-covid-19-pandemic-20200331.pdf>.
5. Du L, Gu YB, Cui MQ, Li WX, Wang J, Zhu LP, Xu B. Investigation on demands for antenatal care services among 2 002 pregnant women during the epidemic of COVID-19 in Shanghai. *Zhonghua Fu Chan Ke Za Zhi*. 2020 Mar 25;55(3):160-165.
6. Aziz A, Zork N, Aubey JJ, Baptiste CD, D'Alton ME et al. Telehealth for High-Risk Pregnancies in the Setting of the COVID-19 Pandemic. *Am J Perinatol*. 2020;37(8):800-808.
7. NHS. Chapter 5: Digitally-enabled care will go mainstream across the NHS. NHS long-term plan [Internet]. UK; 2019 [cited 2020 June 26]. Available from: <https://www.longtermplan.nhs.uk/online-version/chapter-5-digitally-enabled-care-will-go-mainstream-across-the-nhs/>.
8. Pflugeisen BM, Mou J. Patient Satisfaction with Virtual Obstetric Care. *Matern Child Health J*. 2017;21(7):1544-51.
9. Greenhalgh T, Shaw S, Wherton J, Vijayaraghavan S, Morris J et al. Real-World Implementation of Video Outpatient Consultations at Macro, Meso, and Micro Levels: Mixed-Method Study. *J Med Internet Res*. 2018;20(4):e150.
10. Peahl AF, Smith RD, Moniz MH et al. Prenatal care redesign: creating flexible maternity care models through virtual care. *Am J Obstet Gynecol*. 2020;223(3):389.e1-389.e10.
11. Quinn L, Olajide O, Breslin E, Tan BK, Ansar H. Virtual antenatal clinics. *British Journal of Midwifery* 2020;28(9).
12. World Health Organization. mHealth: New Horizons for Health Through Mobile Technologies. Global Observatory for eHealth Series, Volume 3. Geneva, Switzerland: WHO; 2011.
13. Wallwiener S, Müller M, Doster A, Laserer W, Reck C, Pauluschke-Fröhlich J, Brucker SY, Wallwiener CW, Wallwiener M. Pregnancy eHealth and mHealth: user proportions and characteristics of pregnant women using web-based information sources-a cross-sectional study. *Arch Gynecol Obstet*.
14. Van Den Heuvel JFM, Groenhof TK, Veerbeek JHW, Van Solinge WW, Lely AT, Franx A, et al. eHealth as the next-generation perinatal care: An overview of the literature. *J Med Internet Res*. 2018;20(6):e202.

- 399 15. Fryer K, Delgado A, Foti T, Reid CN, Marshall J. Fryer K, et al. Implementation of Obstetric  
400 Telehealth During COVID-19 and Beyond. *Matern Child Health J.* 2020;24(9):1104-1110.
- 401 16. Holcomb D, Faucher MA, Bouzid J, Quint-Bouzid M, Nelson DB, Duryea E. Holcomb D, et al.  
402 Patient Perspectives on Audio-Only Virtual Prenatal Visits Amidst the Severe Acute  
403 Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Pandemic. *Obstet Gynecol.*  
404 2020;136(2):317-322.
- 405 17. Quinn LM, Davies MJ, Hadjiconstantinou M. Virtual Consultations and the Role of  
406 Technology During the COVID-19 Pandemic for People With Type 2 Diabetes: The UK  
407 Perspective. *J Med Internet Res.* 2020;22(8):e21609.