FETAL TELEMEDICINE:
a mixed-methods evaluation

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Rationale

- Ultrasound screening during pregnancy is universally offered in the UK, with the aim of providing parents with accurate information to inform timely intervention.

- Women are referred to a Fetal Medicine Centre when a fetal anomaly is suspected or intensive fetal monitoring is required.

- The caseload and complexity of fetal medicine referrals that can be managed is dependent on the availability of specialist ultrasound expertise.

- Women from Cumbria currently have to travel up to six hours to access specialist fetal medicine opinion in Newcastle upon Tyne, incurring costs for travel and childcare.

- Previous research has demonstrated that telemedicine can effectively transfer real-time ultrasound images via video-conferencing [1,2].

1. Fisk NM et al. BJOG 1996; 103: 1092-5;
2. McCrossan BA et al. Prenat Diagn 2012, 12: 883-7

Evaluation

▶ The evaluation was divided into three parts and undertaken by different collaborators:

Evaluation Aims	Responsibility	Description
1. To determine the technical success of fetal telemedicine;	Fetal Medicine Unit, The Newcastle upon Tyne Hospitals NHS Foundation Trust	Referred women seen via a weekly telemedicine service. Image and audio quality rated (using a 5 point Likert scale) following each consultation.
1. To assess women's experiences and acceptance of tele-ultrasound, including a consideration of family costs;	Newcastle University	a. Referred women completed a questionnaire following first consultation (n.37 completions). b. Follow-up telephone interviews undertaken with a sub-sample of women (n.16).
1. To understand the barriers and enablers of technology adoption from perspective of clinical stakeholders.	University of Cumbria	Semi-structured qualitative interviews undertaken (n.10) with six key clinical stakeholders, two commissioners and two service managers.

Technical set-up

- Service utilised an existing 2x 100Mbp/s fibre optic circuits

- Codec and Videoconferencing unit (Cisco and Polycom) were installed at both sites.

- Bespoke unit incorporating monitor, microphone, camera and codec was assembled to fit in ultrasound room.

- Camera position changeable to show ultrasound image or parents.
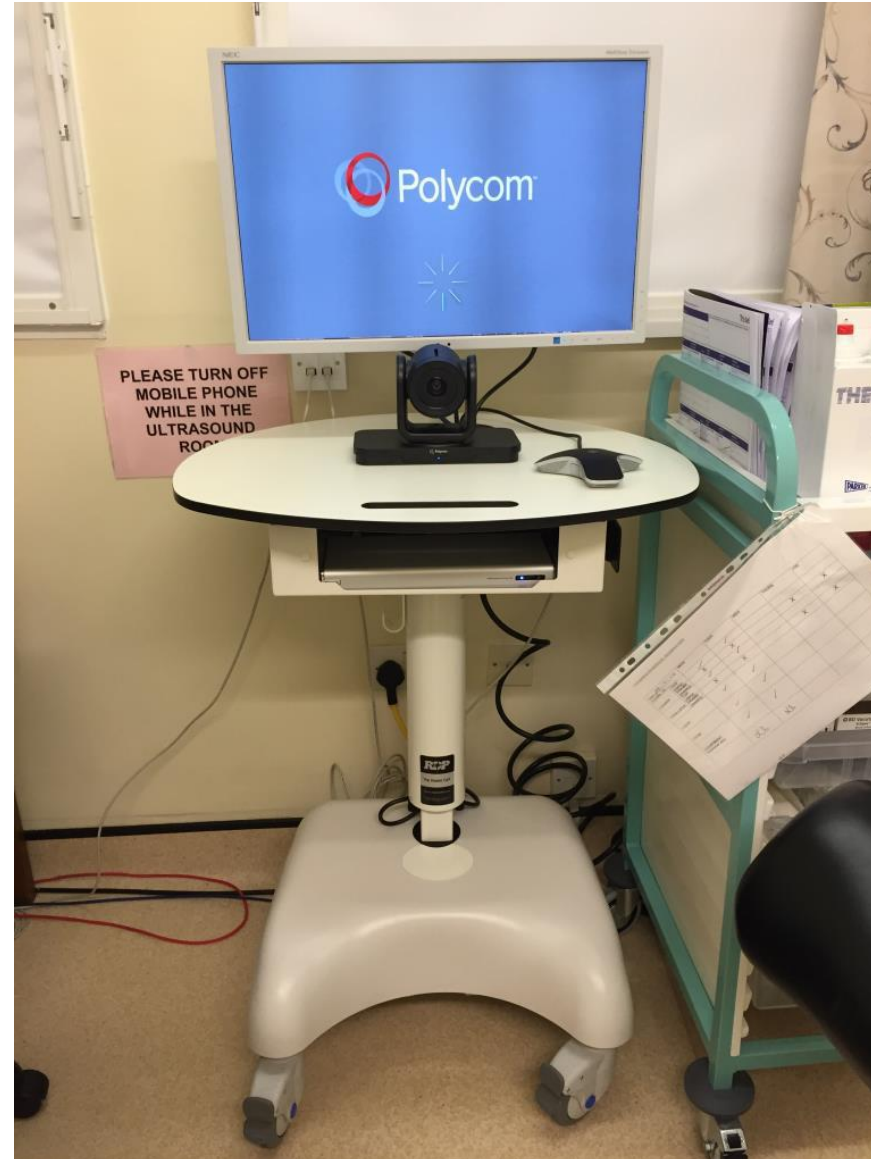
Referral criteria

▶ Referrals for fetal medicine opinion were taken in the usual way and assessed for suitability by the fetal medicine consultant or lead midwife.

▶ Cases were excluded from telemedicine consultation if:

- A) Invasive testing or therapeutic intervention was anticipated

- B) Cardiac anomaly was suspected (separate fetal cardiology clinics)

- C) Facial cleft was suspected (need for 3D ultrasound imaging)

Number of new referrals (2015-16)

New FM centre referrals from DGH (n=80)

Reasons for not having telemedicine consultation:

- Cardiac anomaly (n=13)
- Cleft lip (n=2)
- Invasive test (n=14)
- Twin CT (n=6)
- No FM consultant available (n=5)

New referrals seen via telemedicine (n=40)
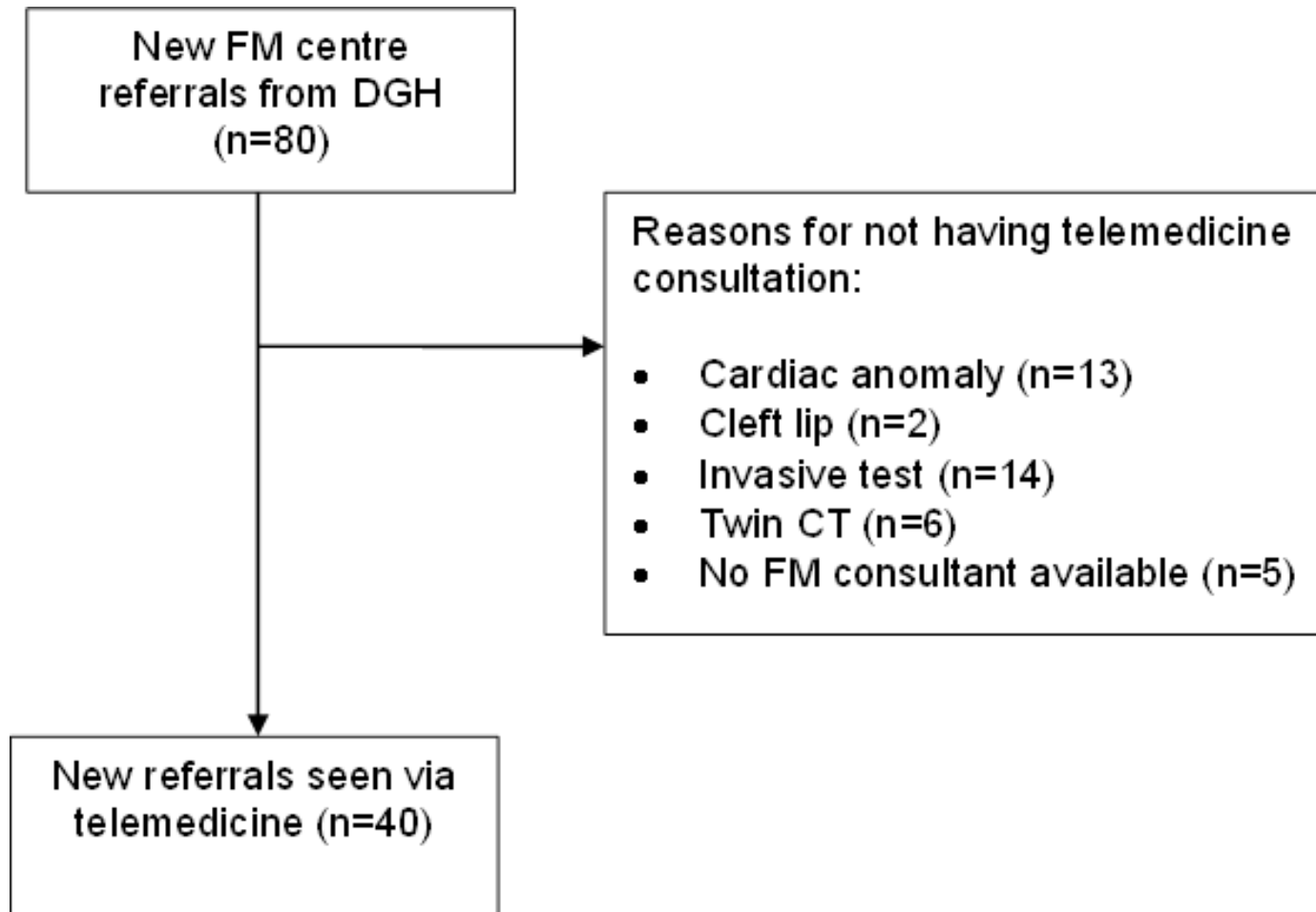
Reasons for referral

New telemedicine referrals

Indication	Number of women
Risk of abnormally invasive placenta (low anterior placenta and previous CS)	11
Preterm small-for-gestational-age fetus	4

Suspected fetal anomaly
    Ventriculomegaly
    Spina bifida
    Abdominal cyst
    Echogenic bowel
    Hydronephrosis
    Horseshoe kidney
    Cardiac arrhythmia (ectopic beats)
	
	4
	2
	1
	1
	4
	1
	1

Suspected twin-twin transfusion syndrome	3
Combined testing for multiple pregnancy	2
Previous history of fetal anomaly	2
Preterm premature rupture of membranes	2
Suspected vasa praevia	1
Rhesus D alloimmunisation	1
Total	40

Telemedicine review

Indication	Number of appointments
Preterm small for gestational age fetus	17
Rhesus D alloimmunisation	8
Triplets	4
Placenta praevia and previous CS	3

Fetal anomaly
    Ventriculomegaly
    Hydronephrosis
    Spina bifida
	
	3
	2
	1

Twin to twin transfusion syndrome	1
Preterm premature rupture of membranes	1

Consultation with no ultrasound scan
    Consultant Paediatric Nephrologist
    Consultant Paediatric Neurosurgeon
	
	1
	1

Total	42

Image quality

- Ultrasound images were generally of high quality throughout the project

- Doppler imaging was unsatisfactory during one examination

- Link failed to connect once

Survey responses:

▶ Questionnaires were completed by 37/40 women following their telemedicine consultation

▶ Women expressed high levels of satisfaction with the telemedicine consultation. Only one women stated that she would not opt for telemedicine consultation in the future.

▶ Median travel time to the local obstetric unit was 20 minutes (Range 4-150)

▶ Estimated journey time to the Fetal Medicine Centre was 230 mins (Range 120-450)

Stakeholder acceptance

▶ Lack of staff acceptance is a major barrier to the adoption of digital innovations in healthcare[*]

▶ Staff acceptance is influenced by:

- Staff perceptions of benefits and usefulness

- Lack of ability and/or confidence in using technology

- Impact of the innovation on workload and staff capacity

- Impact on staff autonomy, credibility and professional identity

- Compatibility of the innovation with established/routine practices

- Requirement to work with others in ways that are at variance with accustomed divisions of labour

* Bidmead et al, 2015; Brewster et al, 2013; Buck, 2009; Segar et al, 2013; Taylor et al, 2015; Vuononvirta et al, 2009.

Qualitative findings – Challenges

- IT - Connectivity

- Management/executive engagement took longer, and was more difficult, than expected; this was mainly due to staffing shortages at the district general hospital:

> It had to do a lot with staffing levels and there were a lot of scanners on maternity leave at the time when we were trying to plan this and actually, right until the day we were starting there was a huge amount of resistance, particularly from the seniors in the radiology department … It was just they felt pressurised because other things were having to be cancelled or there were longer waiting lists for, I don't know, musculoskeletal scans or whatever. So that was the problem (Consultant).

Challenges for Sonographers

- Delivering a shared consultation when used to working alone

It's being watched when I'm not used to having anyone in around me, or not somebody in around me that's maybe above me, professionally. I mean I'm used to working in a room with another sonographer but we're at the same level. But somebody that's actually way above me looking down at what I'm doing, that takes a bit of getting used to. His level of expertise is far greater than mine so having him watch what I'm doing; it is a bit off-putting (Sonographer).

Challenges for Sonographers

- Communication – knowing when an image has been satisfactorily acquired; knowing when to move on:

> Sometimes we're doing what we think we should be doing to get what we need before they're actually asking us to do it and we're already at the point where they wanted us to be. So we've moved ahead before they've asked us to do it because you know if you haven't quite got the image then you think I'll just move it to that position and you'll see it. So sometimes they haven't asked and we've already done it (Sonographer).

- Consequently, sonographers had to resist scanning intuitively

Challenges for Sonographers

- Altered communications with patients

> I just feel I'm not communicating as much with the patient during these … I feel I can't talk because I might not hear what he's asking me to do … and so in that respect I think it's maybe a little bit detrimental to the sonographer patient relationship (Sonographer).

- Patients commented upon clinical conversations but did not report being concerned by them:

> You could hear them discussing it and conferring with each other about different things or double checking things or adjusting things on the screen … or making suggestions on how to get a better image and things like that you know? I did think it was very valuable actually as a way of, kind of sharing the expertise (Int7).

Challenges for patients: Initial reaction

- Patients were asked about their initial reaction; some expressed astonishment:

> "*it was a surprise. I didn't realise they had that facility but I thought that was a great idea*" (Int7)

- Others pointed to the benefits:

> "*I think it will save a lot of people a lot of stress, anxiety, money, time and everything else for something that you know is relatively quite simple*" (Int1).

► Women also commented upon their anxiety:

"I was a little bit anxious about how it was going to happen because obviously we were completely clueless until we got in the room" (Int11).

I was more frightened in case, the results … I think it frightened me more because it was somebody from [the FMC] that was going to do it" (Int14).

► There was, therefore, an element of 'weighing-up' by the women:

"I was fine … I knew it was a good thing as long as we found out whether the baby was healthy or not" (Int10).

Experiencing fetal telemedicine:

▶ Women reported the experience to be unusual but acceptable;

▶ All those interviewed reported satisfaction with their telemedicine consultation;

▶ Most found it a novel experience:

> I can't possibly ever say that I've had ... my internals sort of broadcast to somebody in a different county ... it was kind of like well we've literally just driven down the road to a normal hospital and had a consultation with somebody over the other side of the country (Int12).

Findings – Benefits to service users

▶ Patients highlighted benefits from being seen locally for what is *"only a twenty-minute procedure"* (Int16).

▶ Convenience to women included:

- not having to take time off work (with income implications);

- not having to make complicated childcare arrangements

- less travelling, meaning less expense and discomfort.

It would be three or more hours over there. You'd have to … park then you've got to get in, then you wait for your appointment and, obviously I know things over run for people, and you know you are sat there, and then you get scanned and then … you've got to speak to people again. They might want to see you again for something else. Then you are back and you are doing it all in reverse aren't you so it's, yeah it would literally, we would have to write a whole day off (Int12).

Benefits for the District General Hospital:

▶ Sonographers are upskilled, able to undertake advanced scans and interpret images better;

▶ feel more involved in women's journeys;

▶ find work more interesting and challenging;

▶ have increased access to specialist support:

> We're getting a bit more involved and we're actually saying well I found this and they're agreeing that that's what I think it is … I like that aspect, knowing that I've found this and they've agreed with what I've said and then I find out how they're going to treat the patient and what pathway for the baby. So I do like that aspect of it, I feel we're more involved in the lady's pathway (Sonographer).

Benefits for DGH cont.

▶ Consultants have increased access to specialist support and are better supported in managing complex pregnancy (Obstetrician);

▶ Management of high risk patients has improved as staff have developed insight into managing complex pregnancies (Obstetrician);

▶ An improved standard of care is being delivered locally due to staff being better supported and less isolated professionally (Obstetrician; Radiologists);

I've learned about the topic yes, because when we have discussions … we can discuss why x, y, z was said, or raise concerns. We've recently had two ladies … and both babies eventually died, stillbirth, so you can say 'should we maybe have done x, y, z' and [the answer is] 'no, no, no, that's just the way it is'. It doesn't make it any easier but you're learning medically (Obstetrician).

Benefits cont.

▶ The above benefits were seen to lead to increased patient satisfaction and,

▶ Improved reputation/ kudos for DGH (all DGH contributors); making it more attractive to potential employees (Radiology).

> I think it's a good thing because we're maybe being a pioneer in this service. So I think it's good because we seem to get a lot of negative vibes so this will maybe give us a little bit of a lift … because we've had so much negative press I would hope that this would show ladies that there is things coming back to us and this is a pioneering project that started here (Sonographer).

Fetal Telemedicine - conclusions

▶ Fetal telemedicine enhanced maternity provision at the district general hospital and improved the management of complex pregnancy.

▶ Initial challenges were reported; these could have been major barriers to success; the ways in which staff responded to and overcame these challenges was admirable.

▶ Whilst the literature identifies staff acceptance as a barrier to adoption, tangible benefits are known enablers.

▶ In this instance the identification of early benefits for both patients and all grades of staff influenced their acceptance of fetal telemedicine.

Performance to date:

▶ The telemedicine link is currently utilised to provide fetal medicine consultations for a minimum of one session per week.

▶ To date, 120 women have received specialist opinion via telemedicine, without the need to travel for up to 4 hours each way.

▶ Travel and associated costs have been reduced

▶ Accessing care is more convenient and less stressful for families

▶ Staff at the DGH have reported increased confidence in their ultrasound practice.

Future Opportunities:

- Plans to expand the service to additional units in Cumbria

- The telemedicine link has been used to provide families with consultations with paediatric surgeons and neurologists to plan care after birth.

- There is increasing interest from other clinical specialities to utilise the video-link for paediatric follow up clinics.

Any Questions?

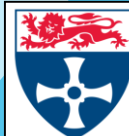Elaine.Bidmead@cumbria.ac.uk

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