Received: 1 July 2023 | Revised: 18 October 2023 | Accepted: 4 November 2023

DOI: 10.1111/aogs.14726

AOGS Acta Obstetricia et Gynecologica Scandinavica

ORIGINAL RESEARCH ARTICLE

Expectations related to home-based telemonitoring of high-risk pregnancies: A qualitative study addressing healthcare providers' and users' views in Norway

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Funding information
Norges Forskningsråd, Grant/Award Number: 326650

Abstract

Introduction: A pregnancy can be evaluated as high-risk for the woman and/or the fetus based on medical history and on previous or ongoing pregnancy characteristics. Monitoring high-risk pregnancies is crucial for early detection of alarming features, enabling timely intervention to ensure optimal maternal and fetal health outcomes. Home-based telemonitoring (HBTM) is a marginally exploited opportunity in antenatal care. The aim of this study was to illuminate healthcare providers' and users' expectations and views about HBTM of maternal and fetal health in high-risk pregnancies before implementation.

Material and methods: To address diverse perspectives regarding HBTM of high-risk pregnancies, four different groups of experienced healthcare providers or users were interviewed ($n = 21$). Focus group interviews were conducted separately with midwives, obstetricians, and women who had previously experienced stillbirth. Six individual interviews were conducted with hospitalized women with ongoing high-risk pregnancies, representing potential candidates for HBTM. None of the participants had any previous experience with HBTM of pregnancies. The study is embedded in a social constructivist research paradigm. Interviews were analyzed using a thematic approach.

Results: The participants acknowledged the benefits and potentials of more active roles for both care recipients and providers in HBTM. Concerns were clearly addressed and articulated in the following themes: eligibility and ability of women, availability of midwives and obstetricians, empowerment and patient safety, and shared responsibility. All groups problematized issues crucial to maintaining a sense of safety for care recipients, and healthcare providers also addressed issues related to maintaining a sense of safety also for the care providers. Conditions for HBTM were understood in terms of optimal personalized training, individual assessment of eligibility,

Abbreviations: BP, blood pressure; CTG, cardiotocography; e-Health, healthcare practice supported by electronic processes and communications; FGI, focus group interview; HBTM, home-based telemonitoring; pPROM, preterm premature rupture of membranes.

and empowerment of an active patient role. These conditions were linked to the importance of competent and experienced midwives and obstetricians operating the monitoring, as well as the availability and continuity of care provision. Maintenance of safety in HBTM in high-risk pregnancies was crucial, particularly so in situations involving emerging acute health issues.

Conclusions: HBTM requires new, proactive roles among midwives, obstetricians, and monitored women, introducing a fine-tuned balance between personalized and standardized care to provide safe, optimal monitoring of high-risk pregnancies.

KEYWORDS
antenatal cardiotocography monitoring, focus group interviews, high-risk pregnancy, hospital at home, Norway, tele-care, user perspective

1 | INTRODUCTION

Due to increasing maternal age and higher rates of adverse medical health conditions, including obesity, the rate of complicated pregnancies has increased.[1] Preterm premature rupture of membranes (pPROM), diabetes mellitus, hypertensive disorders of pregnancy (in particular preeclampsia), and other placental dysfunction syndromes (including fetal growth restriction and preterm delivery) are leading causes of fetal and maternal morbidity and mortality worldwide. The risk evaluation of an ongoing pregnancy may be based on the woman's medical history, previous obstetric history and/or or adverse maternal/fetal development in the present pregnancy. Monitoring of such high-risk pregnancies is crucial for detecting early warning signs, enabling timely treatment and delivery, ensuring optimal maternal and fetal health outcomes. Some adverse pregnancy developments often require long-term hospital admission or frequent hospital outpatient visits.

Recent technological advancements have resulted in several remote monitoring platforms and possibilities for teleconsultation[2] or healthcare practice supported by electronic healthcare technologies (e-Health). Remote monitoring enables specialized and tailored follow up of women with complicated pregnancies, allowing them to stay home as much as possible. Such e-Health technologies are used in the management of various pregnancy complications,[3] encompassing the measurement of vital parameters such as blood pressure (BP) and urinary analysis (for proteinuria detection), as well as blood tests, e.g., for C-reactive protein. More rarely, and only recently, fetal assessment with cardiotocography (CTG) has been offered.[4,5] It has been suggested that obstetrical telemonitoring may contribute to better gestational outcomes, earlier detection of complications, and prevention of intercurrences, and may enable timely intervention even earlier than during hospitalization.[6] Evidence from two recent large-scale studies shows that obstetric outcomes, in selected high-risk pregnancies using telemonitoring, are similar to those with in-house hospital surveillance.[4,5] In addition, telemonitoring may be associated with lower costs without compromising health outcomes.[4,7] Nevertheless, studies are needed to develop and assess the acceptability and efficiency of comprehensive remote monitoring of women with high-risk pregnancies[8] and their fetuses.

Key Message

Comprehensive home-based telemonitoring of high-risk pregnancies may change specialized antenatal care. Multiple perspectives on such follow up highlight eligibility/ability of women, availability of competent professionals, empowerment, and shared responsibility as crucial to maintaining the safety of care recipients and the safe provision of care.

Pilot studies suggest that home-based telemonitoring (HBTM) of both BP and CTG may be a more acceptable and convenient form of antenatal care from users' point of view compared with hospital-based care, although distance to hospital and technical issues may cause concern.[9] Home-based telemonitoring may increase patient satisfaction, engagement, and empowerment.[7,10] However, such technologies may also alter patient–clinician interaction, creating new uncertainties in the follow-up care of women with complicated pregnancies.[11] In addition, both women and antenatal care providers may be ambivalent and reluctant to the idea that e-Health technologies may improve antenatal care.[12,13]

As a result of scarce knowledge and preparation for the implementation phase,[14,15] innovations in e-Health tend to go no further than piloting.[16] Hence, it is crucial to generate knowledge to guide the development and provision of feasible and optimal home-based follow up for complicated pregnancies.[7] The perspectives of women with experiences of high-risk pregnancies may provide crucial understandings of the care needed, whereas midwives' and obstetricians' perspectives may provide understanding of clinical and health-system challenges related to implementing and providing self-/telemonitoring as part of specialized antenatal care.[11]

Home-based telemonitoring in high-risk pregnancies that includes measurement of maternal BP, infection signs (e.g., C-reactive protein and rectal temperature), and CTG has not been

attempted as part of the public health system in Norway. To gain comprehensive understanding of the feasibility and acceptability of HBTM, including perceptions of its opportunities and requirements, and related concerns, it is vital to examine the perspectives of women as well as midwives and obstetricians. The aim of this study was to investigate healthcare providers' and users' expectations and views about HBTM of high-risk pregnancies in Norway before implementation.

1.1 | Study setting

The HOME study is an innovative research project aimed at developing, implementing, and providing HBTM of fetal and maternal health in high-risk pregnancies at Oslo University Hospital. Pregnant women with clinically controlled new-onset hypertension (either preeclampsia without severe features or gestational hypertension), pPROM, or previous at-risk pregnancies (with a high recurrence rate of adverse outcomes) will be eligible, following thorough evaluation by a senior obstetrician, for HBTM as an alternative to hospitalization or frequent outpatient follow up. Women eligible for HBTM will receive information and training at the hospital enabling them to use the equipment for monitoring their own and their fetus's health. The women will be equipped with a tablet connected with a device for highly reliable, remote CTG monitoring, as well as equipment to measure BP, temperature, and C-reactive protein (the latter relevant for the pPROM pregnancies). The women will download a smartphone application to report parameters for in-clinic assessments. The obstetricians responsible for HOME will provide all women with a personalized plan for monitoring, including an app with diagnosis-specific questions related to their symptoms, which may help midwives and obstetricians to detect early warning signs. A time schedule is to be provided for how women will submit their readings and how midwives and obstetricians will respond to these.

In Norway, pregnant women receive health care free of charge, so the provision of HBTM does not entail any financial costs to patients.

2 | MATERIAL AND METHODS

This preclinical part of the HOME study is a qualitative study including both focus group interviews (FGIs) and individual interviews. Applying a social constructivist approach,[17,18] new understandings based on different perspectives on HBTM may be developed. FGIs can facilitate discussions and elicit different views regarding the potentials, conditions and concerns related to HBTM of high-risk pregnancies. Individual interviews in turn provide insights on personal experiences and more coherent individual understandings related to a particular topic.

The research team (GA, KNS, AS, EB) collaboratively developed the presentation of the HOME study and a semi-structured interview guide used in all interviews (Appendix S1). The interview guide was adjusted as appropriate for the different groups of participants, and yet the overall issues addressed regarding HBTM were the same (e.g., communication, patient education, availability of healthcare services). The interview guide aimed to generate reflections and discussions about aspects of HBTM of high-risk pregnancies from both care recipients' and providers' perspectives. The same introduction of HOME was carried out before all interviews, where the interviewers presented a brief outline of the monitoring planned in the HOME study, focusing on how women would carry out the monitoring and the follow-up routines in the clinic.

2.1 | Recruitment

We recruited four groups of participants for interviews: (1) midwives currently following up hospitalized pregnant women with ongoing high-risk pregnancies (FGI, $n=6$); (2) senior obstetricians whose responsibility includes follow up of patients with high-risk pregnancies (FGI, $n=3$); (3) hospitalized patients with ongoing high-risk pregnancies (individual interviews, $n=6$); and (4) women who had experienced stillbirth in a previous pregnancy but had later given birth to a living baby (FGI, $n=6$). In order to include several perspectives on views and expectations of optimal HBTM of high-risk pregnancies, it was crucial to include different groups talking from different experiences either as care providers of women with high-risk pregnancies, or women who have an ongoing or have experienced a high-risk pregnancy. Women who had experienced stillbirth may certainly have a different set of expectations, anxieties and fears concerning pregnancies than women with ongoing high-risk pregnancies. However, their perspective was highly relevant to gain insights into different views and articulations of crucial aspects of optimal follow-up care during high-risk pregnancy. Midwives, obstetricians, and patients were recruited by the HOME study coordinator at the Department of Obstetrics, Oslo University Hospital. Bereaved women were recruited through the Norwegian Stillbirth Society using their network and fora; all had lost a child in stillbirth and had later given birth to a live baby. Most of these women were recruited from the greater Oslo region. None of these participants reported that they were pregnant at the time of the interview.

2.2 | Interviews (Table 1)

All interviews were conducted on-site and took place between March 2022 and July 2022. Two female sociologists—GA (PhD, researcher) and KNS (Professor)—both employed at the University of Oslo, carried out the FGIs. The interviewers were not clinicians and did not know any of the participants beforehand. The FGIs with the midwives and obstetricians were conducted separately to facilitate open discussion based on their different professional background and responsibilities in the clinic. The obstetricians were colleagues and knew each other. The midwives were recruited from two hospital wards and were not all daily colleagues. The participants in the

TABLE 1 Participants.

	Method	*n*	Place	Duration	Other characteristics
Midwives	Focus group	6	Meeting room—Hospital	72 min	Mean work experience: 20 years
Obstetricians	Focus group	3	Meeting room—Hospital	74 min	Mean work experience: 20 years
Bereaved	Focus group	6	Meeting room—Stillbirth Society	96 min	
Hospitalized	Individual interviews	6	Hospital (patient's room)	Mean 51 min	3 hospitalized <1 week, three >1 week, 2 pPROM, 3 hypertensive disorders, 1 cervical insufficiency

FGIs recruited from the Norwegian Stillbirth Society did not know each other, but they shared a crucial life experience. GA conducted the individual interviews with hospitalized women with ongoing high-risk pregnancies. The interviews were digitally recorded and transcribed verbatim.

2.3 | Analysis

The data were analyzed using thematic analysis in an iterative and inductive process.[19] This involved an initial in-depth reading of the data, coding, and categorization, and the processual development of themes, which ultimately resulted in four themes. The interview transcripts were coded independently by two authors (GA and SR), and discrepancies in the coding were discussed and resolved to ensure accuracy of interpretation. The coding was performed using NVivo software for data analysis. GA, SR, and KNS developed the themes, which are reflected in the findings. In the Results section, we highlight the understandings developed based on these themes. A table for each is presented with quotes to illustrate and detail each theme to provide evidence, credibility, and transparency.

2.4 | Ethics statement

The HOME study was approved by the Regional Committee for Medical and Health Research Ethics (ref 314216) on January 11, 2022, and by Data Protection officers at the Oslo University Hospital and University of Oslo. Interview data were stored and handled on a data-sensitive platform at the University of Oslo, complying with current data protection regulations. Informed written consent was obtained from all participants before the interview started. The FGIs were carried out outside office hours, and participants were therefore given a gift voucher (€42) as general compensation. Hospitalized patients were not given such compensation.

3 | RESULTS

The analyses resulted in four themes: eligibility and ability of women, availability of midwives and obstetricians, empowerment and patient safety, and shared responsibility. HBTM of complicated pregnancies was welcomed by the participants as a complementary service to hospital-based services. All groups acknowledged that this may be a better way of following up patients who were comfortable with self-monitoring and remote monitoring, but they did not see this as appropriate for women at highest clinical risk. It was emphasized that such monitoring must be voluntary and cannot be viewed as a substitute to current hospital-based services simply to save costs. Overall, the participants reflected on the appropriate group of women suitable for HBTM as well as the conditions for establishing and maintaining safe HBTM of antenatal health as planned in the HOME study. In the discussions, they articulated several issues that could threaten the safe and optimal operation of HBTM. The women were primarily concerned whether home-monitored women risked being left alone without sufficient support and care. Midwives and obstetricians emphasized that HBTM needs to be operated by highly experienced and competent midwives and obstetricians, as the lack of face-to-face communication with women makes the clinical follow up more challenging. No participants raised concern about personal data security issues. Figure 1 visualizes the four main themes according to the study group categories, illustrating how much each group "colored" each topic, i.e., detailed and highlighted a topic and the degree to which views/discussions overlapped.

3.1 | Eligibility and ability of women (Table 2)

Women and midwives/obstetricians emphasized that inclusion to HBTM must be based on the women's choice and a certainty that women feel safe and in control (quote obstetrician, Table 2). That is, women should not be sent home if feeling unsafe and insecure (quote hospitalized, Table 2). Midwives and obstetricians highlighted the importance of unambiguous and standardized criteria for patient eligibility. In addition, the midwives emphasized that decisions about inclusion were the responsibility of senior obstetricians. If women were not clear-cut candidates, they should not be sent home, or there should be a low threshold for re-hospitalization.

According to the obstetricians, for specific patient groups (e.g., hypertension), the home setting may be a better place for follow up because it is more comfortable and less stressful than the hospital and may have positive effects on BP. The argument was that, currently, some patients, such as those with shortened cervix or pPROM, are hospitalized for weeks, despite a lack of evidence showing that this leads to better outcomes. Hence, such "being-on-the-safe-side patients" should be followed up at home, as it would give

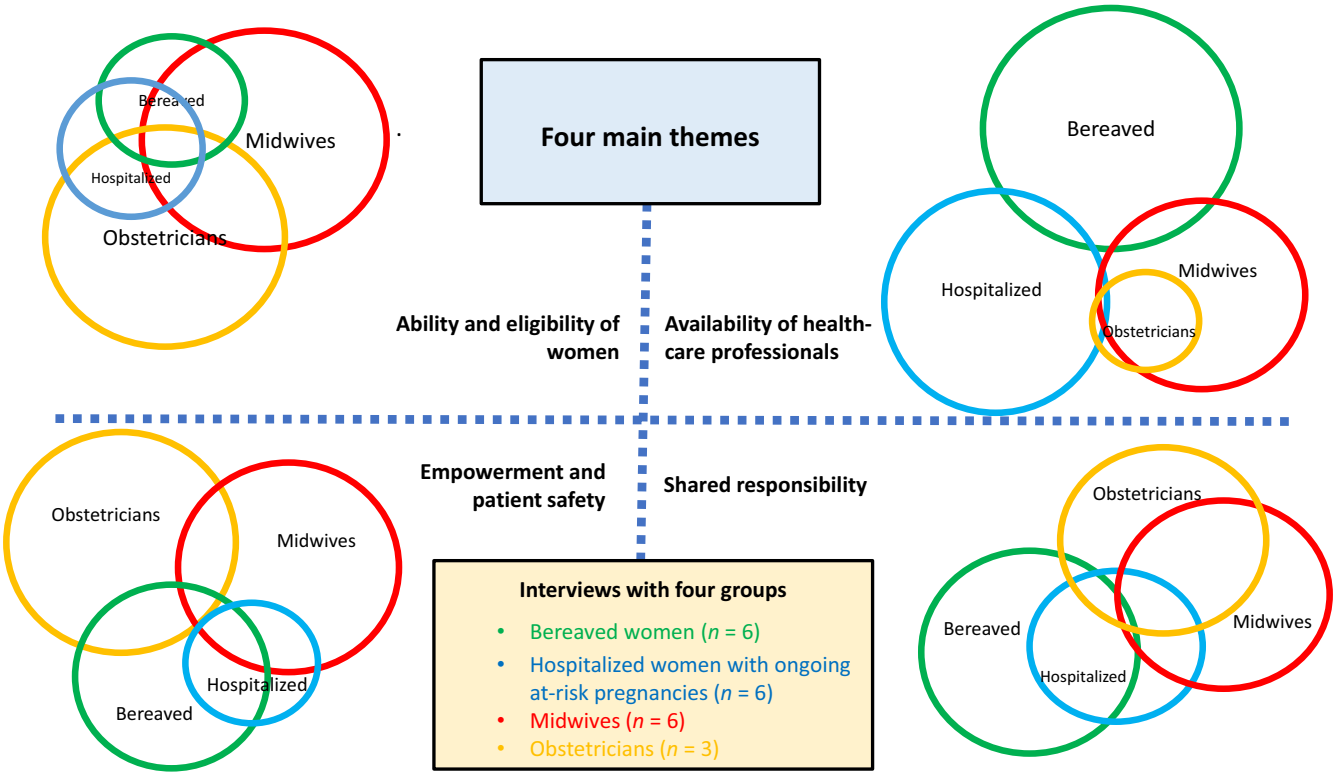

FIGURE 1 Visualization of the extent to which each study group detailed and added to a fuller understanding of each theme. A larger circle means more reflections about the theme, and greater overlap means more similar reflections within each theme. The group of hospitalized women with ongoing at-risk pregnancies is depicted with blue circles and the group of bereaved women is depicted with green circles. Ability and eligibility were topics primarily discussed by the midwives (red circles) and obstetricians (orange circles); availability was a topic discussed in all groups, but less among obstetricians. Patient safety was a topic discussed in most detail among the midwives and obstetricians, emphasizing their responsibility for the patients. Responsibility was a salient topic discussed in all four groups.

TABLE 2 Quotes related to eligibility and ability of women.

Obstetricians	Some patients you have no problem sending home because you think, "She understands when something is in the offing and takes action, and she knows where to call." But then there are a few who you thought would know: "Gee, but why did you not call a week ago?" In a way, you get the feeling that they do not quite manage to take care of themselves then or understand the signals and react in an adequate way. And it's clear that then it kind of sticks, or at least you have a lower threshold for hospitalization and follow them up more closely
Midwives	After all, I'll feel a great need to spend some time with that patient and sort of get an overview of resources. Like, "What can they do? To what extent are they compliant enough to take responsibility for…?" And, "Do we know if they report to us?"
Hospitalized	And I think it's really important to think about how women are asked the question about whether they'd like to [have remote monitoring]. Because in my experience, there are a lot of people who are afraid of taking up too much space here, or disturbing already very busy people who work here. Yeah, so they do not just say yes to be polite (Interviewee 5)
Bereaved	I understand very well that it [remote monitoring] helps women who have high blood pressure, who have a tendency to preeclampsia, because these things will be picked up. And that's why I think they just have to select the right patient group for that

better opportunities to prioritize hospital beds and hands-on care for women at highest obstetric risk (quote bereaved, Table 2).

The midwives questioned whether any currently hospitalized patients would be eligible for HBTM. For instance, pPROM patients are increasingly discharged to home with outpatient follow up at the hospital after a few days. Hence, some midwives considered that currently hospitalized pregnant patients are at such high risk that they would hesitate to discharge them for HBTM follow up. Moreover,

the midwives pointed out that the inclusion criteria for HBTM may not necessarily fit clinical reality, as women with high-risk pregnancies often have highly complex risk profiles (e.g., pPROM with fetal breech position that requires proximity to a delivery service).

Obstetricians and midwives stressed the need for individual assessments of patient eligibility for HBTM, taking into consideration the patient's life/family situation, distance to hospital, as well as the resources and supporting networks of each woman. Some midwives and obstetricians argued that being monitored at home may be challenging for some groups, particularly women with small children or other family care obligations. In addition, they emphasized the necessity to assess the women's expected compliance with HBTM, health literacy, health-seeking behavior, as well as level of Norwegian language/communicative skills before offering HBTM (quote midwives, Table 2).

3.2 | Availability of midwives and obstetricians (Table 3)

Home-monitored women may experience high availability of healthcare professionals and continuity of care as only a few dedicated midwives will operate HOME during office hours. Women emphasized the importance of receiving some sort of confirmation that their data had been received and assessed by midwives/obstetricians. They also stressed that any form of app system confirmation was not necessarily sufficient to maintain a sense of safety if monitored at home. Short phone calls a few times a week with a dedicated HOME midwife and available competent/familiar midwives and obstetricians for ad hoc inquiries/consultations were seen as crucial. Hence, predictable and reliable follow-up contact routines were highly valued. A special concern reflected leaving (anxious) women with high-risk pregnancies feeling left alone with HBTM and too little follow up (quote hospitalized, Table 3).

For the hospitalized women, face-to-face contact and midwives' and obstetricians' routines to visit and check in were important for their feeling of safety. It gave them an opportunity to address issues and concerns without feeling that they were taking up midwives' time illegitimately. The physical presence of women in the hospital, which enables face-to-face communication and touching pregnant women's bodies and abdomens, was viewed as crucial for assessing stability and changes in conditions (quote midwives, Table 3). Remote follow up limits such possibilities to use the clinical gaze and assess symptoms. However, women, and midwives and obstetricians, acknowledged that hospitalized patients may also feel left alone experiencing low availability of clinical staff (quote obstetricians, Table 3).

Staff availability was also seen as dependent on hospital management. Midwives, obstetricians and women questioned whether high work pressure and staff shortages would mean that HOME-affiliated midwives might need to help in extraordinary situations in the ward and occasionally be forced to deprioritize HOME patients (quote bereaved, Table 3). In all interviews, participants expressed concern regarding contact availability outside office hours, i.e., phoning/contacting the Department of Obstetrics alongside all other pregnant women. They were worried that reception staff would not properly understand the high clinical risks of HOME patients. Some women had experienced gatekeeping from reception staff, and their awareness of stress and work pressure in the ward made them hesitant to make contact, fearing that they would not be taken seriously or would even be viewed as hysterical.

3.3 | Empowerment and patient safety (Table 4)

The women typically viewed HBTM as positive, also emphasizing the potential empowerment of both the pregnant woman and her partner to take more active roles in follow up. All groups emphasized the

TABLE 3 Quotes related to availability of midwives and obstetricians.

Obstetricians	It's sort of convenient for us to have the patients hospitalized ensuring that everyone is monitored all the time. But it [an emerging acute situation] may just as well happen while you are admitted to the hospital as when you are at home. But, I think you are getting a much more efficient utilization of health professionals. And if the availability [of healthcare professionals] then for the patients who are at home is good, then I think we'll manage to maintain the patients' sense of safety
Midwives	We are the ones to assess, and if I work with that group, I'd like to see the patient. If she's bleeding, I'd like to look at the pad to see how much it is. "Is it a drop?" Or is it "a real bleeding?" Because this is exactly what women fail to assess
Hospitalized	[It's important] that you do not feel forgotten, because some may feel that if they are sent home and hear, "Yes, here you are, here are some devices you are to use" and then you are out of sight and out of mind! It's just that you sort of get the feeling that you are being taken care of then, even if you are staying at home. (Interviewee 1)
Bereaved	What if suddenly they do not, if something dramatic happens in the maternity ward? Does the midwife still have time to check the results? So that's what I'm a bit concerned about. "How prioritized are you when you are sitting at home versus those who are lying in bed and giving birth in the hospital?"

TABLE 4 Quotes related to empowerment and patient safety.

Obstetricians	So it's also an educational challenge for us, to be able to inform them sufficiently, without scaring the water out of them. Because in theory they can actually die
Midwives	Also, there are the CTGs that the patient must submit by 9 o'clock and then it sounds like it should not be conferred with a doctor until closer to 11? That opens up a rather big span of time. So it seems that nobody really can have substantial risk for what should I say? 1: Anything? [Laughs.] 3: [Laughs.] No, it's definitely marginal [risk] compared to, imagining pathological CTG with a small child
Hospitalized	"The CTG measurements at home, then. That is, if you suddenly get a high pulse on the child, or something urgent happens at home, what, how to deal with it? Because I think that if you are going to run CTGs in the first place, it's because there's a need to monitor the child, and then you also need to be able to act quickly if something is abnormal. So that's the part I'm most concerned about, how they will deal with that." (Interviewee 3)
Bereaved	The training should not just be instrumental—"You put it on like this, and then you press there"—without you getting an understanding of what you have measured, because I think that's important

importance of thorough, tailored information provision and training at the hospital for the women to be able to perform the routines of HBTM (quote obstetricians, Table 4). The women particularly underlined the potential empowering aspect of being able to interpret and understand the various measures they report and to assess other indications of changes in their condition (quote bereaved, Table 4). Interestingly, the women had few concerns about whether they could manage the technical aspect of carrying out the monitoring and digital reporting in an HBTM setting. Training and the availability of professionals was regarded as crucial to feel safe and not being left alone with medical equipment they then must handle. When reflecting at a more personal level, several of the hospitalized women articulated uncertainties regarding both risks and further necessary follow up and felt that their current inpatient follow up was safe and necessary.

The midwives and obstetricians were concerned that HBTM would not follow up each woman closely enough (as CTG will not necessarily be assessed in real time). Negative changes in a woman's condition might be detected late, and hence HBTM might fail to provide timely and sufficient care/measures (quote midwives, Table 4). In relation to this aspect, they emphasized the importance of clear guidelines and procedures, when critical and acute situations occur, and questioned whether women at home were able to communicate emergencies. They underlined that it is crucial to know when women need to be transferred to hospital and, hence, not leave it up to the women to assess the necessary actions. In such situations, they claimed, it would be unsafe for the women to be at home, as acute situations may be frightening and difficult for patients to handle (quote hospitalized, Table 4).

According to the midwives and obstetricians, the extent to which women are able to take care of themselves and contact the hospital at the right time—for the right reason—will probably vary. In their experience, patients often assess differently what they experience as normal and acute compared with midwives and obstetricians. The obstetricians suggested it could be challenging to communicate risk and to instruct HOME patients during acute situations such that they would take the situation seriously but not be overly frightened (quote obstetricians, Table 4). If an acute situation occurs, and if the consequences are fatal (e.g., the baby dies), midwives and obstetricians feared they would feel they had not provided the best/intensive care available/possible (i.e., hospital care).

3.4 | Shared responsibility (Table 5)

Some midwives and obstetricians expressed fear of "losing control" over women during HBTM and commented that the women would have to take a very active role in the monitoring. Hence, to maintain control and fulfill their responsibility, they would have to interact with women differently from at present. According to the obstetricians, discharging women with at-risk pregnancies from the hospital implies a substantial cultural change in how midwives and obstetricians work, more explicitly based on building trust and empowering the women to accomplish the monitoring, while simultaneously feeling safe (quote obstetricians, Table 5). Nevertheless, the midwives and obstetricians expected to have the same medical responsibility for women monitored at home as they have for hospitalized high-risk pregnant patients.

If monitored at home, women will have an increased responsibility in the monitoring process. The midwives and obstetricians emphasized that staying at home may help the women to maintain control as they continue their everyday lives and take an active part in their own health follow up. Hence, by being active and taking on such responsibility, the pregnant women will better understand what happens to their body, the pregnancy, and the fetus. Nevertheless, it would require substantial effort from the women to obtain reassurance and a sense of safety (quote midwives, Table 5). Taken together, the midwives and obstetricians expected that many women would gain a greater sense of safety when they had more responsibility, but they also questioned whether all women would be able to handle that responsibility. Based on their clinical experience, they know that during a high-risk pregnancy, some women struggle with understanding (and caring for) their pregnancy complications, emotions, and needs.

The hospitalized women interviewed typically argued that they would feel the same responsibility regardless of whether they were monitored at home or at the hospital. As pregnant women, they felt

TABLE 5 Quotes related to shared responsibility.

Obstetricians	[We have] control in a different way. Because when the patient is at home, you give the responsibility to them, then it's the patient who has responsibility. And that's a bit hard to give up that responsibility
Midwives	2: Yes, but then you should be confident in yourself as a midwife, right? The patient will feel safe if you [the midwife] give clear messages, and are very certain about what you say. And, not like, "yeah, maybe" or "I'm not quite sure," because then I believe… 1: Yeah, so you have to select midwives too [laughs]. 2: Yeah, they should not be a fresh educated midwife. […] 3: Yeah, but it must be important that the women who will be involved and are to be monitored at home, that they feel self-efficacy and will cope. That must be the most important thing
Hospitalized	[It's important] that the patient is not left with a feeling of responsibility for their own treatment. As long as you have someone you can talk to, who you physically talk to who can explain and reassure you, then you feel that someone else has responsibility (Interviewee 3)
Bereaved	You have to be extremely determined. Because you, you actually have to demand quite a lot yourself. At least in a situation like the one we have been through, it's not someone who just gives you things… you actually have to stand up and demand that: "I need this!" And like, "What do you need?" No one is asking you that. You kind of have to demand a bit yourself then […] You have to fight for yourself in the system!

responsible anyway; responsible for "feeling the baby move" and communicating their own health situation. However, they expressed that it can be difficult to assess what is normal and what is an indication for exacerbation of risk. Some women expressed that it is difficult to handle the responsibility when they are left alone with difficult assessments/decisions (quote hospitalized, Table 5). They expressed fear about not being taken seriously when contacting healthcare services and so not being examined. Women argued that managing the responsibility is easier when there are specific routines with less room for negotiation about hospital follow up.

The women indicated that they were very wary/sensitive of their own body and symptoms when their pregnancy was defined as high-risk. It was challenging for women who had experienced stillbirth to handle the risk of a new pregnancy along with limitations of treatment and follow up, despite their awareness that pregnancies are never 100% free of risk. In subsequent pregnancies, they had experienced anxiety and therefore a substantial need for being in control; for instance, in later pregnancies they felt it crucial to ensure that they received proper follow up. However, some expressed that it is difficult to be active and demanding while simultaneously experiencing severe uncertainty (quote bereaved, Table 5).

4 | DISCUSSION

The findings show that the benefits and potentials of HBTM of risk pregnancies were clearly acknowledged in all groups, and at the same time crucial conditions for and concerns about such monitoring were addressed. In previous studies addressing experiences of women with high-risk pregnancies who had been telemonitored, women experienced an increased sense of freedom and the familiar home environment as comfortable and less stressful than hospital admission.[7,10] They experienced improved access to and continuity of care as well as communication and health outcomes, while decreasing clinic visits and travel time.[9,20,21] The same group also emphasized that experiencing good communication with midwives and obstetricians, as well as timely (re)actions to measurements as crucial to maintaining a sense of safety.[20,22]

Additionally, home-monitored pregnant women stressed the importance of being empowered to interpret and act on their measurements, enabling them to cope with the worries and anxiety related to their increased risk.[21] These results correspond to this study's findings, addressing the expectations and views of both women with previous and ongoing experience with high-risk pregnancies, as well as the views of the healthcare providers for women with high-risk pregnancies. Taken together our results underscore that, compared with the present roles in a hospital setting, this HBTM will demand more active roles, both from the women being telemonitored at home and midwives and obstetricians who operate HBTM. Moreover, our findings highlight that available and competent midwives and obstetricians are crucial to empower and enable an active patient role, particularly in acute situations. However, external dimensions such as a highly pressured specialist health care, staff shortages, and the task of integrating and coordinating flexible and personalized services may present additional challenges in introducing an HBTM model.

The current study also indicates that if women with a risk pregnancy lack available and competent professional support, both women monitored at home and midwives and obstetricians are likely to experience loss of control and safety. Additionally, the expectations and views about changed professional and patient roles in the current study have clear parallels to a previous study illuminating midwives' and obstetricians' experiences related to self-monitoring of BP in high-risk pregnancies.[11] In that study, while self-monitoring did not reduce the responsibility that midwives and obstetricians have for women's health, it enhanced the responsibility and agency of pregnant women and reconfigured the roles, mutual expectations,

and relationships and responsibilities of midwives, obstetricians and pregnant women.[11]

Until now most models of HBTM of high-risk pregnancies offer measurements of single parameters, mainly BP.[11,23] In the current study, we analyzed views and expectations about a more complete HBTM model with several parameters/measures, including CTG, which makes this a comprehensive service applicable for monitoring several pregnancy complications. The first two studies reporting evidence from large-scale studies with a more comprehensive HBTM including CTG, performed in the Netherlands and Denmark, concluded that telemonitoring of complicated pregnancies was as effective and safe as in-house hospital surveillance.[4,5] Such evidence from comparable health systems is crucial for implementing other comprehensive HBTM models for women with high-risk pregnancies and has, together with the current expectation study, guided the pilot phase of the HOME model (ClinicalTrials.gov, NCT05763069). Qualitative interviews will be carried out throughout the further pilot phase of the HOME trial.

The COVID-19 pandemic reinforced the importance of developing more flexible healthcare services in antenatal care with possibilities for remote monitoring and communication with hospital staff.

To gain comprehensive understanding of the acceptability of HBTM of high-risk pregnancy, it is crucial to include views from different groups, including care providers and recipients.[10] The researchers conducting the interviews were social scientists and not clinicians and therefore did not know any of the participants beforehand. This background may have given the interviewers a position during the interviews as externals, and not as representatives or stakeholders of the healthcare system. This may have given them an advantage to address possibly controversial questions regarding professional and patient responsibilities, as well as safety, risks, and anxiety without being understood as partial or normative. However, this position may also have limited the understanding of the complexity of clinical assessments and work, and the experience of high-risk pregnancy, and hence to a lesser degree being able to facilitate or follow up relevant clinical reflections during the interviews. Discussions with the multidisciplinary research team throughout the analysis nevertheless contributed to exploring clinical uncertainties and dilemmas, which in turn strengthened the clinical relevance of our interpretations of the results.

The participants were not familiar with the details of the planned HOME project before the interviews. Therefore, they were given an outline of the model before the interviews started. Hence, the participants had a common basis to discuss and reflect upon. In the FGIs questions, confusions and uncertainties were raised and clarified throughout the sessions. This made the FGIs particularly well suited to enable all participants to reflect on several aspects of such a model, not just the aspects that they themselves had addressed. The presentation of the HOME project may have been perceived by the midwives and obstetricians as a fundamental change of their work, which they had not had the opportunity to influence. As a result, a perception of limited employee participation in the change/development process of patient care may have influenced their acceptance of HBTM.[24]

5 | CONCLUSION

The current study addressing users' and healthcare providers' expectations and views related to HBTM of high-risk pregnancies has shown how such a model may require a new, proactive role among monitored women as well as midwives and obstetricians. Conditions for HBTM were understood in terms of optimal personalized training, individual assessment of eligibility, and empowerment of a more active patient role. To establish a sense of shared responsibility, it is crucial to maintain safety in HBTM in high-risk pregnancies, particularly in situations involving emerging acute health issues. This study's results may provide aspirational and relevant knowledge in the further development of the HOME model through pilot phase, clinical trial and implementation in standard provision of specialized antenatal healthcare. Moreover, multi-perspective studies on real-life experiences of comprehensive HBTM of high-risk pregnancies, including how acute situations are handled, will be necessary.

AUTHOR CONTRIBUTIONS

ACS and ASDP conceived this study, acquired funding, and wrote the study protocol with input from GA, KNS, and EB. GA and KNS collected the study data. GA, KNS, and SR analyzed the data, assisted by ACS, ASDP, and EB. GA, KNS, and SR interpreted the data, and GA drafted the manuscript with input from KNS, ACS, ASDP, EB, ÅW, and SR. All authors revised the manuscript and agreed on the last manuscript version to be submitted.

ACKNOWLEDGMENTS

We would like to thank several collaborators in the HOME study: Anne Elisabeth Bjerkreim for recruiting healthcare professionals for FGIs and patients hospitalized with ongoing high-risk pregnancies for individual interviews, Vilde von Krogh from the Norwegian Stillbirth Society for facilitating the recruitment of women associated with the organization, and Meryam Sugulle for valuable discussions of the study findings and the HOME study design.

FUNDING INFORMATION

This part of the HOME study has received funding from the Research Council of Norway (a "Collaborative and Knowledge-building Project," Ref 326650), the University of Oslo and Oslo University Hospital.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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SUPPORTING INFORMATION

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

How to cite this article: Aasbø G, Staff AC, Blix E, et al. Expectations related to home-based telemonitoring of high-risk pregnancies: A qualitative study addressing healthcare providers' and users' views in Norway. *Acta Obstet Gynecol Scand*. 2023;00:1-10. doi:10.1111/aogs.14726