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Understanding the EMR-Related Experiences of Pregnant Japanese Women to Redesign Antenatal Care EMR Systems

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Abstract: Woman-centered antenatal care necessitates Electronic Medical Record (EMR) systems that respect women's preferences. However, women's preferences regarding EMR systems in antenatal care remain unknown. This work aims to understand the EMR-related experiences that pregnant Japanese women want. First, we conducted a field-based observational study at an antenatal care clinic at a Japanese university hospital. We analyzed the data following a thematic analysis approach and found multiple EMR-related experiences that pregnant women encounter during antenatal care. Based on the observations' findings, we administered a web survey to 413 recently pregnant Japanese women to understand their attitudes regarding the EMR-related experiences. Our results show that pregnant Japanese women want accessible, exchangeable, and biopsychosocial EMRs. They also want EMR-enabled explanations and summaries. Interestingly, differences in their demographics and stages of pregnancy affected their attitudes towards some EMR-related experiences. To respect their preferences, we propose amplifying the roles of EMR systems as tools that promote communication and woman-centeredness in antenatal care. We also propose expanding the EMR design mindset from a biomedical to a biopsychosocial-oriented one. Finally, to accommodate the differences in individual needs and preferences, we propose the design of adaptable person-centered EMR systems.

Keywords: Electronic Medical Record system; user experience; antenatal care; Japan; observational study; survey; pregnancy; women; attitudes; person-centered care

1. Introduction

Electronic Medical Record (EMR) systems are intrinsic to modern day clinics. Their main purpose is to improve healthcare provision [1,2]. Although good healthcare provision nowadays implies patient-centered care [3], the design and implementation of EMR systems rarely takes into consideration the patients' preferences, needs, and values [4]. Healthcare providers are considered the potential users

and buyers of EMR systems and therefore are the main focus of EMR system designers. In this scheme, integrating EMR systems into clinical environments while maintaining patient-centered care remains an unresolved challenge [5]. To tackle this challenge, the patients' attitudes, preferences, and priorities need to be understood and used as a basis for designing patient-centered EMR systems and clinics.

In this work, we focus on EMR systems in Japanese antenatal care settings where pregnant women—rather than patients—are taken care of, rather than being cured. The importance of studying EMR systems in antenatal care derives from the unique needs and aspirations of pregnant women, and the unique context of antenatal care in terms of timing, goals, processes, and outcomes.

First, pregnancy is a special time for women where joy and excitement are accompanied by fear, uncertainty, and anxiety about their pregnancy and future [6]. During their pregnancy, pregnant women are encouraged to be highly involved and actively exchange information with their care providers. As for their partners and family members, it is common for them to be involved in the process and attend the routine antenatal care visits. In this sense, antenatal care settings are unique in that the care providers and receivers do not fall into the usual 'clinician–patient' scheme.

Second, unlike other care processes where the purpose is to cure one patient, antenatal care aims to prevent and early detect diseases that could affect the pregnant woman and her fetus(es). During antenatal care, health data is collected about the pregnant woman and her fetus(es) because health problems occurring during pregnancy could have lifetime health effects on both of them. Therefore, antenatal care is the first point of contact humans have with their medical record. The effective use of EMR systems in antenatal care settings is necessary if we aim to have complete longitudinal health records and reduce future healthcare costs.

The aim of this work is to understand the attitudes, preferences, and priorities of pregnant Japanese women regarding their EMR-related experiences in antenatal care. More specifically, this work aims to answer the following research questions:

- RQ1: What are the current EMR-related experiences of pregnant Japanese women?
- RQ2: What are the ideal EMR-related experiences for pregnant Japanese women?
- RQ3: How important are the different EMR-related experiences for pregnant Japanese women?

To answer these questions, we first conducted a field-based observational study to identify the EMR-related experiences of pregnant women in Japanese antenatal care settings. The observations were conducted at an antenatal care clinic at a Japanese university hospital. The observational data were analyzed following a thematic analysis approach. Based on the observations' findings, we administered a web survey to 413 recently pregnant Japanese women. The survey examined the women's attitudes regarding (i) the use of EMR systems during their checkups; (ii) their online management of their pregnancies; (iii) the contents of their EMRs; and (iv) the way their records are exchanged between their providers. This work is meaningful due to the paucity of information about pregnant women's attitudes, preferences, and priorities regarding the use of EMR systems in antenatal care settings.

1.1. Background—Antenatal Care

Antenatal care is defined as the care a woman receives from healthcare professionals during her pregnancy. First introduced in 1902 by Scottish obstetrician J.W. Ballantyne with prevention as the primary purpose, antenatal care soon spread throughout Europe and is now an international routine medical practice [7]. Usually, the process involves the woman, her partner, her family, and multiple healthcare providers such as obstetricians, midwives, and nurses. For pregnant women, satisfactory antenatal care provides them with enough information about their pregnancy and addresses their concerns seriously [8].

1.2. Background—Antenatal Care in Japan

In 2016, Japan had approximately one million births [9]. Obstetrical practice in Japan is standardized by the Japan Society of Obstetrics and Gynecology (JSOG) and the Japan Association of

Obstetricians and Gynecologists (JAOG) [10]. As of 2011, an estimated 99.7% of pregnant women in Japan undergo the recommended regular antenatal checkups [11]. Healthy women with uncomplicated pregnancies usually receive 14 checkups, starting before their 8th week of pregnancy and continuing until one week after childbirth [10]. In some cases, pregnant women in Japan do *satogaeri shussan* where they return to their natal home during the last stages of their pregnancy [12], a geographical move that entails a change of healthcare providers.

In addition to the antenatal care visits, the pregnant women are provided with the *Boshi Kenko Techo*, a paper-based Maternal and Child Health (MCH) handbook [11]. The MCH handbook is used by almost all pregnant and postpartum women in Japan. It consists of records of the woman's pregnancy, delivery, and child development and health. The handbook is also filled and reviewed by antenatal care providers at hospitals, clinics, or health centers [13]. Historically, the role of the MCH handbook changed with respect to public health needs and policies. The drastic decrease in newborns led to an emphasis on psychosocial support for childbearing and child rearing in recent versions of the handbook [12].

Japanese women can choose between midwife-led (MW-led) antenatal care and obstetrician-led (OB-led) antenatal care. When comparing both types of antenatal care for low-risk pregnancies, Iida et al. [14] found that pregnant women in MW-led care had longer antenatal care visits, conversed more, and received more specific advice than women in the OB-led group. Moreover, women in the MW-led care group gave higher ratings to their satisfaction with care and their perception of woman-centered care. The authors suggest that these results highlight the different roles of the obstetricians and the midwives. The obstetricians' role is to intervene when they find abnormal medical signs while the midwives' role is to promote self-care and autonomy.

1.3. Background—General Overview of EMR Systems in Examination Rooms

In general, the healthcare sector has been slow at adopting EMR systems in examination rooms. Previous studies described multiple EMR adoption barriers, including usability issues, lack of fitness of EMR systems with existing clinical workflows, and concerns about computers negatively affecting the patient-provider relationship. To increase the adoption of EMR systems in healthcare, numerous studies have examined the needs of healthcare providers and the effects of computers on the patient-provider relationship.

Previous studies have shown that healthcare providers do not want EMR systems to disrupt their existing workflows and want them to integrate well into their work practices [15–17]. They want to easily navigate and find information in the EMRs [18–20] and need the EMR systems to support all of their formal [21,22] and informal documentation and communication tasks [23]. The shortcomings of previous EMR systems could be attributed to the task-focused mindset of early system implementers. Early EMR system implementations mostly aimed at allowing individual care providers to efficiently perform certain tasks. Soon, it became clear that analyzing care processes and designing for healthcare teamwork was needed [24].

The presence of a computer in the examination room may also impact the patient-provider relationship and the satisfaction of the patient with the received care. Scott and Purves [25] noted the need to consider the patient, doctor, and computer in a "triadic" relationship when researching patient-provider relationships. Pearce et al. [26,27] further highlighted this "triadic" relationship by showing that the computer influences the human actors during the examination. The computers may amplify existing communication behaviors of clinicians [28] due to a "bottleneck effect" where the clinicians lose the ability to multitask [29,30]. This effect increases as the EMR tasks become more complex [30].

Factors external to the EMR systems could affect the way they are used, including: the doctor and patient characteristics [26,27], the clinical room layout [31], and the content of the examination [32]. Chan et al. [32] found that doctors spent 50% less time using computers in examinations with psychological content. Als [33] found that clinicians appropriated the computers and used them

in unintended ways, like using the computer as a "magic box" that allows them to present their abstractions as medical facts or conclusions while pointing at it. Als [33] also found that the clinicians resorted to the computer when they needed to take some rest or some "time out" to think.

Most of the previous research about EMR systems was situated in a triadic relationship scheme. Since the pregnant women are usually accompanied by a partner or family member, the antenatal care setting targeted in this work does not perfectly fit into the triadic scheme.

1.4. Background—Patient Attitudes towards EMR Systems

Multiple studies showed that the use of EMR systems negatively affects patient-provider communication [34–36]. However, there is currently no evidence that the use of a computer during the examination affects patient satisfaction or the patients' perception of patient-provider communication [37,38].

Patients' characteristics may affect their attitudes towards the use of EMR systems during examinations. Strayer et al. [39] found differences between the attitudes of different patient groups towards the use of tablet computers in the examination room. Although patients had a generally positive attitude regarding their physicians using tablet computers, higher age and education levels were associated with a more negative attitude. People with high school or lower education were less worried about the safety of their health information and the mistakes that tablet computers are prone to. People from minority groups were more likely to state that the interaction became less personal because of the use of the tablet computer.

Previous studies also show that patients want to have the ability to access their EMRs [40–42]. When granted access to their EMRs, patients reported a feeling of autonomy and empowerment, and improved communication with their providers [43–45]. A recent study from Australia explored the attitudes of pregnant women regarding the electronic access of their pregnancy records. The women reported that the electronic system was a valuable tool for communicating information and managing their pregnancy [46].

On the other hand, providers are reluctant to expose all the EMR contents because they do not usually write their EMR notes with the intent of sharing them [47]. The notes are therefore complex and could contain the providers' personal thoughts. Nevertheless, patients prefer having access to their EMRs even when the contents are inconsistent, derogatory or previously undisclosed [43].

In addition, patients were shown to want granular control over their EMRs and the ability to share them temporarily with different healthcare providers [48–51].

1.5. Background—EMR Systems in Japanese Antenatal Care Settings

As of 2007, an estimated 93% of university hospitals, 71% of public hospitals, 33% of private hospitals, and 10% of clinics in Japan were using a form of computerized medical record or order entry system [52]. Since 2007, the adoption of EMR systems has been steadily increasing and is expected to reach 90% in general hospitals by 2020 (www.kantei.go.jp/jp/singi/keizaisaisei/kadaibetu/dai6/siryou1.pdf).

In addition, multiple web and mobile applications for pregnant women were announced in Japan in the last decade [53]. These proposed applications are digital versions of the MCH handbook with extra functionalities such as automatic chart generation and child immunization reminders. The number of pregnant women using these applications is increasing but their usage remains uncommon. Google Play shows less than half a million downloads for "Ninpu-Techo", a pregnancy mobile app developed by Hakuhodo DY Media Partners, Tokyo, Japan and NTT DOCOMO Inc., Tokyo, Japan in 2013 (https://play.google.com/store/apps/details?id=jp.co.hakuhodody.media.nimputecho). To our knowledge, pregnant women in Japan currently do not have online access to their official EMRs inside their providers' systems. Even though EMR systems are commonly used in Japanese antenatal care settings, not much is known about their use or about the pregnant women's attitudes regarding them.

2. Materials and Methods

This work was conducted following the Japanese code of ethics for clinical research. In this work, we did not conduct any invasive interventions on patients, nor publish any personal information of patients, nor focus on the health outcomes of patients. Therefore, due to the nature and content of this research, we were not required to receive the approval of an ethics committee.

This research is a mixed methods research with an exploratory sequential approach—a qualitative study followed by a quantitative study. In the following sections, we describe in detail how this work was conducted. First, we describe how we conducted the field-based observational study and how we analyzed the collected data. Then, we describe how we designed, administered, and analyzed the web survey.

2.1. Field-Based Observational Study

The aim of the field-based study was to identify the different EMR-related experiences of pregnant women in Japanese antenatal care settings. The observations were situated in an antenatal care clinic at a major Japanese university hospital. In the following subsections, we describe how we collected and analyzed the data to extract the women's different EMR-related experiences.

2.1.1. Data Collection

After receiving the approval of the antenatal care providers, one researcher visited the antenatal care clinic to observe the use of EMR systems during antenatal care checkups. The checkups were provided by a team of obstetricians, midwives, and nurses. The researcher visited the antenatal care clinic twice a week over a period of three weeks.

After receiving verbal consent from the pregnant women and their companions, the researcher was allowed to directly observe and take notes during the checkups. In the observations, the researcher focused on (i) the way the EMR system is used during the checkup and (ii) how the different involved parties relate to it. Following the checkups, the researcher engaged in conversation with the clinical staff to clarify ambiguities or gain a deeper understanding of occurrences.

In the antenatal care clinic, the obstetrician and the midwife each had their own EMR system. The pregnant women were seated next to the obstetrician's desk. The room layout was 'semi-inclusive patient controlled'—the pregnant women could have access to the EMR screen by moving the direction of their gaze [54]. On the other hand, the pregnant women's companion had no access to the EMR screen due to the placement of their assigned chairs.

In total, we observed three obstetricians and six midwives performing 37 antenatal care checkups for 35 pregnant women. The pregnant women were between their eighth and 33rd week of pregnancy.

2.1.2. Data Analysis

Following each observation, the notes were transcribed and imported in QDA miner. QDA miner (https://provalisresearch.com/products/qualitative-data-analysis-software/) is a software tool that supports qualitative analysis processes. Once the data was in electronic format, the analysis was conducted by three researchers following a thematic analysis approach. The researchers followed the six phase guide of Braun and Clarke [55]:

- Familiarization with the data: the researchers went through the data multiple times to gain a deeper understanding and familiarize themselves with it.
- Coding the data: after becoming familiar with the data, the researchers generated an initial set of codes. The codes were then associated with different parts of the notes. The coding process was repeated over three iterations during which the codes were extended and refined.
- Searching for the themes: at this stage, the researchers refocused the analysis on a broader level and extracted several themes by combining several codes together.

- Reviewing the themes: once the initial set of themes was identified, the researchers merged some themes together and discarded the themes that had little data associated with them.
- Defining and naming the themes: the themes were finally named and clearly defined in terms of EMR-related experiences.
- Producing the report: the resulting EMR-related experiences are presented in the results section.

2.2. Web Survey

Once the thematic analysis was concluded, multiple EMR-related experiences were identified. For each EMR-related experience, we aimed to understand:

1. Currently, how much are pregnant Japanese women experiencing it?
2. Ideally, how much or how would pregnant Japanese women want to experience it?
3. How important is this EMR-related experience to pregnant Japanese women?

By asking these questions, we gathered information about the pregnant women's current experiences, preferences, and priorities regarding the use of EMR systems in Japanese antenatal care settings.

2.2.1. Web Survey Design

In total, nine EMR-related experiences were extracted. In this section we describe how we mapped the extracted experiences to survey questions.

Five of the nine EMR-related experiences could be experienced by any pregnant Japanese woman receiving antenatal care in a clinic equipped with an EMR system. For each of these five experiences, we asked the women about:

- The current frequency of the experience.
- The ideal frequency of the experience.

    Answers to these types of questions were reported on a 6-point Likert-type frequency scale, with 1 being the high end and 6 being the low end.

- The importance of the experience to them.

    Answers to this type of question were reported on the following scale ("1 = Very important", "2 = Important", "3 = Slightly important", "4 = Not important").

Four EMR-related experiences cannot be currently experienced by most of the pregnant women in Japan. This assumption is based on our knowledge of available health IT tools in Japan. However, future EMR system designs could provide such experiences. Therefore, for each of these four experiences, we asked the women about:

- Wanting the experience.

    Answers to this type of question were reported on the following scale ("1 = Strongly want", "2 = Want", "3 = Slightly want", "4 = Do not want", "5 = Do not care").

- The importance of having the experience.

    Answers to this type of question were reported on the following scale ("1 = Very important", "2 = Important", "3 = Slightly important", "4 = Not important").

The scales in the survey had no midpoint. In this case, the use of scales with no midpoint was purposeful as studies have shown that Japanese people tend to choose the midpoint if such an option is available [56].

2.2.2. Web Survey Method

Our target sample was 20–44-year-old Japanese women who had recent antenatal care experience.

We collected the data through a Japanese survey research company. The company has access to an online panel where web survey participants receive point-based compensation that could be exchanged later on for cash or gift cards. The company invited women aged 20–44 for a preliminary screening. The women who had a pregnancy in the last year, and had at least three antenatal care checkups, were invited to take the web survey. The survey data were collected over a period of two days in September 2018.

In addition to the questions regarding their EMR-related experiences, we asked about their level of education and their overall satisfaction with the antenatal care they received. We were also able to automatically collect demographic items (age, personal income, household income, area of residence) through the available data from the online panel. In total, the survey consisted of 25 questions, was administered in Japanese, and took around ten minutes to complete. The survey questions are shown in Figure A1 in the Appendix A.

To analyze the web survey data, we used SPSS 25.0 (IBM, New York, NY, USA, 2017). In our analyses, we used non-parametric statistical tests as described in the results.

3. Results

3.1. EMR-Related Experiences

By analyzing the data collected in the field observational study, we identified nine themes in terms of EMR-related experiences. The names and the definitions of the themes are shown in Table 1. The last column, "Type", indicates if the pregnant women can currently have the experience or if they may have it in the future.

Table 1. EMR-related experiences.

Experience	Definition	Type
Explanation	The providers using the EMR screen as an explanation support tool.	Current
Interruption	EMR systems hinder the communication of the women and their providers.	Current
Exclusion	The pregnant women feeling excluded by not being able to see the EMR screen.	Current
Distrust	Sensitive psychosocial data not being documented in detail inside the EMR.	Current
Exchange	Different providers exchanging the women's medical records.	Current
Online Viewing	The pregnant women being able to view the contents of their EMRs online.	Future
Online Editing	The pregnant women being able to add content to their EMRs online.	Future
Summarization	The women having access to a summary of their pregnancy.	Future
Assistance	The women being able to manage their antenatal care appointments online.	Future

3.1.1. Explanation

During antenatal care checkups, the providers explain to the pregnant women and their companions the current state of the pregnancy and the rationale behind all clinical decisions. In the observations, we found that the obstetricians used the EMR screen as an explanation support tool. While verbally explaining the status of the pregnancy, the obstetricians were reading notes from the EMR and elaborating on them while pointing towards the screen. We also observed instances where the obstetricians used automatically generated charts and ultrasound images from existing EMR notes to visually communicate the information to the pregnant women.

3.1.2. Interruption

Through the observations, we found that the use of the EMR system interrupted the communication between the pregnant women and the obstetricians. We observed the healthcare providers spending major parts of the checkups keyboarding and facing the EMR screen. During

that time, the pregnant women waited silently or tried to engage in conversation. When addressed, the obstetricians responded by alternating between the pregnant women and the EMR screen.

Controversially, the obstetricians appeared to use the EMR system as an excuse to pause the communication with the pregnant women. By turning to their screens and using the EMR system, they were able to control the communication as they pleased. The obstetricians used this strategy either to take some time to think or to avoid communicating in highly emotional situations. In one instance, the obstetrician had to inform the pregnant woman that her pregnancy needed to be terminated. The woman started crying. Consequently, the midwife approached the woman to provide her with emotional support while the obstetrician turned to his EMR screen to separate himself from the situation.

3.1.3. Exclusion

On multiple occasions, the pregnant women and their companions were visibly trying to get closer to the EMR screen to see what the obstetricians were doing. Due to the physical layout of the antenatal care clinic, the pregnant women and their companions were excluded from viewing the EMR screen.

3.1.4. Distrust

Through the discussions with the midwives, we found that the antenatal care staff is reluctant to document sensitive psychosocial information in detail in the EMR system. One midwife stated, "If we have concerns over some psychosocial issues such as domestic abuse, we note it indirectly in the record. We do not write it literally; we use codes to pass the message to the other clinical staff".

3.1.5. Exchange

In japan, many pregnant women return to their hometown during the last stages of their pregnancy. This custom, referred to as *satogaeri shussan* in Japanese, allows them to be with their mothers when they give birth. This geographical move entails a change of antenatal care providers. In this case, the different providers need to exchange the women's medical records. In our observations, when a pregnant woman transferred from another clinic, she usually brought along a paper copy of the medical record. Based on the provided copy, the antenatal care team created a new EMR and only added the important information. Therefore, the complete data in the medical records are lost during this transfer.

3.1.6. Online Viewing

In the observations, we found that the pregnant women do not have any personal access to their EMRs. To access the contents of their EMRs, they have to fill out an application and submit it to the hospital administration which in turn will prepare a copy for them. With the current EMR systems, most pregnant women in Japan cannot access their EMRs online.

3.1.7. Online Editing

In addition to not having any viewing access, the pregnant women do not currently have any way to add content to their EMRs. In the observations, we found that some pregnant women monitor themselves at home and bring their home-monitored data to their antenatal care visits. The antenatal care providers review this data and add their conclusion in an EMR note. However, the complete data remains out of the EMRs.

3.1.8. Summarization

During the antenatal care checkups, the obstetricians provide the women with information regarding the state of their pregnancy and explain the next steps to them. Currently, this pregnancy

summary is verbally communicated to the pregnant women. However, in some cases, the antenatal care providers also store the pregnancy summary in the EMR system.

3.1.9. Assistance

Currently, the appointment for the next visit is decided at the end of each antenatal care checkup. The obstetricians and the pregnant women discuss their availability to find a time that suits them both. The appointment is then scheduled using the EMR system. Future changes to the appointment can be made through phone calls.

3.2. Web Survey Participants

We received 413 valid survey responses, 258 (62.5%) from currently pregnant Japanese women, and 155 (37.5%) from previously pregnant Japanese women. The previously pregnant women had a pregnancy during the last year. All respondents had attended at least three antenatal care checkups in Japan during the last year.

Mann-Whitney U tests comparing the responses of currently pregnant and previously pregnant women showed statistically significant differences between these subgroups on five items in the survey. These items related to the women's:

- Current experiences of Exclusion and Distrust.
- Aspired experiences of Explanation and Interruption.
- Priorities regarding the experience of Explanation.

Therefore, we separate these subgroups when analyzing the answers to these five items.

Participants were from 44 out of 47 prefectures in Japan and their ages were distributed as follows: 20–24 (8.7%), 25–29 (31.5%), 30–34 (41.4%), 35–39 (15.5%), and 40–44 (2.9%). The age had a very weak negative correlation ($r = -118$, $p < 0.05$) with the acceptable amount of interference caused by the use of EMR systems during checkups.

The participants' highest levels of education were distributed as follows: less than high school (1.7%), high school graduate (23.2%), technical school graduate (37%), bachelor's degree (36.3%), and master's degree (1.7%). The level of education had a very weak negative correlation ($r = -0.155$, $p < 0.001$) with the reported frequency of interference caused by the use of EMR systems during the checkups.

The participants' personal income levels, in Japanese yen, ranged from: less than 2 million (47.2%), 2–4 million yen (18.6%), 4–6 million (4.6%), and 10–12 million (0.2%). 5.5% of the participants reported that they do not know their personal income level and 23.5% did not provide personal income data.

The participants' household income levels, in Japanese yen, covered a wide range including: less than 2 million (3.9%), 2–4 million (18.9%), 4–6 million (24.2%), 6–8 million (14.8), 8–10 million (7.7%), 10–12 million (1.7%), 12–15 million (0.7%), 15–20 million (0.5%) and more than 20 million (0.2%). 6.1% of the participants reported that they do not know their household income level and 21.3% did not provide household income data.

One reason for not reporting the income level could be that Japanese people view this information as highly private and are reluctant to disclose it. It is important to note that Mann-Whitney U tests showed no significant differences on any of the survey items between respondents who reported their income levels and respondents who did not report their income levels. Spearman's correlations showed that the participants' income level did not have significant correlations with any of the questions related to the EMR system.

The level of satisfaction with the received care significantly correlated with age ($r = 0.251$, $p < 0.001$), personal income level ($r = -0.670$, $p < 0.001$), and household income level ($r = -0.840$, $p < 0.001$). This may reflect that younger and higher income Japanese women have higher expectations for care. The level of satisfaction with the care did not significantly correlate with any questions about the EMR-related experiences.

3.3. Pregnant Japanese Women's Attitudes toward the EMR-Related Experiences

First, we present the survey findings separately for each EMR-related experience. Then, we summarize the findings to describe the current experiences, aspirations, and priorities of pregnant Japanese women regarding the use of EMR systems in antenatal care.

3.3.1. Attitudes towards the Experience of *Explanation*

The first three questions of the survey aimed to understand Japanese women's opinions about the current frequency (Q1), the optimal frequency (Q2), and the importance (Q3) of providers using the EMR screen as an explanation support tool. Since we found significant differences between currently and previously pregnant women on (Q2) $z = -2.2$, $p < 0.05$, and (Q3) $z = -2.2$, $p < 0.05$, we report the findings separately for these subgroups.

Both subgroups reported that most of the providers very rarely used the EMR screen as an explanation support tool. When asked (Q1) "How often does your antenatal care provider use the EMR system to explain something to you?", the median response for currently pregnant women was "Very rarely" and the modal response was "Not at all" (32.6%). Similarly, for previously pregnant women, the median response was "Very rarely" and the modal response was "Not at all" (34.8%). However, 24.7% of the currently pregnant women and 25.8% of the previously pregnant women reported their providers "Frequently" or "Very frequently" using the EMR system to explain something to them.

Ideally, for both subgroups, the providers would occasionally use the EMR screen to explain something to them. When asked (Q2) "Ideally, how often do you think the antenatal care providers should use the EMR system to explain something to you?", the median and the modal response for currently pregnant women was "Occasionally" (35.3% of the women). Similarly, for previously pregnant women, the median and the modal response was "Occasionally" (47.1% of the women). Currently pregnant women were more likely than previously pregnant women to think their providers should "Frequently" use the EMR screen as an explanation support tool (31% vs. 19.4%).

For both subgroups, the use of the EMR screen by the providers as an explanation support tool was slightly important. When asked (Q3) "How important do you think it is that the antenatal care providers use the EMR system to explain something to you?", the median and modal responses for both subgroups was "Slightly important" (42.2% for currently pregnant women and 36.8% for previously pregnant women). However, previously pregnant women were more likely than currently pregnant women to choose "Not important" as a response (17.4% vs. 13.2%).

3.3.2. Attitudes towards the Experience of *Interruption*

We asked two questions to understand Japanese women's attitudes about the current frequency (Q4) and the acceptable amount (Q5) of interference caused by the use of EMR systems. One question (Q6) was asked to understand the importance of EMR systems not interfering with their communication with the providers. Since we found significant differences between currently and previously pregnant women on (Q5) $z = -2.3$, $p < 0.05$, we report the findings of (Q5) separately for these subgroups.

For most of the women, the use of the EMR system very rarely interfered with communication with their providers. When asked (Q4) "How often does the use of EMR systems by the antenatal care providers interfere with your communication with them?", the median and modal response was "Very rarely" (48.7%). However, 18.2% of the women answered "Occasionally". Only 5.3% answered "Frequently" and 1.5% answered "Very frequently".

When asked (Q5) "Ideally, how often would the use of the EMR system interfere with your communication with the antenatal care providers?", the median and modal responses were "Very rarely" (40.3 % for currently pregnant women and 33.5% for previously pregnant women). Previously pregnant women were more likely than currently pregnant women to accept more interference with 11% answering "I do not mind the interference" and 1.3% answering "I am okay with a lot of interference".

For currently pregnant women, only 4.7% answered "I do not mind the interference" and none of them answered "I am okay with a lot of interference".

Both subgroups agreed it was important that the use of the EMR system does not interfere with their communication with their providers. When asked (Q6) "How important do you think it is that the use of EMR systems does not interfere with your communication with the antenatal care providers?" 45% answered "Important" and 16.5% "Very important". Only 3.9% of the women indicated it was "Not important".

3.3.3. Attitudes towards the Experience of *Exclusion*

We asked three questions to understand whether Japanese women felt excluded because they could not see the EMR screen (Q7), the ease with which they want to see the EMR screen (Q8), and the importance of being able to see the EMR screen (Q9). Since we found significant differences between currently and previously pregnant women on (Q7) z = −2.3, $p < 0.05$, we report the findings of (Q7) separately for these subgroups.

When asked (Q7) "Does the inability of seeing the EMR screen make you feel excluded?", the median and modal response for both subgroups was "Very slightly" (49.2% of currently pregnant women, and 44.5% of previously pregnant women). Previously pregnant women were more likely to report a stronger feeling of exclusion. 16.8% of previously pregnant women reported feeling it "Moderately" and 7.7% answered "Strongly". Only 14% and 3.9% of the currently pregnant women answered "Moderately" and "Strongly", respectively.

For both subgroups, the EMR screen is ideally "Easy" (57.9%) and "Very easy" (25.2%) to see.

When asked (Q9) "How important do you think it is that you and your companions can see the EMR screen during the checkups?", 43.1% answered "Important" and 36.1% answered "Slightly important".

3.3.4. Attitudes towards the Experience of *Distrust*

We asked three questions to understand the women's perceptions about how sensitive psychosocial information is documented in their EMR.

When asked (Q14) "With what level of detail do providers document sensitive psychosocial information in the EMR?", 57.6% of the women answered "I do not know" and 11.9% responded that this type of information is "Not documented". Currently pregnant women were significantly more likely than previously pregnant women (z = −2.4, $p < 0.05$) to think that sensitive psychosocial information goes undocumented (14% vs. 8.4%).

For both subgroups, sensitive psychosocial information is ideally documented in detail in the EMR. When asked (Q15) "Ideally, how do you think sensitive psychosocial information should be documented in the EMR?", the answers were distributed as follows: 10.2% chose "Very highly detailed", 18.4% chose "Highly detailed", 39% chose "Detailed", 20.8% chose "Slightly detailed", 9% chose "Ambiguously", and 2.7% chose "Not documented".

Both subgroups also agreed on the importance of documenting sensitive psychosocial information in detail in the EMR. When asked (Q16) "How important do you think it is that the providers document sensitive psychosocial information in detail in the EMR?", 15% indicated it was "Very important" and 47.2% indicated it was "Important". Only 1.9% indicated it was "Not important".

3.3.5. Attitudes towards the Experience of *Exchange*

As mentioned earlier, some women in Japan do *satogaeri shussan* which implicates a change in their antenatal care providers. When asked (Q17) "When you changed providers, how did your providers share medical records?", 37% indicated that they did not change their providers, 17.2% did not know, 14.8% reported that all the data was exchanged electronically, 9.4% reported that all the data was exchanged using paper documents, 8.7% reported that all the data was exchanged both in electronic format and paper format, 2.4% indicated that no exchange of records happened, and the

rest reported a mix of both electronic and paper formats. One respondent reported that the exchange happened using a sealed envelope, therefore she could not tell the format of the medical record.

The electronic exchange of medical records was the preferred choice for Japanese women. When asked about the *ideal way of exchanging information between their providers* (Q18), 15.5% answered "I do not know". 39.7% chose "All the information electronically" and 28.6% indicated that ideally all the information is exchanged both electronically and using paper records.

Finally, pregnant Japanese women agreed on the *importance of providers exchanging medical records* with 50.8% indicating it was "Very important", and 36.3% indicating it was "Important".

3.3.6. Attitudes towards the Experience of *Online Viewing*

Figure 1 shows the distribution of Japanese women's answers about wanting to access their EMRs online.
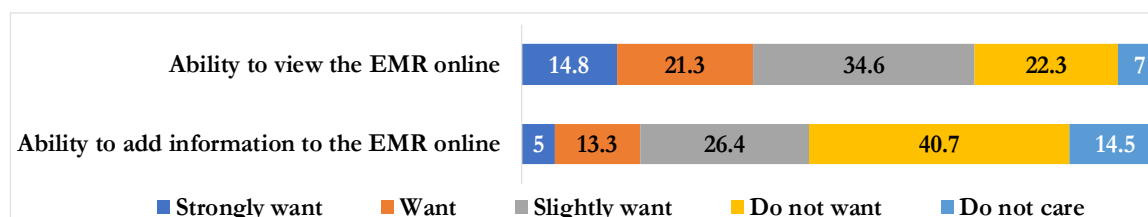

Figure 1. Do pregnant Japanese women want online access to their EMR? The numbers shown in the chart represent the percentage of women who chose that answer.

When asked (Q10) "Do you want to be able to view your EMR online?", the median and modal answer was "Slightly want" (34.6%).

When asked (Q11) "Do you think it is important to be able to view your EMR online?", the median and modal answer was "Slightly important" (37.5%). The results show a discrepancy in the opinions of Japanese women about the importance of having online access to view their EMR with 26.9% of the women reporting it was "Important" while 23% reported it was "Not important".

3.3.7. Attitudes towards the Experience of *Online Editing*

Unlike their attitudes to having *Viewing Access*, the majority of pregnant Japanese women reported that they do not want to have online access to add information to their EMR. when asked (Q12) "Do you want to be able to add information to your EMR online?", the median and modal answer was "I do not want" (40.7%) with 14.5% of the women answering "I do not care". Only 5.1% and 13.3% "Strongly want" and "Want" online access to add information to their EMR, respectively.

When asked (Q13) "Do you think it is important to be able to add information to your EMR online?", 40% responded "Not important" and 36.1% responded "Slightly important". Only 18.6% thought it was "Important" and 5.3% thought it was "Very important".

3.3.8. Attitudes towards the Experience of *Summarization*

We asked two questions to understand whether Japanese women want to have access to a summary of their pregnancy (Q20) and how important is it for them to have this access (Q21).

The survey results show that Japanese women want and think it is important to have access to a summary of their pregnancy data. 42.4% of the respondents "Want" and 18.4% "Strongly want" to *have access to a summary of their pregnancy*. 42.1% think it is "Important" and 18.6% think it is "Very important" to have that access.

3.3.9. Attitudes towards the Experience of *Assistance*

We asked two questions to understand whether Japanese women want to manage their antenatal care appointments online (Q22) and how important it is for them to have this option (Q23).

The survey results show that Japanese women slightly want and think it is slightly important to have the capability of managing their antenatal care appointments online. When asked about *wanting to manage their antenatal care appointments online*, the median and modal answer was "Slightly want" (30%). However, 27.6% indicated they "Want" and 13.3% indicated they "Strongly want". When asked about the *importance of having the capability to manage their antenatal care appointments online*, the median and modal answer was "Slightly important" (40%) with 32.4% indicating it is "Important" and 10.7% indicating it is "Very important".

3.4. Summary of the Findings

Our survey results showed that Japanese women want to easily see the EMR screen during antenatal care checkups and want the providers to occasionally use it as an explanation support tool. They want to view their EMR and manage their appointments online, have their psychosocial information documented in detail, and have access to their pregnancy summary. They want their providers to exchange their medical records both electronically and using paper files. They do not want the EMR system to interfere with the communication during the checkups nor have online access to modify their EMR.

Our survey further showed that for Japanese women, the most important EMR-related experience is the exchange of information between their different healthcare providers. The least important EMR-related experience is having online access to add information to the EMR. A heat map representing the importance of each EMR-related experience is shown in Figure 2.

EMR-Related Experience	Very important	Important	Slightly important	Not important
The providers using the EMR screen as an explanation support tool.	10.4	34.6	40.2	14.8
EMR systems not hindering the communication of the women and their providers.	16.5	45.0	34.6	3.9
The women being able to see the EMR screen.	12.6	43.1	36.1	8.2
Sensitive psychosocial data being documented in detail inside the EMR.	15.0	47.2	35.8	1.9
Different providers exchanging the women's medical records.	50.8	36.3	12.1	0.7
The women being able to view the contents of their EMRs online.	12.6	26.9	37.5	23.0
The women being able to add content to their EMRs online.	5.3	18.6	36.1	40.0
The women having access to a summary of their pregnancy.	18.6	42.1	34.6	4.6
The women being able to manage their antenatal care appointments online.	10.7	32.4	40.0	16.9

Figure 2. A heat map representing the importance of each EMR-related experience for pregnant Japanese women. The numbers shown in the map represent the percentage of women who chose that answer.

4. Discussion

Through a web survey, this work empirically examined the experiences, aspirations, and priorities of pregnant Japanese women regarding different EMR-related experiences. The findings showed that pregnant Japanese women want more access to their EMRs inside and outside the antenatal care clinics. The findings also showed that pregnant Japanese women regard the exchange of the EMR between providers and its content as highly important.

We first discuss the difference in attitudes between different groups of women. We then discuss some opportunities and challenges for designing antenatal care EMR systems that meet the preferences of pregnant Japanese women.

4.1. Different Women, Different Attitudes

Previous studies [39] have shown that different groups of people have different attitudes towards the use of computers in the examination room. Similarly, our results show that different groups of women had different attitudes towards the use of EMR systems in antenatal care checkups. Currently, we do not have enough information to understand the real reasons behind these differences in attitudes. We therefore present possible explanations for these differences.

Women with higher levels of education were more likely to report fewer interferences caused by the use of the EMR system. One possible reason could be that women with higher levels of education are accustomed to using computers in their jobs and thus do not view the use of EMR systems as an interference. Another reason could be that the healthcare providers exhibit different EMR usage patterns when caring for women with different levels of education.

Older women were less accepting of interferences caused by the use of the EMR system. This could be attributed to older Japanese women being more likely to have experienced more pregnancies, being at higher risk of complications, or being more assertive than younger Japanese women.

Previous studies found no evidence that the use of a computer during the examination affects patient satisfaction or the patients' perception of patient-provider communication [37,38]. In our study, we found no relation between any EMR-related experience and the reported satisfaction with care. These results imply that the women's satisfaction with their care is unrelated to their experiences with the EMR system.

In other respects, younger and higher income Japanese women reported lower levels of satisfaction with their care. This could be attributed to higher expectations for their care.

Currently and previously pregnant women significantly differed on five survey items. First, previously pregnant women were more likely to report higher feelings of exclusion because they could not see the EMR screen during checkups. One explanation could be the increased use of EMR systems by the providers in the final checkups of antenatal care. In fact, during the last five routine checkups which take place between the 36th and 40th week of pregnancy, antenatal care providers start performing and documenting a Non Stress Test (NST). In this case, some currently pregnant women may have not yet experienced this increased EMR use. The difference could also be attributed to the *remembering self* [57] of previously pregnant women that is insensitive to duration and focuses on the peak EMR use that was experienced in the final antenatal care checkups.

Similarly, previously pregnant women were more likely to think that sensitive psychosocial information is documented in the EMRs. This could be due to the postpartum depression screening that takes place after childbirth.

Finally, currently pregnant women were more likely to want their providers to use the EMR screen as an explanation support tool. They were also more likely to think it is important that they do so. In addition, they were less likely to accept interferences caused by the EMR system. Both of these aspirations could be attributed to the fear and uncertainty of pregnant women regarding their pregnancy and their future [6]. In contrast, most of the previously pregnant women have successfully given birth even though the EMR system might have interfered with their communication and the providers may not have used the EMR screen as an explanation support tool.

4.2. Opportunities and Challenges

For pregnant Japanese women, the most important EMR-related experience was the exchange of medical records between their different providers. Most women preferred that the exchange be made electronically. However, 28.6% preferred that the exchange be made both electronically and with paper files. These results imply that some pregnant Japanese women see value in paper records or

have uncertainties regarding electronic exchanges. Furthermore, the current EMR systems are built using different vendor-specific standards. Therefore, the electronic exchange entails the exchange of human-readable information and not machine processable information. To tackle this problem, future EMR systems should comply with EMR interoperability standards. Such standards include openEHR [58] for implementing EMR databases and HL7 FHIR [59] for exchanging EMR contents.

The survey results also showed that pregnant Japanese women want their sensitive psychosocial information to be documented in detail in their EMRs. However, our study and previous studies suggest that the healthcare providers ambiguously document certain sensitive psychosocial information or do not document them at all [60,61]. This could be attributed to the uncertainty of the providers regarding the security of EMRs and the laws governing healthcare data. In addition, some providers may regard psychosocial information as "subjective" and "not legitimate enough" to be placed in the official and permanent medical record [61]. Documenting and communicating sensitive psychosocial information between the antenatal care providers is particularly important since 5% of Japanese women experience domestic violence during pregnancy [62]. Furthermore, addressing domestic violence remains difficult in a society that values endurance and keeping family secrets [63]. In this case, we need to better understand the reasons why healthcare providers are reluctant to clearly include such information in the EMRs and design systems that alleviate these concerns.

The survey results further showed that pregnant Japanese women want to remotely view their EMR and pregnancy summary. Currently, the antenatal care providers do not write the EMR notes with the intent of sharing them. Granting the women online viewing access could increase the documentation workload for the providers, as extra work would be needed to make the EMR's content comprehensible for the pregnant women. Moreover, it could increase existing fears about the security of the records, making the providers more reluctant to document sensitive information. One way to avoid these possible consequences is to grant the women access only to their pregnancy summary and test results [64].

Movements, such as the OpenNotes movement (https://www.opennotes.org/about/), that encourage healthcare providers to summarize the contents of EMRs and allow the patients to access them, are currently gaining momentum outside of Japan. Patients who have access to their visit notes view the access positively and believe it helps them take better care of themselves [65]. Currently in Japan, summaries are not always included in the EMR because the providers compile them upon request. The main challenge for granting the women access to their summary is the potential increase of the providers' workload. In this case, the automatic generation of pregnancy summaries from the EMR contents could alleviate this problem. Much research has been conducted on mining knowledge out of free-text EMR notes and resulted in multiple clinical Natural Language Processing (NLP) applications. These clinical NLP applications follow rule-based or machine learning Information Extraction (IE) approaches [66]. With the highly structured antenatal care EMR notes, both IE approaches could prove successful.

Conversely, the survey results showed that pregnant Japanese women do not want the EMR system to interfere with the communication with their providers. They are also interested in seeing the EMR screen during the checkups. However, previous studies have shown that the providers sometimes use the EMR system as an *accomplice* to take some "time out" or avoid certain interactions [33,67]. In this case, a woman-centered EMR design would reduce the data input requirements and allow the pregnant women and their companions to see the EMR screen during checkups. By doing so, the providers would lose some of their ability to use the EMR system as an *accomplice*. If we assume that the providers resort to the EMR system out of need, then fulfilling the pregnant women's aspirations has to be accompanied by reducing the providers' need for a "time out." To do that, we need to further understand the reasons behind the providers' need for a "time out" and their use of the EMR system as an *accomplice*.

Interestingly, pregnant Japanese women did not want online access to add information to their EMRs. This implies that pregnant Japanese women view the EMR as an official and critical document

that should only be filled out by healthcare professionals. Indeed, in Japan, the contents of the EMR have to be confirmed by the responsible doctor and EMR systems usually implement this function [68].

Finally, the EMR system's use as an explanation support tool can be improved through the use of large, interactive, and mobile screens as described in many previous medical informatics and HCI works [69–72].

4.3. EMR System Design Implications

Based on the previous findings and discussions, we present a list of recommendations to inform the future design and implementation of EMR systems in Japanese antenatal care settings.

First, to respect the priorities of pregnant Japanese women, we need to address the EMR systems' interoperability issues that technically hinder the exchange of EMRs, and the EMR systems' security issues that legally and socially hinder this exchange.

Second, we need to adopt a holistic view of health when designing EMR systems. Pregnant women understand the importance of their psychosocial state for the well-being of their pregnancy. We need to align our viewpoints with theirs and shift from designing biomedical EMR systems to designing biopsychosocial EMR systems. In addition to creating data models and spaces for psychosocial information in the EMR systems, we need to address the security and ethical challenges that relate to it.

Third, pregnant Japanese women want their EMRs to contain complete and shareable data but they do not want to participate in the creation of this data. This implies that they view the EMR as a one-way communication tool for their providers to efficiently communicate the state of their pregnancy to the relevant parties. They also want EMR-supported explanations and summaries to better understand their pregnancies. This implies that they view the EMR as a tool that provides them with information and awareness regarding their pregnancy. Adopting their viewpoints would require us to shift our view of EMR systems from tools that support note-taking and healthcare bureaucracy to tools that promote communication, woman-centeredness and autonomy.

Finally, EMR systems are usually customized according to the needs and preferences of the healthcare providers that will use them. However, women with different demographics or at different stages of pregnancy were shown to have different experiences, aspirations, and priorities regarding the use of EMR systems. Future EMR system designs could accommodate these differences by automatically adapting their functionality according to the particular needs and preferences of the healthcare receiver. By doing so, we would obtain *person-centered EMR systems* that fit the vision of person-centered healthcare systems [73,74].

Even though our previous analysis and discussion focus on pregnant women's preferences for EMR systems in Japanese antenatal care, the provided insights could apply to the design of person-centered EMR systems in other cultural and healthcare settings.

4.4. Limitations and Future Work

First, due to the nature of web surveys, our study suffers from coverage bias, as women with no Internet access are not represented in the sample. We consider the survey coverage to be a weak limitation of this study for two main reasons: (i) the Internet penetration in Japan was estimated at 93.98% as of 2017 [75] and (ii) our target sample does not include elderly people who are the most likely to be offline.

Second, this survey does not make a distinction between obstetrician-led and midwife-led antenatal care, the type of institution and the clinical layout in which antenatal care was received, and the types of EMR systems that were used during the checkups. Nor does it make a distinction between the number of pregnancies and the types of pregnancies that the women experienced. Further research is needed to understand how these factors could have an effect on EMR-related experiences, aspirations, and priorities.

5. Conclusions

Through an observational field study, we identified EMR-related experiences of pregnant Japanese women in antenatal care settings. Then, through a web survey, we identified the attitudes of pregnant Japanese women towards these EMR-related experiences. We discussed the possible reasons for our findings and presented challenges and opportunities for meeting women's preferences in Japanese antenatal care.

Our web survey of 413 Japanese women showed that pregnant Japanese women want to view the contents of their EMRs and better understand their pregnancies though EMR-enabled explanations and summaries. Accordingly, future design endeavours should emphasize the roles of EMR systems as tools to promote communication, woman-centeredness and autonomy in antenatal care. Our results also showed that pregnant Japanese women want their psychosocial information documented in detail in the EMR. This implies that they view their psychosocial state as highly important for the well-being of their pregnancy and health. Respecting their viewpoints requires us to shift from designing biomedical EMR systems to designing biopsychosocial EMR systems. Interestingly, women with different demographics or at different stages of their pregnancy had different experiences, aspirations, and priorities regarding the use of EMR systems. If we strive to optimize the individual experiences, adaptable EMR systems could accommodate these differences in needs and preferences. These adaptable systems would be person-centered EMR systems and designing them would be a step towards establishing person-centered healthcare systems.

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Appendix A. Survey Questions

Q1	**Currently, the antenatal care providers use the EMR screen to explain to me stuff about the pregnancy**
	Very frequently, Frequently, Ocassionaly, Rarely, Very rarely, Not at all
Q2	**Ideally, the antenatal care providers use the EMR screen to explain to me stuff about the pregnancy**
	Very frequently, Frequently, Ocassionaly, Rarely, Very rarely, Not at all
Q3	**Do you think its important that the providers use the EMR to explain to you something?**
	Very important, Important, Somewhat important, Not important at all
Q4	**Currently, the EMR interferes with my communication with the providers**
	Very frequently, Frequently, Ocassionaly, Rarely, Very rarely, Not at all
Q5	**Ideally, how much interference is allowed by the use of the EMR?**
	I am okay with a lot, I do not mind the interference, Ocassionaly, Rarely, Very rarely, Not at all
Q6	**Do you think its important that the EMR does not interfere with the communication**
	Very important, Important, Somewhat important, Not important at all
Q7	**Currently, I feel excluded because I cannot see the EMR screen**
	Very strongly, Strongly, Moderately, Slightly, Very slightly, Not at all
Q8	**Ideally, how easy should it be to see the EMR screen**
	Extremely easy, Very easy, Easy, Hard, Very hard, Exteremely hard
Q9	**Do you think its important that you and your companions see the EMR screen**
	Very important, Important, Somewhat important, Not important at all
Q10	**Do you want to have access to view your EMR**
	Strongly want, Want, Slightly want, Do not want, Do not care
Q11	**Do you think its important that you have viewing access to your EMR**
	Very important, Important, Somewhat important, Not important at all
Q12	**Do you want to have access to add information to your EMR**
	Strongly want, Want, Slightly want, Do not want, Do not care
Q13	**Do you think its important that you have access to add information to your EMR**
	Very important, Important, Somewhat important, Not important at all
Q14	**With what level of detail do providers document sensitive psychosocial information in the EMR?**
	Very highly detailed, Highly detailed, Detailed, Slightly detailed, Ambiguous, Not entered
Q15	**Ideally, how do you think sensitive psychosocial information should be documented in the EMR?**
	Very highly detailed, Highly detailed, Detailed, Slightly detailed, Ambiguous, Not entered
Q16	**How important do you think itis that the providers document sensitive psychosocial information in detail in the EMR?**
	Very important, Important, Somewhat important, Not important at all
Q17	**When you changed providers, how did they exchange the medical record**
	All electronically, All paper, All electronically and all paper, Some electronically, Some paper, Some electronically and some paper, Other, No sharing, I do not know, I did not change providers
Q18	**When you change providers, how do you think they should exchange your medical record**
	All electronically, All paper, All electronically and all paper, Some electronically, Some paper, Some electronically and some paper, Other, No sharing, I do not know
Q19	**Do you think its important that your providers exchange information**
	Very important, Important, Somewhat important, Not important at all
Q20	**Do you want to have access to a summary of your pregnancy?**
	Strongly want, Want, Slightly want, Do not want, Do not care
Q21	**Do you think its important that you have access to a summary of your pregnancy?**
	Very important, Important, Somewhat important, Not important at all
Q22	**Do you want to manage your antenatal care appointments online?**
	Strongly want, Want, Slightly want, Do not want, Do not care
Q23	**Do you think its important to be able to manage your antenatal care appointments online?**
	Very important, Important, Somewhat important, Not important at all
Q24	**How was the care that your received during your pregnancy?**
	Very good, Good, Rather good, Rather bad, Bad, Very bad
Q25	**what is your level of education?**
	Less than high school, High school graduate, Technical school graduate, Bachelor's degree, Master's degree

Figure A1. The survey questions and their corresponding answer sets.

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