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# Using eHealth to Increase Autonomy Supportive Care

## A Multicenter Intervention Study in Antenatal Care

Helle Johnsen, RM, MEd, MSc, Karina Fischer Blom, RM, Anne Lee, RN, MSc, Birgitte Nørgaard, PhD, MScN, RN

eHealth solutions are increasingly implemented in antenatal care to enhance women's involvement. The main aim of this study was to evaluate women's assessment of autonomy supportive care during the antenatal care visits among low-risk pregnant women. An intervention study was conducted including a control group attending standard antenatal care and an intervention group having access to an eHealth knowledge base, in addition to standard care. A total of 87 women were included in the control group and a total of 121 women in the intervention group. Data were collected using an online questionnaire 2 weeks after participants had given birth. Data were analyzed using $\chi^2$ tests and Wilcoxon rank sums. Use of an eHealth knowledge base was associated with statistically significant higher scores for women's overall assessment of antenatal care visits, the organization of antenatal care visits, confidence after antenatal care visits, and involvement during antenatal care visits. We also found a statistically significant higher overall self-perceived autonomy supportive care in the intervention group compared with the control group.

**KEY WORDS:** Antenatal care, Antenatal preparation, Autonomy supportive care, eHealth, Telemedicine

eHealth is an expanding field combining medical informatics, public health, and business. It refers to how healthcare services and information are delivered through the Internet.[1] Within antenatal care, eHealth research has so far primarily focused on online interventions supporting lifestyle change during pregnancy.[2,3] Research has to a lesser extent addressed the role of eHealth solutions during the client-professional meeting.

Our everyday health is increasingly affected by Internet use.[4] At the same time, Internet use seems to vary among different groups of citizens. Demographic variables such as educational background, employment status, sex, and age affects the extent to which the general public uses the Internet to retrieve health information.[5] Yet, during pregnancy, almost all women use the Internet as a health information source.[6–10] Studies have shown that pregnant women seek information anonymously using the Internet.[9,11] Women search for several types of information online including lifestyle advice, stages of pregnancy and birth, fetal development, and pathological conditions.[7–10]

Pregnant women primarily use commercial search engines to retrieve health information.[8,9,12] This can constitute a problem, because this search strategy may not provide women with evidence-based knowledge. Healthcare professionals have raised concerns about the quality and accuracy of Internet information,[13,14] whereas the women themselves report that Internet information is mostly reliable and useful during pregnancy.[10,15,16]

Pregnancy is considered to be a transitional period in life, and studies have shown that women are more motivated to learn and make changes in their everyday lives in an effort to promote fetal health.[17,18] Online information has been found to affect women's decision-making processes during pregnancy.[6,8,9,19] At the same time, studies show that women use online information as a supplement to the information provided by healthcare professionals.[9,19–21] These findings suggest that there is a need to develop eHealth solutions that can enhance pregnant women's evidence-based knowledge, support their decision-making processes, and inform their meetings with healthcare professionals.

This study reports on results from a Danish national welfare technology program exploring the use of home monitoring and eHealth knowledge bases. The main aim of the study was to evaluate participant ratings of autonomy-supportive care during the antenatal care visits among low-risk pregnant women who were granted access to an eHealth knowledge base compared with women who attended standard

**Author Affiliations:** Department of Nutrition and Midwifery (Ms Johnsen), Metropolitan University College, Copenhagen; Department of Gynecology and Obstetrics (Ms Blom), Herlev Hospital; and Department of Public Health (Ms Lee and Ms Nørgaard), University of Southern Denmark, Odense.

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**Corresponding author:** Helle Johnsen, RM, MEd, MSc, Midwifery Program, Metropolitan University College, Sigurdsgade 26, 2200 Copenhagen N, Denmark (hejo@phmetropol.dk).



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antenatal care. Moreover, women's doubts regarding the importance of lifestyle during pregnancy, their assessment of general lifestyle information, and their level of feeling prepared for the birth and the postpartum period were investigated, as well as the applicability of the different eHealth themes, the women's evaluation of the themes, and their involvement of others in the use of the eHealth knowledge base.

## METHODS

The study was carried out as a multicenter intervention study including a control group attending standard antenatal care. A Web-based questionnaire was used to collect data from the control group before initiating the intervention (July 2013 to September 2013) and from the intervention group (March 2014 to December 2014).

### Setting and Participants

In Denmark, maternity care is part of public healthcare and antenatal care for pregnancies without complication is provided by midwives and general practitioners.[22] Primipara and multipara women with expected low-risk pregnancies were recruited from four midwifery-led antenatal care centers. Women who did not read or speak Danish, or with expected complications in pregnancy, were not included in the study.

### The Intervention

The eHealth knowledge base, My ePregnancy, was developed at the Midwifery Program, Metropolitan University College in Copenhagen, and the Department of Gynecology and Obstetrics, Herlev Hospital in Herlev. The knowledge base was designed to provide women with information concerning the themes: Healthy Living, Becoming a Family, Ready for Birth, and Pregnancy Complications. Within each subtheme, the women had access to evidence-based information and recommendations, frequently asked questions, e-learning programs, quizzes, videos, and animations. In addition, a text message service that encouraged the women to exercise and a search function were included in the eHealth knowledge base.

Before project start, midwives were trained in the use of the eHealth knowledge base. The intervention group was granted access to the eHealth knowledge base by a personal log in before the first visit, and participants were encouraged to use the knowledge base as an information source and to prepare for their meeting with the antenatal care provider.

### Questionnaire

The Web-based questionnaire comprised demographic items and generic and validated instruments, supplemented by context-relevant items regarding the specific intervention. Hence, participant perceptions of autonomy-supportive care were assessed using the Health Care Climate Questionnaire (HCCQ) including five items.[23] The HCCQ is scored on a 7-point Likert scale ranging from "strongly agree" to "strongly disagree." Participants' perceived competencies during pregnancy were assessed using the Perceived Competence with Diabetes (PCD) scale,[23] including five items and a 4-point Likert response scale. From the national survey of patient experiences among women giving birth, five items were included.[24] Responses were given on a 4-point Likert scale and with the possibility of answering "not able to evaluate."

After adjusting to local conditions, the compiled questionnaire was evaluated for face validity in a peer process by an expert panel of healthcare professionals from the two healthcare institutions. Afterwards, the questionnaire was pilot tested by four pregnant women meeting the inclusion criteria. After completing the questionnaire, participants were interviewed by telephone about its usability and relevance, their time spent on answering, and the timing in relation to giving birth. The pilot test revealed no need for changes.

The Web-based questionnaire was administered through a personal e-mail link. The control group received a letter with information on the research project and a link to the questionnaire within 2 weeks after giving birth. The intervention group received an e-mail with a link to the questionnaire within 2 weeks after giving birth. For both groups, two reminders were sent if no response was received within 14 days. If no response was received after 21 days, participants were contacted by telephone. In an attempt to increase participation, a voucher was distributed for each group as a lottery.

### Data Analysis

Data on the participant assessments of the antenatal care visit, general lifestyle information, and level of preparation were dichotomized into the top rating for each question versus the collapsed results of all lower ratings and then described by proportions and analyzed by $\chi^2$ tests and Wilcoxon rank sums. To calculate subscale mean scores, both HCCQ and PCD item scores were reversed following international guidelines.[23,25] All analyses were performed in Stata, version 14 (StataCorp, College Station, TX).

### Ethical Considerations

Potential participants in the control group were informed about the project by letter including the fact that project participation was voluntary and anonymous. Potential participants in the intervention group received written information about the project along with their invitation to their first antenatal visit. A week later, they were contacted by telephone by a member of the research team and asked if they wanted to participate in the study. Candidates were informed that participation was voluntary and anonymous and that they could withdraw from the study at any time. Those who agreed to

participate signed a written consent form. In both groups, all personal identifiers were removed during the analyses to preserve anonymity. The study was approved by the Danish Data Protection Agency, identification number 2007-58-0006, and needed no further ethical approval according to Danish legislation.

## RESULTS

### Population

A total of 312 women were considered eligible for inclusion in the study, 150 in the control group and 162 in the intervention group, respectively. In the control group, 19 participants were excluded because of abortion or referral to another hospital and 44 did not answer the questionnaire, leaving 87 for final analyses (response rate, 66.4%). Of the 162 participants included in the intervention group, 14 were excluded because of abortion or referral to another hospital and 27 did not anwer the questionnaire, leaving 121 for final analyses (response rate, 81.8%).

### Respondents' Demographic Data

There were no statistically significant differences between intervention and control groups regarding demographic measures. There was a larger proportion of primiparous participants in the intervention group ($P = .424$) (Table 1).

**Table 1.** Respondents' Demographic Data by Group

| | Control Group (n = 87) | Intervention Group (n = 121) |
|---|---|---|
| **Mean age, y** | 33 | 31 |
| **Primipara, % (n)** | 39.1 (34) | 44.6 (54) |
| **Multipara, % (n)** | 60.9 (53) | 55.4 (67) |
| **Place of giving birth, % (n)** | | |
| Hospital (out-patient) | 27.6 (24) | 42.2 (51) |
| Hospital (in-patient) | 70.1 (61) | 55.4 (67) |
| At home | 2.3 (2) | 2.5 (3) |
| **Educational stage, % (n)** | | |
| Primary school | 2.3 (2) | 1.7 (2) |
| Secondary school | 77.0 (67) | 74.4 (90) |
| High school | 17.2 (15) | 17.4 (21) |
| Not stated | 3.4 (3) | 6.5 (8) |
| **Education, % (n)** | | |
| None | 8.0 (7) | 5.0 (6) |
| Craftsman | 12.6 (11) | 7.4 (9) |
| Higher education (short) | 11.5 (10) | 10.7 (13) |
| Higher education (medium) | 32.2 (28) | 32.2 (39) |
| Higher education (long) | 32.2 (28) | 35.5 (43) |
| Other | 1.1 (1) | 2.5 (3) |
| Not stated | 2.3 (2) | 6.5 (8) |
| **Occupation, % (n)** | | |
| Employed | 73.7 (64) | 76.0 (92) |
| Pregnancy sick leave | 9.2 (8) | 7.4 (9) |
| Not employed | 11.5 (10) | 10.0 (11) |
| Early retiree | 3.4 (3) | 0.8 (1) |
| Not stated | 2.3 (2) | 6.5 (8) |

### Antenatal Care Visits and Autonomy-Supportive Care

Participants in the intervention group were more likely to score their overall assessment of the antenatal care visit to be really good or good ($P = .006$) and the organization of the antenatal care visits as really good or good ($P = .0006$) compared with the control group. Furthermore, participants in the intervention group were more likely to assess their confidence after the antenatal care visits higher ($P = .001$) and their involvement during the antenatal care visits to be appropriate ($P = .002$) (Table 2).

In the intervention group, participants assessed self-perceived autonomy-supportive care higher for three of five items compared with the control group (data not shown). The remaining two items indicated higher autonomy-supportive care in the intervention group, but results were not statistically significant. We found an overall HCCQ mean score of 5.95 and 6.31 for the control and intervention groups, respectively ($P = .007$). Likewise, the PCD subscale was analyzed with a reversed average score across all items. We found an overall PCD score of 6.55 and 6.59 for the control and intervention groups ($P = .563$), respectively, with no differences in any of the single item scores between control and intervention groups.

### General Information on Lifestyle During Pregnancy

Participants in the control group were more likely to have no doubts about the importance of lifestyle during pregnancy compared with the intervention group. No statistically significant differences were found in participant assessments of general lifestyle information (Table 2).

### Level of Feeling Prepared

In the intervention group, participant scores for feeling prepared for birth and nutrition for the baby indicated higher yet statistically insignificant levels of feeling prepared on three out of five items. Overall, participants in the intervention group were more likely to report a higher level of feeling prepared compared with the control group ($P = .021$ and $P = .002$, respectively) (Table 2).

### My ePregnancy

This item was evaluated by participants in the intervention group only, since they had access to the eHealth knowledge base. Most participants in the intervention group rated the information relating to the themes Healthy Living, Becoming a Family, Ready for Birth, and Pregnancy Complications to be really good or good. The theme Ready for Birth was accessed by half of the participants in the intervention group (50%) (Table 3).

Respondents in the intervention group were also asked whether they involved others in the use of My ePregnancy;

**Table 2.** Respondents' Assessment of the Antenatal Care Visits and Autonomy-Supportive Care, General Lifestyle Information, and Level of Feeling Prepared

| Proportion Answering "Strongly Agree/Partly Agree/Agree" | Control Group (%) (n = 87) | Intervention Group (%) (n = 121) | P |
|---|---|---|---|
| Overall assessment of the antenatal care visits, "really good/good" | 93.0 | 98.3 | .006 |
| Assessment of the organization of the antenatal care visits, "really good/good" | 93.1 | 94.2 | .0006 |
| Confidence after the antenatal care visits, "very confident/confident" | 95.4 | 100.0 | .001 |
| Assessment of involvement during the antenatal care visits, "appropriate" | 91.9 | 100.0 | .002 |
| Assessment of partner's involvement during antenatal care visits, "appropriate" | 75.6 | 74.0 | .260 |
| Have you had any doubts about the importance of lifestyle, "no, not at all/no, only a minor degree" | 86.0 | 83.5 | .0008 |
| Proportion Answering "Really Good/Good" | | | |
| Assessment of general information regarding smoking and pregnancy | 45.4 | 50.4 | .367 |
| Assessment of general information regarding alcohol and pregnancy | 46.5 | 55.5 | .149 |
| Assessment of general information regarding exercise and pregnancy | 74.4 | 80.7 | .129 |
| Assessment of general information regarding nutrition and pregnancy | 71.0 | 78.2 | .097 |
| Proportion Answering "Really Good/Good" | | | |
| I felt prepared for birth | 82.4 | 90.8 | .061 |
| I felt prepared for breastfeeding/other nutrition for the baby | 84.7 | 84.9 | .371 |
| I felt prepared for practicalities regarding the delivery unit | 75.3 | 89.1 | .053 |
| I felt prepared for the initial time with the newborn (sleep patterns, well-being) | 63.5 | 74.8 | .021 |
| I felt prepared for the initial time after the birth (parenthood, relationship) | 65.9 | 82.4 | .002 |

nearly two-thirds (59.3%) answered "yes" or "yes, sometimes" to this question. More than half of the participants (53.7 %) involved their partners in the use of My ePregnancy, while other family members (9.1%), friends (7.4%), or other acquaintances (3.3%) (data not shown) were less likely to be involved.

## DISCUSSION

Our study found that participants in the intervention group generally assessed their confidence higher than controls, and were more likely to assess their involvement during the antenatal care visit to be appropriate. The importance of women's involvement during pregnancy is reflected in previous studies showing that, when women are involved actively in their own care, they are more likely to rate their antenatal care highly.[26] Our study also found that significantly more women in the intervention group assessed the overall antenatal care visit to be good or very good. Further analyses of HCCQ revealed significantly higher overall HCCQ scores in the intervention group; HCCQ assesses participants' perceptions of the degree of support for autonomy from healthcare providers.[23] It builds on self-determination theory (SDT) and includes the core psychological needs of competence, relatedness, and autonomy.[27] Although autonomy is often connected to individualism, autonomy in SDT refers to individuals' opportunity to act with volition in relationships to healthcare professionals and whether their decision-making is externally forced.[27,28] The importance of autonomy-supportive care has also been highlighted empirically. Several studies within antenatal care show women's need to build relationships with their care providers and to be supported in their decision-making processes.[26,29]

The eHealth knowledge base was designed to give women in antenatal care the opportunity to prepare for pregnancy, birth, and the postnatal period. Significantly more women in the intervention group felt that they were prepared for the initial time with the newborn and the time immediately after birth. Related findings have been presented in a qualitative study testing a postnatal mobile device application (app) among parents discharged early from hospital. The study showed that parents found the knowledge base in the app easier to navigate than paper information pamphlets.[30] In this study, no significant differences were found in other types of preparation or in women's assessment of the general lifestyle information that they received in antenatal care. This may be because during pregnancy women use a wide range of information sources in addition to information from healthcare professionals, such as the Internet, family, friends, books, and magazines.[19,31] Multiple information sources have shown to lead to conflicting health information,[31] which suggests that an eHealth knowledge base may serve to reduce complexity for women and their partners during pregnancy.

Study results revealed that information on smoking and alcohol was the least accessed information in the eHealth knowledge base. Smoking and alcohol consumption during pregnancy is associated with increased risk for both mother and the unborn child.[32,33] A recent register study has shown that the prevalence of maternal smoking in early pregnancy in Denmark is 12.5%.[34] In addition, a Danish cross-sectional

**Table 3.** Respondents' (Intervention Group) Assessment of My ePregnancy

| | % (n = 121) |
|---|---|
| **Did you find information about "healthy living" applicable? "Yes"** | 41.2 |
| Nutrition | 33.1 |
| Exercise | 27.3 |
| Smoking | 0.8 |
| Alcohol | 0.8 |
| Overall assessment of information, "really good/good" | 93.6 |
| **Did you find information about "pregnancy complications" applicable? "Yes"** | 41.2 |
| Overall assessment of information, "really good/good" | 93.6 |
| **Did you find the "ready for birth" information applicable? "Yes"** | 50.0 |
| Contractions | 33.9 |
| Onset of birth | 33.1 |
| In the delivery room | 14.1 |
| Pelvic floor exercises | 23.1 |
| Breastfeeding | 18.9 |
| Overall assessment of information, "really good/good" | 96.4 |
| **Did you find the "becoming a family" information applicable? "Yes"** | 37.7 |
| A new family | 26.5 |
| New mother | 14.9 |
| Family home | 12.4 |
| Sexual relationship | 21.5 |
| Overall assessment of information, "really good/good" | 90.7 |

study has shown that the overall proportion of women who report binge drinking during the early pregnancy is 35%.[35] These studies indicate that evidence-based information on smoking and alcohol consumption is relevant for pregnant women. However, almost all participants in our study did not access this information. This may be because of different risk interpretations among pregnant women who smoke and consume alcohol.[36,37] It may also be a result of morality issues surrounding smoking and alcohol consumption during pregnancy.[36,37] In our study, information and e-learning on smoking and alcohol consumption in the eHealth knowledge base was specifically designed to be nonjudgmental. Still, results indicate that barriers exist around the use of an eHealth knowledge base when this information addresses socially unacceptable behavior.

Half of the participants in the intervention group used the eHealth knowledge base to prepare for birth. Previous studies show that antenatal education is highly valued among women and it can support their decision making within maternity services.[38] Findings in our study showed that more than half of the participants in the intervention group involved their partners in the use of the eHealth knowledge base. A Nordic study has shown that the information needs of fathers-to-be are often overlooked during the antenatal care visits because of a primary focus on the needs of the baby and the mother.[39] Thus, partners' access to online antenatal education may be an important supplement to more general information imparted by healthcare professionals.

## MAJOR STRENGTHS AND LIMITATIONS SPECIFIC TO THIS STUDY

Major strengths in our study are the inclusion of a control group, the use of validated questions and scales in the questionnaire, similarities in age and demographic data between control and intervention groups, and the collection of data from the control group before testing the intervention. However, our study also has several limitations. One limitation is that findings cannot identify causal relationships but only associations between use of the eHealth knowledge base and participant evaluations. Furthermore, we recognize that the positive results in the intervention group might be affected by the midwives' heightened awareness during the project period. Another limitation is the small sample size included in the study. Finally, most study participants had higher levels of education and read and spoke Danish, which affects generalization of study findings to less-educated pregnant women and to women from ethnic minority groups.

## CONCLUSION AND FURTHER RESEARCH

The main results from this study show that use of an eHealth knowledge base was associated with statistically significant differences in participant assessments of the antenatal care visits. Participants in the intervention group reported higher levels of confidence, involvement, and autonomy-supportive care. Use of an eHealth knowledge base was not associated overall with statistically significant differences in participant assessments of general lifestyle information and level of feeling prepared for the birth and the postpartum period. Participants in the intervention group assessed the quality of the different eHealth themes to be good or very good, and more than half of the women involved their partners in the use of the eHealth knowledge base. The eHealth knowledge base was used mostly to prepare for birth, while information on smoking and alcohol consumption was the least used. Although our study shows some promise for the use of eHealth knowledge bases, further studies are needed to explore these potential uses, including how eHealth knowledge bases may contribute to the collaboration between women and healthcare professionals in antenatal care.

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Registration Deadline: February 29, 2020

Disclosure Statement:

The authors and planners have disclosed that they have no financial relationships related to this article.

Provider Accreditation:

Lippincott Professional Development will award 1.0 contact hour for this continuing nursing education activity.

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Payment:

- The registration fee for this test is $12.95