# Early labour experience and labour characteristics after introduction of an electronic early labour educational intervention

Enid Leren Myhre [a],[*], Mirjam Lukasse [a], Bente Dahl [a], Marte Myhre Reigstad [b]

[a] Centre for Women's, Family and Child Health, Faculty of Health Sciences, University of South-Eastern Norway, Kongsberg, Norway
[b] Norwegian Research Centre for Women's Health, Department of Obstetrics and Gynaecology, Oslo University Hospital, Oslo, Norway

## ARTICLE INFO

## ABSTRACT

*Objective:* The study's aim was to compare first-time mothers' experience of early labour and subsequent labour characteristics before and after introducing an online early labour educational intervention. This article also reports on further testing of the underlying structure of the of the Early Labour Experience Questionnaire (ELEQ) in a Norwegian setting.

*Methods:* Pre- and post-intervention cohorts were recruited. The ELEQ was translated into Norwegian, back-translated and distributed among primiparous mothers whilst in hospital. Confirmatory factor analyses were used to evaluate model fit, and the internal consistency of the scale was measured by Cronbach's α coefficient. The relationship between cohorts and demographic characteristics were analysed using chi-square statistics and *t*-tests.

*Results:* Confirmatory factor analysis of the Swedish version of the ELEQ for primiparous women showed an acceptable fit. Neither the overall score nor the scores on the subscales for emotional well-being, emotional distress and perceptions of midwifery care differed significantly, but there was a significant difference between the groups on a few of the items. The cervix was significantly more dilated upon admission in the post-intervention group, and oxytocin use was significantly reduced. The number of telephone consultations increased significantly after the intervention was introduced.

*Conclusion:* The intervention did not improve women's experience with early labour. However, women who received the intervention were admitted in more advanced labour and required less oxytocin. The increased number of telephone consultations may indicate that an online early labour educational programme cannot replace women's need to communicate directly with staff.

## Introduction

Early labour can be defined as a period with painful contractions and cervical change, including cervical effacement and dilatation up to 5 cm [1]. In the literature, early labour is often referred to as the latent stage of labour [1,2]. However, women do not consider labour to consist of different phases [3], thus we favour the term 'early labour', as it captures the fact that this phase is part of the labour process.

There is no established standard duration for early labour [1]. For some, it is short, while for others it may continue for hours and even days [4]. Women's experience with their early labour has received increased attention in recent years, and both a metasynthesis and a systematic review report a lack of satisfaction with the care given in early labour prior to hospital admission [5,6]. However, results from several large studies suggest that hospital admission in early labour is associated with increased risk of medical interventions [7–9]. In accordance with NICE (National Institute for Health and Care Excellence) guidelines, clinical practice recommendations in Norway specify that women in early but not active labour should generally not be admitted to hospital [2,10–11].

In a randomized trial, researchers found that women receiving structured antenatal education programmes arrived at the maternity

ward in active labour more often and used less epidural analgesia than those receiving routine care [12]. Evidence also suggests that easy access to relevant and reliable information could be a way of empowering and supporting women to better manage early labour, as women desire information during pregnancy and want to use that information to participate in care decisions [13]. Further, information should be shared with women's labour companions to enable them to feel more confident and thus provide better support at home [5].

NICE recommends that one-to-one information provision should be supplemented in other formats, such as digital information [14]. Digitalization offers new opportunities in health care, however, there seems to be a need for trustworthy digital sources of professional information about pregnancy and childbirth. While advances in information technology make knowledge easily accessible, the increasing use of web-based information needs further research [5]. In a systematic review of research on health information needs, sources of information and barriers to accessing health information among pregnant women, the authors conclude that more research is warranted [15].

Valid feedback from women about their experiences of care is crucial for evaluating labour care quality. The Early Labour Experience Questionnaire (ELEQ) was developed to assess primiparous women's affective experiences and satisfaction with early labour care [16]. As the ELEQ was validated in a Canadian setting, Swedish researchers subjected it to further testing in a Swedish setting on primiparous and multiparous women [17]. Their findings suggest that the Swedish versions of the ELEQ are considered valid questionnaires for use in a Swedish setting; however, they suggest confirmatory factor analysis for further validation of the questionnaire [17]. To our knowledge, the ELEQ is the only valid questionnaire measuring early labour care. As labour care in Norway and Sweden is quite similar, we chose to apply the SWE-ELEQ-PP (the Swedish version of the ELEQ for primiparous women) in our sample, and to initially perform confirmatory factor analysis to test the dimensional structure in an additional population.

**The PreCare study**

This study is part of the PreCare study, whose overall aim is to develop a web-based educational resource for women in early labour and to test how it affects women's experience of early labour [18,19].

The first part of the PreCare study explored women's experience with existing information and their knowledge needs in pre-admission early labour [19]. Findings from this study were used to build the content of the website Latens.no, which was then developed through an iterative process involving a multidisciplinary research team, health personnel, users, a graphic designer, and an expert in software development [18].

The aim of the current study was twofold: to evaluate the SWE-ELEQ-PP, to test how well the relationship between the observed variables and their underlying latent constructs fit our population; and to compare first-time mothers' experience of early labour and subsequent labour characteristics before and after introducing an electronic early labour educational intervention.

**Materials and methods**

*Sample size*

In the sample size calculation, participants' experience of early labour was defined as the primary outcome measure. We used baseline values similar to those presented by the developers of ELEQ (16) and hypothesized that women receiving the intervention would have a better experience (>10 % change in score) of early labour across all three domains. Based on a significance level of 5 % and a power of 80 %, we required a sample size of at least 173 participants in each group (pre- and post- invention). As the sample size determined from the primary outcome was within several widely cited 'rules of thumb' when determining sample size requirements for CFA, it was decided that CFA could be performed.

*Procedure and participants*

A before-and-after study was conducted at Oslo University Hospital, Ullevål for three months in 2019 and 2020. The pre-intervention cohort was recruited January–April 2019, and the post-intervention cohort was recruited September–December 2020. Women considered eligible for participation included nulliparous women with one foetus in cephalic lie ≥ 37 weeks gestation and a spontaneous start of labour, who stayed home for some part of their early labour (as defined by the women themselves). Exclusion criteria included pre-existing or arising conditions in pregnancy that precluded staying at home in early labour, and non-Norwegian speaking women. Midwives at the hospital identified eligible women when they called or presented at the hospital and if they responded positively to "have you stayed at home during some part of early labour". The identified women were invited by active approach during their postpartum stay to participate in the study. If they accepted, written consent was obtained. This to ensure that the memory of early labour was still fresh, whilst also not disrupting the labour process. Completed questionnaires were retrieved on the same or following day.

*Intervention*

Latens.no is a web-based educational intervention. It consists of a website with easy-to-access, free-of-charge, high-quality relevant information and advice related to early labour, and is openly available online [20]. Topics covered on the website include information and advice related to early labour. For example, the differences between Braxton Hicks contractions and labour contractions, and descriptions of what happens in early labour are explained in various formats. In addition, the website offers advice on several topics (e.g., 'How to Feel Better at Home', 'Movement and Rest' and 'When Do I Call the Hospital?') [20]. The website is considered a supplement to standard care, and it is repeatedly stated across the website that telephone calls are welcomed by the midwives when in early labour. The website was launched in July 2020, and information about it was widely distributed to the target group through text messages, flyers, and health personnel at the hospital.

*Outcome measures*

*The SWE-ELEQ-PP*

An exploratory factor analysis of the Swedish version of the ELEQ for primiparous women presented a three-factor solution—emotional well-being, emotional distress, and perceptions of midwifery care—with 23 items [17]. Cronbach's α ranged from 0.81 to 0.86, indicating good internal consistency [17].

Permission to translate and use the ELEQ was obtained from Janssen et al. and Ängeby et al. [16,17]; both versions were translated into Norwegian and checked via back-translation. The Norwegian version is quite similar to the Swedish version, since the Norwegian and Swedish languages and labour care systems are closely related. As in the Swedish study [17], the item 'Would you recommend this type of early labour to a friend' was removed before translation, because no alternative treatment options for childbirth are available in Norway. Similarly to Sweden, midwives are responsible for care in Norway's labour wards; 'nurse' was thus translated to 'midwife' throughout. All items were rated on a five-point Likert scale ranging from 1 ('Yes, definitely') to 5 ('Not at all'). All items were recorded such that a higher value represented a more positive rating. To ensure that women were evaluating the care they received *prior* to hospital admission, the following instruction was given: 'Please answer these questions in relation to the time you spent in early labour before you came to the hospital'.

The Norwegian version was piloted by 15 women who had recently given birth (none of whom were included in the study). The pilot test showed that the overall questionnaire was acceptable and understandable in Norwegian. However, several respondents remarked that Q22

('Did the midwife and the doctor work as a team in providing your care?'), was difficult to answer; an 'I don't know' option was therefore added to the answers for this question.

### Background variables

Questions related to marital status, education, total family income, working status of participant, working status of partner, country of birth and mother tongue were added to the questionnaire. The remaining background variables (age, pre-pregnancy BMI of participant and use of cigarettes or snus in pregnancy) were retrieved retrospectively from the medical record system 'CSAM Partus' using an identification key.

### Labour characteristics

Data on labour characteristics were retrieved retrospectively from the medical record system 'CSAM Partus' using an identification key. This included cm dilatation on admission, time from first telephone contact to admission (in minutes), number of telephone consultations in early labour, number of women who visited the hospital prior to admission, number of visits to labour ward prior admission, mode of delivery, use of Epidural analgesia, use of oxytocin.

### Ethical considerations

The study was conducted in accordance with the World Medical Association's Declaration of Helsinki [21], and approval for the study was granted by the Norwegian Centre for Research Data (NSD: 107878) and the local data protection official at Oslo University Hospital (18/12350). Participants were informed that participation was voluntary and that they could withdraw at any time without giving reasons and without it affecting their care. They were provided with written and oral information and given time to consider whether they wanted to participate, and informed consent was obtained from all participants.

### Statistical analyses

Confirmatory factor analysis was performed in Stata. IBM's Statistical Software Package for the Social Sciences (SPSS, Version 26) was used for all the descriptive analyses.

Confirmatory factor analyses (CFA) enabled us to test the SWE-ELEQ-PP, based on the previous exploratory factor analyses study [17] performed among a similar population. Both pre-/post-intervention participants were included in the CFA. The model tested was estimated through covariance matrices using maximum likelihood estimation. Model fit was assessed through fit statistics, with the root mean square error of approximation (RMSEA) $\leq 0.08$, standardized root mean square residual (SRMR) $\leq 0.08$, comparative fit index (CFI) $\geq 0.95$ and Tucker-Lewis index (TLI) $\geq 0.95$ [22]. The Cronbach's α coefficient values were used to assess the internal consistency reliability, and values $> 0.70$ were regarded as desirable [23].

An independent-samples *t*-test was run to determine if there were differences in age and pre-pregnancy BMI between pre-/post-intervention participants. Chi-square tests were conducted between pre-/post-intervention participants and marital status, education, total family income, working status of participant, country of birth and mother tongue, as expected cell frequencies were greater than five. A Fisher's exact test was conducted between pre-/post-intervention participants and partner's employment status. Standard linear regression was used to control for potential confounding factors.

Pre-/post-intervention groups were compared in 'intention-to-treat' analyses. We included all participants in the post-intervention group in the analysis, regardless of whether they had used Latens.no., in order to accurately reflect real-life practice conditions, where not all women

would utilize the website. Given the answer options on the questionnaire, answers were treated as continuous variables and analysed via independent *t*-test and Levene's test of variances. One questionnaire in the post-intervention group had 3 unanswered questions (12 %). Two (1 in each group) had 2 unanswered questions (8 %), and 19 questionnaires (9 in the pre-intervention group, 10 in the post-intervention group) had 1 unanswered question (4 %). Missing data were not systematic in relation to items. As per the developers' suggestion, the questionnaire with 10 % or more of the items unanswered was removed before analysis [16], resulting in 174 participants in the pre-intervention group and 178 in the post-intervention group. For the remaining unanswered questions, data were imputed using the mean of all responses to that item, as suggested by constructors of the ELEQ [16]. After pilot-testing suggested that Q22 was difficult to answer, 'I don't know' was added as an option, as we had translated the middle option on the Likert scale to *verken eller* (meaning 'neither/nor')— 37.1 % of our respondents chose this option, imputed as 'neither/nor' in the analysis.

When analysing participants' labour characteristics, independent-samples *t*-tests were run to determine whether there were differences in cm dilatation upon admission, time from first telephone contact to admission and number of telephone consultations in early labour between pre-/post-intervention participants. Chi-square tests were conducted between pre-/post-intervention participants and number of women who visited the hospital prior to admission, number of visits to labour ward prior to admission, mode of delivery, use of epidural analgesia and use of oxytocin. The statistical significance was assumed at *p* level $< 0.05$ throughout [24].

### Results

Table 1 describes the participants' characteristics. The sample consisted of 352 women: 174 who were recruited before Latens.no was launched (pre-intervention), and 178 who were given access to Latens.no (post-intervention). The response rate was 90.2 % in the pre-intervention cohort and 86.4 % in the post-intervention cohort (Flow-chart in Appendix 1). There was no statistically significant difference between pre-/post-intervention participants for marital status, total family income, working status, country of birth and mother tongue. As Table 1 shows, participants in the post-intervention group had a significantly higher educational level than those in the pre-intervention group (*p* = 0.03). However, unadjusted analyses were performed throughout, as an initial linear regression model showed that education did not have a confounding effect on the total score on women's Perceptions of Early Labour in the PreCare Study.

Overall, the CFA showed an acceptable fit. Goodness-of-fit statistics revealed that the CFI (0.839) and the TLI (0.820) are below what is considered acceptable, but the RMSEA (0.078) and SRMR (0.067) were within acceptable ranges—indicating that the three factors obtained from the SWE-ELEQ-PP can be validated. Reliability testing using Cronbach's α resulted in 0.79 for emotional well-being, 0.77 for emotional distress, 0.86 for perceptions of midwifery care and 0.88 for the total score.

However, the CFA indicated a poor fit of Q9. All factor loadings were between 0.31 and 0.80—except for Q9, with a factor loading of 0.19—and all factor loadings were statistically significant (*p* $\leq 0.001$): i. e., they were significantly contributing in terms of the definition of their respecting factors. The $R^2$ values were between 0.10 and 0.65, except Q9, which had an $R^2$ of 0.03. The overall $R^2$ was 0.99 (Table 2).

Table 3 presents all the items on the SWE-ELEQ-PP with mean and standard deviation, and a comparison between the pre- and post-intervention groups. Neither overall score (as measured by the SWE-ELEQ-PP total score) nor the scores on the emotional well-being

**Table 1**

Background characteristics of the Pre- and Post-Intervention Participants in the PreCare Study (N = 352).

| | Study group | | | |
| --- | --- | --- | --- | --- |
| | Pre-intervention (*n* = 174) | Post-intervention (*n* = 178) | Total (N = 352) | *p* value* |
| Age in years (M ± SD) | 31.2 ± 3.8 | 31.3 ± 3.3 | 31.3 ± 3.6 | 0.73 |
| Pre-pregnancy BMI of participant (M ± SD) | 22.4 ± 3.2 | 22.6 ± 3.0 | 22.5 ± 3.1 | 0.71 |
| Use of cigarettes or snus in pregnancy (n. %) | | | | 0.45 |
|     Yes | 2 (1.1) | 5 (2.8) | 7 (2.0) | |
|     No | 171 (98.3) | 172 (96.6) | 343 (97.4) | |
|     Missing | 1 (0.6) | 1 (0.6) | 2 (0.6) | |
| Marital status (n. %) | | | | 0.95 |
|     Co-habiting | 113 (64.9) | 114 (64.0) | 227 (64.5) | |
|     Married or other | 61 (35.1) | 64 (36.0) | 125 (35.5) | |
|     Missing | 0 | 0 | 0 | |
| Education (n. %) | | | | 0.03 |
|     Secondary or grammar school | 21 (12.1) | 9 (5.1) | 30 (8.5) | |
|     Higher education | 153 (87.9) | 169 (94.9) | 322 (91.5) | |
|     Missing | 0 | 0 | 0 | |
| Total family income (n. %) | | | | 0.43 |
|     0–400,000 | 8 (4.6) | 7 (3.9) | 15 (4.3) | |
|     400,000–700,000 | 23 (13.2) | 19 (10.7) | 42 (11.9) | |
|     700,000–1,000,000 | 43 (24.7) | 37 (20.8) | 80 (22.7) | |
|     >1,000,000 | 93 (53.4) | 114 (64.4) | 207 (58.8) | |
|     Missing | 7 (4.0) | 1 (0.6) | 8 (2.3) | |
| Working status of participant (n. %) | | | | 1.00 |
|     Yes | 165 (94.8) | 170 (95.5) | 335 (95.2) | |
|     No | 8 (4.6) | 8 (4.5) | 16 (4.5) | |
|     Missing | 1 (0.6) | 0 | 1 (0.3) | |
| Working status of partner (n. %) | | | | 0.50 |
|     Yes | 167 (96.0) | 171 (96.1) | 338 (96.0) | |
|     No | 3 (1.7) | 6 (3.4) | 9 (2.6) | |
|     Missing | 4 (2.3) | 1 (0.6) | 5 (1.4) | |
| Country of birth (n. %) | | | | 0.22 |
|     Norway | 125 (71.8) | 141 (79.2) | 266 (75.6) | |
|     Other | 46 (26.4) | 37 (20.8) | 83 (23.6) | |
|     Missing | 3 (1.7) | 0 | 3 (0.9) | |
| Mother tongue (n. %) | | | | 0.16 |
|     Norwegian | 127 (73.0) | 145 (81.5) | 272 (77.3) | |
|     Other | 43 (24.7) | 33 (18.5) | 76 (21.6) | |
|     Missing | 4 (2.3) | 0 | 4 (1.1) | |

* *p* value analysed with independent-samples t-tests and Levene's test of variances or chi-square/Fisher's exact tests accordingly.

**Table 2**

Confirmatory Factor Analysis of the Swedish Version of the Early Labour Experience Questionnaire for Primiparous Women (SWE-ELEQ-PP) (N = 352).

| | Cronbach's α | Std. factor loading | *p* value | $R^2$ |
| --- | --- | --- | --- | --- |
| **Emotional well-being** | 0.79 | | | |
| *While you were in early labour at home did you feel:* | | | | |
| Q4: Happy? | | 0.45 | < 0.001 | 0.21 |
| Q1: Safe? | | 0.64 | < 0.001 | 0.41 |
| Q5: Excited? | | 0.31 | < 0.001 | 0.10 |
| Q8: Comfortable? | | 0.58 | < 0.001 | 0.34 |
| Q7: Relaxed? | | 0.67 | < 0.001 | 0.45 |
| Q2: Confident? | | 0.72 | < 0.001 | 0.51 |
| Q13: In control? | | 0.70 | < 0.001 | 0.49 |
| **Emotional distress** | 0.77 | | | |
| *While you were in early labour at home did you feel:* | | | | |
| Q14: Confused? | | 0.56 | < 0.001 | 0.31 |
| Q3: Scared? | | 0.68 | < 0.001 | 0.46 |
| Q9: Tense? | | 0.19 | 0.001 | 0.03 |
| Q11: Anxious? | | 0.71 | < 0.001 | 0.51 |
| Q6. Distressed? | | 0.71 | < 0.001 | 0.51 |
| Q12: Insecure? | | 0.72 | < 0.001 | 0.52 |
| **Perceptions of midwifery care** | 0.86 | | | |
| *When you were at home in early labour, and had telephone contact or were on a visit before, did the midwife:* | | | | |
| Q15: …give you the information you wanted? | | 0.79 | < 0.001 | 0.62 |
| Q16: …reassured you when you needed it? | | 0.80 | < 0.001 | 0.65 |
| Q17: …spend enough time with you? | | 0.72 | < 0.001 | 0.52 |
| Q18: …listen carefully to what you had to say? | | 0.74 | < 0.001 | 0.55 |
| Q19: …treat your family and/or friends with respect? | | 0.50 | < 0.001 | 0.25 |
| Q20: …respect your wishes about going to the hospital? | | 0.61 | < 0.001 | 0.38 |
| Q21: …did you feel that you had confidence in the midwife? | | 0.74 | < 0.001 | 0.55 |

**Table 2** (*continued*)

|  | Cronbach's α | Std. factor loading | *p* value | $R^2$ |
|---|---|---|---|---|
| Q22: …did the midwife and the doctor work as a team in providing your care? |  | 0.46 | < 0.001 | 0.21 |
| Q23: …did you feel that the midwife always was at ease and calm with you? |  | 0.36 | < 0.001 | 0.13 |
| Q24: …do you feel that the midwife treated you in a rude way? |  | 0.36 | < 0.001 | 0.13 |
| Overall | 0.88 |  |  | 0.99 |
| **Latent variable covariances** |  |  |  |  |
|  | Emotional well-being | Distress | Perceptions of midwifery care | |
| Emotional well-being | 1.00 |  |  | |
| Distress | 0.83 | 1.00 |  | |
| Perceptions of midwifery care | 0.37 | 0.38 | 1.00 | |

subscale, the emotional distress subscale or the perceptions of midwifery care subscale differed significantly between the groups. The item measuring whether they felt relaxed while in early labour at home was significantly higher among women in the post-intervention group (3.23 ± 1.14 vs 3.52 ± 1.11, *p* = 0.02). However, the items measuring whether the midwife listened carefully to what they had to say (4.60 ± 0.68 vs 4.37 ± 1.01, *p* = 0.01), treated their family and/or friends respectfully (4.77 ± 0.54 vs 4.43 ± 0.92, *p* < 0.001) and treated them rudely (4.66 ± 0.85 vs 4.40 ± 1.13, *p* = 0.01), were significantly higher in favour of the women in the pre-intervention group (Table 3) (Note

that all items were recorded such that a higher value represented a more positive rating).

Clinical labour characteristics related to giving birth are presented in Table 4. The cervix was significantly more dilated at time of admission in the post-intervention group (4.1 ± 2.2 vs 5.1 ± 2.3, *p* < 0.001) and we found significantly reduced use of oxytocin in the post-intervention group, with 59.2 % using it pre-intervention, and 44.4 % using it post-intervention (*p* = 0.006). Additionally, the number of telephone consultations increased significantly after the intervention was introduced (2.3 ± 1.0 vs 2.6 ± 1.3, *p* = 0.01) (Table 4).

**Table 3**
Descriptions and Comparisons Between Items Related to Pre- and Post-Intervention Women's Perceptions of Early Labour in the PreCare Study (N = 352).

|  | Pre-intervention | | Post-intervention | | |
|---|---|---|---|---|---|
|  | Mean (SD) | Range | Mean (SD) | Range | *p* value* |
| **Emotional well-being** | **24.72 (5.16)** |  | **25.34 (4.90)** |  | **0.25** |
| *While you were in labour at home did you feel:* |  |  |  |  |  |
| Q4: Happy? | 3.52 (1.15) | 1–5 | 3.40 (1.21) | 1–5 | 0.34 |
| Q1: Safe? | 4.07 (0.95) | 1–5 | 4.16 (0.89) | 1–5 | 0.39 |
| Q5: Excited? | 4.43 (0.84) | 1–5 | 4.49 (0.77) | 1–4 | 0.48 |
| Q8: Comfortable? | 2.93 (1.30) | 1–5 | 3.03 (1.23) | 1–5 | 0.42 |
| Q7: Relaxed? | 3.23 (1.14) | 1–5 | 3.52 (1.11) | 1–5 | 0.02 |
| Q2: Confident? | 3.40 (1.04) | 1–5 | 3.39 (1.10) | 1–5 | 0.92 |
| Q13: In control? | 3.14 (1.13) | 1–5 | 3.36 (1.11) | 1–5 | 0.07 |
| **Emotional distress** | **14.34 (3.08)** |  | **14.16 (3.30)** |  | **0.59** |
| *While you were in labour at home did you feel:* |  |  |  |  |  |
| Q14: Confused? | 3.37 (1.33) | 1–5 | 3.38 (1.41) | 1–5 | 0.93 |
| Q3: Scared? | 3.38 (1.20) | 1–5 | 3.29 (1.24) | 1–5 | 0.51 |
| Q9: Tense? | 4.59 (0.77) | 1–5 | 4.55 (0.74) | 1–4 | 0.63 |
| Q11: Anxious? | 3.01 (1.25) | 1–5 | 2.93 (1.24) | 1–5 | 0.58 |
| Q6. Distressed? | 2.60 (1.16) | 1–5 | 2.67 (1.22) | 1–5 | 0.56 |
| Q12: Insecure? | 2.49 (1.14) | 1–5 | 2.48 (1.22) | 1–5 | 0.93 |
| **Perceptions of midwifery care** | **44.05 (5.06)** |  | **42.78 (6.81)** |  | **0.05** |
| *When you were at home in early labour, and had telephone contact or were on a visit before, did the midwife:* |  |  |  |  |  |
| Q15: …give you the information you wanted? | 4.43 (0.74) | 2–5 | 4.33 (0.95) | 1–5 | 0.31 |
| Q16: …reassured you when you needed it? | 4.20 (0.88) | 2–5 | 4.07 (1.10) | 1–5 | 0.23 |
| Q17: …spend enough time with you? | 4.47 (0.84) | 2–5 | 4.40 (0.98) | 1–5 | 0.50 |
| Q18: …listen carefully to what you had to say? | 4.60 (0.68) | 2–5 | 4.37 (1.01) | 1–5 | 0.01 |
| Q19: …treat your family and/or friends with respect? | 4.77 (0.54) | 2–5 | 4.43 (0.92) | 1–5 | < 0.001 |
| Q20: …respect your wishes about going to the hospital? | 4.31 (1.01) |  | 4.12 (1.15) | 1–5 | 0.10 |
| Q21: …did you feel that you had confidence in the midwife? | 4.29 (0.92) | 2–5 | 4.26 (1.02) | 1–5 | 0.73 |
| Q22: …did the midwife and the doctor work as a team in providing your care? | 3.57 (0.92) | 1–5 | 3.65 (1.05) | 1–5 | 0.47 |
| Q23: …did you feel that the midwife always was at ease and calm with you? | 4.75 (0.60) | 2–5 | 4.76 (0.59) | 1–5 | 0.86 |
| Q24: …do you feel that the midwife treated you in a rude way? | 4.66 (0.85) | 1–5 | 4.40 (1.13) | 1–5 | 0.01 |
| **Single items** |  |  |  |  |  |
| Q10: While you were in labour at home did you feel supported? | 4. 67 (0.60) | 2–5 | 4.75 (0.59) | 1–5 | 0.23 |
| Q25: Did you feel you went to the hospital at the right time? | 4.28 (1.14) | 1–5 | 4.10 (1.32) | 1–5 | 0.18 |
| **Total score** | **97.14 (12.85)** |  | **96.28 (13.62)** |  | **0.54** |

* *p* value analysed with independent t-test and Levene's test of variances. Note: All items were recorded such that a higher value represented a more positive rating.

**Table 4**
Labour Characteristics of the Pre- and Post-Intervention Participants in the PreCare Study (N = 352).

| | Pre- intervention (*n* = 174) | Post- intervention (*n* = 178) | Total (N = 352) | *p* value* |
|---|---|---|---|---|
| *Cm* dilatation on admission M ± SD | 4.1 ± 2.2 | 5.1 ± 2.3 | 4.6 ± 2.3 | < 0.001 |
| Time from first telephone contact to admission (in minutes) M ± SD | 745 ± 718 | 795 ± 864 | 770 ± 794 | 0.55 |
| Number of telephone consultations in early labour M ± SD | 2.3 ± 1.0 | 2.6 ± 1.3 | 2.5 ± 1.1 | 0.01 |
| Number of women who visited the hospital prior to admission (n. %) | | | | 0.60 |
| Yes | 63 (36.2) | 59 (33.1) | 122 (34.7) | |
| No | 110 (63.2) | 119 (66.9) | 229 (65.1) | |
| Missing | 1 (0.6) | 0 | 1 (0.3) | |
| Number of visits to labour ward prior admission (n. %) | | | | 0.40 |
| 0 visits | 110 (63.2) | 119 (66.9) | 229 (65.1) | |
| 1 visit | 48 (27.6) | 50 (28.1) | 98 (27.8) | |
| More than 1 visit | 15 (8.6) | 9 (5.1) | 24 (6.8) | |
| Missing | 1 (0.6) | 0 | 1 (0.3) | |
| Mode of delivery (n. %) | | | | 0.26 |
| Vaginal delivery | 125 (71.8) | 134 (75.3) | 259 (73.6) | |
| Operative vaginal delivery | 35 (20.1) | 37 (20.8) | 72 (20.5) | |
| Caesarean section | 13 (7.5) | 7 (3.9) | 20 (5.7) | |
| Missing | 1 (0.6) | 0 | 1 (0.3) | |
| Use of Epidural analgesia (n. %) | | | | 0.13 |
| Yes | 126 (72.4) | 115 (64.6) | 241 (68.5) | |
| No | 47 (27.0) | 63 (35.4) | 110 (31.3) | |
| Missing | 1 (0.6) | 0 | 1 (0.3) | |
| Use of oxytocin (n. %) | | | | 0.006 |
| Yes | 103 (59.2) | 79 (44.4) | 182 (51.7) | |
| No | 70 (40.2) | 99 (55.6) | 169 (48) | |
| Missing | 1 (0.6) | 0 | 1 (0.3) | |

*p* value analysed with independent-samples t-tests and Levene's test of variances or chi-square test accordingly.

## Discussion

Overall results from the SWE-ELEQ-PP are unable to demonstrate that Latens.no improved early labour experience. However, when assessing the labour characteristics, we found that women in the post-intervention group presented at the labour ward with greater cervical dilatation than the pre-intervention group. Women in the post-intervention group also received less oxytocin during labour. Moreover, the number of telephone consultations increased significantly after the intervention was introduced. The CFA of the SWE-ELEQ-PP is within an acceptable fit, despite the poor fit of one item.

While this study was unable to show that introducing an online early labour educational intervention improved women's early labour experience when measured with the ELEQ, it might be argued that a null finding is positive, in light of recent research on pregnant women's mental health during COVID-19. Our pre-intervention cohort in this study was recruited pre-COVID-19, and our post-intervention cohort was recruited during the second wave in Norway. A systematic review of perinatal mental health outcomes during COVID-19 indicates an increase in depressive and anxiety symptoms in pregnant and postpartum women [25]; the authors suggest that perinatal women were faced with a heightened sense of unpredictability and uncertainty, increased stress and decreased practical and emotional support. All of the aforementioned factors may impact women's experience of early labour [26]. Additionally, COVID-19 has resulted in shifts in hospital guidelines, limiting the partner's presence at the hospital; this, in turn, may have resulted in unmet support expectations, with a subsequent negative experience for women.

Our results also show that women in the pre-intervention group scored significantly more positively on three of the questions related to midwifery care: whether the midwife listened carefully to what they had to say, treated their family and/or friends respectfully or treated them rudely. This may be explained by the fact that COVID-19 brought on changing care guidelines, possibly affecting how women in the post-intervention group perceived perinatal care. Alternatively, evidence suggests that when technology is used in healthcare services, the satisfaction of the therapeutic relationship between the healthcare professional and the individual may decrease [14]. Technology has the potential to lessen social interaction, thus increasing feelings of anxiety, loneliness, and disconnection—this may also have played a part in reducing patient satisfaction in these three areas, following the introduction of Latens.no.

Participants with access to Latens.no felt significantly more relaxed while in early labour at home compared to participants in the pre-intervention group. This finding is somewhat surprising, given that other research shows an uptick in distress among pregnant women during COVID-19 [25,27]. Although this only concerns a single item, it may indicate that digital support is a pragmatic but valuable supplement in improving women's experience of early labour care [18,19].

The most striking result from this study is that women in the post-intervention group presented at the labour ward with more cervical dilatation and required less oxytocin. Women with access to Latens.no presented at the labour ward with a mean dilatation of 5.1 cm (SD ± 2.3) compared to 4.1 cm (SD ± 2.2) in the pre-intervention group (p < 0.001). The World Health Organization's recommendations from 2018 specify that women be considered in active labour when their cervix is 5 cm dilatated [1]. Hospital admittance is generally not recommended until active labour [2]. These findings indicate that participants with access to Latens.no had more timely admission to the labour ward. Several factors could explain this result. Firstly, it might indicate that women who received access to a suitable amount of trustworthy information at the appropriate time were better able to cope with early labour at home. This explanation is supported by a randomised trial of structured antenatal training sessions to improve the birth process, where women who received antenatal training arrived at the maternity ward in active labour more often than the reference group [12]. However, the result may also indicate that fear of being separated from their partner or contracting COVID-19 delayed access to the labour ward, and pandemic-related delays in hospital admission have been reported [28]. It is also interesting to note that more participants in the pre-intervention cohort considered that they came to the hospital at the right time, although this finding was not statistically significant.

Significantly fewer women received oxytocin in the group with access to Latens.no, with 103 participants (59.2 %) using it in the pre-intervention group and 79 participants (44.4 %) in the post-intervention group. This result agrees with findings in several other studies, which report significantly more use of oxytocin in women presenting at the labour ward in earlier stages of labour [8,9]. As the use of oxytocin can be associated with several adverse effects, this is a positive finding.

The number of telephone consultations was significantly higher in the group with access to Latens.no—something that is likely explained by the intervention. In a previous publication from the PreCare study [19], we report that many women were reluctant to call the hospital despite wanting to talk to health professionals. Following this, we ensured that statements were abundant on Latens.no informing women that telephone calls are welcomed by the midwives. Given that women with access to Latens.no had timelier admission, this finding may support the hypothesis that women using the information on Latens.no were able to actively participate in care decisions. However, it might also be explained by the changing care guidelines due to COVID-19, leading to more questions and uncertainty.

Overall, the CFA of the Swedish version of the ELEQ for primiparous women demonstrates an acceptable fit. However, Q9 was found to be a poor fit ('While you were in labour at home did you feel tense?'). A possible explanation for this may be our translation of the word 'tense'. In Q9, the word 'tense' was translated to the Norwegian word *spent*. In Norwegian, one meaning of *spent* is 'tense', but another meaning is 'excited/expectant/eager/curious' when facing something unknown. Neither the developers of the ELEQ or the Swedish researchers preforming the exploratory factor analyses noted any issues with Q9 in their reliability testing [16,17]. This might be because both the English word 'tense' and the Swedish word *spänd* primarily have negative connotations [29,30], as opposed to the Norwegian word *spent*, which has both positive and negative connotations.

*Strengths and limitations*

The midwifes in the hospital received the same information about the study prior to data collection in both cohorts. Nevertheless, knowledge of the intervention may result in differences in the care given, and hence represent a bias.

It is difficult, perhaps impossible, to prove a causal effect of our intervention from the current data due to the nature of this study, including the history bias of COVID-19. The pre-intervention cohort in this study was recruited pre-COVID-19, and the post-intervention cohort was recruited during the pandemic's second wave in Norway. At the time of data collection among the post-intervention-group, there was still limited research on COVID-19 and pregnancy, but there was no evidence that pregnant women were at a higher risk of developing COVID-19 than the general population [31]. Our participants were likely to have been affected by COVID-19 to some degree, and results need to be interpreted with caution.

The CFA of the SWE-ELEQ-PP indicates a poor fit of Q9 ('While you were in labour at home did you feel tense?'). Correspondingly, the model may be improved in this respect. However, factor loadings and covariances may be specific to our participants, and perhaps not generalizable. In addition, the purpose of this study was not to improve the questionnaire, but rather to test the underlying structure of the SWE-ELEQ-PP in a Norwegian setting.

## Conclusions

Results from our study at Norway's largest delivery ward show that whilst digital support did not significantly improve women's experience with early labour, it was associated with timelier admission and reduced use of oxytocin. Digital media is already extensively used by pregnant women, and the social context within which the positive and negative experiences of early labour occur extends well beyond in-person interactions. Thus, we suggest further investigation into the use of technology in healthcare delivery to understand how it facilitates social support, well-being and outcomes related to giving birth. Finally, the CFA of the SWE-ELEQ-PP demonstrates an acceptable fit and we recommend its use, but the translation of Q9 should be carefully considered.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A.  Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.srhc.2023.100821.

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