Prospective longitudinal cohort questionnaire assessment of labouring women’s preference both pre- and post-delivery for either reduced pain intensity for a longer duration or greater pain intensity for a shorter duration

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Editor’s key points

- Better understanding of the impact of different components of labour pain is needed.
- This study assessed the effect of pain duration and intensity on the pain experience.
- Patients preferred lower intensity, longer duration compared with higher intensity, short duration labour pain.
- Further work is needed to direct management of labour pain to meet patient expectations.

Background. Assessments of labour pain focus on pain intensity, not on duration. We aimed to assess the importance labouring women apply to pain intensity and duration before labour and post-delivery.

Methods. Forty healthy women scheduled for labour induction were enrolled in this institutional review board-approved, prospective cohort study. Participants completed a pain preference questionnaire before active labour and within 24-h of delivery. The questionnaire consisted of seven stem questions that evaluated preference for pain intensity or duration. The pain preference ratio was determined by dividing the percentage of women who preferred reduced pain intensity for longer duration by that of those who preferred greater pain intensity for shorter duration (estimate of the odds). The overall hypothetical pain burden was determined by multiplying intensity by time. All questions presented the same overall hypothetical pain burden.

Results. Pain preference questionnaire scores demonstrated preference for low intensity pain for a longer duration rather than higher intensity for a shorter duration, both pre-labour (P<0.001) and post-delivery (P<0.001): the null median imputed as 3 of 6 (i.e. no preference for pain intensity over pain duration). This preference for pain duration over intensity was greater post-delivery compared with before labour (P=0.03). There was a significant correlation (r=0.83; P=0.04) between the pain preference ratio vs overall hypothetical pain burden before labour but not after delivery (r=0.28; P=0.59).

Conclusions. In this preliminary labour assessment, women preferred lower pain intensity at the cost of longer pain duration. This suggests that pain intensity is the primary driver of hypothetical pain burden—a preference reinforced post-delivery.

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Pain perception during labour is generally measured by numerical rating scores (NRSs) or visual analogue scales (VASs). The McGill Pain Questionnaire was developed in the labour setting, and in addition to numbers to describe pain intensity, this tool utilizes expressive pain descriptors with affective components related to the pain.1 However, neither these expressive descriptors nor the numerical scores consider the duration of the pain experienced. Duration of pain is an important component when considering the overall burden of pain and ongoing labour analgesia requirements.2 ‘Area-under-the-curve’ (AUC) is the product of pain intensity by pain duration, which could be used to provide a more informative description of the overall labour pain burden.3 Consideration of the duration of pain (reflected by the duration of labour) is clinically relevant as labouring women may forgo labour analgesia if they expect to deliver imminently. Some studies have found that neuraxial labour techniques used to reduce pain intensity may prolong the duration of labour, and consequently this might increase the overall labour pain burden despite reducing pain intensity.4–7 Alternatively, if neuraxial techniques were to reduce labour duration as has been sometimes previously reported,8 then the overall labour pain burden would decrease, additionally driven by both a pain intensity and labour duration reduction.
Women’s preference for pain intensity relative to labour duration has not previously been reported. The primary study aim was to assess whether women would prefer reduced pain intensity for a longer labour duration or greater pain intensity for a shorter labour duration. This was evaluated through structured scenarios of equal hypothetical pain burden, both before labour and post-delivery. The study null hypothesis was that women would have no preference for lower pain intensity over a longer labour duration, compared with higher pain intensity over a shorter labour duration.

**Methods**

After Stanford University Human Subjects Institutional Review Board approval and written informed consent, 40 participants who underwent scheduled induction of labour were enrolled in this prospective cohort study, from August 2011 to January 2012. The inclusion criteria included: age $\geq$ 18 yr, ASA physical status I or II, term gestation (≥ 37 weeks), and singleton gestation. Patients were excluded from study participation if they met any of the following criteria: chronic pain, recent antenatal use of regular analgesia medication, substance abuse, and psychiatric or cognitive disorder (e.g. anxiety or depression).

Study participants were given a pain preference questionnaire to complete after admission to the labour and delivery suite. They completed the questionnaire initially before the onset of active labour (defined by regular painful contractions), and again within 24 h of delivery. The pain preference questionnaire (see Appendix) was designed specifically for this study (B.C.). The questionnaire comprised seven stems, six principal questions and one ‘dummy’ question, each enquiring about preference for labour pain intensity and pain duration. Each of the six principal stems had two choice options: one for greater intensity but for a shorter duration and the other for less pain intensity but for a longer duration. Both choice options in the same stem comprised the same area-under-the-curve and overall hypothetical pain burden. The overall hypothetical pain burden was determined by multiplying intensity by time.

A ‘dummy’ question (Question 5, Appendix) with different hypothetical pain burdens (different pain intensity but same labour duration) was used to assess whether the participants were reading and comprehending the questions adequately and completing the questions with due care. We decided a priori that if this ‘dummy’ question was incorrectly answered, we would reject the entire questionnaire. Only the answers to the principal six stem choices were analysed.

In the questionnaire, the intensity of pain was evaluated using an NRS 0–10, with 0 = no pain and 10 = worst pain imaginable. The duration of pain was evaluated using whole hour periods. The AUC hypothetical pain burden was determined as the product of pain intensity (NRS) and duration (h) (i.e. pain NRS multiplied by the number of hours in pain). Patient characteristic (age, weight, height, and race) and obstetric (parity, number of previous vaginal, Caesarean deliveries, or all) data were recorded. The use of labour epidural analgesia (yes/no) and i.v. fentanyl dose (μg) administered during labour was documented. The duration of active labour and the duration of the second stage of labour were recorded. The delivery mode (spontaneous, assisted, or Caesarean) and the presence of vaginal injury (laceration or episiotomy) was also documented. At the post-delivery visit, study participants were asked to recall what their pain score was at the time they requested epidural analgesia.

**Statistical analysis**

The primary aim of this study was to assess women’s preference for lower pain intensity over a longer labour duration compared with higher pain intensity for a shorter labour duration using the pain preference questionnaire before labour and post-delivery. From initial pilot data, we estimated requiring 35 patients to show a 30% difference (2.1 vs 3 (out of 6); standard deviation (SD) 1.7) in overall preference for lower pain intensity for a longer labour duration compared with higher pain intensity for a shorter labour duration (Power 0.8, α 0.05, two-tailed t-test using GPower 3.0.10 for Windows written by Franz Faul, Universität Kiel, Germany). The primary study outcome was the initial pre-labour pain preference compared with a null median of no pain preference.

Patient’s preference for pain intensity over pain duration (0 = prefers lower pain intensity over a longer labour duration, 1 = prefers higher pain intensity for a shorter labour duration) for each of the six stem choices was summed both pre-labour and post-delivery and compared with an expected null median. The null median was imputed as 3 of 6 (i.e. no preference for pain intensity over pain duration). Wilcoxon one-sample signed-ranks test of median was used to compare actual with the null median, and Wilcoxon paired signed-ranks test of medians was utilized for pre-labour and post-delivery pain preference testing. The medians of nulliparous and multiparous women were compared using the Mann–Whitney U-test.

To determine the impact of pain intensity/duration relative to overall hypothetical pain burden, we plotted and correlated the pain preference ratio and overall hypothetical pain burden both pre-labour and post-delivery for each of the six stem choices. The pain preference ratio was created by dividing the percentage of women who preferred reduced pain intensity for a longer duration by that of those who preferred greater pain intensity for a shorter duration for each of the six stem choices. This pain preference ratio is an estimate of the odds. The overall hypothetical pain burden was determined by multiplying pain intensity by time for each of the same question. For example Question 1, the pre-labour ratio was 1.4 (58% who preferred low pain intensity divided by 42% who did not). The post-delivery ratio was 4.6 (82 who preferred low pain intensity divided by 18 who did not). The overall hypothetical pain burden was 18 (pain of 6 multiplied by 3 h or 2 multiplied by 9) (Table 2). Correlations between the pre-labour and post-delivery pain preference ratio and overall hypothetical pain burden were determined using Spearman rank-order correlation coefficients.
The χ² and McNemar tests were applied as appropriate to compare pain preference categorical variables for pre-labour and post-delivery statistical comparisons (Table 2). Patient characteristic, analgesia, and obstetric data are summarized with descriptive statistics where results are expressed as mean (SD), median [inter-quartile range (IQR)], or numbers (percentage). P<0.05 was considered statistically significant. Data were analysed using IBM SPSS version 20.0.0 for Windows (IBM Corp., Armonk, NY, USA).

**Results**

The study cohort consisted of 40 participants of whom 37 participants completed both the pre-labour and post-delivery survey (Fig. 1). No patients were lost to follow-up and no patients requested to be removed from the study. Patient characteristic and obstetric data of the 37 patients who completed the questionnaires are presented in Table 1.

The median [IQR] pre-labour pain preference questionnaire score (0–6, with <3 preferring lower labour pain intensity for a longer duration and >3 preferring higher labour pain intensity for a shorter duration) was 1 [0–3], which was statistically significantly different (P<0.001) compared with a null median of 3 of 6. The median [IQR] post-delivery pain preference questionnaire score of 1 [0–2] was also statistically significantly different (P<0.001) compared with an expected null median of 3. There was a statistically significant difference between the pre-labour and post-delivery pain preference scores (median difference 0, 95% confidence interval 0–1; P=0.03). The results of the individual questions of the pain preference questionnaire are outlined in Table 2. Three out of the six pre-labour stem choices and four of six post-delivery stem choices demonstrated a preference for lower intensity of pain at the expense of a longer duration (Table 2).

There was a significant correlation (r=0.83; P=0.04) between the pain preference ratio and the AUC overall hypothetical pain burden before labour (Fig. 2). There was no correlation (r=0.28; P=0.59) between the pain preference ratio and the AUC overall hypothetical pain burden after delivery. The mean (SD) duration of labour was 505 (382) min, and the median [IQR] of the second stage of labour was 39 [12–80] min. Thirty-five (88%) of the women underwent a vaginal delivery, and 5 (12%) required a Caesarean delivery. In the vaginal delivery group, 2 (6%) women required episiotomy, and 11 (31%) and 14 (40%) sustained first- and second-degree lacerations, respectively. Median [IQR] pre-labour pain preference was 1 [0–2.5] in nulliparous and 2.5 [0–4] in multiparous women (P=0.377). There was no difference in the median [IQR] post-delivery pain preference in nulliparous (1 [0–3]) and multiparous (1 [0–2]) women (P=0.98). Although parity did not impact on pre-labour and post-delivery pain preference scores, it was associated with a significant shorter duration of labour (P<0.001). The pain NRS before women received epidural analgesia was 6.7 (2.1). Thirty-seven women (93%) received labour epidural analgesia. I.V. fentanyl was administered to 11 (28%) of women; with a median [IQR] dose of 100 μg [100–200 μg] in women receiving this systemic labour analgesic.

**Fig 1** Flowchart diagram of the study.
Discussion

The current study demonstrates women’s preference for reduced labour pain intensity at the cost of longer labour duration rather than higher pain intensity for a shorter period. This ‘trade-off’ preference is reinforced post-delivery. The relative importance that labouring women apply to pain intensity and pain duration, given scenarios with the same overall hypothetical pain burden, has not been previously examined or determined. The study findings suggest that pain intensity is the primary driver of overall hypothetical pain burden and that women are prepared to have longer pain duration if the intensity is low.

Pain intensity measured with verbal pain quantification indices such as VAS and NRS comprise the primary constituent of pain assessments in the labour setting. Decisions regarding labour analgesia administration and dose adjustments are based upon maternal ratings of pain intensity. In the realms of both clinical practice and research, the numerical response is a gauge for provision, type, and magnitude of analgesia provided. Analgesic efficacy is assessed by the pain intensity reductions provided. Additionally, pain intensity rating scores during labour are used to compare analgesic therapy efficacy such as patient-controlled epidural analgesia vs combined spinal-epidural analgesia, and i.v. analgesic modalities. Pain duration is not reflected in many of these comparative analgesic technique assessments.

The current study suggests that in the presence of functional epidural analgesia, low pain intensity is considered of greater value in the labouring woman than pain duration. A number of studies suggest that the duration of labour may be prolonged by epidural labour analgesic techniques, particularly in the second stage of labour. Preference for pain intensity over duration that is reinforced post-delivery demonstrates that the labouring woman is likely to elect for an efficacious analgesic therapy for reducing pain intensity even if she may consider this technique to prolong labour duration. The significant correlation between the pain preference ratio and overall hypothetical pain burden before labour but not after delivery suggests that pain duration may be a bigger concern before labour than after delivery, when pain intensity preference is most apparent.

Our findings suggest that interpretations of currently used numerical scales to guide therapies for reduction of pain

Table 1 Patient characteristic, obstetric, and neonatal data of the study population (n=37). Values expressed as mean (sd), median [IQR; range] and number (percentage) as appropriate

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>n (%)</th>
<th>Mean (SD)</th>
<th>Median (IQR)</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>29</td>
<td>29 [25 – 34; 21 – 44]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height (cm)</td>
<td>164</td>
<td>164 (8)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>81</td>
<td>81 [70 – 104; 57 – 136]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>13</td>
<td>13 (35%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>12</td>
<td>12 (32%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>6</td>
<td>6 (16%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>6 (16%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nulliparous</td>
<td>19</td>
<td>19 (51%)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Gravidaity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>19</td>
<td>19 (51%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>13</td>
<td>13 (35%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 2</td>
<td>5</td>
<td>5 (14%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 Pain preference questionnaire results. NRS = numerical rating score (0 – 10, 0 = no pain and 10 = worst pain imaginable). %, Percentage of respondents choosing reduced pain for a longer duration vs more pain for a shorter duration option for each question. *P = 0.02 and †P = 0.03 (unadjusted P-values) comparing pre-labour vs post-delivery survey

<table>
<thead>
<tr>
<th>Options for pain intensity (NRS) and duration (h)</th>
<th>Pre-labour survey (%)</th>
<th>Post-delivery survey (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1: 2/10 for 9 h or 6/10 for 3 h</td>
<td>58</td>
<td>82*</td>
</tr>
<tr>
<td>Q2: 4/10 for 12 h or 8/10 for 6 h</td>
<td>84</td>
<td>82</td>
</tr>
<tr>
<td>Q3: 5/10 for 2 h or 10/10 for 1 h</td>
<td>74</td>
<td>89†</td>
</tr>
<tr>
<td>Q4: 3/10 for 9 h or 9/10 for 3 h</td>
<td>82</td>
<td>84</td>
</tr>
<tr>
<td>Q6: 1/10 for 18 h or 9/10 for 2 h</td>
<td>58</td>
<td>66</td>
</tr>
<tr>
<td>Q7: 2/10 for 2 h or 4/10 for 1 h</td>
<td>50</td>
<td>55</td>
</tr>
</tbody>
</table>

Fig 2 Pain preference ratio vs overall hypothetical pain burden. The pain preference ratio assessment before labour and after delivery plotted against the overall hypothetical pain burden for each of the six questions (see the Methods section for explanation).
intensity in the labour setting are suitable. The novel bi-dimensional (valuing both the intensity and the duration aspects of the hypothetical pain burden) assessment technique described in the current study may be a potentially useful tool for measuring labour pain. For example, a labouring woman could be administered a hypothetical pain burden rating and then asked how long she would be prepared to stay at that pain level. This is particularly useful in the second stage of labour when the desire for patient comfort needs to be balanced with the potential for motor blockade. Overall hypothetical pain burden may also be useful as a research tool to compare efficacy of analgesic techniques. Labour pain changes with progress of labour, and therefore, a measure of total labour pain may be a useful tool to supplement or replace repeated measures of NRS and VAS throughout labour.

The interpretation of our data should be framed within the fact that the vast majority of women (93%) received epidural analgesia. Furthermore, the current study was small and limited to women who delivered at our institution where the expectation is to request and receive neuraxial labour analgesia. The current study will need to be expanded to include other cultures and institutions in which neuraxial analgesia is not the norm. Furthermore, the study population was not large enough to assess whether other factors such as support during labour, mode of delivery, mode of analgesia, or parity influenced the outcome. Also, the survey was conducted only in women undergoing induction of labour. We did not assess prior labour experience that may impact on pain and analgesic perceptions. However, we found no difference in pain preference among the nulliparous and multiparous women studied. We report results of a cohort population, but acknowledge that each woman may have specific and different individual requirements. Additionally, the current study is limited by a single post-delivery measurement to determine pain perceptions. These data were also collected 12–24 h post-delivery; recall and perceptions may change with increasing time intervals from delivery. Although the pain preference questions have inherent face validity as they ask patients to rank scenarios using simple numbers related to pain intensity as used in NRS and related to duration of labour, the questionnaire requires further validation and reliability testing and also further studies to validate the results and the study methodology. In future applications of this questionnaire, we suggest including an additional reverse ‘dummy’ question and randomizing the order of the pain intensity tick boxes. Additionally, the current study did not measure the frequency of uterine contractions. The frequency of uterine contractions is important to consider when evaluating the duration of labour and pain intensity.

The study utilized an NRS as a scaled rating to assess pain intensity because NRS is easily understood, widely utilized in this setting, and correlates strongly with a VAS pain score. We realize that other pain intensity rating scales, categorical pain ratings, objective pain assessments, and also different measures of duration may have been considered and could have impacted on the pain preferences. We did not assess women’s satisfaction with labour pain. Maternal satisfaction of epidural analgesia is generally very high, and the relationship between pain intensity scores and maternal satisfaction with labour analgesia is poor, with many non-analgesic factors such as private room and decision-making impacting on this measure.

In conclusion, the current study demonstrates that in a labour setting, women prefer reduced labour pain intensity for a longer duration compared with greater pain for a shorter duration. Pain intensity appears to be the primary driver of overall hypothetical pain burden, and in labouring women this ‘trade-off’ preference is reinforced post-delivery. In the presence of functional epidural analgesia, the study suggests that the current practice of directing therapy towards reduced pain intensity is considered of greater value by labouring woman than pain duration. However, further studies to confirm the results and validate the questionnaire in different labouring populations and settings are required.

Authors’ contributions
B.C., G.H., L.W., and C.F.W.: substantial contribution to conception, acquisition and design, analysis and interpretation of data. B.C., G.H., L.W., and C.F.W.: drafting the article or revising it critically for important intellectual content. B.C., G.H., L.W., and C.F.W.: final approval of the version to be published.

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Declaration of interest
None declared.

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Appendix

Pain Preference Survey

After surgery you may experience pain. Remember that pain is treatable. These questions examine your preference for potential painful situations. For these questions, pain intensity is rated using a pain scale 0–10, with 0=no pain and 10=worst pain imaginable.

(1) Which scenarios would you prefer?
- Pain intensity of 2 (out of 10) for 9 h
- Pain intensity of 6 (out of 10) for 3 h

(2) Which scenarios would you prefer?
- Pain intensity of 4 (out of 10) for 12 h
- Pain intensity of 8 (out of 10) for 6 h

(3) Which scenarios would you prefer?
- Pain intensity of 5 (out of 10) for 2 h
- Pain intensity of 10 (out of 10) for 1 h

(4) Which scenarios would you prefer?
- Pain intensity of 3 (out of 10) for 9 h
- Pain intensity of 9 (out of 10) for 3 h

(5) Which scenarios would you prefer?
- Pain intensity of 2 (out of 10) for 7 h
- Pain intensity of 6 (out of 10) for 7 h

(6) Which scenarios would you prefer?
- Pain intensity of 1 (out of 10) for 18 h
- Pain intensity of 9 (out of 10) for 2 h

(7) Which scenarios would you prefer?
- Pain intensity of 2 (out of 10) for 2 h
- Pain intensity of 4 (out of 10) for 1 h

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