# The Prince of Songkla University Pain Curve for Predicting Labor Progress

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**Abstract:** During labor not only labor pain but also vaginal examinations cause adverse effects on a woman and her fetus. Thus, it is essential to develop a method to monitor labor progress besides vaginal examinations. This applied research aimed to develop the Prince of Songkla University Pain Curve instrument and test its sensitivity in predicting labor progress during the first stage of labor. Primiparous women were recruited by convenient sampling in a labor room at a central hospital in southern Thailand. In phase I (n = 350), pain (using the 100 mm Visual Analogue Scale) and duration of time from each cervical dilation were recorded and then the Pain Curve was developed. In phase II (n = 350), the instrument was examined for its sensitivity in prediction of labor progress. Results indicated that it had a slightly moderate sensitivity in predicting progress of labor from latent to maximum slope phases, but had a high sensitivity in the deceleration phase. The implication is that to monitor labor progress, it might be beneficial to use this instrument additional to standard curve instruments. Using the Prince of Songkla Pain Curve could also lower a number of vaginal examinations in assessment cervical dilations for predicting labor progress. Further testing and refinement of this instrument is required in the future with different samples including Thai women in larger sample size.

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**Keywords:** Labor pain, Prediction of labor progress, Labor progress, Instrument development, Sensitivity

## Introduction

Pain during labor is one of the most severe pains[1] and increases over time throughout labor.[2] Pain during labor comes not only from uterine contractions and cervical dilation but also from vaginal examinations for monitoring labor progress. Receiving vaginal examinations causes some women to experience pain ,[3] shame,[4,5] and fear.[5] Receiving vaginal examination for the first time makes some women have greater experience of pain and more negative experiences than those having later vaginal

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examinations.[6] In one study in England (n = 104), more than half of the women experienced pain and distress from receiving vaginal examination during labor.[7] In a study in Thailand (n = 81), during labor 50% of the women experienced moderate pain, 35.8% little pain and 11% severe pain; additional findings showed that women experienced discomfort, shame, fear, and fear of infection from vaginal examination.[8] Another disadvantage of vaginal examination is introduced infection.[9] In Thai laboring women, the number of vaginal examinations ranges from one to eight with an average of 3.83 times (SD = 1.21),[8] which is similar to the study of Freeman and colleagues[10] (range from one to eight times and 72% receiving vaginal examination two to four times).

Currently assessment of labor progress around the world is generally undertaken using cervical dilation and the Friedman Curve. However, the progress of the active phase of labor in women is longer than in the past, according to the results of monitoring cervical dilation and duration using the Friedman Curve in 1,329 primiparous women.[11] However, in one study (n = 97 primiparous women) there was little difference in time in the first stage of labor compared to time in the Friedman Curve and the researcher suggested that it was necessary to develop a graph to enable a better prediction of the progress of labor.[12] In addition, another similar graph, the Partograph, is designed for use in third world countries but its use is limited, as there are now a lot of technologies, such as drugs for induction/augmentation during labor,[13] which are also applied in practice in Thailand. Up until now it would have been necessary to find another method that can predict the progress of labor instead of using only vaginal examinations for assessment of cervical dilation. Therefore, we developed a new graph of pain level, the Prince of Songkla University (PSU) Pain Curve relating labor pain to uterine contractions and cervical dilation, which reflect the progress of labor and can be used by health personnel such as doctors, nurses and midwives. The English version of PSU Pain Curve was developed. Furthermore, using the PSU Pain Curve might lower the number of vaginal examinations for monitoring the progress of labor.

## Study Aim

To develop the PSU Pain Curve graph and test its sensitivity in prediction of the progress of labor.

## Methods

*Research design:* There were two study phases: *Phase I* was the development of the graph "PSU Pain Curve" and *Phase II* was the testing of its sensitivity in predicting the progress of labor in the first stage.

*Participants:* Yamane's formula ($n = N/(1+Ne^2)$) where N = 2,767 primiparous women in year 2012, with confidence interval 95%, and error 5%, was used to calculate the required number of participants;[14] In each phase of the study, a sample size was required of 350 primiparous women during labor being measured for labor pain at least twice. The study used the data of pain in the analysis only in the phase that women did not receive oxytocin.

Participants who met the inclusion criteria were recruited by convenience sampling. Inclusion criteria were: primiparous pregnant women with height of at least 147 cm (ensuring normal labor)[15], age 16-35 years, no health complications, 37-42 weeks gestation, singleton fetus with vertex presentation and no fetal distress, and having true labor .

*Ethical considerations:* This study was approved by the Human Ethics Committee of the School of Nursing, Prince of Songkla University and a central hospital in southern Thailand before conducting the study. In labor room, nurses screened women in labor and asked for their permission to let a research assistant (RA) approach them. The RA explained to these women about purposes of the study, and their rights in participation, including confidentiality. Written informed consent was also obtained by RA before collecting data.

*Data collection:* The setting was the labor room at a central hospital in Southern Thailand. The study was conducted for 15 months from August 2013 to October, 2014. RA was trained by the principal investigator (PI) conducting the study, to collect data regarding labor pain and duration of time in each cervical dilation in both phases of the study and plot the graph. The vaginal examinations were performed to assess cervical dilation by the nurses in labor room as standard practice.

*Participant enrollment:* The enrollment was as follows (Figure 1):

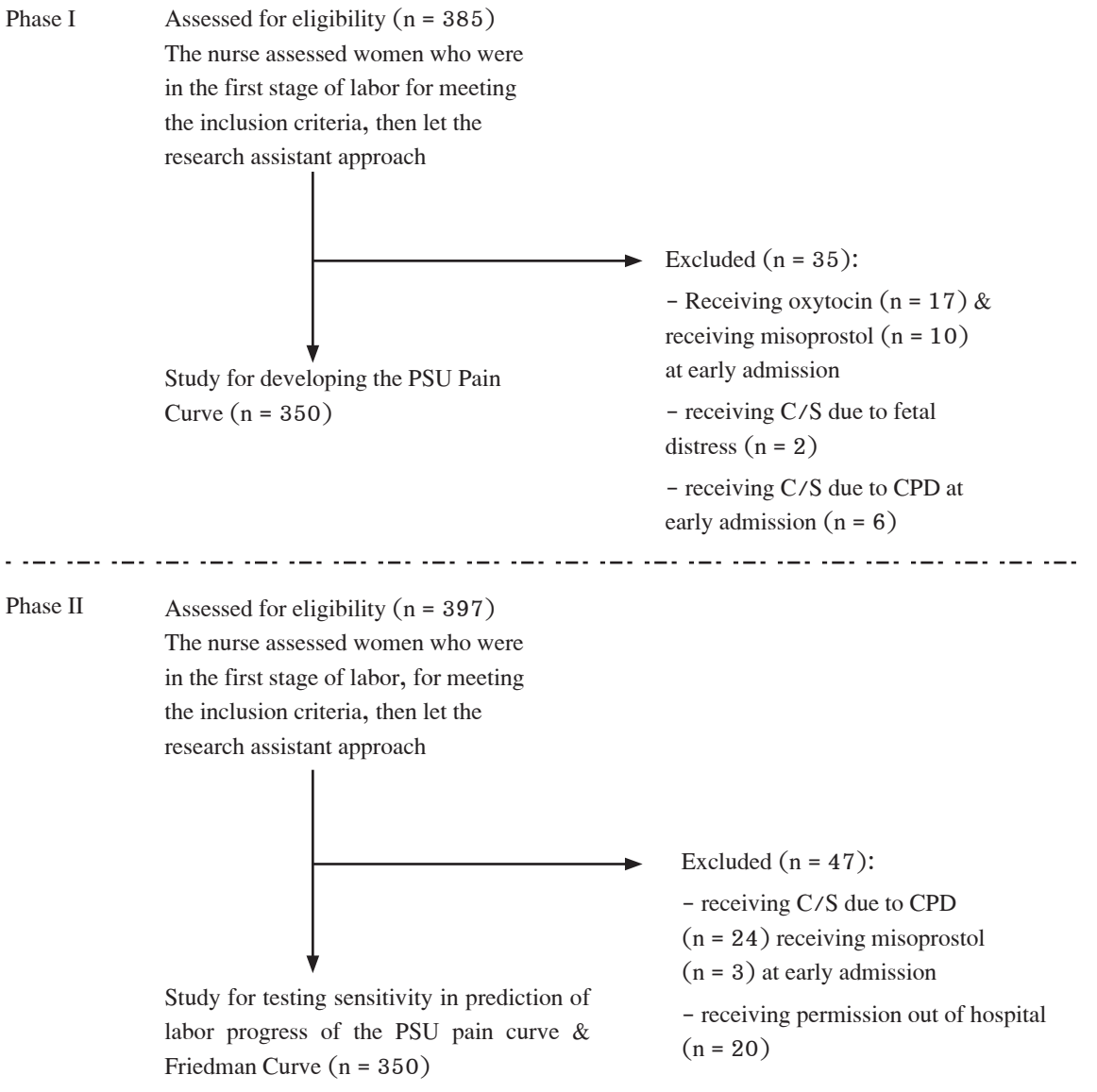
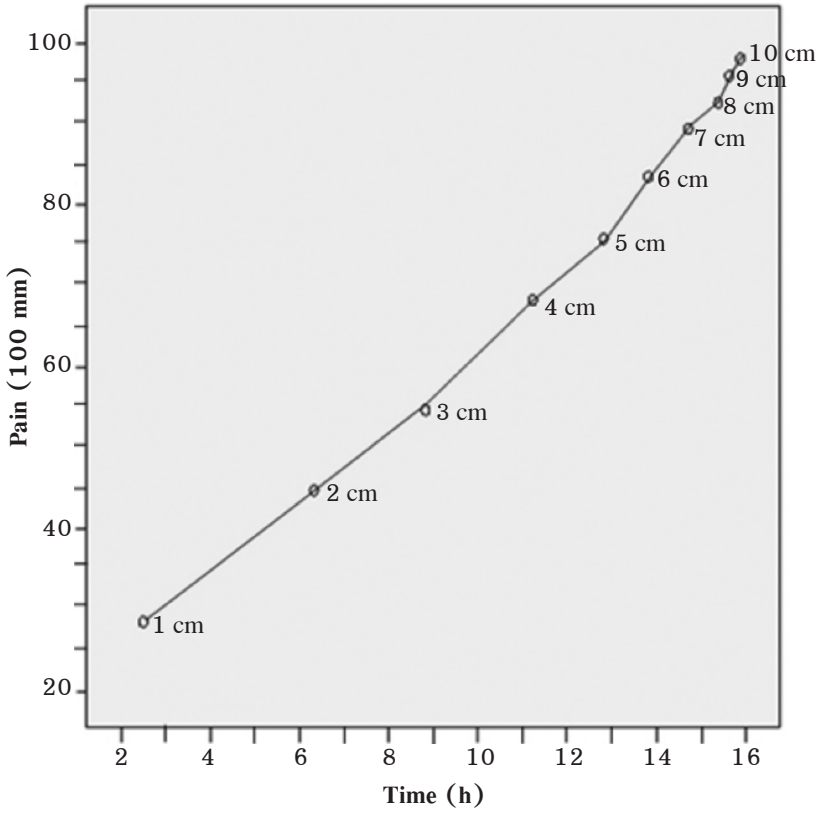



**Figure 1** Flow diagram of selection procedure of each phase

Phase I: The RA collected demographic, obstetric, and infant data, and duration of time (from the labor record) and the pain level at each cervical dilation of participants, from onset of labor in the first stage. The pain levels were rated by participants using the 100 mm Visual Analogue Scale (VAS), a Thai version which was developed by the PI, yielding a reliability of 0.98.[16] The 100 mm VAS states "no pain" on the left end and "very severe pain" on the right end of the scale; the scale ranges from the lowest pain (0 mm) to highest pain (100 mm). Scoring was undertaken using a ruler for the number in mm. Pain was measured immediately after the vaginal examination at each cervical dilation or whenever there was any change of cervical dilation from 1 cm until 10 cm. The VAS has a high convergent validity with its numerical rating scale (r = 0.90-0.92)[17] and high reliability (r = 0.98).[18]

The PSU Pain Curve, as shown in Figure 2, was developed by the PI based on mean pain level and median duration of time (due to data deviated from normal distribution) in the first stage of labor of 350 primiparous participants. Data from the period after receiving oxytocin augmentation were not included in the analysis. The results of phase I were reported to the university, and 3 blinded experts (readers of the university) then approved the validity of PSU Pain Curve. The test-retest reliabilities of the PSU Pain Curve, gaining 1 from either PI or RA; the interrater reliability between PI and RA got the perfect reliability of 1 as well.




Note. Dotted line in the graph represents cervical dilation from 1-10 cm

**Figure 2.** The PSU Pain Curve

***Phase II:*** Firstly, the RA was trained to plot the PSU Pain Curve by the PI, and nurses assessed the cervical dilation through vaginal examination. The level(s) of pain, at each cervical dilation, and duration of time in the first stage of labor were recorded by RA. Then, the first level of pain was drawn 90° angle from the Y axis (axis of labor pain level) to the dotted line of cervical dilation; while at the cutting point of the graph was drawn at a 90° angle to the duration of time in the first stage of labor on the X axis. After that, the rest of the graph was be plotted with the level of pain against the duration by RA throughout the first stage of labor. The intersection of the two factors mentioned above would then present on the PSU Pain Curve (the dotted line as a standard line in figure 2) to predict the cervical dilation. PI rechecked the plotted graph to affirm its accuracy and then interpreted the prediction of labor pain on the progress of labor.

Interpretation of the prediction of the PSU Pain Curve in predicting labor progress would fall into two categories: either correction or incorrectness. If the prediction were right: the pain level should fall (to predicted cervical dilation) exactly or closely to the dotted line of cervical dilation (± 0.5 to that point of cervical dilation). For the correctness of prediction, two characteristics would be presented: the two lines (the actual cervical dilation dotted line and the pain level predicted line) in the graph might run parallel to each other, or they might run exactly on top of each other. Nonetheless, the correctness of prediction for each phase, latent, acceleration, maximum slope, and deceleration, would be independently interpreted. In the opposite, if the prediction was wrong, the pain level might fall either above or below this level, or even fall farther outside of the dotted line of cervical dilation.

The graph was reported for four parts of the prediction of the labor progress accordingly: the latent phase is the phase of onset of labor to 3 cm cervical dilation; Acceleration phase is the phase of cervical dilation from 3 to 4 cm; Maximum slope is the phase of cervical dilation from 4 to 9 cm; and the Deceleration phase is the phase of cervical dilation from 9 to 10 cm.[19,20] Sensitivity is susceptibility to detect either the correction or the incorrectness of the prediction of labor pain level on the progress of labor. The formula of the sensitivity is indicated by the number of corrections in predicting progress of labor/(a number of corrective predictions + a number of wrong predictions).[21,22]

*Data analysis:* Demographic, obstetric and infant data were analyzed using frequencies, percentages, means and standard deviations (SDs). The means or medians of pain level and duration at each cervical dilation in the first stage of labor were used for developing the PSU Pain Curve. The prediction of progress of labor of the PSU Pain Curve was reported on the sensitivity test.

## Results

The mean age of participants in the two phases was similar (22.93 years for phase I and 22.42 years for phase II). Most of the participants in each phase were Buddhist, with education level ranging from less than high school to master degree. Most of the participants were housewives or employees. The majority in both phases had low to moderate income. These and other characteristics are presented in Table 1.

The results showed that the PSU Pain Curve (Figure 2) in predicting the progress of labor in the first stage had a slightly moderate sensitivity in the latent (60% in probability in correct detection of increasing of cervical dilation), acceleration (54%), and maximum slope (57%) phases but high sensitivity (87%) in the deceleration phase. Table 2 showed the sensitivity of the PSU Pain Curve in predicting labor progress in the first stage of labor.

**Table 1** Demographic, Obstetric, and Infant Data of Participants in Each Phase

| Characteristics | **Phase I (n = 350)** | **Phase II (n = 350)** |
|---|---|---|
| Mean age in years (SD) | 22.93(4.97) | 22.42(4.80) |
| Religion, n (%) | | |
| Buddhist | 290(82.9) | 289(82.6) |
| Islamic | 60(17.1) | 60(17.1) |
| **Educational level, n (%)** | | |
| <High school | 131(37.5) | 162(46.4) |
| High school | 48(13.8) | 49(14.0) |
| Vocational school | 73(21.0) | 76(21.7) |
| Bachelor's degree | 91(26.2) | 62(17.7) |
| Master's degree | 4(1.1) | 0 |
| Missing | 3 | 1 |
| **Occupation, n (%)** | | |
| Housewife | 144(41.4) | 165(47.4) |
| Employee | 114(32.6) | 107(30.7) |
| Business | 50(14.3) | 41(11.8) |
| Government official | 11(3.2) | 6(1.7) |
| Agriculture | 5(4.0) | 13(3.7) |
| Student | 11(3.2) | 15(4.3) |
| Others | 4(1.2) | 1(0.3) |
| Missing | 2 | 2 |
| **Family income/month (US$), n (%)** | 7(2.0) | 12(3.6) |
| <100 | 121(35.4) | 114(34.0) |
| 100-300 | 109(31.9) | 110(32.8) |
| 301-600 | 56(16.4) | 57(17.0) |
| 601-900 | 49(14.3) | 42(12.5) |
| >900 | 8 | 15 |
| Missing | | |
| Weight, kg(SD) | 66.01(12.72) | 65.58(12.11) |
| Height, cm(SD) | 157.88(8.94) | 157.50(10.78) |
| Receiving analgesic, n (%) | | |
| Yes | 7(2.0) | 6(1.7) |
| No | 342(97.7) | 344(98.3) |
| Missing | 1 | 0 |
| Receiving oxytocin, n (%) | | |
| Yes | 148(42.3) | 127(36.4) |
| No | 202(57.7) | 222(63.6) |
| Missing | 0 | 1 |
| Relative/s at bed side | | |
| Yes | 333(95.1) | 318(91.1) |
| No | 17(4.9) | 31(8.9) |
| Missing | 0 | 1 |
| Mean infant weight, g (SD) | 3055.79(364.63) | 3055.79(384.27) |

Note: Percentages are for those of non-missing.

**Table 2** The Sensitivity of the PSU Pain Curve in the Prediction of Labor Progress (n = 350)

| First stage of labor | Prediction of increasing of cervical dilation | | |
|---|---|---|---|
| | Correct (n) | Incorrect (n) | sensitivity |
| Latent | 138 | 91 | 0.60+ |
| Acceleration | 72 | 60 | 0.54+ |
| Maximum slope | 129 | 98 | 0.57+ |
| Deceleration | 160 | 23 | 0.87* |

Note: + represents moderate; *represents high sensitivity [23,24,25]

## Discussion

The results of level of pain predicting labor progress, that is the "sensitivity" of PSU Pain Curve, showed its slightly moderate sensitivity (about more than 50% correction in detection of cervical dilation or labor progress) in latent (60% correction), acceleration (54% correction), and maximum slope (57% correction) phases, except the high sensitivity in the deceleration phase (87% correction) to predict the progress of labor. Due to few women (1.7-2%) receiving analgesic drugs, their effects may not have contributed upon labor pain in this study.

Our slightly moderate sensitivities may be explained that while much of the pain resulting from uterine contractions as well as cervical dilation, some pain may be related to psychological influences.[26] Time and the duration of uterine contractions might have some influence upon individual women's perception and reporting the level of labor pain. In addition, our study demonstrated that some women did not have their relatives present at bedsides and this may have made them experience more pain than those who had their relatives at the bedside. Our results were in accordance with some studies,[27,28,29] regarding the effects of relatives upon decreasing labor pain. Altogether factors mentioned above might explain some variations in slightly moderate percentage of correctness in predicting labor progress, by using the level of pain.

Nonetheless, the PSU Pain Curve showed high sensitivity in the deceleration phase to predict the progress of labor. It could be explained that there were some ceiling effects of the VAS in measuring pain while cervical dilation rising from 9 to 10 cm occurred, which was similar to a previous study.[30]

Our data imply that it would be beneficial to use the PSU Pain Curve for monitoring the progress of labor, in addition to the standard graphs, such as, the Friedman Curve, due to its quite satisfied sensitivity in predicting the progress.

## Limitations and recommendations

In this study, as some participants (42.3% in phase I and 36.4% in phase II) received oxytocin for augmentation, we thus did not include their pain level after they received this drug in developing the PSU Pain Curve graph. We also did not test the use of the graph after receiving this drug. Hence, this might be a limitation for generalization of the PSU Pain Curve to the general population, for those primiparous women using oxytocin. Due to small number of participants at each cervical dilation, some limits upon the generalizability occurred.

The results indicate that, to monitor labor progress, it might be beneficial to use the PSU Pain Curve, additional to standard curves. Using the PSU Pain Curve could also lower a number of vaginal examinations, thus, reducing the adverse effects from assessment cervical dilation in predicting labor progress. Further studies should test whether PSU Pain Curve use together with the present standard curves has beneficial on lower a number of vaginal examinations. Others might develop a new graph of pain to predict the first stage labor progress in larger sample size in various samples including Thai laboring women.

## Conclusion and implication for nursing practice

The PSU Pain Curve had slightly moderate sensitivity and should be used together with standard curves, such as, the Friedman Curve (using in accordance with vaginal examination) for monitoring the progress of the first stage of labor. Therefore, using the PSU Pain Curve might help lower a number of vaginal examinations in predicting labor progress. In addition, it could lower pain and psychological distress from vaginal examinations. Nurses should use the PSU Pain curve in women having spontaneous onset of labor, not receiving oxytocin drug, or being suspected cephalopelvic disproportion. It should be done with caution until further testing and refinement to the instrument is undertaken.

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## References

1. Beigi NMA, Broumandfar K, Bahadoran P, Abedi HA. Women's experience of pain during Childbirth. Iran J Nurs Midwifery Res. 2010; 15(2): 77-82.
2. Pillitteri, A. Maternal & child health nursing: Care of the childbearing & childrearing family (7 th ed.). Philedelphia: Wolters Kluwer; 2014.
3. Seval MM, Yuce T, Kalafat E, Duman B, Aker SS, Kumbasar H, et al. Comparison of effects of digital vaginal examination with transperineal ultrasound during labor on pain and anxiety levels: a randomized controlled trial. Ultrasound Obstet Gynecol. 2016; 48(6): 695-700.
4. Dixon L, Foureur M. The vaginal examination during labour: Is it of benefit or harm?. NZCOM Journal. 2010; 42: 21-26.
5. Oscarsson M, Benzein E. Women's experiences of pelvic examination: an interview study. J Psychosom Obstet Gynaecol. 2002; 23(1): 17-25.
6. Wijma B, Gullberg M, Kjessler B. Attitudes towards pelvic examination in a random sample of Swedish women. Acta Obstet Gynecol Scand. 1998; 77(4): 422-28.
7. Lewin D, Fearon B, Hemmings V, Johnson G. Women's experiences of vaginal examinations in labour. Midwifery. 2005; 21(3), 267-77.
8. Phumdoung S, Youngvanichsate S. Thai women's experiences of receiving vaginal examinations during labor. Songkla Med J. 2009; 27(6): 465-70.
9. Cunningham FG, Leveno KJ, Bloom SL, Hauth JC, Rouse DJ, Spong CY. Williams obstetric (23 rd ed.). New York: Mc Graw Hill Medical; 2010.
10. Freeman LM, Adair V, Timperley H, West SH. The influence of the birthplace and models of care on midwifery practice for the management of women in labour. Women Birth. 2006; 19(4): 97-105.
11. Zhang J, Troendle JF, Yancey MK. Reassessing the labor curve in nulliparous women. Am J Obstet Gynecol. 2002; 187(4): 824-28.
12. Cesario SK. Reevaluation of Friedman's labor curve: A pilot study. J Obstet Gynecol Neonatal Nurs. 2004; 33(6): 713-22.
13. Groeschel N, Glover P. The Partograph: Used daily but rarely questioned. Aust J Midwifery. 2001; 14(3): 22-27.
14. Yamane T. Statistics: An introductory analysis (2nd ed.). New York: Harper & Row; 1967.
15. Toh-adam R, Srisupundit K, Tongsong T. Short stature as an independent risk factor for cephalopelvic disproportion in a country of relatively small-sized mothers. Arch Gynecol Obstetet. 2012; 285: 1513-16.
16. Phumdoung S, Manasurakarn B, Rattanasombat K, Mahattanan S, Maneechot K, Chanudom B et al. Effect of the Prince of Songkla University Birthing Bed on duration, pain, and comfort level during second-stage labor in primiparous Thais. Pacific Rim Int J Nurs Res. 2013; 17(1): 56-67.
17. Good M, Stiller C, Zauszniewski JA, Anderson GC, Stanton-Hicks M, Grass JA. Sensation and distress of pain scales: reliability, validity, and sensitivity. J Nurs Meas. 2001; 9(3): 219-38.

18. Phumdoung S, Manasurkarn B, Rattanasombat K, Mahattana S, Maneechot K, Chanudom B, et al. Effect of the Prince of Songkla University Birthing Bed on duration, pain, and comfort level during second-stage labor in primiparous Thais. Pacific Rim Int J Nurs Res. 2013; 17(1): 56-67.
19. Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, et al. Williams obstetrics (24 th ed.). New York: Mc Graw Hill Medical Education; 2014.
20. Neal JL, Lowe NK, Patrick TE, Cabbage LA, Corwin, EJ. What is the slowest-yet-normal cervical dilation rate among nulliparous women with spontaneous labor onset?. J Obstet, Gynecol, and Neonatal Nurs. 2010, 39(4), 361-69.
21. Akobeng AK. Understanding diagnostic tests 1: sensitivity, specificity and predictive values. Acta Paediatrica. 2006; 96(3): 338-41.
22. Lalkhen AG, McCluskey A. Clinical test: sensitivity and specificity. CEACCP. 2008; 8(6): 221-23.
23. Ingram DL, Occhiuti AR, Herman PF. Moderate sensitivity, high specificity, and low positive predictive value of the group B streptococcal (GBS) Latex Agglutination (LA) antigen detection test. Pediatr Res. 1984; 18: 278A. (doi:10.1203/00006450-198404001-01109).
24. Kinns J, Mai W, Seiler G, Zwingenberger A, Johnson V, Caceres A, et al. Radiographic sensitivity and negative predictive value for acute canine spinal trauma. Vet Radiol Ultrasound. 2006; 47(6): 563-70.
25. Adjusting motion detection sensitivity. Retrieved February 5, 2017 from ftp://ftp.panasonic.com/networkcamera/htmlom/.../id_om01_0250.htm
26. Frahm R, Mundt A. [Labor pain from the viewpoint of modern knowledge of pain physiology.] Zentralbl Gynäkol. 1986; 108(4): 203-11.
27. Chamnikul T, Srisaeng P. The effects of relative support program on pain during the first stage of labor among primiparous women. J Nurs Sci Health. 2010; 33(1): 33-42.
28. Madi BC, Sandall J, Bennett R, MacLeod C. Effects of female relative support in labor: A randomized controlled trial. Birth.1999; 26(1): 4-8.
29. Hodnett ED, Gates S, Hofmeyr GJ, Sakala C. Continuous support for women during childbirth. Cochrane Database Syst Rev.2012; Oct 17. doi:10. 1002/ 14651858. CD003766.pub4.
30. Phumdoung S. Inconsistency and ceiling effect in repeated measures of labor pain using VAS. Songkla Med J. 2004; 22(3): 155-61.

# กราฟความปวดมหาวิทยาลัยสงขลานครินทร์กับการทำนายความก้าวหน้าของการคลอด

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**บทคัดย่อ:** ในระยะคลอดไม่เพียงแต่ความปวดแต่การตรวจภายในยังมีผลกระทบต่อมารดาและทารกได้ ดังนั้นการหาวิธีทำนายความก้าวหน้าของการคลอดอื่นนอกจากการตรวจภายในจึงสำคัญ การวิจัยเชิงประยุกต์นี้มีวัตถุประสงค์เพื่อพัฒนากราฟความปวดขึ้น (กราฟความปวดมหาวิทยาลัยสงขลานครินทร์:กราฟความปวดพีเอสยู) และทดสอบความไวในการทำนายความก้าวหน้าของการคลอด ในระยะที่ 1 วิธีดำเนินการวิจัย กลุ่มตัวอย่างเป็นมารดาครรภ์แรกสุ่มโดยวิธีสะดวกในห้องคลอด โรงพยาบาลศูนย์แห่งหนึ่ง ในระยะที่ 1 ของการวิจัย (n =350) เก็บข้อมูลระดับความปวดโดยใช้มาตรวัดความปวดด้วยสายตาและระยะเวลาที่ใช้ในแต่ละเซนติเมตรของการเปิดของปากมดลูกและสร้างกราฟความปวดพีเอสยู ระยะที่ 2 ของการวิจัย (n = 350) ทดสอบความไวในการทำนายความก้าวหน้าของการคลอดของกราฟความปวดพีเอสยู พบว่ากราฟความปวดพีเอสยูมีความไวในการทำนายในระดับค่อนข้างปานกลางจากระยะไม่ก้าวหน้าถึงระยะปากมดลูกเปิดเร็วมากแต่มีความไวสูงในระยะปากมดลูกเปิดช้า กล่าวได้ว่าถ้ามีการใช้กราฟความปวดพีเอสยู อาจจะมีประโยชน์ช่วยทำนายความก้าวหน้าของการคลอดได้โดยใช้เสริมกับการใช้กราฟมาตรฐานอื่นๆ และอาจช่วยลดจำนวนครั้งของการตรวจภายในเพื่อประเมินการขยายของปากมดลูกในการทำนายความก้าวหน้าของการคลอดได้ นอกจากนี้ควรได้มีการทำวิจัยในกลุ่มต่าง ๆ รวมทั้งกลุ่มตัวอย่างขนาดใหญ่ในมารดาชาวไทย

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**คำสำคัญ :** ความปวดในระยะคลอด การทำนายความก้าวหน้าของการคลอด ความก้าวหน้าของการคลอด การพัฒนาเครื่องมือ ความไว

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