Is There An Association Between Second Stage of Labor and Urinary Incontinence in Multiparous Women?

Lotem Gross
Department of Obstetrics & Gynecology https://orcid.org/0000-0003-4897-5205
Hadas Ganer Herman
Department of Obstetrics & Gynecology
Noa Gonen
Department of Obstetrics & Gynecology
Omer Rockenshtein
Edith Wolfson Medical Center, Holon
Jacob Bar
Department of Obstetrics & Gynecology
Shimon Ginath
Department of Obstetrics & Gynecology
Michal Kovo (michalkovo@gmail.com)
Department of Obstetrics & Gynecology https://orcid.org/0000-0002-5443-5670

Research Article

Keywords: Multipara, Prolonged second stage, Second stage, Stress urinary incontinence, Urinary incontinence, Vaginal delivery

Posted Date: August 4th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-237646/v1

Abstract

Purpose

It is unclear whether the length of second stage of labor plays a role in the development of urinary incontinence (UI). We aimed to study the association between the cumulative length of the second stage of labor in multiparous women, and urinary incontinence.

Methods

This was a longitudinal cohort study, in women with three vaginal deliveries (VDs), between 2008–2017. UI was assessed using the Urinary Distress Inventory (UDI-6) questionnaire. Women with a cumulative second stage length in three deliveries in the upper 90th percentile, were compared to women with a cumulative second stage length below the 90th percentile. To detect a 15-point difference in the UDI-6 score between the groups, a sample size of 280 women was needed.

Results

Thirty-one women were included in the ≥ 90th length of second stage group, and 275 in the < 90th length of second stage group. Demographic and obstetrical characteristics were similar in both groups. There were no between group differences in mean UDI-6 score − 12.3 ± 17.5 in the ≥ 90th length of second stage group vs. 14.9 ± 18.2 in the < 90th length of second stage group, p = 0.55. No association was found between the cumulative length of second stage of deliveries and UDI score. A linear regression model revealed that maternal BMI was found to be independently associated with UDI-6 score, CC 0.67, 95% CI 0.19–1.15, p = 0.006.

Conclusion

The cumulative length of the second stage in multiparous women is not associated with urinary incontinence.

Introduction

Pregnancy and delivery are well known contributing factors to pelvic floor injury, through a mechanism of neural injury [1], and injury to pelvic floor muscles [2] and connective tissue [3]. The term pelvic floor dysfunction includes pelvic organ prolapse, urinary incontinence (UI) and anal incontinence (AI), and its rate reaches 25–41% in parous women [4–6]. The rate of women with UI rises with the number of deliveries [7] and it is more common in women who had a vaginal delivery (VD) as compared with cesarean delivery (CD) [8]. Another known obstetric risk factor associated with UI is forceps delivery [9], while the correlation between birth-weight and UI is inconsistent [10, 11].

The role of second stage of labor in the development of UI had been addressed in several studies, most of which focused on nulliparous patients. For example, Brown et al. [12] found that nulliparous women who had a VD after prolonged second stage reported a significantly higher rate of UI three months after delivery. However, in a follow up study of the same population this relationship was not demonstrated 18 months after delivery [4]. Other studies reported mixed results regarding the role of second stage of labor in the development of UI [13–16], yet these included heterogeneous populations regarding their mode of delivery, CD and operative deliveries, as well as women who were nulliparous and multiparous.

Therefore, data on the effects of second stage of labor on pelvic floor dysfunction, among a population of parous women, are scarce. We hypothesized that parous women with a prolonged cumulative length of second stages in deliveries, would have more frequent and severe complaints of UI as compared to women with a shorter second stage of labor. Therefore, we studied the long-term effects of the total length of second stage of labor in parous women, on pelvic floor dysfunction.

Methods

1.1. Design

This was a longitudinal cohort study conducted at the department of Obstetrics and Gynecology at the Edith Wolfson Medical Center, Holon, Israel. The study was approved by the institutional review board (IRB approval ID 0041-18-WOMC). This paper is reported in accordance with the STROBE statement, according to the guidelines for observational studies (http://strobe-statement.org).

1.2. Participants

Included in the study were women with three consecutive VDs, at our institution, between November 2008 - April 2017, who consented to participate in a telephone survey, that was performed between March - June 2018. Excluded from the study were women who had UI before their first delivery, underwent an operative delivery or cesarean delivery, patients who experienced 3rd or 4th degree perineal tears, multiple pregnancy, or a preterm delivery (< 34 weeks of gestation), in any of their deliveries, or those who reported having a fourth delivery or being pregnant at the time of the questionnaire. Women with missing data regarding the length of the 2nd stage of labor were not included in the final analysis. The minimal time between the last VD and the questionnaire was one year.

1.3. Patients and data

The questionnaire was performed by trained residents who were blinded to data collected from patients' files. The questioner assessed the presence of urinary incontinence using the validated Urinary Distress Inventory Short Form (UDI-6) questionnaire [17], in Hebrew [18], scoring 0-100. Women were also asked about their medical history, the use of chronic medications, current height and weight, smoking status, and any urologic or uro-gynecologic treatment for UI or pelvic organ prolapse.

Data regarding obstetrics and delivery outcomes were obtained from computerized medical files and included the length of the second stage of each delivery, perineal tears or episiotomy, use of epidural anesthesia, maternal morbidities during pregnancy (e.g. diabetes mellitus) and birth-weight. Maximal birth-weight was defined as the maximal birth-weight delivered by each woman (in any of the three deliveries). Prolonged second stage was defined as second stage greater than 3 hours with an epidural anesthesia or greater than 2 hours without epidural anesthesia, in nulliparous women. For multiparous women prolonged second stage was defined as second stage greater than 2 hours with epidural anesthesia and greater than 1 hour without epidural anesthesia [19].

We calculated the sum of three consecutive VDs second stage lengths (minutes), and analyzed the percentiles of the studied cohort. For the purpose of the study the results of the UDI-6 questionnaire were compared between women whose sum of second stage lengths was ≥ the 90th percentile, and women whose sum of second stage lengths was < the 90th percentile.

1.4. Statistical analysis

We assumed the average UDI-6 score in the < 90th lengths of second stage group would be 15 points lower than in the ≥ 90th lengths of second stage group. To detect a 15 point difference in the UDI-6 score between the groups, assuming a 25 standard deviation (SD), with a group size ratio of 1:9, a sample size of 280 women, 28 in the ≥ 90th second stage lengths group and 252 in the < 90th second stage lengths group, was calculated to be suffice, with a power of 85% and an alpha error of 0.05.

Data were analyzed with Epi Info, version 7.0 (Centers for Disease Control and Prevention, Atlanta, GA). Continuous variables were calculated as mean ± standard deviation (SD) or median (interquartile range, IQR) and compared using the student's t-test or the non-parametric Mann-Whitney test as appropriate. Categorical variables were calculated as rate (percentage), and compared with Chi square or Fisher's exact test as appropriate. All tests were two tailed, and the threshold for statistical significance was defined as p-value < 0.05

Three regression analyses were performed. In the first logistic regression, UDI-6 served as a dichotomic dependent variable: yes to any of 6 questions / no to all 6; in the second logistic regression, stress urinary incontinence (SUI) served as a dichotomic dependent variable (yes/no). A third linear regression was performed, in which UDI-6 score served as the dependent variable, and a correlation coefficient (CC) was calculated. The following served as independent variables: maternal age, body mass index (BMI), maximal birth-weight and total length of the second stages.

Results

During the study period 2573 women had three consecutive VDs in our hospital. Of them 478 were found eligible to participate in the study, while 345 (72%) gave their consent and completed the questionnaire. Three hundred and six were included in final analysis. The time between the last delivery and the questionnaire ranged from 1–3 years. The average length of three second stages in our study population

was 116 min ± 74, while the 90th percentile was 222 minutes (Fig. 1). The < 90th percentile group included 275 women with an average of 99.0 ± 54.2 min of three 'second stages' length. The ≥ 90th second stage lengths group included 31 women, with an average of 268.6 ± 46.2 min.

Table 1 presents maternal demographic and obstetric characteristics of the study groups. There were no between group differences regarding maternal age, BMI, or the rate of obesity or smoking status. None of the patients had any surgical procedures nor did any receive medical treatment for pelvic floor dysfunction (including UI).

Table 1
Demographic characteristics of the study groups

	≥ 90th second stage lengths group **n = 31**	**< 90th second stage lengths group** **n = 275**	**P value**
Age (years)	34.2 ± 3.7	33.0 ± 8.2	0.41
Gravidity, median (range)	3 (3–5)	3 (3–7)	0.57
BMI (kg/m^2)	24.8 ± 4.0	23.5 ± 4.2	0.10
Obesity	3 (9.6%)	24 (8.7%)	0.74
Smoking	7 (22.5%)	59 (21.4%)	0.88
Data are presented as mean ± SD or n (%), or median (range), as appropriate. BMI – body mass index. Obesity was defined as BMI > 30			

Table 2 presents obstetric characteristics of the study groups. As expected according to the study design, more patients in the ≥ 90th second stage lengths group had prolonged second stage (as defined) in any delivery, as compared to patients in the < 90th second stage lengths group, 74.2% vs. 4%, $p < 0.001$. There were no between group differences in deliveries > 4000 grams, maximal birth-weight, rate of maternal diabetes mellitus, episiotomy or epidural anesthesia in any delivery.

Table 2
Obstetric characteristics of the study groups

	≥ 90th second stage lengths group n = 31	< 90th second stage lengths group n = 275	P value
Mean gestational age (weeks)	39.6 ± 0.8	39.5 ± 0.9	0.74
Additive length of second stage of labor, (minutes)	268.6 ± 46.2	99.0 ± 54.2	< 0.001
Epidural anesthesia in any delivery	31 (100%)	247 (89.8%)	0.09
Maximal birth-weight (grams)	3630 ± 345	3532 ± 370	0.15
Birth-weight > 4000 grams, in any delivery	3 (9.6%)	22 (8.0%)	0.72
Episiotomy, in any delivery	16 (51.6%)	127 (46.1%)	0.56
DM, at any delivery	3 (9.6%)	22 (8.0%)	0.72
Prolonged 2nd stage*			
Any delivery	23 (74.2%)	11 (4%)	< 0.001
First delivery	18 (58.0%)	8 (2.9%)	< 0.001
Second delivery	3 (9.6%)	1 (0.3%)	0.003
Third delivery	2 (6.4%)	2 (0.7%)	0.05

*Data are presented as mean ± SD or n (%) as appropriate. n: Number, DM – diabetes mellitus, pre-gestational or gestational. *Prolonged second stage was defined according to ACOG definitions* (19)

The average time interval from last delivery and completing UDI-6 questionnaire was 1.89 ± 0.65 years in the ≥ 90th second stage lengths group, and 2.06 ± 0.69 years in the < 90th second stage lengths group, p = 0.83. The rate of women with a positive response to any of the questions in the UDI-6 questionnaire was similar in both groups, 51.6% in the ≥ 90th second stage lengths group, and 54.9% in the < 90th second stage lengths group, p = 0.72. The rate of women with SUI was similar between the groups, 29% in the ≥ 90th second stage lengths group, and 40.3% in the < 90th second stage lengths group, p = 0.22. The mean UDI-6 score was also similar in the ≥ 90th second stage lengths group and the < 90th second stage lengths group − 12.3 ± 17.5 vs. 14.9 ± 18.2, respectively, p = 0.45 (Table 3).

Table 3
Questionnaire evaluation of the study groups

	≥ 90th second stage lengths group **n = 31**	**< 90th second stage lengths group** **n = 275**	**P value**
Time from last delivery, mean ± SD (years)	1.89 ± 0.65	2.06 ± 0.69	0.83
UDI-6, any positive answer, n (%)	16 (51.6%)	151 (54.9%)	0.72
Stress urinary incontinence, n (%)	9 (29.0%)	111 (40.3%)	0.22
UDI-6, mean score ± SD	12.3 ± 17.5	14.9 ± 18.2	0.45

SD: standard deviation, n: Number, UDI – urine inventory index

Time from last delivery- time interval from last delivery to the questionnaire evaluation

A logistic regression model assessing the odds ratio for women who answered “yes” to any of the questions in the UDI-6 questionnaire, and a logistic regression model for SUI, found no association to current maternal age, BMI, maximal birth-weight nor to the cumulative length of second stage in three deliveries (Table 4). In a linear regression model, only maternal BMI was found to be **independently associated** with UDI-6 score: CC 0.67, 95% CI 0.19–1.15, p = 0.006, (Table 5).

Table 4
Logistic regression models for stress urinary incontinence and for UDI-6 (any positive answer)

	OR	95% C.I		P value
		Lower	Upper	
Logistic regression model for stress urinary incontinence (yes/no)				
Age (years)	1.02	0.97	1.06	0.38
BMI (kg/m^2)	1.04	0.98	1.09	0.15
Maximal birth-weight (grams)	0.99	0.99	1.00	0.68
Total lengths of 2nd stage (min.)	0.99	0.99	1.00	0.76
Logistic regression model for UDI-6 (yes/no)				
Age (years)	1.04	0.98	1.09	0.15
BMI (kg/m^2)	1.05	0.99	1.11	0.06
Maximal birth-weight (grams)	0.99	0.99	1.00	0.60
Total lengths of 2nd stage (min.)	0.99	0.99	1.00	0.85
OR: odds ratio, C.I: confidence interval; BMI – body mass index;				

Table 5
Linear regression model for UDI severity (score 0-100)

	CC	95% CI		P value
		Lower	Upper	
Age, years	0.07	-0.18	0.33	0.55
BMI, kg/m^2	0.67	0.19	1.15	0.006
Maximal birthweight, grams	0.00	-0.006	0.005	0.89
Total length of second stage in all deliveries, minutes	-0.007	-0.03	0.02	0.60
CC: correlation coefficient; CI: confidence interval; BMI: body mass index				

Notably, when separately comparing women in both extremities of our study population, e.g. those whose sum of second stage lengths was ≥ the 90th percentile (n = 31), and women whose sum of second stage lengths was < the 10th percentile (n = 31), mean UDI-6 score was comparable in both groups, 20 ± 13.95 in the < 10th percentile group vs. 18.49 ± 16.03 in the ≥ 90th percentile group, p = 0.78. The rate of women

with UI was similar in both groups, 0.48 in the < 10th percentile group vs. 0.52 in the ≥ 90th percentile group, $p > 0.99$, and so was the rate of women with SUI (35% vs. 29%, respectively, $p = 0.46$).

Discussion

The present study demonstrates that in parous women, the cumulative time lengths of second stage of labor of three consecutive VDs, is not associated with UI.

The role of the second stage of labor in the development of UI is controversial, with some studies suggesting that prolonged second stage of labor is associated with a rise in complaints of UI in primiparas [12], while others have mixed results regarding its role in the development of UI, evaluated 3–12 months after delivery [4, 13]. Notably, in a study performed by Van Kessel et al., with a longer follow-up time interval of approximately seven years since the index delivery, no correlation was found between prolonged second stage in the first delivery and UI [20]. Another possible contributing factor to the development of UI is the “active phase" of the second stage of labor, in which the parturient is encouraged to push. Farrel et al. found postpartum UI to be associated with the “passive” phase, but not the “active” phase, in a univariate analysis [15], although this did not maintain significance in a multivariate analysis. On the other hand, Groutz et al. found that among primiparas, both the length of the second stage, and the “active phase" during the second stage of labor, correlated with SUI one year after delivery [16].

The rate of UI in parous women ranges between 25–41% [4–6], while in the current study over 50% of women reported persistent UI more than 12 months after their last delivery, and 40% of women reported SUI. In the current study we concentrated on the time length of the 'second stages' of labor in three consecutive deliveries, as a possible factor contributing to the development of UI. We found BMI is correlated to UI complaints, but according to our findings the cumulative second stage of labor, in multiparous women, does not significantly impact the development of UI. Multiple VDs can result in cumulative obstetric injury to the pelvic floor, and damaged tissue caused by each delivery might not fully recover. The mechanisms involved in the development of UI include direct muscular damage, and/or cumulative damage to the pudendal nerves. This may explain the overall higher rate of UI and SUI in the population of multiparas we studied. Nevertheless, the net time that a parturient is exposed to the possible harmful influence of the second stage of labor, probably has no direct effect on the development of UI.

Notably, despite the relatively high rate of UI in the studied cohort, none sought any medical treatment. As UI is perceived as a “quality of life” issue, it is clearly under-treated. These findings should raise the need for patients' as well as health care providers' education, and the need to address these topics in parous women.

There are several strengths to the current study. First, its focus of a well-defined population of multiparas, with a similar obstetric background - all delivered vaginally, all deliveries were led by a midwife, and all occurred at a single center. Second, we evaluated the presence and severity of UI using the validated UDI-

6 questionnaire. Third, long term follow-up was assessed in the current study. Finally, the study was powered to assess our primary outcome.

Limitations of this study should be recognized. First, we did not use an objective assessment of UI nor of other pelvic floor dysfunctions, such as anal incontinence or pelvic floor prolapse. Second, station of the fetal head, and duration of active pushing, were not assessed. In addition, the effects of second stage of labor on study outcomes among women of advanced maternal age were not assessed, as the cohort was composed of relatively younger women at the time of delivery.

In conclusion, the cumulative duration of the second stages of labor, in multiparous women, has no impact on the development of UI. In addition, UI, and specifically SUI, are probably more common than assumed among multiparas, and warrant the attention of physicians and patient education. Further studied are needed to develop safe and effective interventions to prevent the development of UI, and to investigate the effect of different risk factors with even longer follow up to menopause.

Declarations

Funding - This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors

Conflicts of interest/Competing interests - The authors declare that they have no conflict of interest

Availability of data and material - The data that support the findings of this study are available from the corresponding author, [MK], upon reasonable request.

Code availability- Not applicable

Ethics approval - The questionnaire and methodology for this study was approved by the institutional Human Research Ethics committee (ID 0041-18-WOMC)

Consent to participate Verbal informed consent was obtained prior to the interview

Consent for publication - Not applicable

Authors' contributions:

Dr. L Gross: project development, data collection, manuscript writing ; Dr. H Ganer-Herman: data analysis and interpretation, writing review and editing; Dr. N Gonen: data collection, analysis and interpretation; O Rockenshtein: data collection; Prof. S Ginath: project development, data analysis and approved the final version of this article; Prof. J Bar: data analysis and interpretation approved the final version of this article; Prof. , M Kovo: conceptualization, writing review and editing, supervision.

References

1. Snooks SJ, Swash M, Henry MM, Setchell M (1986) Risk factors in childbirth causing damage to the pelvic floor innervation. Int J Colorectal Dis. Jan;1(1):20–4
2. Delancey John OL, Kearney Rohna C, Queena, Speights Steven BS (2003) The appearance of levator ani muscle abnormalities in magnetic resonance images after vaginal delivery. Obstet Gynecol 101(1):46–53
3. Delancey JOL (2002) Fascial and muscular abnormalities in women with urethral hypermobility and anterior vaginal wall prolapse. Am J Obs Gynecol 186(3):356–360
4. Gartland D, Donath S, MacArthur C, Brown SJ (2012) The onset, recurrence and associated obstetric risk factors for urinary incontinence in the first 18 months after a first birth: An Australian nulliparous cohort study. BJOG An Int J Obstet Gynaecol 119(11):1361–1369
5. Rortveit G, Hunskaar S (2006) Urinary incontinence and age at the first and last delivery: The Norwegian HUNT / EPINCONT study. Am J Obs Gynecol 195:433–438
6. Minassian VA, Bazi T, Stewart WF (2017) Clinical epidemiological insights into urinary incontinence. Int Urogynecol J Pelvic Floor Dysfunct 28:687–696
7. Nygaard I, Barber M, Burgio K. Prevalence of symptomatic pelvic floor disorders in US women. J Am Med Assoc [Internet]. 2008;300(11):1311–6. Available from: http://jama.ama-assn.org/content/300/11/1311.short
8. Tahtinen RM, Cartwright R, Tsui JF, Aaltonen RL, Aoki Y, Cardenas JL et al (2016 Jul) Long-term Impact of Mode of Delivery on Stress Urinary Incontinence and Urgency Urinary Incontinence: A Systematic Review and Meta-analysis. Eur Urol 70(1):148–158
9. Handa VL, Blomquist JL, McDermott KC, Friedman S, Munoz A (2012 Feb) Pelvic floor disorders after vaginal birth: effect of episiotomy, perineal laceration, and operative birth. Obstet Gynecol 119(2 Pt 1):233–239
10. Gyhagen M, Bullarbo M, Nielsen TF, Milsom I (2013) Prevalence and risk factors for pelvic organ prolapse 20 years after childbirth: A national cohort study in singleton primiparae after vaginal or caesarean delivery. BJOG An Int J Obstet Gynaecol 120(2):152–160
11. Thom DH, Brown JS, Schembri M, Ragins AI, Creasman JM, Van Den Eeden SK (2011 Nov) Parturition events and risk of urinary incontinence in later life. Neurourol Urodyn 30(8):1456–1461
12. Brown SJ, Gartland D, Donath S, MacArthurc C (2011) Effects of prolonged second stage, method of birth, timing of caesarean section and other obstetric risk factors on postnatal urinary incontinence: An Australian nulliparous cohort study. BJOG An Int J Obstet Gynaecol 118(8):991–1000
13. Eason E, Labrecque M, Marcoux S, Mondor M (2004 Feb) Effects of carrying a pregnancy and of method of delivery on urinary incontinence: a prospective cohort study. BMC Pregnancy Childbirth 4(1):4
14. Van Kessel K, Reed S, Newton K, Meier A, Lentz G. The second stage of labor and stress urinary incontinence. 2001
15. Farrell SA, Allen VM, Baskett TF (2001 Mar) Parturition and urinary incontinence in primiparas. Obstet Gynecol 97(3):350–356

16. Groutz A, Rimon E, Peled S, Gold R, Pauzner D, Lessing JB et al (2004) Cesarean Section: Does it Really Prevent the Development of Postpartum Stress Urinary Incontinence ? A Prospective Study of 363 Women One Year After Their First Delivery. Neurourol Urodyn 6(23):2–6
17. Uebersax JS, Wyman JF, Shumaker SA, McClish DK, Fantl JA (1995) Short forms to assess life quality and symptom distress for urinary incontinence in women: the Incontinence Impact Questionnaire and the Urogenital Distress Inventory. Continence Program for Women Research Group. Neurourol Urodyn 14(2):131–139
18. Reuven Y, Yohay Z, Glinter H, Yohai D, Weintraub AY (2017) Validation of the Hebrew version of the short form of the Urogenital Distress Inventory (UDI-6). Int Urogynecol J Pelvic Floor Dysfunct 28:1891–1894
19. Cheng YW, Caughey AB. Defining, Normal M and Abnormal Second Stage of Labor. Obstet Gynecol Clin NA [Internet]. 2019;44(4):547–66. Available from: https://doi.org/10.1016/j.ogc.2017.08.009
20. Van Kessel K, Reed S, Newton K, Meier A, Lentz G (2001 Jun) The second stage of labor and stress urinary incontinence. Am J Obstet Gynecol 184(7):1571–1575

Figures

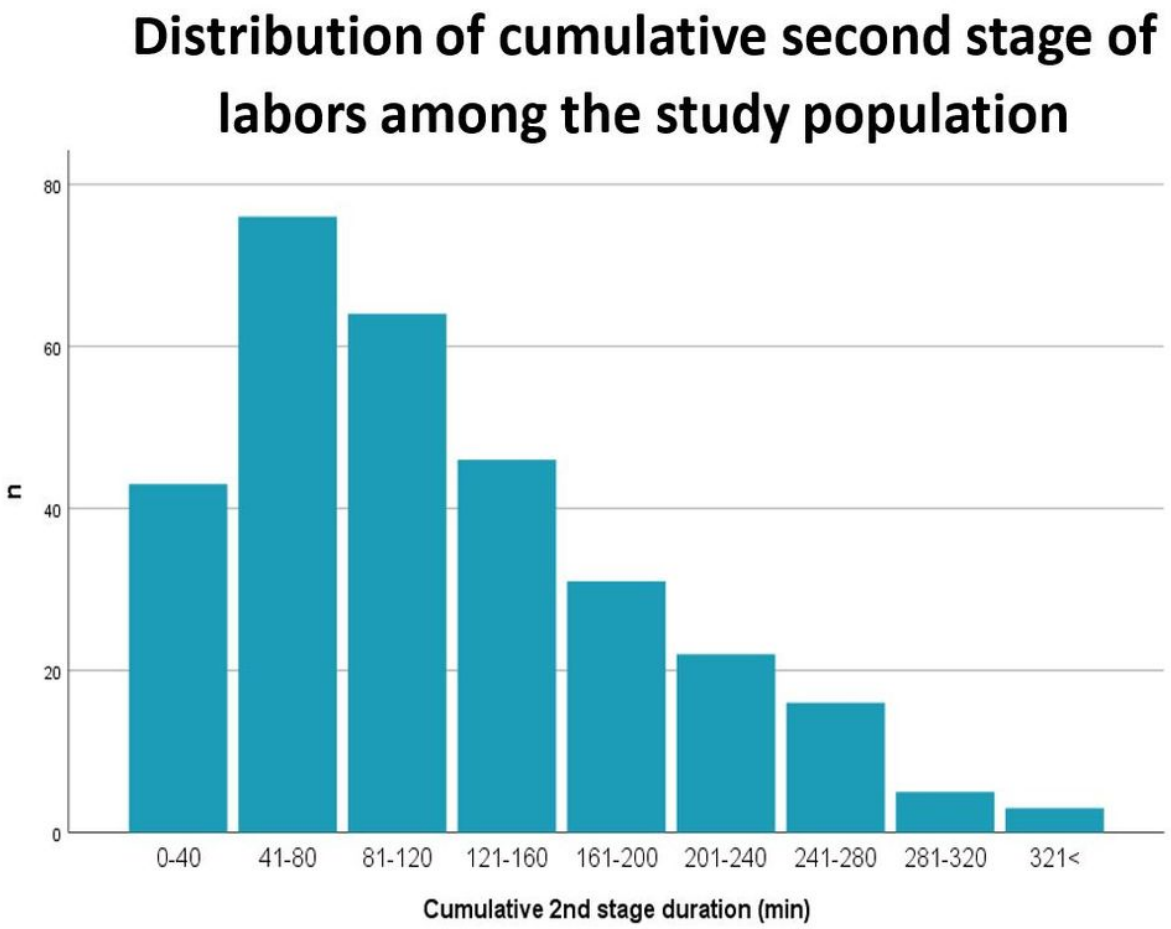

Figure 1

Cumulative length of three 'second stages' in study