

Impacts of Labour Onset Methods

While spontaneous labor leads to fewer cesarean deliveries, shorter hospital stays, and better psychological outcomes, scheduled interventions offer reduced stillbirth risks at later gestations.

Abstract

Spontaneous labor and scheduled interventions yield distinct maternal, neonatal, and psychological outcomes among term, singleton pregnancies. Studies report that spontaneous onset is linked with lower rates of cesarean delivery, epidural use, episiotomy, and shorter hospital stays. In several investigations—especially among nulliparous women—induction correlates with increased risks of cesarean section, instrumental delivery (in some reports), postpartum hemorrhage, and longer hospitalization, although one study noted a potential protective effect against pelvic floor injury when induction occurred at 39 weeks.

Neonatal outcomes appear comparable in terms of Apgar scores and mortality. However, scheduled interventions are associated with reduced stillbirth rates at later gestations while also showing mixed findings for NICU admissions, respiratory complications, birth trauma, and neonatal acidosis. Psychological measures reveal that induced labor tends to correspond with lower childbirth satisfaction, as evidenced by lower visual analogue scale scores and altered cortisol levels during the latent phase of labor. Long-term observations indicate lower rates of childhood infections after spontaneous labor, with similar frequencies reported for respiratory and skin conditions, and insufficient data to confirm differences in developmental or prolonged maternal health outcomes.

Paper search

Using your research question "What are the clinical, psychological, and physiological impacts of waiting for spontaneous labour onset compared to scheduled medical interventions?", we searched across over 126 million academic papers from the Semantic Scholar corpus. We retrieved the 500 papers most relevant to the query.

Screening

We screened in papers that met these criteria:

- **Intervention Comparison:** Does the study compare spontaneous labor onset with planned medical interventions (either induction of labor or planned cesarean section)?
- **Population - Gestation:** Does the study focus on pregnant women at term (37-42 weeks gestation)?
- **Population - Singleton:** Does the study exclusively examine singleton pregnancies?
- **Study Design:** Is the study either a primary research study (RCT, cohort study, or case-control study) or a systematic review/meta-analysis?
- **Outcomes:** Does the study report at least one clinical, psychological, or physiological outcome?
- **Emergency Status:** Does the study focus on planned interventions rather than emergency interventions or complications requiring immediate delivery?
- **Risk Status:** Does the study examine a general obstetric population rather than focusing exclusively on high-risk conditions?
- **Study Size:** Is the study design more robust than a case report or case series (i.e., includes a comparison group)?

We considered all screening questions together and made a holistic judgement about whether to screen in each paper.

Data extraction

We asked a large language model to extract each data column below from each paper. We gave the model the extraction instructions shown below for each column.

- **Study Design:**

Identify and record the specific type of study design. Look in the methods section for explicit description of study design.

Possible design types include:

- Prospective observational study
- Retrospective cohort study
- Cross-sectional study
- Longitudinal study

If multiple design elements are present, list all. If design is unclear, note "Design not clearly specified" and provide any available details about methodology.

Extraction should capture the core research approach used in the study.

- **Study Setting and Population Characteristics:**

Extract detailed information about:

- Geographic location (country, specific healthcare facility)
- Type of healthcare setting (tertiary academic center, population database, etc.)
- Total sample size
- Inclusion/exclusion criteria for participants
- Key demographic characteristics (maternal age, parity, pregnancy characteristics)

Look in methods section for participant selection details. If multiple subgroups are analyzed, note the total sample and breakdown of each group.

Record numerical values where possible. If ranges are provided, include both minimum and maximum values.

- **Labour Onset Method:**

Categorize and describe the specific method of labour onset for each study group:

- Spontaneous labour onset
- Medically induced labour
- Specific induction techniques used (if detailed)

Extract precise details about:

- Timing of intervention (gestational age)
- Reasons for induction (medical vs. elective)
- Any standardized protocols followed

If multiple induction methods are described, list all. If reasons for induction are not fully specified, note "Induction reason not specified".

- **Outcome Measures:**

List all primary and secondary outcome measures related to:

- Clinical outcomes (mode of delivery, interventions during labour)
- Psychological measures (stress scales, anxiety assessments)
- Physiological measures (cortisol levels, hormonal responses)
- Neonatal outcomes (Apgar scores, NICU admission)

For each outcome, extract:

- Specific measurement tool/scale used
- Timing of measurement
- Numerical results or statistical significance

Prioritize outcomes directly addressing physiological, psychological, and clinical impacts of labour onset method.

- **Key Comparative Findings:**

Extract the primary comparative results between spontaneous and induced labour groups, focusing on:

- Statistically significant differences
- Effect sizes
- Confidence intervals (if provided)

Look in results and discussion sections for:

- Comparative statistical analyses
- Interpretation of key differences
- Potential clinical or practical implications

Record exact p-values and numerical comparisons where available. If no significant differences were found, explicitly note this.

Results

Characteristics of Included Studies

Study Design	Population Characteristics	Intervention Type	Primary Outcomes Measured	Full text retrieved
Systematic review and meta-analysis	Women aged 19 and older with live, singleton, cephalic pregnancies at 37 0/7 until 41 6/7 weeks gestation	Induction of labor vs. expectant management	Childbirth experience measured by Childbirth Experience Questionnaire (CEQ) and Visual Analogue Scale (VAS)	No
Retrospective cohort study	Term singleton pregnancies in cephalic presentation aiming for vaginal delivery; mean maternal age 31.8 years, mean Body Mass Index (BMI) 24.2	Induction of labor vs. spontaneous labor	Maternal childbirth experience (VAS), mode of delivery, labor complications	Yes
Retrospective cohort study	Nulliparous women with singleton, vertex, non-anomalous gestations delivering between 38 0/7 and 41 6/7 weeks	Non-medically indicated induction vs. expectant management	Maternal outcomes (e.g., cesarean delivery, postpartum hemorrhage), neonatal outcomes (e.g., Neonatal Intensive Care Unit (NICU) admission)	Yes
Retrospective cohort study	13,971 women with live, cephalic singleton pregnancies who delivered at term	Elective and medically indicated induction vs. spontaneous labor	Mode of delivery, maternal complications, neonatal outcomes	No
Retrospective cohort study	2101 women delivering live singleton, term babies throughout 2012	Induction of labor vs. spontaneous labor	Mode of delivery, obstetric hemorrhage	No

Study Design	Population Characteristics	Intervention Type	Primary Outcomes Measured	Full text retrieved
Retrospective cohort study	3,884 women with a single baby in vertex presentation delivering between 38 and 40 weeks of pregnancy	Induction of labor vs. spontaneous labor	Cesarean section rate, use of analgesia, neonatal outcomes	Yes
Prospective observational study	Primiparous women with singleton, vertex vaginal delivery; mean maternal age 29.7 years	Elective induction at 39 weeks vs. spontaneous vaginal delivery	Pelvic floor injury, maternal and neonatal outcomes	Yes
Retrospective national cohort study	5,017,524 singleton, low-risk pregnancies with a non-anomalous fetus delivered at 39-42 weeks gestation	Induction of labor at 39 weeks vs. expectant management	Maternal and perinatal morbidity	No
Retrospective cohort study	174 low-risk nulliparous pregnant people delivering at 39 weeks and over	Elective induction at 39 weeks vs. expectant management	Cesarean delivery rate, maternal and perinatal outcomes	No
Retrospective matched cohort study	15,366 nulliparous women with singleton, cephalic pregnancies, 266-287 days gestation, birth weight 3000-4000g	Elective induction vs. spontaneous labor	Mode of delivery, epidural use, neonatal outcomes	No
Retrospective cohort study	22,232 nulliparous women with singleton pregnancies delivering at 37 weeks gestation	Induction of labor vs. spontaneous labor (comparing private and public patients)	Mode of delivery, maternal and neonatal outcomes	Yes

Study Design	Population Characteristics	Intervention Type	Primary Outcomes Measured	Full text retrieved
Retrospective cohort study with longitudinal follow-up	474,652 women aged 20-35 years, giving birth between 37+0 and 41+6 weeks gestation to a singleton baby in cephalic presentation	Induction of labor vs. spontaneous labor	Maternal interventions, mode of delivery, neonatal outcomes, long-term child outcomes	Yes
Retrospective cohort study with cross-sectional elements	42,950 women aged 20-44 years, first-time mothers with singleton cephalic-presenting infants at 37-40 weeks' gestation	Induction of labor vs. spontaneous labor	Cesarean section rate, maternal interventions	Yes
Retrospective cohort study	11,849 low-risk, laboring women with singleton, vertex pregnancies at 37-41 weeks' gestation	Elective induction vs. spontaneous labor	Mode of delivery, maternal interventions, neonatal outcomes	No
Prospective observational cohort study	200 nulliparous women with singleton pregnancies and cephalic fetal presentation	Induction at 41 weeks vs. spontaneous labor at 40 weeks	Mode of delivery, Apgar scores, duration of labor	No
Prospective observational study	167 women with low-risk, singleton pregnancies, who delivered at term	Induction of labor vs. spontaneous labor	Physiological and psychological stress responses, mode of delivery, neonatal outcomes	No
Retrospective cohort study	29,693 term second deliveries in cephalic position in women who had previously given vaginal birth	Elective induction vs. spontaneous labor	Secondary cesarean section rate	No

Study Design	Population Characteristics	Intervention Type	Primary Outcomes Measured	Full text retrieved
Retrospective observational study	237 nulliparous women with uncomplicated singleton pregnancies at 39-41 weeks gestation	Induction of labor vs. expectant management	Mode of delivery, maternal and neonatal outcomes	Yes
Retrospective cohort study	336 primigravida pregnant women	Induction of labor vs. spontaneous labor	Cesarean delivery rate, neonatal outcomes	Yes
Prospective observational study (protocol)	Women with singleton pregnancies at 39 weeks gestation	Spontaneous labor vs. induction of labor	Spontaneous onset of labor, mode of delivery, obstetric complications	Yes
Randomized clinical trial	Low-risk pregnant women with singleton cephalic fetus and no previous cesarean deliveries	Physical exercise at 38 weeks vs. usual activities	Rate of labor induction, mode of delivery, neonatal outcomes	No
Prospective observational study	2,359 low-risk singleton pregnancies between 40 + 0 and 41 + 6 gestational weeks	Induction of labor at 40 or 41 weeks vs. spontaneous onset of labor	Maternal and neonatal outcomes	Yes
Retrospective cohort study	1,271,549 women with singleton deliveries at 37 weeks' gestation or greater	Elective induction vs. expectant management	Perinatal mortality, mode of delivery, maternal complications, neonatal outcomes	Yes
Retrospective cohort study	6,501 women with singleton, non-anomalous pregnancies delivering between 41 + 0 to 43 + 0 weeks	Induction of labor at >41 + 0 weeks vs. expectant management	Mode of delivery, maternal and neonatal outcomes	No
Retrospective cohort study	485 term, nulliparous women with singleton gestations	Elective induction vs. spontaneous labor	Cesarean delivery rate, maternal and neonatal outcomes	No

Based on the information provided in the rough draft, we found the following characteristics across the 25 studies:

- Study designs: Retrospective cohort studies were the most common, followed by prospective observational studies. We also found one each of systematic review/meta-analysis, randomized clinical trial, and retrospective observational study.
- Population characteristics: All studies focused on singleton pregnancies. Some studies specifically examined nulliparous women or low-risk pregnancies.
- Intervention types: Most studies (24/25) compared induction of labor to either spontaneous labor or expectant management. One study examined a different intervention (physical exercise vs. usual activities).
- Primary outcomes measured: Mode of delivery was the most commonly reported outcome, followed by neonatal outcomes and maternal outcomes. Other outcomes included complications, childbirth experience, and analgesia use.

Clinical and Physiological Effects

Maternal Outcomes

Outcome Type	Spontaneous Labor	Scheduled Intervention	Key Differences
Cesarean Section Rate	Generally lower	Generally higher	Increased risk with induction, especially in nulliparous women
Instrumental Delivery	Variable	Often higher	Increased risk with induction in some studies
Epidural Use	Lower	Higher	Consistently higher rates with induction
Episiotomy	Lower	Higher	Higher rates observed with induction
Postpartum Hemorrhage	Variable	Often higher	Increased risk in some studies
Length of Hospital Stay	Shorter	Longer	Longer stays associated with induction
Pelvic Floor Injury	Variable	Lower in some studies	Potential protective effect of induction at 39 weeks

Based on the information provided in the rough draft, we identified comparisons between spontaneous labor and scheduled interventions for 7 outcomes:

- Spontaneous labor was associated with lower rates in 4 outcomes (cesarean section, epidural use, episiotomy, length of hospital stay) and variable rates in 3 outcomes (instrumental delivery, postpartum hemorrhage, pelvic floor injury).

- Scheduled interventions were associated with higher rates in 6 outcomes (cesarean section, instrumental delivery, epidural use, episiotomy, postpartum hemorrhage, length of hospital stay) and lower rates in some studies for 1 outcome (pelvic floor injury).

Key findings:

- Increased risk with induction was reported for cesarean section, instrumental delivery (in some studies), postpartum hemorrhage (in some studies), and length of hospital stay.
- Consistently higher rates with induction were found for epidural use and episiotomy.
- A potential protective effect of induction at 39 weeks was reported for pelvic floor injury in some studies.

Neonatal Outcomes

Outcome Type	Spontaneous Labor	Scheduled Intervention	Key Differences
NICU Admission	Variable	Often higher	Increased rates with induction in some studies, but lower in others
Apgar Scores	Generally similar	Generally similar	No consistent significant differences
Respiratory Complications	Variable	Variable	Mixed findings across studies
Stillbirth Rate	Higher at later gestations	Lower	Reduced rates with induction, especially at later gestational ages
Neonatal Mortality	Generally similar	Generally similar	No consistent significant differences
Birth Trauma	Lower	Often higher	Increased rates reported in some studies
Neonatal Acidosis	Lower	Higher	Higher rates observed in some studies

We analyzed 7 neonatal outcomes comparing spontaneous labor to scheduled interventions:

- For NICU Admission and Respiratory Complications, variable results were reported for both spontaneous labor and scheduled interventions, with mixed findings across studies.
- For Apgar Scores and Neonatal Mortality, generally similar results were reported between spontaneous labor and scheduled interventions, with no consistent significant differences.
- For Stillbirth Rate, higher rates at later gestations were reported for spontaneous labor and lower rates for scheduled interventions. Studies reported reduced rates with induction, especially at later gestational ages.
- For Birth Trauma and Neonatal Acidosis, lower rates were reported for spontaneous labor and higher rates for scheduled interventions. Some studies reported increased rates of birth trauma with induction, and higher rates of neonatal acidosis were observed in some studies for scheduled interventions.

Long-term Health Impacts

Outcome Type	Spontaneous Labor	Scheduled Intervention	Key Differences
Childhood Infections	Lower	Higher	Increased hospitalizations for infections in induction group
Respiratory Conditions	Similar	Similar	No significant differences in asthma rates
Skin Conditions	Similar	Similar	No significant differences in eczema rates
Developmental Outcomes	Limited data	Limited data	Insufficient evidence to draw conclusions
Maternal Long-term Health	Limited data	Limited data	Insufficient evidence to draw conclusions

We found comparisons between spontaneous labor and scheduled intervention for 5 outcome types:

- For childhood infections, lower rates were reported in the spontaneous labor group and higher rates in the scheduled intervention group. The key difference noted was increased hospitalizations for infections in the induction group.
- For respiratory conditions and skin conditions, similar rates were reported between the two groups. No significant differences were reported for asthma or eczema rates.
- For developmental outcomes and maternal long-term health, limited data was reported for both groups. The evidence was reported as insufficient to draw conclusions for these outcomes.

Thematic Analysis

Decision-Making and Timing

Several studies we examined discussed the timing of induction as a factor influencing outcomes. Key findings include:

- Stock et al. (2012) reported that elective induction of labour between 37 and 41 weeks was associated with reduced perinatal mortality compared to expectant management, with the effect most pronounced at later gestational ages.
- Burn et al. (2021) reported benefits of induction at 39 weeks in terms of reduced stillbirth rates and certain maternal complications.
- Jacquemyn et al. (2012) noted that the increased risk of cesarean section with induction was not significant when performed after 41 weeks.

The decision-making process regarding induction involves:

- Balancing potential benefits (e.g., reduced stillbirth rates) against risks (e.g., increased maternal interventions)
- Considering individual patient factors, including parity, maternal age, and presence of risk factors

- Emphasizing individualized decision-making, taking into account both maternal and fetal considerations

Psychological Impact and Experience

Several studies addressed the psychological impact and maternal experience of different labor onset methods:

- Adler et al. (2020) reported that women who underwent labor induction were significantly less satisfied with their childbirth experience compared to those with spontaneous onset of labor, as indicated by lower Visual Analog Scale (VAS) scores.
- Haj-Yahia et al. (2020) found that induced women had lower cortisol concentrations during the latent phase of labor compared to those with spontaneous onset. However, they reported no significant differences in psychological stress measures between the groups.
- Adjie et al. (2024) reported mixed findings on childbirth experiences. While overall Childbirth Experience Questionnaire (CEQ) scores showed no significant differences between induction and expectant management, Visual Analogue Scale (VAS) assessments favored expectant management.

These findings suggest that the method of labor onset can have significant impacts on women's psychological experiences of childbirth. However, the variability in measures used and outcomes reported across studies makes it challenging to draw definitive conclusions.

Healthcare System Influences

The impact of healthcare system factors on labor management and outcomes was evident in several studies:

- Craven et al. (2020) highlighted differences in intervention rates between private and public patients, with private patients more likely to undergo pre-labor cesarean sections and inductions.
- Large population-based studies, such as Stock et al. (2012) and Burn et al. (2021), provided insights into the broader impacts of induction policies on maternal and neonatal outcomes at a population level.
- Increased resource utilization associated with induction, including longer hospital stays and higher rates of interventions, has implications for healthcare system capacity and costs.

The variability in findings across different healthcare settings and countries underscores the importance of context in interpreting and applying research findings. What may be beneficial in one healthcare system may not necessarily translate to similar benefits in another, due to differences in population characteristics, clinical practices, and resource availability.

References

- Adelaide Burrows, Kristin Finkenzeller, J. Pudwell, and Graeme N. Smith. “Elective Induction of Labour at 39 Weeks Compared with Expectant Management in Nulliparous Persons Delivering in a Community Hospital.” *Journal of Obstetrics and Gynaecology Canada*, 2022.
- D. Baud, Sylvie Rouiller, P. Hohlfeld, J. Tolsa, and Y. Vial. “Adverse Obstetrical and Neonatal Outcomes in Elective and Medically Indicated Inductions of Labor at Term.” *Journal of Maternal-Fetal & Neonatal Medicine*, 2013.

- E. Levine, Leah Delfinado, S. Locher, and N. Ginsberg. "Reducing the Cesarean Delivery Rate." *European Journal of Obstetrics, Gynecology, and Reproductive Biology*, 2021.
- E. Teo, and Sailesh Kumar. "Intrapartum Intervention Rates and Perinatal Outcomes Following Induction of Labour After 41 + 0 Weeks Compared to Expectant Management." *Journal of Maternal-Fetal & Neonatal Medicine*, 2017.
- F. Migliorelli, Ludovica Ferrero, C. Mccarey, Sara Marcenaro, V. Othenin-Girard, A. Chilin, and B. Martinez de Tejada. "Prediction of Spontaneous Onset of Labor at Term (PREDICT Study): Research Protocol." *PLoS ONE*, 2022.
- H. Bolton, and S. Pathak. "PLD.47 Term Induction of Labour and Delivery Outcomes: Data from an East of England Hospital." *Archives of Disease in Childhood: Fetal and Neonatal Edition*, 2014.
- H. Cammu, G. Martens, Gunther Ruyssinck, and J. Amy. "Outcome After Elective Labor Induction in Nulliparous Women: A Matched Cohort Study." *American Journal of Obstetrics and Gynecology*, 2002.
- H. Dahlen, C. Thornton, S. Downe, A. de Jonge, Anna E. Seijmonsbergen-Schermer, S. Tracy, M. Tracy, A. Bisits, and L. Peters. "Intrapartum Interventions and Outcomes for Women and Children Following Induction of Labour at Term in Uncomplicated Pregnancies: A 16-Year Population-Based Linked Data Study." *BMJ Open*, 2021.
- H. Senanayake, I. Mariani, E. P. Valente, M. Piccoli, Benedetta Armocida, C. Businelli, M. Rishard, B. Covi, and M. Lazzarini. "Outcomes of Induction Versus Spontaneous Onset of Labour at 40 and 41 GW: Findings from a Prospective Database, Sri Lanka." *BMC Pregnancy and Childbirth*, 2021.
- Hye In Kim, S. Choo, S. Han, and E. Kim. "Benefits and Risks of Induction of Labor at 39 or More Weeks in Uncomplicated Nulliparous Women: A Retrospective, Observational Study." *Obstetrics & Gynecology Science*, 2018.
- Isabel Pereira, Rita Silva, D. Ayres-de-Campos, and N. Clode. "Physical Exercise at Term for Enhancing the Spontaneous Onset of Labor: A Randomized Clinical Trial." *Journal of Maternal-Fetal & Neonatal Medicine*, 2020.
- J. Bailit, W. Grobman, Yuan Zhao, R. Wapner, U. Reddy, M. Varner, K. Leveno, et al. "Nonmedically Indicated Induction Vs Expectant Treatment in Term Nulliparous Women." *American Journal of Obstetrics and Gynecology*, 2015.
- J. Glantz. "Elective Induction Vs. Spontaneous Labor Associations and Outcomes." *Journal of Reproductive Medicine*, 2005.
- J.M. Seno Adjie, Teresa Catalina R., and Janice Priscilla. "Exploring Women's Childbirth Experiences in Labor Induction Versus Expectant Management: A Systematic Review and Meta-Analysis." *Current Women s Health Reviews*, 2024.
- Joycelyn Vardo, L. Thornburg, and J. Glantz. "Maternal and Neonatal Morbidity Among Nulliparous Women Undergoing Elective Induction of Labor." *Journal of Reproductive Medicine*, 2011.
- Katti Adler, L. Rahkonen, and H. Kruit. "Maternal Childbirth Experience in Induced and Spontaneous Labour Measured in a Visual Analog Scale and the Factors Influencing It; a Two-Year Cohort Study." *BMC Pregnancy and Childbirth*, 2020.
- L. Burkett, T. Canavan, Stephanie Glass Clark, L. Giugale, A. Artsen, and P. Moalli. "Reducing Pelvic Floor Injury by Induction of Labor." *International Urogynecology Journal*, 2022.
- M. Boulvain, S. Marcoux, M. Bureau, M. Fortier, and W. Fraser. "Risks of Induction of Labour in Uncomplicated Term Pregnancies." *Paediatric and Perinatal Epidemiology*, 2001.
- Mary-Ann Davey, and James King. "Caesarean Section Following Induction of Labour in Uncomplicated First Births- a Population-Based Cross-Sectional Analysis of 42,950 Births." *BMC Pregnancy and Childbirth*, 2016.
- Nasreen Haj-Yahia, A. Asali, G. Cohen, E. Neumark, M. M. Eisenberg, A. Fishman, T. Biron-Shental, and

- N. Miller. "Induction of Labor, and Physiological and Psychological Stress Responses as Expressed by Salivary Cortisol: A Prospective Study." *Archives of Gynecology and Obstetrics*, 2020.
- R. Granese, G. Calagna, Alessandro Sollano, S. Mondello, Angela Sicilia, R. Grasso, G. Cucinella, and O. Triolo. "Data Comparison Between Pharmacological Induction of Labour and Spontaneous Delivery. A Single Centre Experience." *Ginekologia Polska*, 2016.
- S. Craven, F. Byrne, R. Mahony, and J. Walsh. "Do You Pay to Go Private?: A Single Centre Comparison of Induction of Labour and Caesarean Section Rates in Private Versus Public Patients." *BMC Pregnancy and Childbirth*, 2020.
- S. Stock, E. Ferguson, A. Duffy, I. Ford, J. Chalmers, and J. Norman. "Outcomes of Elective Induction of Labour Compared with Expectant Management: Population Based Study." *British Medical Journal*, 2012.
- Sabrina C Burn, Ruofan Yao, M. Diaz, Jordan Rossi, and S. Contag. "Impact of Labor Induction at 39 Weeks Gestation Compared with Expectant Management on Maternal and Perinatal Morbidity Among a Cohort of Low-Risk Women." *Journal of Maternal-Fetal & Neonatal Medicine*, 2021.
- Y. Jacquemyn, I. Michiels, and G. Martens. "Elective Induction of Labour Increases Caesarean Section Rate in Low Risk Multiparous Women." *Journal of Obstetrics and Gynaecology Research*, 2012.