

# Factors Associated With Increased Rates of Caesarean Section in Women of Advanced Maternal Age

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## Abstract

**Objective:** To compare rates of Caesarean section between mothers of advanced age (35 to 40, and over 40 years) and those aged 20 to 34, using the Robson classification system to examine additional maternal factors.

**Methods:** A total of 134 088 hospital deliveries in Ontario between April 1, 2011, and March 31, 2012, were grouped into Robson's 10 mutually exclusive and totally inclusive classification categories. Records from the three Robson groups that made the greatest contribution to the overall CS rate were stratified by maternal age, health condition, obstetrical complication, assisted reproductive technology usage, smoking during pregnancy, and socioeconomic status.

**Results:** Rates of CS increased with advancing maternal age; in women aged 20 to 34, 35 to 40, and over 40, the rates were 26.2%, 35.9%, and 43.1%, respectively. The top three Robson groups by contribution to CS rates involved women who had one or more of the following factors: previous Caesarean section, primiparity, conception by means of assisted reproductive technology, chronic hypertension, gestational diabetes, diabetes mellitus, preeclampsia, placenta previa, placental abruption, or large for gestational age infants. The prevalence of these factors increased with advancing maternal age, yet mothers aged  $\geq 35$  with one or more health conditions or obstetrical complications had higher CS rates than mothers aged 20 to 34 with the same condition(s) or complication(s).

**Conclusion:** Health conditions and obstetrical complications alone in older women do not account for increased rates of CS. The preferences of the individual care provider and the mother on CS rates may play a key role and require further investigation.

**Key Words:** Caesarean section, Robson classification, advanced maternal age, obstetrical factors

Competing Interests: None declared.

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## Résumé

**Objectif :** Comparer les taux de césarienne des mères d'âge avancé (de 35 à 40 ans et de plus de 40 ans) à ceux des mères âgées de 20 à 34 ans, en utilisant le système de classification de Robson en vue d'examiner des facteurs maternels additionnels.

**Méthodes :** Au total, 134 088 accouchements s'étant déroulés en milieu hospitalier en Ontario entre le 1<sup>er</sup> avril 2011 et le 31 mars 2012 ont été groupés en fonction des 10 catégories mutuellement exclusives et totalement inclusives de Robson. Les dossiers des trois groupes Robson ayant le plus contribué au taux global de césarienne ont été stratifiés en fonction de l'âge maternel, de l'état de santé, des complications obstétricales, du recours à des techniques de procréation assistée, du tabagisme pendant la grossesse et du statut socioéconomique.

**Résultats :** Les taux de césarienne étaient proportionnels à l'âge maternel : chez les femmes de 20 à 34 ans, de 35 à 40 ans et de plus de 40 ans, les taux ont été de 26,2 %, de 35,9 % et de 43,1 %, respectivement. Les trois groupes Robson ayant le plus contribué au taux global de césarienne étaient composés de femmes qui présentaient un ou plusieurs des facteurs suivants : antécédents de césarienne, primiparité, conception au moyen de techniques de procréation assistée, hypertension chronique, diabète gestationnel, diabète sucré, prééclampsie, *placenta praevia*, décollement placentaire ou hypertrophie fœtale. Bien que la prévalence de ces facteurs ait été proportionnelle à l'âge maternel, les mères âgées de 35 ans ou plus qui comptaient un ou plusieurs troubles de santé (ou complications obstétricales) présentaient des taux de césarienne supérieurs à ceux des mères âgées de 20 à 34 ans qui comptaient le ou les mêmes troubles (ou complications).

**Conclusion :** Les taux accrus de césarienne chez les femmes plus âgées ne peuvent être attribués qu'à la seule présence de troubles de santé et de complications obstétricales. Les préférences des fournisseurs de soins et des mères en matière d'accouchement pourraient jouer un rôle clé en ce qui concerne les taux de césarienne, ce qui nécessite la tenue d'études plus approfondies.

## INTRODUCTION

Over the last three decades, the number of women 35 years of age and older who were first time mothers in high-income countries has steadily increased.<sup>1</sup> Between 1987 and 2005, Canada witnessed a threefold increase in women 35 and older who gave birth for the first time.<sup>2</sup> Many women in high-income countries delay childbearing until they are 35 or older because they want to complete their education, secure employment, and become financially stable before having children.<sup>3</sup> However, women 35 years of age and older who become pregnant are at increased risk of developing gestational diabetes, having a Caesarean section, having a stillbirth, and giving birth to infants that are preterm, have low birth weight, or have one or more congenital anomaly.<sup>4-8</sup> As a result, mothers of advanced age will undoubtedly require additional health care services and may also have longer hospital stays, thus incurring more associated costs.<sup>9,10</sup>

Understanding the specific childbearing characteristics of women of advanced age compared with their younger counterparts and the underlying causes of the increased CS rates would facilitate targeting of modifiable risk factors in older woman. This would ultimately reduce the need for additional obstetrical intervention, including CS, thus improving outcomes for mothers and infants and reducing the length and cost of these hospital admissions.

The aim of this study was to examine the increased rates of CS in women of advanced maternal age using the Robson classification system,<sup>11</sup> with additional analysis of the impact of maternal health and pregnancy behaviours, maternal medical conditions, obstetrical complications, and socioeconomic status on CS rates.

## METHODS

We conducted a retrospective cohort study of women who delivered in a hospital in Ontario, using data from the Better Outcomes Registry & Network, a provincial maternal-child health registry. The cohort was restricted to women  $\geq 20$  years of age who gave birth to a live born infant of  $> 20$  weeks' gestation and weighing  $> 500$  grams, between April 1, 2011 and March 31, 2012.

## ABBREVIATIONS

ART	assisted reproductive technology
BORN	Better Outcomes Registry & Network
IUGR	intrauterine growth restriction
LGA	large for gestational age
PROM	premature rupture of membranes

We examined records for maternal variables including pregnancy history (parity and previous CS), whether assisted reproductive technology methods were used to achieve pregnancy, and maternal smoking status during pregnancy. Each record was then linked by maternal postal code to census data to examine maternal material and social deprivation indices.<sup>12</sup>

Records were then classified into 10 mutually exclusive and totally inclusive Robson groups with sub-group modification following recommendation from the Society of Obstetricians and Gynaecologists of Canada<sup>13</sup> (Table 1). Records within all Robson groups were stratified into three maternal age groups: 20 to 34, 35 to 40, and  $> 40$  years of age. Records falling into the three Robson groups with the greatest contribution to the overall CS rate were examined for pre-existing maternal health conditions (chronic hypertension, pre-existing diabetes, and cardiac disease) and obstetrical complications (gestational hypertension, gestational diabetes, preeclampsia, intrauterine growth restriction [i.e., below the 10th percentile], large for gestation age [i.e., above the 90th percentile], premature rupture of membranes, placenta previa, and placental abruption) for the maternal age groups of 20 to 34 years of age and  $> 35$  years of age (Table 2). Because of small cell sizes that could result in compromised privacy (i.e., risk of identification), the two older age groups were combined for this section of the analysis.

Analysis was conducted using crude and multivariable models adjusting for maternal smoking during pregnancy and material and social deprivation indices. Analyses were conducted using SAS 9.3 software (IBM Corp., Armonk NY).

Ethics approval was obtained from the Ottawa Hospital Research Ethics Board for this study.

## RESULTS

There were 38 517 Caesarean sections performed among the 134 088 women who delivered in an Ontario hospital between April 1, 2011, and March 31, 2012, giving an overall CS rate of 28.7% (Table 3). Only 26.2% of younger women aged 20 to 34 delivered by CS (27 180 Caesarean sections in 103 663 women), while 35.9% of women aged 35 to 40 (8818/24 585) delivered by CS (Figure). Moreover, women over 40 years of age had the highest CS rate of any age group (43.1%; 2519/5840). While women from the two older age groups combined (35 to 40 and  $> 40$  years of age) represent only 22.7% of all deliveries, they account for 29.4% of all Caesarean sections.

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