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Processes of obstetrical care and outcomes among Ontario physicians versus non-physicians: a population-based study

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ABSTRACT

Objective We compared processes of antepartum, intrapartum and postpartum care and obstetrical outcomes between physicians and non-physicians.

Design This is a population-based retrospective matched cohort study.

Setting The study was conducted in Ontario, Canada.

Participants Physicians and non-physicians residing in high-income urban areas from 1 April 2009 to 26 November 2018 were included. Physicians were matched to non-physicians on maternal age, calendar year, parity, conception by assisted reproductive technology and singleton versus multifetal gestation. We compared processes of antepartum, intrapartum and postpartum care between physicians and non-physicians.

Outcome measures The primary outcome was mode of delivery (caesarean section, C-section vs vaginal delivery). Secondary outcomes included obstetrical anal sphincter injury among those experiencing vaginal birth and differences in urgent healthcare contacts (maternal and neonatal) during the postpartum period.

Results 7327 physicians were matched 1:5 to 36 185 non-physicians and were well balanced except for comorbidities (physicians had fewer comorbidities). Physicians had more antenatal ultrasounds and invasive prenatal testing, received labour anaesthesia more often and were more often delivered by their own care provider. In adjusted analyses, physicians and non-physicians had a similar risk of C-section (aRR 0.97, 95% CI 0.93 to 1.00, p=0.07). There was no difference in neonatal urgent care contacts; non-physicians had a higher risk of maternal urgent postpartum care (adjusted relative risk [aRR] 1.22, 95% CI 1.08 to 1.37, p<0.0001).

Conclusions Physicians and non-physicians of similar age and with similar pregnancy characteristics had a comparable rate of C-section, which may be related to a lack of cost drivers for C-section in Ontario.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Population-based study of health outcomes for all physicians in Ontario experiencing an in-hospital obstetrical delivery.
⇒ Ontario has a universal healthcare system, enabling comprehensive evaluation of all antenatal visits, obstetrical interventions and outcomes.
⇒ We did not have occupation information for non-physicians.
⇒ We were unable to explore differences in the use of elective versus urgent C-section among physicians versus non-physicians.

INTRODUCTION

Physicians may experience different processes of obstetrical care and outcomes compared with non-physicians by virtue of their knowledge of and access to the healthcare system.[1 2] Physicians are more knowledgeable with respect to obstetrical processes of care, and they may request specific interventions that may influence their outcomes. Superior access to the healthcare system might also lead to more unnecessary intervention; for example, additional ultrasound surveillance may result in findings that lack clinical significance but lead to further intervention.[3] There is scant literature examining whether physicians choose the same obstetrical treatment for their patients that they would choose for themselves; one US study found significantly lower rates of caesarean delivery among physicians compared with non-physicians, although this may be influenced by financial incentives within the US private system.[1]

Obstetrical processes of care and outcomes among physicians versus non-physicians within a publicly funded healthcare system have not yet been examined. Residents of Ontario, Canada, access healthcare through a publicly funded system, under which they are covered for all essential care, including obstetrical care. Physician payments for obstetrical deliveries are established in the Ontario Health Insurance Plan (OHIP) Schedule of Benefits, and payments for vaginal deliveries and caesarean sections are comparable, mitigating the effect of financial incentives on obstetrical management decisions.

The objective of this study was to determine whether physicians in Ontario's publicly funded healthcare system experience different processes of obstetrical care and obstetrical outcomes compared with high-income non-physicians. The primary outcome of interest was mode of delivery (caesarean section vs vaginal delivery) between physicians and non-physicians. Secondary outcomes of interest included differences in other antepartum, intrapartum and postpartum processes of care and obstetrical anal sphincter injury (OASIS) as well as maternal and neonatal postpartum emergency room visits and hospitalisations.

METHODS

Study Design & Data Sources

We performed a population-based retrospective matched cohort study of reproductive-aged women 20–50 years in the province of Ontario, Canada. The study protocol was published[4] at St. Michael's Hospital. The paper has been written in accordance with the Reporting of studies Conducted using Observational Routinely collected Data guidelines[5] (online supplemental table 1). Physicians were identified using data from the College of Physicians and Surgeons of Ontario (CPSO), the sole licencing body for all practising Ontario physicians (including postgraduate trainees). To study important covariates and health outcomes among physicians, we linked CPSO data to the population-based databases housed at ICES (formerly the Institute for Clinical Evaluative Sciences). ICES is an independent, non-profit research institute whose legal status under Ontario's health information privacy law allows it to collect and analyse healthcare and demographic data, without consent, for health system evaluation and improvement. Deliveries were identified in the ICES MOMBABY dataset, derived from the Canadian Institutes for Health Information Discharge Abstract Database (CIHI DAD), which links inpatient records of delivering mothers and their babies and has been used widely in prior population-based studies.[6–8] Demographic information was obtained through the Registered Persons Database (RPDB) and CENSUS datasets to determine area-level income quintile and rurality based on postal code. The Immigration, Refugees and Citizenship Canada Permanent Resident Database was used to ascertain immigration status. The OHIP contains information on physician billings for all Ontario residents, and the ICES Physician Database and Corporate Physician Database contain physician specialty information, allowing ascertainment of antenatal care provider. Assessment of prior healthcare utilisation was determined through CIHI DAD, National Ambulatory Care Reporting System and OHIP. Datasets were linked using unique encoded identifiers and analysed at ICES.

In Ontario, all medically necessary treatment, including invasive prenatal testing, is covered under OHIP. Since December 2015, the physician fees for one cycle of in vitro fertilisation are covered under OHIP; fertility medications and other assisted reproductive technology (ART) (eg, ovulation induction with intrauterine insemination) are not publicly funded.

Study population, exposure assessment and matching

We included women in Ontario who experienced a live or stillbirth delivered at 20+ weeks from 1 April 2009 to 26 November 2018. The exposure of interest was physician occupation; we included all female physicians licenced by the CPSO between 1 January 1995 and 26 November 2018 residing in urban areas. Non-physician individuals who experienced a delivery were identified from MOMBABY and linked to the RPDB; we restricted to those residing in high-income urban areas to minimise the potential impact of observed differences related to socioeconomic status rather than physician occupation.

Deliveries among physicians were matched to deliveries among non-physicians using 1:5 exact ratio matching without replacement. We matched on maternal age at delivery (±1 year), calendar year of delivery (±1 year), parity (0 vs 1+ prior births), use of ART in the index pregnancy (binary) and singleton versus multifetal gestation.

Demographic characteristics were measured at the time of the delivery and included maternal age (continuous), calendar year of delivery (continuous), immigration status (recent immigrant within 5 years, long-term immigrant>5 years, resident),[9] comorbidities (categorical), pre-existing hypertension (binary), hypertensive disorders of pregnancy (binary), pre-existing diabetes (binary), gestational diabetes (binary), previous live births (0, 1, 2+), previous stillbirths (0, 1, 2+), previous miscarriages (binary), multifetal gestation (binary), pregnancy conceived with any type of ART (binary, assessed through MOMBABY), gestational weeks at delivery (<37 weeks, 37–41 weeks, 41+ weeks), severe small for gestational age infant (SGA, defined as <5% for sex and gestational age, which has been found to more reliably capture true pathology than a <10% cut-off in population-based studies)[10] and large for gestational age infant (LGA, defined as >10% for sex and gestational age). Comorbidities were categorised into Aggregated Diagnosis Groups (ADGs) (0, 1–5, 6–9, >10) based on healthcare utilisation in 2 years prior to the delivery using the Johns Hopkins ACG System V.10.[11]

Assessment of processes of care

We evaluated antepartum, intrapartum and postpartum processes of care and compared them between physicians and their matched counterparts. The processes encompassed investigations, procedures or other care decisions that the pregnant individual may choose or decline and which may influence their obstetrical outcome.

Antepartum care

We evaluated number of antenatal visits, number of antenatal ultrasounds, use of invasive prenatal testing (chorionic villus sampling or amniocentesis) and antenatal external cephalic version (OHIP), a procedure

performed late in pregnancy to achieve cephalic presentation, in the event that the fetus is breech.

Intrapartum care

We evaluated the type of care provider attending the delivery, which was ascertained through OHIP billings. If more than one provider was present, both providers were accounted for (eg, if a family physician and obstetrician attended a delivery, the delivery was counted under both providers). We also evaluated whether the individual's own antenatal care provider attended their delivery, as some providers may deliver their own physician patients as a professional courtesy. We evaluated for differences in induction of labour, using a strict definition of mechanical or pharmacological induction (oral, vaginal or cervical administration of an oxytocic agent). We also evaluated for differences in uptake of episiotomy, OASIS, trial of labour after caesarean (TOLAC) and receipt of labour anaesthesia, defined based on anaesthesia billing codes.

Postpartum care

We evaluated the length of maternal stay in the hospital following delivery. The number of outpatient healthcare visits from discharge to 42 days postpartum was also assessed (maternal and neonatal, emergency department [ED] and office visits). Maternal and neonatal visits were assessed separately based on OHIP billing codes.

Outcome assessment

The primary outcome was mode of delivery (C-section vs operative vaginal delivery vs spontaneous vaginal delivery). Secondary outcomes were differences in other antepartum, intrapartum and postpartum processes of care, OASIS among those with a vaginal delivery and number of urgent healthcare contacts (maternal and neonatal emergency department visits or hospitalisations) during the 42-day postpartum period.

Statistical analysis

We described the distributions of demographic and delivery characteristics of physicians and non-physicians using medians, interquartile ranges and proportions and standardised differences before and after matching. We then evaluated antepartum and intrapartum processes of care within the matched sets to determine if there were differences in these factors between physicians and non-physicians.

To estimate the risk of C-section versus vaginal delivery among physicians versus non-physicians (primary outcome), we applied a modified Poisson regression model under a generalised estimating equation approach to account for correlation between the matched sets. We adjusted for comorbidities (ADGs 0–5, 6–9, >10), diabetes (binary), gestational diabetes (binary), hypertensive disorders of pregnancy (binary), gestational age at delivery (weeks, categorical), SGA and LGA. This model was repeated for the outcome of OASIS among those undergoing vaginal birth. We also evaluated maternal postpartum urgent care (emergency department visits or hospitalisations) using a Poisson regression model, adjusting for the same factors with the addition of mode of delivery. Neonatal care was evaluated using a Poisson regression model, adjusting for SGA, LGA and gestational weeks at delivery.

All statistical tests were two sided, with $p<0.05$ considered statistically significant and standardised differences>0.10 considered a meaningful difference between groups.[12] Complete case analyses were performed as data were rarely missing (use of ART missing in <0.001%). Analyses were performed using SAS V.9.4.

Patient and public involvement

None.

RESULTS

Study population

We identified 7237 deliveries among 4667 physicians and compared them to 177 038 deliveries among 138 074 non-physicians (figure 1). Prior to matching, physicians were older than non-physicians at delivery, with a median age of 34 years (IQR 32–36) in physicians and 32 years (IQR 29–35) in non-physicians (standardised difference (StD) 0.39). Physicians had fewer ADGs, with an overall median of 5 (IQR 3–7) among physicians versus 6 (IQR 4–8, StD=0.40) among non-physicians. Physicians were more likely to be nulliparous compared with non-physicians (48.9% vs 43.2%, StD=0.11) and more likely to have conceived with ART compared with non-physicians (8.7% vs 4.8%, StD=0.16). Physicians and non-physicians had experienced similar rates of prior miscarriage (24.3% vs 25.4%, StD=0.03) (table 1).

After matching, physicians and non-physicians were well balanced in their characteristics, except for comorbidities (median ADGs 5 (IQR 3–7) for physicians and 6 (IQR 4–8) among non-physicians, StD=0.40). Physicians were less likely to deliver postdates; only 7.5% of physicians delivered in or beyond their 41st week of pregnancy compared with 11.5% of non-physicians (StD=0.11). Compared with physicians, non-physicians were more likely to have an LGA fetus (4.4% vs 2.4%, StD=0.11).

Processes of care

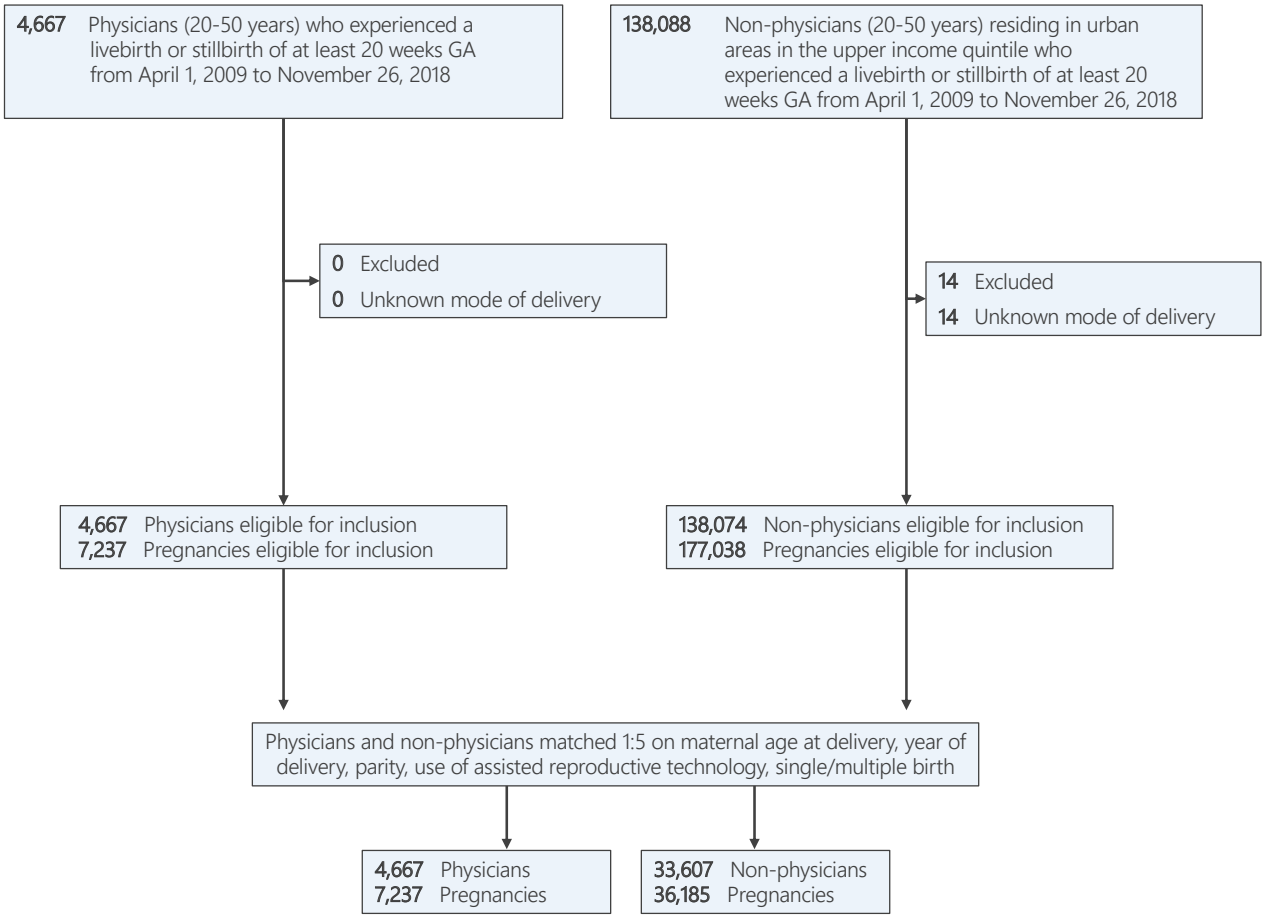
Antepartum care

The median number of antepartum visits was similar between physicians and non-physicians (10 visits (IQR 9–12) vs 11 visits (IQR 8–12), StD=0.08). The median number of ultrasounds during pregnancy was higher among physicians (6 (IQR 4–8) vs 5 (IQR 3–8), StD=0.12). Physicians were more likely to undergo invasive prenatal diagnostic testing (6.3% vs 3.9%, StD=0.11) (table 2).

Intrapartum care

Physicians and non-physicians had a similar frequency of attendance by an obstetrician at their delivery (85.0% and 84.8%, respectively, StD=0.03). Physicians were more likely to be delivered by the obstetrician or

Figure 1.



Note: <6 physician pregnancies could not be matched. The pre-match number has been adjusted to meet privacy requirements. GA=gestational age

Figure 1 Flowchart of physicians and non-physicians included in the study. GA, gestational age.

family physicians who followed them in their pregnancy compared with non-physicians (physicians: n=2537, 35.1%; non-physicians: n=9772, 27.0%). Non-physicians were more likely to have a provider other than an obstetrician or family physician attend their delivery (9.5% of non-physicians vs 5.4% of physicians, StD=0.16). There were no differences in induction of labour, use of episiotomy or TOLAC between physicians and non-physicians. Physicians were more likely to have labour anaesthesia (87.2% vs 80.0%, StD=0.20) (table 2).

Mode of delivery

The estimated relative risk of C-section was slightly lower for physicians (29.9% vs 32.2%, RR 0.93, 95% CI 0.89 to 0.86, p<0.0001). After adjusting for comorbidities, diabetes (pre-existing and gestational), hypertension (pre-existing and hypertensive disorders of pregnancy), gestational age, SGA and LGA, there was no difference in the risk of C-section (aRR 0.97, 95% CI 0.91 to 1.00, p=0.07). Conversely, the risk of spontaneous vaginal delivery was slightly higher among physicians in unadjusted analyses (58.6% vs 56.6%, RR 1.03, 95% CI 1.01 to 1.06, p=0.0013), but after adjustment, there was no difference (aRR 1.01, 95% CI 0.99 to 1.03, p=0.25). The risk of operative vaginal delivery was similar between physicians and non-physicians before and after adjustment (11.6% vs 11.2%, aRR 1.03, 95% CI −0.96 to 1.11, p=0.36); among those undergoing operative vaginal delivery, 172 (20.5%) of physicians and 953 (23.6%) of non-physicians had a forceps-assisted vaginal delivery; the remainder had vacuum-assisted deliveries. There was no difference in the risk of OASIS; the aRR was not calculable due to the low number of individuals experiencing the outcome.

Postpartum

Following delivery, there were no differences in length of stay or outpatient maternal and neonatal visits between physicians and non-physicians (table 2). In adjusted analyses, considering maternal comorbidities and mode of delivery, non-physicians had a higher risk of maternal urgent postpartum care (ED or hospitalisation in the first 6 weeks postpartum) than physicians (aRR 1.22, 95% CI 1.08 to 1.37, p<0.0001). Children born to physicians and non-physicians had a similar risk of ED visits and

Table 1 Characteristics of physicians and non-physicians at the time of delivery before and after matching

Characteristic	Before matching			After matching		
	Physicians n=7237	Non-physicians n=177 038	Standardised difference	Physicians n=7237	Non-physicians n=36 185	Standardised difference
Maternal age at delivery (years)						
Median (IQR)	34 (32–36)	32 (29–35)	**0.39***	34 (23–26)	24 (32–36)	0
Immigration status (n, %)						
Resident	5917 (81.8)	142 431 (80.5)	0.03	5917 (81.8)	28 926 (79.9)	0.05
Long-term immigrant	954 (13.2)	24 482 (13.8)	0.02	954 (13.2)	5244 (14.5)	0.04
Recent immigrant (≤5 y)	366 (5.1)	10 125 (5.7)	0.03	366 (5.1)	2015 (5.6)	0.02
Comorbidities in the 2 years prior to delivery (n, %)—Johns Hopkins Aggregated Diagnosis Groups						
Median (IQR)	5 (3–7)	6 (4–8)	**0.40***	5 (3–7)	6 (4–8)	**0.40***
0	9 (0.1)	354 (0.2)	0.03	9 (0.1)	46 (0.1)	0
1–5	4208 (58.1)	73 614 (41.6)	**0.33***	4208 (58.1)	15 254 (42.2)	**0.32***
6–9	2571 (35.5)	79 156 (44.7)	**0.19***	2571 (35.5)	16 267 (45.0)	**0.19***
10+	449 (6.2)	23 919 (13.5)	**0.25***	449 (6.2)	4618 (12.8)	**0.23***
Hypertension	137 (1.9)	4430 (2.5)	0.04	137 (1.9)	1052 (2.9)	0.07
HDP	482 (6.7)	13 141 (7.4)	0.03	482 (6.7)	2914 (8.1)	0.05
Diabetes	65 (0.9)	2505 (1.4)	0.05	65 (0.9)	513 (1.4)	0.05
Gestational diabetes	434 (6.0)	11 918 (6.7)	0.03	434 (6.0)	2760 (7.6)	0.06
Previous live births† (n, %)						
0	3535 (48.9)	76 513 (43.2)	**0.11***	3535 (48.9)	17 642 (48.9)	0
1	2614 (36.1)	68 882 (38.9)	0.06	2614 (36.1)	12 282 (33.9)	0.05
2+	1088 (15.0)	31 520 (17.8)	0.08	1088 (15.0)	6228 (17.2)	0.06
Missing	–	124 (0.1)	–	–	33 (0.1)	–
Prior C-section						
Yes	958 (13.2)	5122 (14.2)	0.03	958 (13.2)	5122 (14.2)	0.03
Multifetal gestation (twins or higher-order multiples, n, %)						
	404 (5.6)	7623 (4.3)	0.06	404 (5.6)	2020 (5.6)	0
Pregnancy conceived with assisted reproductive technology (any method)‡ (n, %)						
ART	627 (8.7)	8422 (4.8)	**0.16***	627 (8.7)	3135 (8.7)	0
Missing	–	42 (0)	–	–	13 (0)	–
History of prior miscarriage§						
	1756 (24.3)	44 876 (25.4)	0.03	1756 (24.3)	9604 (26.6)	0.05
Gestational weeks at delivery						
Median (IQR)	39 (38–40)	39 (38–40)	0.10	39 (38–40)	39 (38–40)	0.06
<37 weeks	642 (8.9)	14 035 (7.9)	0.04	642 (8.9)	3192 (8.8)	0
37–40 weeks	6054 (83.7)	142 114 (80.3)	0.09	6054 (83.7)	28 826 (79.7)	0.10
41+ weeks	541 (7.5)	20 889 (11.8)	0.15	541 (7.5)	4167 (11.5)	**0.14***
Small or large for gestational age fetus (n, %)						
SGA	364 (5.0)	7336 (4.1)	0.04	364 (5.0)	1626 (4.5)	0.02
LGA	175 (2.4)	8269 (4.7)	0.12	175 (2.4)	1588 (4.4)	**0.11***

Physicians were matched 1:5 to non-physicians on maternal age (±1 year), calendar year of delivery (±1 year), parity (0, 1+), pregnancy conceived with assisted reproductive technology (binary), singleton or multifetal gestation (binary). For multifetal gestational—if at least one fetus was SGA or LGA, classified in this way.
*Denotes significance (significant values also in bold)
†<6 physicians had missing values for prior live births, suppressed for privacy requirements.
‡<6 physicians had unknown values for conception by ART, suppressed for privacy requirements.
§<6 physicians and non-physicians had missing values for miscarriage, suppressed for privacy requirements.
ART, assisted reproductive technology; HDP, hypertensive disorders of pregnancy; LGA, large for gestational age, >10% for sex and gestational weeks; SGA, small for gestational age, <5% for sex and gestational weeks.

Table 2 Antepartum and intrapartum processes of care for matched physicians and non-physicians

Process of care	Overall (n=43 422)	Physicians (n=7237)	Non-physicians (n=36 185)	Standardised difference
Antepartum				
Number of antenatal visits				
Median (IQR)	11 (8–12)	10 (9–12)	11 (8–13)	0.08
Number of ultrasounds				
Median (IQR)	5 (4–8)	6 (4–8)	5 (3–8)	**0.12***
Invasive prenatal testing (chorionic villous sampling or amniocentesis)				
N (%)	1862 (4.3)	457 (6.3)	1405 (3.9)	**0.11***
External cephalic version				
N (%)	78 (0.2)	16 (0.2)	62 (0.2)	0
Intrapartum				
Care provider at delivery†				
Obstetrician	36 888 (85.0)	6213 (85.9)	30 675 (84.8)	0.03
Family physician	6603 (15.2)	970 (13.4)	5633 (15.6)	0.06
Other	3843 (8.9)	390 (5.4)	3453 (9.5)	**0.16***
Delivery by own antenatal care provider‡				
Obstetrician	12 272 (28.3)	2140 (34.4)	8680 (28.3)	**0.13***
Family physician	3268 (49.5)	565 (58.3)	2703 (48.0)	**0.21***
Induction of labour§				
N (%)	4692 (10.8)	720 (10.0)	3872 (11.0)	0.04
Episiotomy				
N (%)	5713 (13.2)	966 (13.4)	4747 (13.1)	0.01
Trial of labour after caesarean (TOLAC)				
N (%)	1005 (2.3)	148 (2.1)	857 (2.4)	0.03
Labour anaesthesia received				
N (%)	35 257 (81.2)	6309 (87.2)	28 948 (80.0)	**0.20***
Postpartum				
Maternal length of stay (days)				
2 (1–3)	2 (1–3)	2 (1–2)	2 (1–3)	0.04
Maternal postpartum outpatient visits (within 42 days of delivery)				
Median (IQR)	1 (0–2)	1 (0–1)	1 (0–2)	0.09
Neonatal postpartum outpatient visits (within 42 days of delivery)				
Median (IQR)	2 (0–3)	2 (0–3)	2 (0–3)	0.06

*Denotes significance (significant values also in bold).
†Based on physician billings. If more than one physician attended the delivery (eg, obstetrician and family physician), it may be billed by both physicians. Therefore, the column percentages exceed 1. Similarly, if no physician bills the delivery, the delivery may represent a delivery by midwifery, or a missed billing.
‡Denominator limited to those who had antenatal care by an obstetrician or family physician, respectively.
§Strict definition, mechanical and/or pharmacological (administration of an oral, vaginal or cervical oxytocic agent) only.

hospitalisation, after adjustment for gestational weeks of delivery and growth abnormalities (aRR 0.81, 95% CI 0.62 to 1.06, p=0.13) (table 3). Although the direction of the effect is lower, these differences were not significant.

DISCUSSION

In this population-based study of over 200 000 individuals, there were few differences in processes of obstetrical care for physicians and non-physicians. Physicians were significantly older at the time of delivery, were more likely to be nulliparous, had fewer comorbidities and were significantly more likely to have conceived with ART. After matching to ensure balance between groups, physicians were more likely to undergo prenatal ultrasounds and invasive prenatal diagnostic testing, receive labour anaesthesia and be delivered by their own care provider but were less likely to have postpartum maternal urgent care

Table 3 Intrapartum and postpartum outcomes for matched physicians and non-physicians

Outcome	Physicians (n=7237)	Non-physicians (n=36 185)	Unadjusted RR (95% CI)	Adjusted RR† (95% CI)
Intrapartum				
Mode of delivery				
Caesarean section	2161 (29.9)	11 656 (32.2)	**0.93 (0.89 to 0.86), p<0.0001***	0.97 (0.93 to 1.00), p=0.07
Operative vaginal	838 (11.6)	4035 (11.2)	1.04 (0.97 to 1.11), p=0.28	1.03 (0.96 to 1.11), p=0.36
Spontaneous vaginal	4238 (58.6)	20 494 (56.6)	**1.03 (1.01 to 1.06), p=0.0013***	1.01 (0.99 to 1.03), p=0.25
Obstetrical anal sphincter injury				
N (%)	122 (1.7)	624 (1.7)	0.98 (0.81 to 1.18), p=0.82	–‡
Postpartum				
Maternal postpartum emergency department visits or hospitalisations				
N (%) Median (IQR)	403 (5.6) 0 (0–0)	2827 (7.8) 0 (0–0)	**0.71 (0.63 to 0.80), p<0.0001***	**0.82 (0.73 to 0.93), p=0.0014***
Neonatal ED visits or hospitalisation				
N (%) Median (IQR)	845 (11.7) 0 (0–0)	4739 (13.1) 0 (0–0)	0.87 (0.66 to 1.15), p=0.32	0.81 (0.62 to 1.06), p=0.13

Neonatal outcomes adjusted for SGA, LGA and gestational weeks of delivery.
*Denotes significance.
†Intrapartum outcomes adjusted for comorbidities (Aggregated Diagnosis Groups), diabetes, gestational diabetes, hypertension or hypertensive disorder of pregnancy, gestational age at delivery, small for gestational age (SGA, <5% for sex and gestational weeks) and large for gestational age (LGA, >10% for sex and gestational weeks). Maternal postpartum outcomes adjusted for the same variables as well as mode of delivery (caesarean section, operative vaginal or spontaneous vaginal delivery).
‡Adjusted RR not calculable due to low number experiencing the outcome.

visits than non-physicians. There were no differences in mode of delivery or other any other obstetrical outcomes.

Physician access to the healthcare system may lead to different obstetrical outcomes through attendance of their own antenatal care provider at delivery and access to additional visits and diagnostic imaging through pregnancy. In this study, physicians were more likely than non-physicians to be delivered by their own antenatal care obstetrician provider. Outcomes associated with delivery by one's antenatal care provider compared with the on-call obstetrician have been evaluated in one single-centre study, and only marginal effects on caesarean delivery and third-degree and fourth-degree lacerations were seen, favouring delivery by the antenatal care provider.[13] Conversely, increased access may result in poorer outcomes; as an example, additional ultrasound surveillance may result in findings that lack clinical significance but lead to further intervention.[3] Although physicians in this study experienced higher rates of invasive prenatal diagnostic testing and more ultrasounds compared with non-physicians, their processes of care and outcomes were largely similar. Notably, rates of caesarean delivery were similar between physicians and non-physicians. Johnson and Rehavi[1] evaluated differences in C-section rates between physicians and non-physician parents with at least one college degree in California and Texas (where the baseline C-section rates are 33.2% and 35.3%, respectively) and found that US physicians were 10% less likely to have a caesarean delivery compared with their non-physician counterparts. They postulated that physicians were less susceptible to the financial incentives of treating physicians in the US healthcare system.[1] In our study, the rates of operative delivery (forceps- and vacuum-assisted delivery) between physicians and non-physicians were similar. Our findings suggest that in Ontario's public healthcare system, where healthcare providers are paid equally regardless of mode of delivery, non-physicians receive the same standard of intrapartum obstetrical care as physicians.

A prior Canadian study examined labour and delivery experiences of physicians through qualitative interviews.[14] They found that physicians' high level of knowledge regarding obstetrics was a 'double-edged sword', as they exhibited a higher level of understanding but also more anticipatory anxiety based on prior clinical experiences. Many of the interviewees felt that physicians may have worse obstetrical outcomes due to increased monitoring and intervention or lower tolerance for risk. Our study, inclusive of all physicians delivering in Ontario, is reassuring—in spite of the higher use of some medical interventions among physicians, such as labour anaesthesia, there were no differences in mode of delivery. Our prior work using these data has also demonstrated that maternal and perinatal outcomes for physicians are similar to those for non-physicians, after adjusting for maternal age and other important factors.[15]

Both the risk of miscarriage and infertility among physicians have been raised as concerns in recent literature.[16–18] Physicians report higher rates of miscarriage than would be expected for the general population[17 19]; we were unable to evaluate rates of miscarriage among all physicians, but in this cohort of physicians experiencing

an obstetrical delivery, they had similar rates of prior miscarriage compared with their non-physician counterparts. The higher rates of ART use among physicians in this study might be explained by superior access to healthcare resources or by a truly higher risk of infertility among physicians. The increased use of ART in our unmatched cohort should be noted; although the mechanism cannot be elucidated using these data, it may corroborate prior literature, where one in four woman physicians self-reported a diagnosis of infertility.[16] Further investigation is needed to determine whether physicians' increased use of these services is due to increased rates of infertility or increased access to care.

Our finding of fewer urgent postpartum visits among physicians suggests that physicians may have other means of access to care outside of emergency services in the postpartum period compared with non-physicians. Recent Canadian literature has identified limited access to follow-up with obstetrical providers in the 6-week postpartum period as a significant gap.[20 21] In our matched cohort, 5.6% of physicians and 7.8% of non-physicians accessed emergency services during the postpartum period; providing options for timely care outside of the emergency department is an urgent priority for postpartum individuals in Ontario.

We compared obstetrical deliveries among all Ontario physicians versus non-physicians to explore processes of care and outcomes through a unique data linkage. This analysis included all practising physicians in Ontario; the data linkage allowed for a comprehensive assessment of outcomes. Still, there are limitations. We did not have occupational information on non-physicians. To create a fair comparator group, we compared physicians to non-physicians residing in high-income areas, as they would have fewer financial barriers to ART and fewer sociodemographic risk factors that may drive obstetrical outcomes. We were unable to explore the specific method of ART with the available data, as this variable included any method of ART. More physicians had pregnancies conceived with the use of ART compared with non-physicians, but we could not determine whether these differences were due to ART access or increased rates of infertility among physicians. Similarly, we could not determine if the increased rate of invasive testing among physicians was related to screening abnormalities or physician choice. We were unable to assess for differences in the use of elective versus urgent C-section due to a high proportion of patients missing this variable. Other important covariates, such as prepregnancy body mass index, were not available in these data.

CONCLUSIONS

Physicians and non-physicians delivering in Ontario experience similar obstetrical processes of care and outcomes, with a few notable exceptions, including increased antenatal ultrasounds, invasive prenatal testing, receipt of labour analgesia and delivery by own care provider. We found no difference in the rate of C-section among physicians and non-physicians, which may be related to the lack of cost drivers for C-section compared with vaginal birth in Ontario.

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