Trends in very early discharge from hospital for Ontario midwifery clients from 2003-2017: a cohort study

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Abstract (250 words)

Background: Very early discharge from hospital following birth is an element of Ontario midwifery care. Our objective was to determine if the proportion of babies under Ontario midwifery care who experience very early hospital discharge has changed over time.

Methods: We conducted a retrospective, population-based cohort study, including all term newborns born by spontaneous vaginal birth at an Ontario hospital between 2003-2017 who were attended by midwives. Our primary outcome was very early discharge from hospital for the newborn, which was defined as discharge <6 hours after birth. Secondary outcomes were pediatric consultation prior to hospital discharge, phototherapy prior to hospital discharge, and readmission for treatment of jaundice.

Results: The study cohort included 102,014 newborns. There was a small absolute decrease in very early discharge, from 34.2% in 2003-04 to 30.7% in 2016-17. Rates of pediatric consultation, phototherapy prior to hospital discharge, and readmission for jaundice have all risen slightly. In 2016-17, rates of very early discharge ranged from 5.6% to 71.3% across 73 Ontario hospitals. The change in very early discharge rates in the 39 hospitals where midwives were conducting births in both 2003-04 and 2016-17 ranged from an increase of 21.1% to a decrease of 39.2%.

Interpretation: Wide variation across Ontario in very early discharge rates for midwifery clients points to room for improvement to make more efficient use of health care resources. Further research to identify the factors that influence rates of very early discharge could help to inform efforts to promote optimal levels of early discharge.

Keywords: midwifery; infant, newborn; term birth; patient discharge; length of stay

Introduction

Very early discharge from hospital following birth has been an element of the Ontario model of midwifery care since the profession was originally regulated and funded in 1994.[1] Midwifery clients and their newborns who have uncomplicated births are eligible for discharge within 3-4 hours of birth.[2] A complete newborn exam is conducted by the attending midwife prior to hospital discharge. Postpartum care in the first week is then provided in the home, with the first visit typically occurring within approximately 24 hours of the birth.[3] Postpartum home visits include breastfeeding support, and the Ontario model of midwifery care has demonstrated good maternal and neonatal outcomes, including high rates of breastfeeding.[3–6] Research evidence shows that if antenatal care is adequate and there is good follow-up, early discharge yields good parent satisfaction.[7] Early discharge from hospital for midwife-attended hospital births represents a cost-savings to the health care system. Changes to the rate of very early discharge for midwifery clients are important as they may impact the cost-effectiveness of midwifery care.

Over time, a variety of changes in policy and practice may have influenced rates of very early discharge for Ontario midwifery clients.[8,9] One example of this is the provincial government's 2003 policy of offering a 60-hour postpartum stay to anyone who wanted it.[9] Another factor has been the introduction of universal bilirubin screening for newborns, which typically is performed at or beyond 24 hours of age.[8,10] Universal bilirubin screening was gradually adopted in Ontario following publication of the Canadian Pediatric Society's (CPS) 2007 hyperbilirubinemia guideline[8,11] and has been more actively promoted through a provincial hyperbilirubinemia quality-based procedure (QBP) published in 2013.[12] In response to anecdotal evidence that in some Ontario hospitals the proportion of midwifery clients being discharged early has decreased, we conducted a study with the objective of quantifying the patterns of early discharge among

Ontario midwifery clients. Our primary research question was "Has the proportion of babies under the care of Ontario midwives who experience early discharge from hospital following a spontaneous vaginal birth changed over time?" Our secondary question was "Has there has been variation in this rate between hospitals?"

Methods

We conducted a retrospective population-based cohort study that included all term newborns born by spontaneous vaginal birth at an Ontario hospital between April 1, 2003, and February 28, 2017 who were attended by midwives. The study was conducted at ICES, an independent, non-profit research institute whose legal status under Ontario's health information privacy law allows it to collect and analyze health care and demographic data, without consent, for health system evaluation and improvement. These datasets were linked using unique encoded identifiers and analyzed at ICES. We used data from ICES's MOMBABY dataset, which links the inpatient admission records of people who give birth at an Ontario hospital and with the records of their newborns using data from the Discharge Abstract Database (DAD), a national database that captures administrative, clinical and demographic information on all hospital discharges. We used service provider type codes that are captured in the DAD to determine whether or not a registered midwife was one of the care providers during the intrapartum hospital admission. We excluded births that occurred prior to 37 weeks gestation, stillbirths, multiple births, and non-cephalic presentations. We excluded cases where the time of birth or time of discharge were missing from the record, and excluded all cases where the length of hospital stay was greater than 4000 hours (5.4 months). We also excluded all newborns who were admitted to one of the provinces two pediatric hospitals (which do not conduct births).

Our primary outcome was very early discharge from hospital for the newborn. We calculated length of stay using time of birth and time of hospital discharge and then created a dichotomous variable based on defining the primary outcome as discharge <6 hours after birth. Our three secondary outcomes were pediatric consultation prior to hospital discharge, phototherapy prior to hospital discharge, and readmission for treatment of jaundice (See Supplementary Table 1 for the codes used to create these variables). We identified the following covariates a priori: maternal factors - maternal parity (primiparous vs. multiparous), rural residence (based on maternal postal code and determined using PCCF+),[13] maternal material deprivation (measured in quintiles using the Ontario Marginalization Index[14]), diabetes, and hypertension; newborn factors - gestational age category (37-38 weeks, 39-40 weeks, 41+ weeks); hospital factors – annual birth volume (≤500, 501-1000, 1001-2000, ≥2001), proportion of total births attended by midwives (<10%, 10-20%, >20%); and policy factors – the CPS guidelines (2007 onwards), Ontario's hyperbilirubinemia QBP (2013 onwards). We also conducted a secondary analysis of the crude annual rates of early discharge after excluding all newborns where the birth was conducted by a physician (See Supplementary Table 1 for the codes used to exclude physician births).

We calculated the frequency of each outcome by fiscal year, and graphed the trends over time. We used log binomial regression (using the GLIMMIX procedure) to model the relationship between covariates and the primary outcome (very early discharge), and to calculate relative risks. We used complete case analysis for our regression models (i.e., cases with missing values for any covariate were excluded from the models), because less than 2% of our very large cohort was missing data, and missing data were missing at random. This approach to handling missing data is valid and simple given these conditions.[15] We also calculated rates of very early discharge for each hospital by fiscal year to examine individual hospital trends and changes over time, and

to compare overall rates of very early discharge between hospitals. All analyses were conducted using SAS version 9.4.

The use of data in this project was authorized under section 45 of Ontario's Personal Health Information Protection Act, which does not require review by a Research Ethics Board.

Results

Figure 1 shows the cohort creation flow diagram. The study cohort included 102,014 newborns. The characteristics of included newborns are shown in Table 1. Newborns who were discharged from hospital within six hours of birth were more likely to be born to an older, multiparous mother, and less likely to be born before 39 weeks or after 40 weeks, to live in a rural area or a neighborhood with high levels of material deprivation, or to be born to a mother with diabetes or hypertension.

Figure 2 shows the crude rate of very early discharge for term, singleton, cephalic newborns born via spontaneous vaginal birth by fiscal year for all births in the study cohort and for just those conducted by midwives (n=86,412). There was a small absolute decrease in this rate over time, from 34.2% in 2003-04 to 30.7% in 2016-17 for the whole study cohort. After excluding physician-conducted births this rate was roughly 3% higher but followed a similar trend. Figure 3 shows the overall rate of pediatric consultation, phototherapy prior to hospital discharge, and readmission for jaundice during this same time period, with the rates of all three rising slightly. Univariate analyses for our two policy factors (the CPS hyperbilirubinemia guidelines, and Ontario's hyperbilirubinemia QBP) found no statistically significant change associated with these variables so they were not included in the final model. Results of the final model are shown in Table 2. After adjusting for maternal parity, rural residence, maternal socioeconomic status,

gestational age at birth, diabetes, and hypertension, we found a small underlying temporal trend of a decreasing rate of very early discharge each year (RR: 0.99, 95% CI: 0.988,0.998; p=0.013). Multiparity was associated with higher rates of early discharge, while rural residence and being in the lowest two material deprivation quintiles was associated with lower rates of early discharge. Additional variation in rates of early discharge was associated with hospital characteristics: newborns born at hospitals with >2000 births per year were more likely to be discharged from hospital early, while those born at hospitals with a higher proportion of births attended by midwives were less likely to be discharged early.

We found wide variation in the rates of very early discharge by hospital. Figure 4 shows that in 2016-17, the rates of very early discharge ranged from 5.6% to 71.3% across seventy-three different Ontario hospitals. We examined trends in the rates of very early discharge for each hospital over time, and examined changes around the times that new hyperbilirubinemia guidelines were released (2007 and 2013). There were no consistent patterns in the rate of very early discharge in relation to these policy changes. This inconsistency is illustrated in Figure 5, which shows the change in rates of very early discharge in the 39 hospitals where midwives were conducting births in both 2003-04 and 2016-17, which ranged from an increase of 21.1% to a decrease of 39.2%.

Discussion

We found a lower overall rate of very early discharge from hospital for term newborns born by spontaneous vaginal birth at an Ontario hospital who were attended by midwives than we anticipated. Although the intended model for Ontario midwifery care includes very early discharge from hospital where clinically appropriate, and midwife-attended spontaneous vaginal

births are generally a low risk cohort, less than a third of our cohort left the hospital within 6 hours of birth. We also found wide variation between hospitals in rates of very early discharge and in how these rates have varied over time, with the highest rates being more than twice the mean rate. While the pattern of very early discharge was not associated with policy factors related to universal hyperbilirubinemia screening, we observed temporal increases in the rates of pediatric consultation, phototherapy treatment prior to hospital discharge, and readmission for jaundice which reflect changes in midwives' clinical practice related to hyperbilirubinemia screening.

We were unable to find any other publications examining the rates of very early discharge in Canada. Outside of the midwifery model of care, early discharge has been defined variously as discharge on the same day as birth or discharge within 24-48 hours.[16–18] A 2012 survey of Canadian hospitals found that the length of stay following vaginal births decreased from 3.2 days in 1993 to 2.0 days in 2012.[19] While the length of stay for term singleton vaginal births attended by any health care professional in Canada has decreased over time,[16,20] outside of the context of midwifery care, very early discharge is not supported in Canada by current guidelines or service delivery models (which do not typically provide in-home early postpartum care from a primary care provider). As would be expected, given the rates of very early discharge in our study, the rate of phototherapy prior to hospital discharge was lower than for non-midwife-attended births in Ontario during the same time frame.[10] Between 2003-2011, rates of readmission for jaundice in our study were similar to previously reported rates for the rest of the Ontario population.[10]

The factors contributing to variation in rates of very early discharge are complex. Our finding that there was not a consistent association between length of stay and policy factors related to hyperbilirubinemia screening makes sense given that a) implementation of the CPS

hyperbilirubinemia guidelines occurred very gradually across Ontario hospitals, and b) the ways in which hospitals operationalized screening varied.[8] A survey of Ontario midwives found that logistical barriers to offering bilirubin screening after hospital discharge have been overcome by midwives in some communities but persist in others.[21] Presentation of the preliminary findings presented in this paper to audiences of midwives confirmed that hyperbilirubinemia screening is not the only factor influencing rates of very early discharge. Differences between hospital recommendations for minimum length of stay following epidural anesthesia, for example, or for ruling out newborn sepsis, will likely contribute to differences in practice related to early discharge. Variation in rates of very early discharge is also influenced by other contextual factors including hospital staffing and structural capacity, budgetary constraints driving a push to shorten length of stay, and championing of clinical protocols that do not take into consideration the in-home follow-up that midwives provide. Finally, very early discharge may impact midwives' workload, and anecdotally there appears to be variation in how this element of midwifery care is promoted by midwives to midwifery clients.

Our study has several limitations. First, midwifery care was integrated into the Ontario health care system in 1994 but some of the key variables needed for our study (e.g., gestational age) were not collected until 2003. Therefore, we could not examine rates of very early discharge from 1994 to 2003. Second, we expect that some newborns in the cohort had valid clinical reasons not to be discharged very early. However, we did not have access to full clinical records and were unable to identify neonatal clinical factors warranting a longer stay in hospital, or measure if this proportion changed over time or varied between hospitals. Third, we chose to include all midwife-attended births even though in some cases there may have been a transfer of care to a physician (our secondary analysis showed that about 16% of births were conducted by a

physician). Although births conducted by a physician may have involved some kind of complication that would influence suitability for very early discharge, we have shown elsewhere that a high proportion of transfers of care from midwives to obstetricians occur in situations where there is not a clinical indication.[22] We chose not to exclude physician-conducted births because from a policy and health resource perspective it is useful to describe the outcomes for all midwife-attended births. Finally, given the limitations inherent to retrospective cohort studies, our findings do not allow us to draw any conclusions about causal factors contributing to the trend and variation in rates of very early discharge.

The wide variation across Ontario hospitals in rates of very early discharge for midwifery clients points to room for improvement to make more efficient use of health care resources. The safety of early discharge accompanied by in-home postpartum care is supported by evidence from RCTs,[23–25] and is corroborated in the context of Ontario midwifery care by population-based studies which demonstrate very low rates of neonatal morbidity and mortality.[26,27] While not all midwifery clients will be appropriate candidates for very early discharge, it is incumbent upon both midwives and hospital to examine how very early discharge can be facilitated when appropriate. Ensuring that midwives are involved in developing clinical protocols that will impact the care they provide may help contribute towards this objective. Finally, the myriad of factors driving rates of very early discharge are not well understood; further research to identify the hospital, midwife, and midwifery client level factors that influence rates of very early discharge could help to inform efforts to promote optimal levels of early discharge.

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Figure 1. Cohort creation

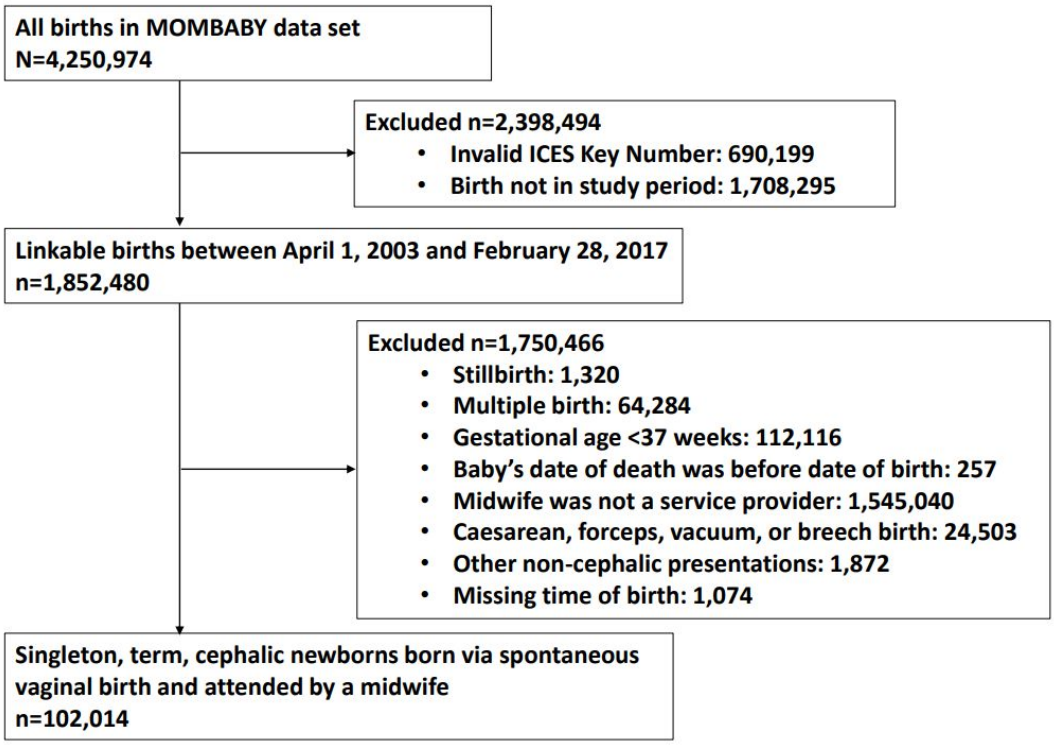

Table 1: Baseline Characteristics by Newborn Length of Stay

Characteristic	Length of Stay < 6 hours (N=32,447)	Length of Stay ≥ 6 hours (N=69,405)
Maternal Age		
<20	385 (1.2%)	1,601 (2.3%)
20-24	2,890 (8.9%)	8,202 (11.8%)
25-29	9,273 (28.6%)	21,810 (31.4%)
30-34	13,416 (41.3%)	26,352 (38.0%)
35-39	5,755 (17.7%)	10,094 (14.5%)
≥40	728 (2.2%)	1,346 (1.9%)
Maternal Parity		
Primiparous	10,356 (31.9%)	29,223 (42.1%)
Multiparous	10,356 (31.9%)	29,223 (42.1%)
Gestational Age		
37-38	5,339 (16.5%)	12,876 (18.6%)
39-40	20,945 (64.6%)	42,842 (61.7%)
≥41	6,143 (18.9%)	13,660 (19.7%)
Missing	20 (0.1%)	27 (0.0%)
Deprivation Quintile *		
1 (Least deprived)	8,144 (25.1%)	15,156 (21.8%)
2	7,171 (22.1%)	14,491 (20.9%)
3	6,082 (18.7%)	13,208 (19.0%)
4	5,480 (16.9%)	12,344 (17.8%)
5 (Most deprived)	5,025 (15.5%)	12,856 (18.5%)
Missing	545 (1.7%)	1,350 (1.9%)
Rural		
N	29,376 (90.5%)	60,525 (87.2%)
Y	3,040 (9.4%)	8,844 (12.7%)
Missing	31 (0.1%)	36 (0.1%)
Maternal Risk Factors		
Maternal Diabetes	154 (0.5%)	1,453 (2.1%)
Maternal Hypertension	247 (0.8%)	1,896 (2.7%)

* Ontario Marginalization Index Material Deprivation Quintile

Table 2. Model of Very Early Discharge

	Crude Rate of Early Discharge (%)	Relative Risk (95% Confidence Interval)	P Value
Fiscal Year	-	1.00 (0.99, 1.00)	0.3465
Parity			
Primiparous*	26.17		
Multiparous	35.47	1.78(1.73, 1.84)	<.0001
Rural			
N*	32.68		
Y	25.58	0.85(0.80, 0.90)	<.0001
Material Deprivation Quintile			
1 (High SES)*	34.95		
2	33.10	1.00(0.95, 1.04)	0.8189
3	31.53	0.97(0.93, 1.02)	0.2148
4	30.75	0.92(0.88, 0.97)	0.0008
5 (Low SES)	28.10	0.81(0.78, 0.85)	<.0001
Gestational Age at Birth in Weeks			
39-40*	32.84		
37-38	29.31	0.88(0.85, 0.91)	<.0001
≥41	31.02	0.88(0.84, 0.91)	<.0001
Volume of Births Per Year at Hospital			
>2000*	35.87		
1001-2000	27.14	0.91(0.83, 1.00)	0.0531
501-1000	23.30	0.94(0.78, 1.13)	0.5202
≤500	27.38	0.92(0.74, 1.15)	0.4860
Proportion of Births Attended by Midwives at Hospital			
<10%*	37.10		
10-20%	31.99	0.89(0.84, 0.95)	0.0001
>20%	26.74	0.83(0.76, 0.90)	<.0001
Diabetes			
N*	32.21		
Y	9.58	0.20(0.17, 0.24)	<.0001
Hypertension			
N*	32.29		
Y	11.53	0.28(0.24, 0.32)	<.0001

***Reference group**

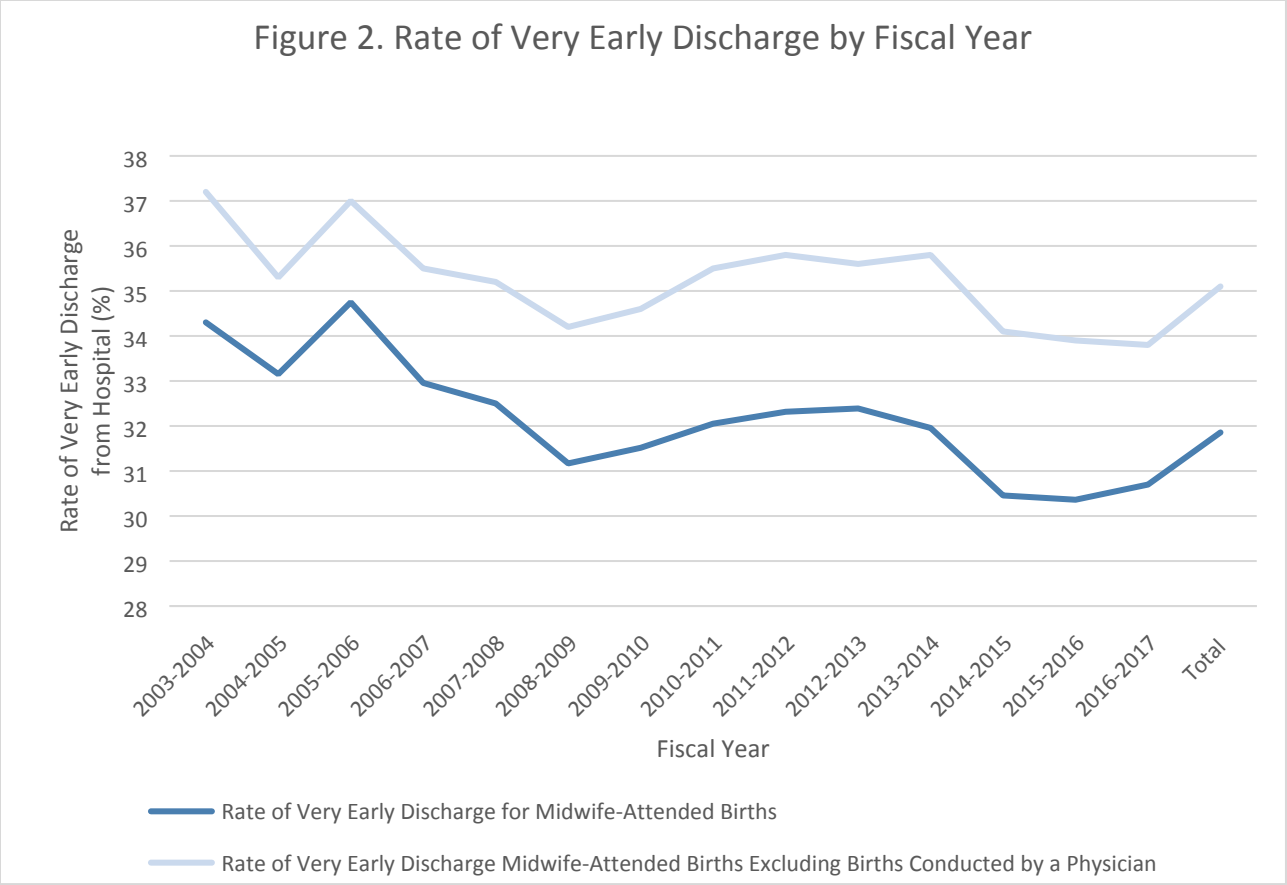
Figure 2. Rate of Very Early Discharge by Fiscal Year
Rate of Very Early Discharge from Hospital (%)
38
37
36
35
34
33
32
31
30
29
28
2003-2004
2004-2005
2005-2006
2006-2007
2007-2008
2008-2009
2009-2010
2010-2011
2011-2012
2012-2013
2013-2014
2014-2015
2015-2016
2016-2017
Total
Fiscal Year
Rate of Very Early Discharge for Midwife-Attended Births
Rate of Very Early Discharge Midwife-Attended Births Excluding Births Conducted by a Physician

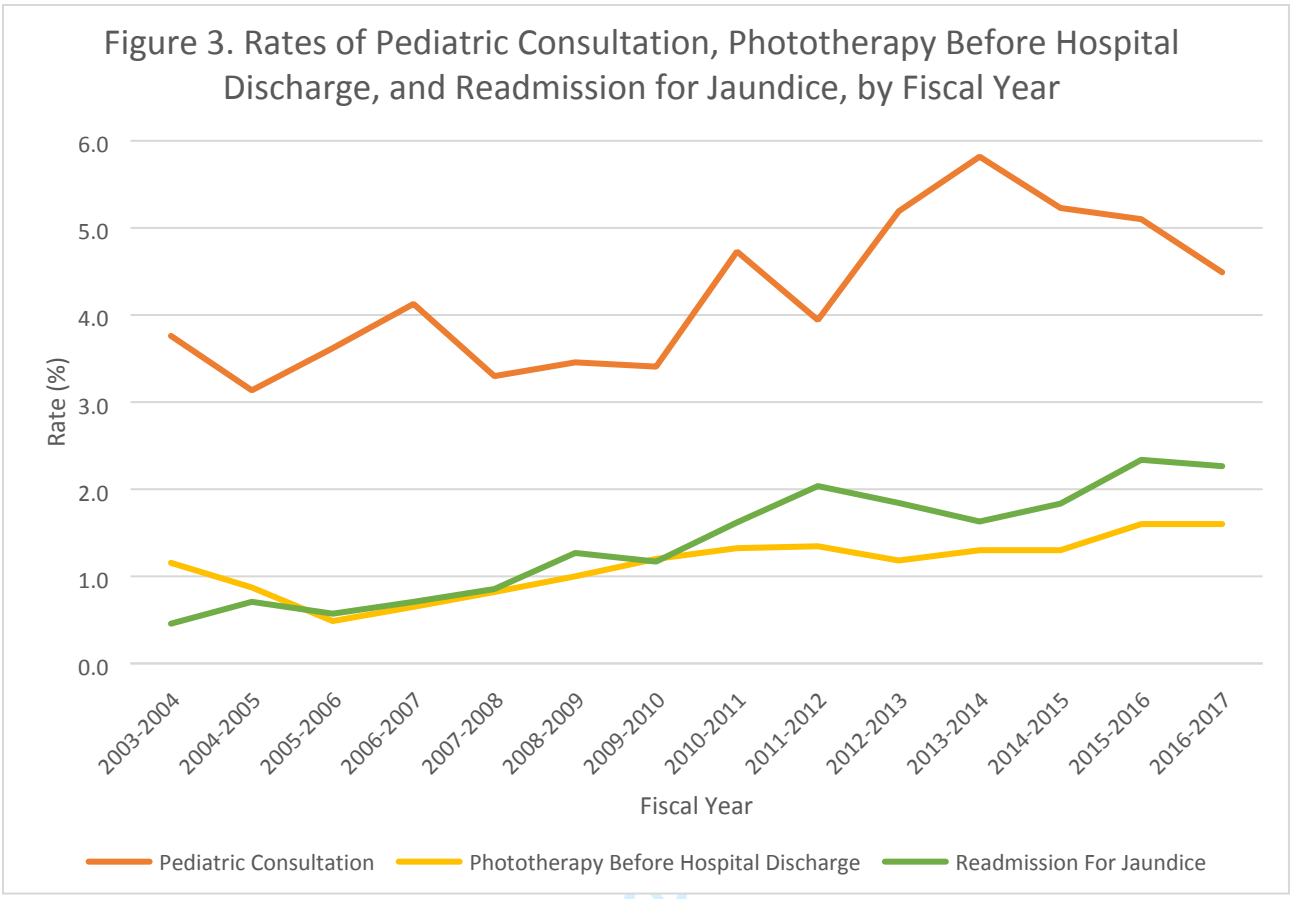
Figure 3. Rates of Pediatric Consultation, Phototherapy Before Hospital Discharge, and Readmission for Jaundice, by Fiscal Year
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Rate (%)
2003-2004
2004-2005
2005-2006
2006-2007
2007-2008
2008-2009
2009-2010
2010-2011
2011-2012
2012-2013
2013-2014
2014-2015
2015-2016
2016-2017
Fiscal Year
Pediatric Consultation
Phototherapy Before Hospital Discharge
Readmission For Jaundice

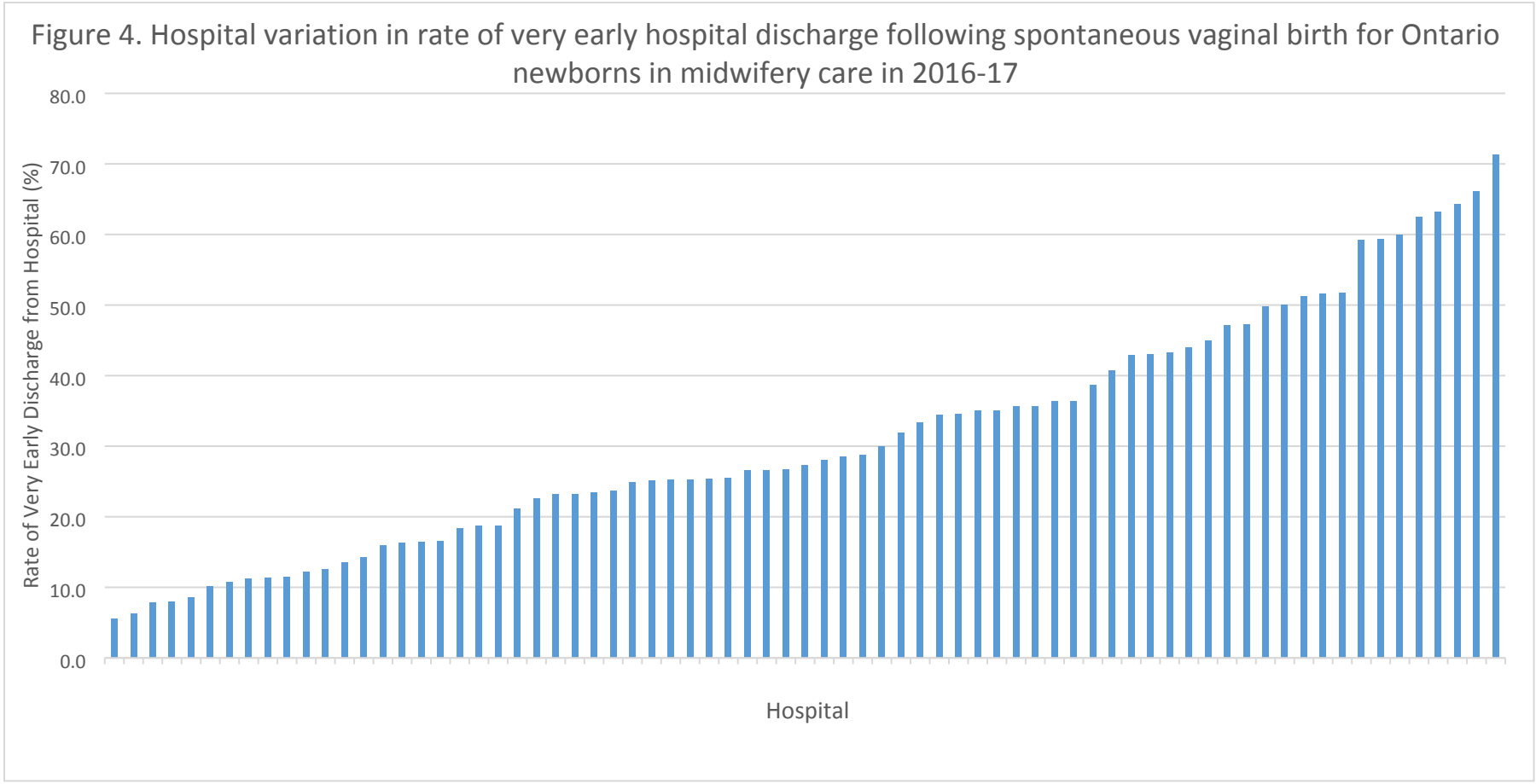
Figure 4. Hospital variation in rate of very early hospital discharge following spontaneous vaginal birth for Ontario newborns in midwifery care in 2016-17
Rate of Very Early Discharge from Hospital (%)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Hospital

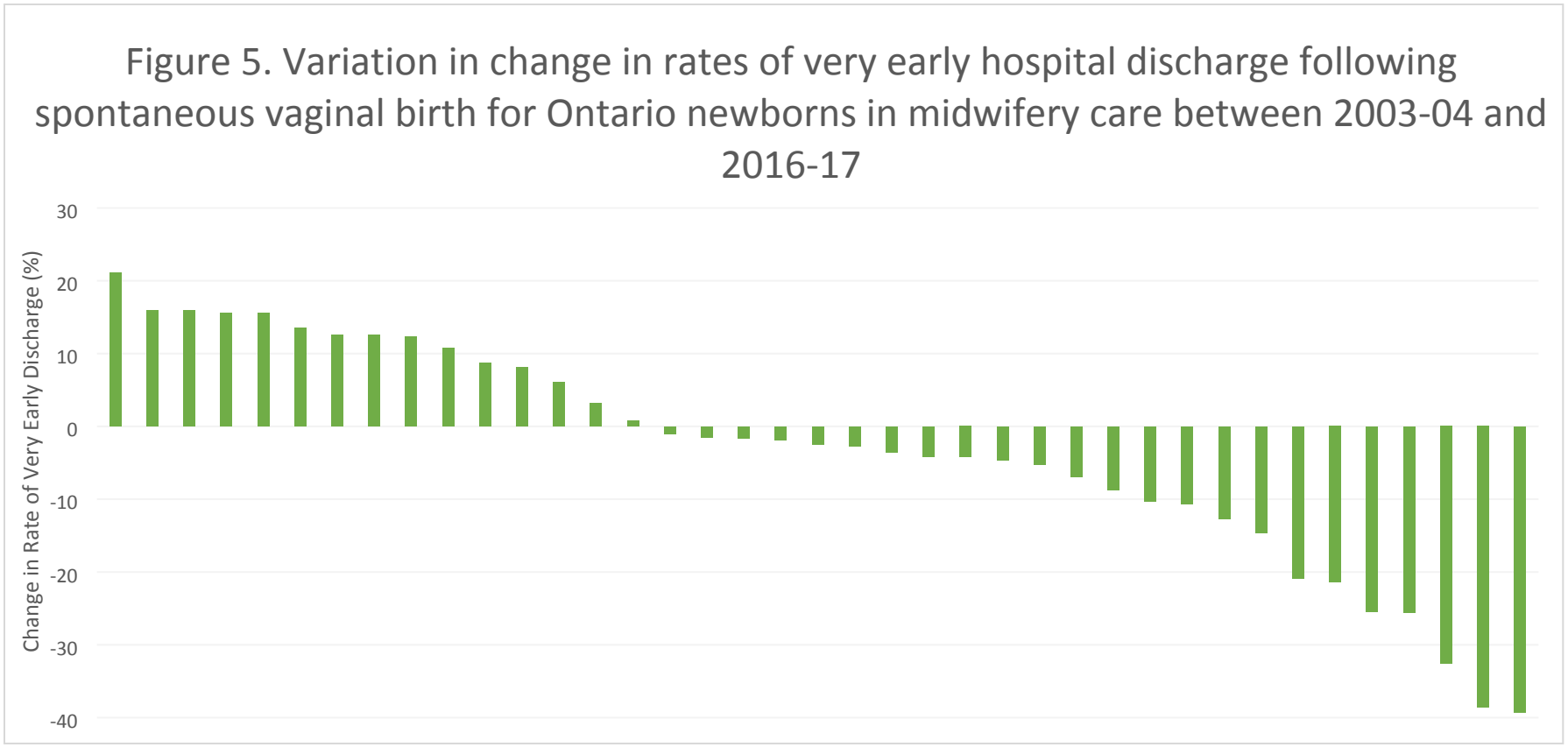
Figure 5. Variation in change in rates of very early hospital discharge following spontaneous vaginal birth for Ontario newborns in midwifery care between 2003-04 and 2016-17
Change in Rate of Very Early Discharge (%)
30
20
10
0
-10
-20
-30
-40