Journal of Midwifery & Women's Health www.jmwh.org
Original Research

Estimating the Financial Impact of Reducing Primary Cesareans

Susan A. DeJoy[1], CNM, PhD, MSN, Matthew G. Bohl[2], MPH, Kathleen Mahoney[3], MD, MBA, Constance Blake[4], RNC-OB, EdD, MSN

Introduction: Preventing a primary cesarean birth in nulliparous women with term, singleton, vertex pregnancies (NTSV) is recognized as an important strategy to reduce maternal morbidities and risks to the newborn. Multiple professional organizations are supporting approaches to safely reduce NTSV cesarean rates, including the American College of Obstetricians and Gynecologists; the Society for Maternal-Fetal Medicine; and the Association of Women's Health, Obstetric and Neonatal Nurses. The American College of Nurse-Midwives (ACNM) is leading one such effort as part of its Healthy Birth Initiative: the Reducing Primary Cesareans (RPC) Learning Collaborative. The objective of this study is to estimate the cost savings of a decrease in NTSV cesareans at one hospital participating in the RPC Learning Collaborative.

Methods: All women giving birth at Baystate Medical Center from October 1, 2016, to March 31, 2017, and their newborns were identified by Medicare Severity Diagnosis Related Group (N = 1747). Total hospital costs were calculated using a resource consumption profile for each of 6 groups: women who had vaginal birth, primary cesarean, and repeat cesarean and their linked newborns. A model was developed to estimate cost differences for the first and second births and overall cost savings.

Results: For the NTSV birth, total costs for primary cesarean and newborn care were $5989 higher compared with vaginal birth and newborn care. For the subsequent birth, repeat cesareans and newborn care were $4250 higher compared with vaginal birth. In 2016, 69 primary cesareans were prevented, for an actual cost savings of $413,241. Projecting the prevention of 66 subsequent repeat cesareans would result in additional savings of $280,500, for a total savings of $693,741. Apgar score at 5 minutes and length of stay remained unchanged.

Discussion: Participation in ACNM's RPC Learning Collaborative led to significant savings in hospital costs during the first year without affecting quality metrics. This cost comparison model could be replicated by other hospitals involved in cesarean reduction endeavors.

J Midwifery Womens Health 2020;65:56–63 © 2019 by the American College of Nurse-Midwives.

Keywords: cost, cost-effectiveness analysis, cesarean, childbirth, pregnancy outcomes, health care cost

INTRODUCTION

Based on a significant body of research, physiologic labor and vaginal birth have been documented to be the safest childbirth options for women who are at low risk at the onset of labor and for their newborns.[1–3] Despite this, cesarean birth rates in the United States continue to rise. The rate for low-risk cesarean birth, defined as birth to nulliparous women with singleton, vertex-presenting fetuses greater than 37 weeks' gestation (ie, NTSV births), increased by 45% in the past 20 years, from 18.4% in 1997 to 26% in 2017.[4] Low-risk women who experience a first cesarean birth are very likely to have a repeat cesarean birth, a key driver for the 55% increase in overall cesarean birth rate from 20.7% in 1996 to 32.0% in 2017.[5] Although cesarean birth is a useful intervention when necessary, increasing rates in the United States have been associated not with improvements in maternal or newborn outcomes but rather with well-documented increases in maternal morbidities and risks to the newborn.[6,7] In addition, after adjusting for risk factors, cesarean birth rates vary 10-fold among US hospitals, from 7.1% to 69.9%, and rates vary 15-fold among low-risk women, from 2.4% to 36.5%.[8]

The combination of variation in rates, lack of outcome improvements, and increases in morbidity are hallmarks of procedure overuse and suggest there is opportunity for improvement.[9] As a result, several initiatives to reduce the incidence of primary cesarean birth and support intended vaginal birth have been proposed and are the subject of current evaluation.[10–13] The American College of Nurse-Midwives (ACNM) began one such endeavor in 2015 as part of its Healthy Birth Initiative: the Reducing Primary Cesareans (RPC) Learning Collaborative, which focuses on reducing the incidence of NTSV cesareans through the use of a midwife-led interprofessional team and implementation of research-based care bundles.[14] These bundles include promoting progress in labor, promoting comfort in labor, and assessing fetal well-being through intermittent auscultation of the fetal heart in labor. The RPC Learning Collaborative includes a quality improvement focused curriculum, team coaching to support

[1]Division of Midwifery and Community Health, Department of Obstetrics and Gynecology, Baystate Medical Center, Springfield, Massachusetts
[2]Clinical Financial Planning and Decision Support, Baystate Health, Springfield, Massachusetts
[3]Healthcare Quality, Baystate Medical Center, Springfield, Massachusetts
[4]Department of Nursing, Baystate Medical Center, Springfield, Massachusetts

Correspondence
Susan A. DeJoy
Email: susan.dejoy@outlook.com

ORCID
Susan A. DeJoy https://orcid.org/0000-0003-2095-3290

 1526-9523/09/$36.00 doi:10.1111/jmwh.13010

Quick Points

- Reducing nulliparous, term, singleton, vertex (NTSV) cesareans in low-risk women is essential to decrease maternal morbidities and newborn risks.
- Estimating cost savings from reductions in NTSV cesareans is an important part of determining quality and value.
- Determining hospital costs is done using Medicare Severity Diagnosis Related Group codes and the hospital financial decision support system.
- Significant cost savings are realized when NTSV cesarean birth rates are reduced. Quality of care is not affected.
- This model can be replicated by any collaborative group of midwives, physicians, nurses, and financial analysts.

implementation of the care bundles, and a data management system to track process and key outcome measures.

Baystate Medical Center in Springfield, Massachusetts, joined the RPC Learning Collaborative in its startup year (2015) and continues to participate. Baystate Medical Center is a nationally ranked, 718-bed independent academic medical center and is home to the Baystate Midwifery Education Program and the University of Massachusetts Medical School-Baystate. As a major referral care center and the only level III neonatal intensive care unit and level III perinatal referral center for western Massachusetts, it is home to one of New England's busiest maternal health services, wherein more than 4000 women give birth each year. Certified nurse-midwives attend approximately 30% of these women during birth and practice in a variety of midwifery models of care. These include 2 full-scope midwifery practices with their own panels of pregnant women; a separate triage practice where midwives evaluate all women presenting for obstetric and gynecologic concerns and also supervise midwifery students, medical students, and resident physicians; and a separate midwifery laborist practice where midwives provide general labor care to all women and function as supervising faculty for residents on the labor floor.[15]

The Baystate Obstetric Service experienced a 14% decrease in the NTSV cesarean birth rate from 31.1% (2015) to 26.7% (2016) through its implementation of RPC quality methodology and the intermittent auscultation of the fetal heart in labor care bundle. In discussing these results, the Baystate RPC leadership team questioned what the financial impact of this change might be. Many quality improvement and safety initiatives, like RPC, have robust metrics to measure clinical impact but lack the same rigor around cost metrics.[10,16] Because consideration of cost is an essential component of determining value[6,7,17] and cesarean birth is associated with more cost than vaginal birth,[6] we sought to quantify the cost impact of each NTSV cesarean converted to a vaginal birth as a result of the RPC project. Furthermore, because a primary cesarean commits a woman to a 95% chance of a second cesarean in our institution, we also calculated the additional cost impact of prevention of a repeat cesarean in the subsequent pregnancy. We included provider payments in the overall financial impact calculation as Baystate Health is an integrated health care system that includes an insurance partner.

METHODS

A model was developed to determine the estimated average dollar cost of the reduction in NTSV cesareans at Baystate.[18–24] We considered the actual total costs, not charges or payments, of hospital care at our institution for a woman's first and second births and the associated newborn care. To offset these costs from a systems perspective, we included payments to the maternal health care provider (midwife or physician) and to the pediatric provider.

To determine average costs, we identified women who gave birth between October 1, 2016, and March 31, 2017, as well as their newborns, using McKesson Performance Analytics, version 20.0, the hospital's decision support system. McKesson functions as a data warehouse, containing all billing and clinical diagnosis and procedure data. The women were identified based on their Medicare Severity Diagnosis Related Group (MS-DRG), a classification system based on diagnosis developed by the Centers for Medicare and Medicaid Services (CMS; Table 1).[25] This system is intended to standardize hospital billing assigned to inpatient encounters, and all hospital encounters have MS-DRG codes assigned at discharge. Newborns were identified by the McKesson program that links newborns to the birthing woman. There were rare instances in which a woman was included without a newborn because of inaccuracies in the field linking woman and newborn. This represented 0.01% of births and did not affect overall calculations.

Vaginal births were defined as MS-DRGs 767, 768, 774, and 775. Primary cesareans were defined as MS-DRGs 765 and 766 (Table 1). Because there was no Current Procedural Terminology code associated with primary cesareans, the secondary qualification used to define primary cesareans was a "primary cesarean section" billing code, which was marked on the bill of all patients who received that service. For the projected second birth, we compared repeat cesarean births and newborns born via repeat cesarean with the vaginal births and vaginally born newborns described above. The repeat cesarean sample was defined by MS-DRGs 765 and 766, as well as the billing code for "repeat cesarean section." Newborns were included in the analysis based on their mothers' inclusion and were grouped based on the mode of birth.

To remove potential cost outliers that would not be included in a group of NTSV births, women who had multiple

births were excluded from the analysis, as were any newborns associated with multiple births. Premature newborns coded with MS-DRG 790 were excluded from the analysis, as were women who gave birth prematurely. We examined any case in which a woman or newborn had a length of stay greater than 3 standard deviations from the sample mean. Because none of these women or newborns were associated with NTSV births, they were excluded.

We questioned whether women's or newborns' outcomes were affected by the decreased NTSV cesarean rate, so that more vaginal births would lead to more morbidity and hence more cost. We tracked Apgar scores at 5 minutes and length of stay for NTSV births during the project period.

Once women and their newborns were identified, all financial information was extracted using account numbers. No patient names or other identifying information were collected. We calculated total hospital costs for each woman and newborn in the sampled groups. Total hospital cost includes the cost of patient care services as well as overhead costs. The total hospital cost assigned to a patient was the sum of the cost of individual service items. The total hospital cost was calculated using a resource consumption profile for each of the previously described samples. The resource consumption profile uses several pieces of cost information: the cost allocated to each procedure and service provided in the hospital, also called a charge code; the aggregated total hospital cost for all women and newborns in each sample; and the total costs by cost groups for further analysis. The cost groups most relevant to this analysis were labor and delivery, nursing, pharmacy, supply, and surgery. Miscellaneous hospital costs were aggregated into the *all other* cost group. The average total hospital cost was calculated by dividing the total hospital cost of each sample by the sample size. The average professional payment (midwife, obstetrician, pediatrician) for all women and newborns included in the analysis was determined based on payments made to Baystate Health employed providers. Not all women and newborns included in the analysis were cared for by Baystate-employed providers, but because the payer mix was similar between Baystate and community providers, the average collection was applied to all cases.

To model the cost impact of the RPC project, we determined the difference in a woman's average total hospital cost between a vaginal birth and a primary cesarean, as well as the average difference in total hospital cost between a newborn born vaginally and by cesarean. The same process was repeated to calculate the difference in average professional payments. By calculating the difference in average hospital costs and provider payments for both groups of women and newborns, the total savings associated with converting primary cesareans to vaginal births were determined. The cost difference was applied to the volume of primary cesareans prevented during the first year of the RPC project (2016) to quantify the savings.

To quantify impact of prevention of the first cesarean on the second birth, a further analysis was performed to determine the cost savings of preventing repeat cesareans. We

Table 1. Medicare Severity Diagnosis Related Groups for Vaginal Birth, Cesarean Birth, and Newborn

DRG	DRG Description	Comments
	Cesarean sections	
765	Cesarean section with complication or comorbidity/major complication or comorbidity	Primary or any order repeat cesarean
766	Cesarean section without complication or comorbidity/major complication or comorbidity	Primary or any order repeat cesarean
	Vaginal deliveries	
767	Vaginal delivery with sterilization and/or dilation and curettage	Any order vaginal delivery
768	Vaginal delivery with O.R. procedure except sterilization and/or dilation and curettage	Any order vaginal delivery
774	Vaginal delivery with complicating diagnoses	Any order vaginal delivery
775	Vaginal delivery without complicating diagnoses	Any order vaginal delivery
	Newborns	
789	Neonates, died or transferred to another acute care facility	Captures newborn deaths
790	Extreme immaturity or respiratory distress syndrome, neonate	Includes respiratory distress syndrome, any gestational age
791	Prematurity with major problems	Captures late preterm with unsure dating
792	Prematurity without major problems	Captures late preterm with unsure dating
793	Full-term neonate with major problems	Any full-term newborn
794	Neonate with other significant problems	Captures all newborns with problems not associated with prematurity
795	Normal newborn	All term newborns

Abbreviations: DRG, diagnosis related group; O.R., operating room.
The *cesarean section* and *vaginal delivery* wording in the table content reflects the DRG language.
Source: 2018 ICD-10 CM and GEMS.[25]

Table 2. Estimate of Cost Savings of Nulliparous, Term, Singleton, Vertex (NTSV) Vaginal Birth Compared with NTSV Primary Cesarean Birth at Baystate Medical Center

	Costs for Woman's Care,[a] $			Costs for Newborn's Care,[a] $			
	Vaginal Birth, Average Total Cost or Payment	Primary Cesarean Birth, Average Total Cost or Payment	Average Cost or Payment Difference[b]	Vaginal Birth, Average Total Cost or Payment	Primary Cesarean Birth, Average Total Cost or Payment	Average Cost Difference or Payment[b]	Total Cost Difference, Vaginal vs Cesarean[b]
Hospital costs							
Anesthesia	99	134	(36)	–	–	–	
Diagnostics	100	285	(185)	228	498	(269)	
Labor and delivery	2954	627	2327	–	–	–	
Nursing	2462	4197	(1736)	2594	5142	(2548)	
Pharmacy	223	493	(269)	41	103	(62)	
Supplies	61	177	(115)	–	–	–	
Surgery	126	3617	(3491)	–	–	–	
All other	115	137	(23)	177	282	(105)	
Total	6140	9667	(3527)	3039	6025	(2985)	(6512)
Professional payment	894	2122	228	411	706	295	523
Total cost difference, vaginal vs cesarean			(3299)			(2690)	(5989)

[a] Values may have been rounded to the nearest whole dollar amount.

[b] A number in parentheses indicates less cost/payment for a vaginal birth compared with a cesarean birth. A number without parentheses indicates more cost for a vaginal birth compared with a cesarean birth.

examined average costs for a second vaginal birth compared with a first vaginal birth, average labor costs for a vaginal birth after cesarean compared with a first vaginal birth, and average surgical costs for a primary compared with a repeat cesarean birth. There were no significant differences, so the average hospital costs and average provider payments for the repeat cesarean group were compared with those for the same vaginal birth group used in the first analysis. Based on our hospital data, 95% of women who have an NTSV cesarean would have a repeat cesarean in the following pregnancy. The subset of women who experienced repeat cesarean after an unsuccessful trial of labor was small, and the costs associated with their care did not significantly affect the average cost of a repeat cesarean. Examination of the resource consumption profile at the group level provided detail on which services accounted for differences in hospital costs.

RESULTS

In 2016, the RPC project at Baystate Medical Center resulted in a 14% decrease in NTSV cesarean birth, or 69 fewer NTSV cesareans. We modeled the cost savings for the cesareans prevented by comparing costs for primary and repeat cesarean births, vaginal births, and associated newborn care and provider payments for vaginal and cesarean birth.

A total of 1747 births with MS-DRG and secondary billing qualification were identified (Figure 1). Eighty-nine women and 106 newborns were excluded because of multiple births, preterm births, and length of stays greater than 3 standard deviations from the mean. There were no women or newborns with an NTSV birth in this extended length of stay group. After exclusions, 6 groups were sampled to determine average costs: vaginal births (n = 1142), primary cesarean births (n = 270), repeat cesarean births (n = 246), newborns from vaginal birth (n = 1126), newborns from primary cesarean birth (n = 268), and newborns from repeat cesarean birth (n = 257).

In consideration of NTSV births, the woman's average total hospital cost of a vaginal birth was $6140 compared with $9667 for a primary cesarean (Table 2). The difference in average hospital cost was $3527. Major costs for vaginal birth fell in the labor and delivery cost group, whereas the major costs of primary cesarean fell in the surgery cost group. The higher cost of surgery accounted for much of the cost difference. The differences in cost were also driven by nursing services. Nursing costs for the woman were much lower for a vaginal birth because of fewer total days spent in the hospital. The average total length of stay for a vaginal birth (2.6 days) was nearly 2 days shorter than a primary cesarean (4.4 days). Provider professional payment was $228 more for a primary cesarean compared with a vaginal birth, resulting in $3299 more cost for a woman's NTSV cesarean compared with an NTSV vaginal birth.

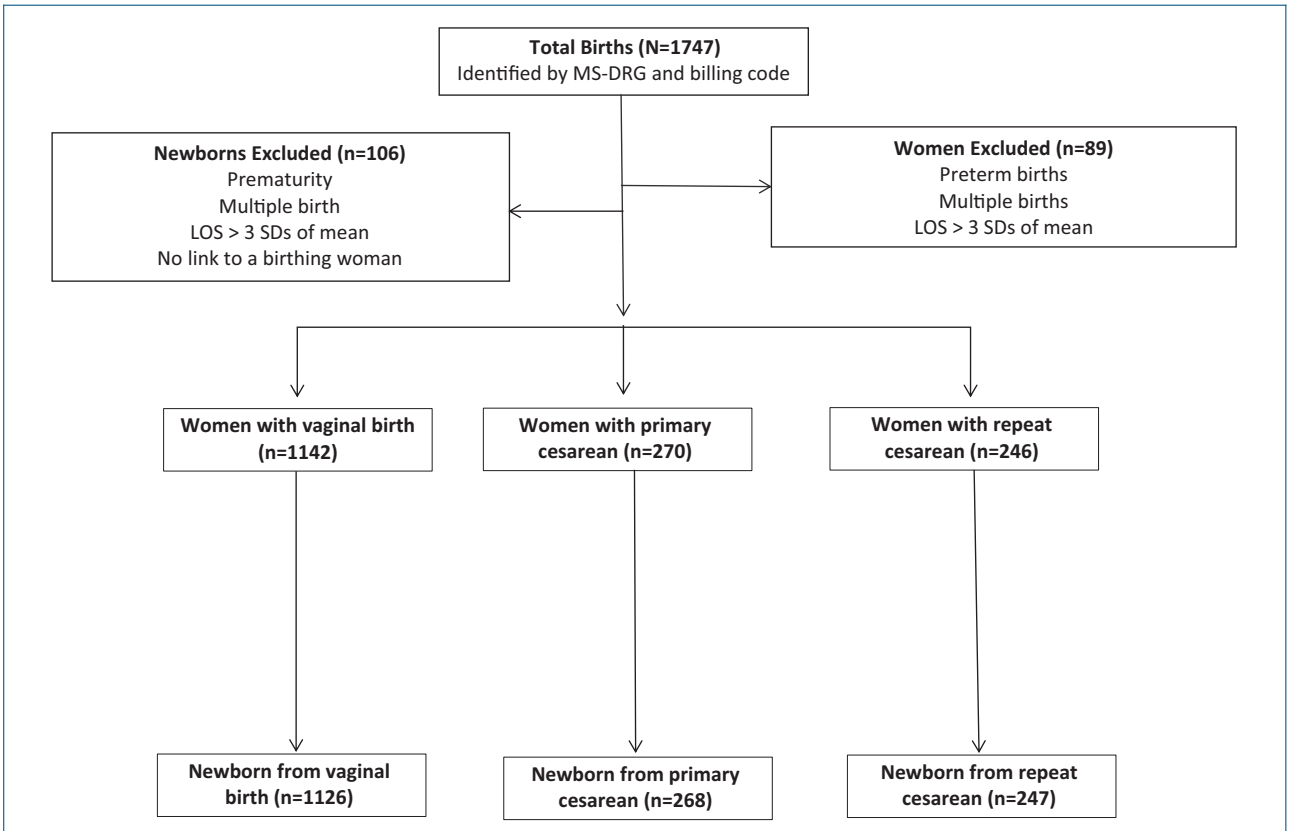

Figure 1. Identification of Birthing Women and Their Newborns for Cost Analysis: October 1, 2016, to March 31, 2017, Baystate Medical Center

Abbreviations: LOS, length of stay; MS-DRG, Medicare Severity Diagnosis Related Group.

The average total cost for a newborn born with a vaginal NTSV birth was $3039 (Table 2). This was compared with the average total cost of $6025 for a newborn born via NTSV primary cesarean. The difference in average total cost of $2985 was driven by the difference in nursing services, which accounted for $2548 of the cost difference. The average length of stay for vaginally born newborns (2.4 days) was much lower than for newborns born by primary cesarean (4.5). Provider professional payment was $295 more for primary cesarean compared with vaginal birth, resulting in $2690 more total cost for a newborn born via primary cesarean compared with vaginal birth. Therefore, total costs for the woman and her newborn, and the professional payment, were $5989 less for an NTSV vaginal birth than an NTSV cesarean birth.

In considering the subsequent pregnancy, the woman's average total hospital cost for a repeat cesarean was $9081 (Table 3). The average total hospital cost for a vaginal birth was unchanged, at $6140. The difference in average hospital cost was $2942 per birth. The cost difference was driven by the costs of both surgery and nursing, similar to the NTSV birth. The length of stay difference was not as large as for the NTSV cesarean, which decreased the cost savings associated with nursing. The surgery component was still a major driver. The difference in average provider professional payment was $228.

The average total cost for a newborn born via repeat cesarean was $4742 (Table 3). The average total hospital cost for the subsequent newborn born vaginally was unchanged, at $3039, resulting in $1703 more hospital cost for a newborn born via repeat cesarean compared with vaginal birth. Nursing costs were the main driver of the cost savings, because of the shorter length of stay for newborns born vaginally. The difference in provider professional payment was $157. Therefore, total costs for the woman and her newborn, and the professional payment, were $4250 less for a second vaginal birth than a repeat cesarean birth.

Table 4 shows the combined cost savings of converting a primary cesarean to a vaginal birth, $5989 per birth. The combined cost savings of converting a repeat cesarean to a vaginal birth in 95% of second pregnancies was $4250 per birth. The RPC project at Baystate Medical Center was associated with a reduction of 69 primary cesareans in 2016 and a projected 66 future repeat cesareans. We therefore estimated total cost savings for the first year of the RPC project at Baystate Medical Center as $693,741, which includes $413,241 for the prevention of the primary cesarean and $280,500 for the prevention of a repeat cesarean.

When implementing an NSTV reduction project, it is important to evaluate the impact on quality of care. The RPC Learning Collaborative mandates that participating hospitals track newborn Apgar score at 5 minutes as a balancing measure. For our project, we additionally looked at a woman's and newborn's length of stay. The distribution of Apgar scores at 5 minutes did not change, with 98% of 5-minute Apgar scores greater than or equal to 7 in both years. Length of stay was also unchanged during the project year compared with the base-

Table 3. Estimate of Cost Savings of Subsequent Vaginal Birth Compared with Repeat Cesarean Birth at Baystate Medical Center

	Costs for Woman's Care,[a] $			Costs for Newborn's Care,[a] $			
	Subsequent Vaginal Birth, Average Total Cost or Payment	Repeat Cesarean Birth, Average Total Cost or Payment	Woman's Average Cost or Payment Difference[b]	Newborn, Subsequent Vaginal Birth, Average Total Cost or Payment	Newborn, Repeat Cesarean Birth, Average Total Cost or Payment	Newborn Cost or Payment Difference[b]	Total Cost Difference, Subsequent Vaginal vs Repeat Cesarean[b]
Hospital costs							
Anesthesia	99	128	(30)	–	–	–	
Diagnostics	100	253	(153)	228	478	(250)	
Labor and delivery	2954	386	2567	–	–	–	
Nursing	2462	3388	(926)	2594	3941	(1347)	
Pharmacy	223	407	(184)	41	85	(44)	
Supplies	61	216	(154)	–	–	–	
Surgery	126	4196	(4070)	–	–	–	
All other	115	106	8	177	239	(62)	
Total	6140	9081	(2942)	3039	4742	(1703)	(4645)
Professional payment	1894	2122	228	411	578	167	395
Total cost difference, vaginal vs cesarean			(2714)			(1535)	(4250)

[a] Values may have been rounded to the nearest whole dollar amount.
[b] A number in parentheses indicates less cost/payment for a vaginal birth compared with a cesarean birth. A number without parentheses indicates more cost for a vaginal birth compared with a cesarean birth.

Table 4. Estimate of Total Cost Savings of Reduction in NTSV Cesarean Births in 2016 at Baystate Medical Center: Index and Subsequent Birth

	Savings from Each NTSV Cesarean Prevented	Number NTSV Cesareans Prevented	Total Savings in NTSV Cesarean Prevented	Savings from Each Repeat Cesarean Prevented	Number Repeat Cesareans Prevented	Total Savings in Repeat Cesareans Prevented	Total Cost Impact of Reducing NTSV Cesareans, 2016
	$		$	$		$	$
Woman	3299	69	227,631	2714	66	179,124	406,755
Newborn	2690	69	185,610	1535	66	101,310	286,920
Total	5989	69	413,241	4250	66	280,500	693,741

Abbreviation: NTSV, nulliparous, term, singleton, vertex.

line year. In addition, we examined length-of-stay outliers in the model, and none were women who had NTSV births.

DISCUSSION

Over the course of this initiative project, we estimated the cost impact of the 14% reduction in NTSV cesarean birth as a result of participation in the ACNM-led RPC Learning Collaborative and the cost impact of a projected reduction in repeat cesareans when the primary cesarean is prevented. Using a model that used actual average hospital costs and professional payments for cesarean and vaginal births for women and newborns at our institution, we estimated significant hospital system's cost savings of more than $413,000 for the first year of the project and projected future savings of more than $280,000 in prevention of repeat cesareans. Balancing measures were unchanged, suggesting no reduction in quality of care. The benefit of safely reducing NTSV cesarean birth is certainly reflected in cost savings and adds positively to the value of our care to birthing women.

An understanding of hospital cost determination was essential in model development. Intuitively, costs during labor would be higher for nulliparous women and women

attempting vaginal birth after cesarean than for multiparous women. However, costs were remarkably similar. The explanation lies in how costs are determined by the hospital. Costs for labor and birth are mainly determined by 2 things: the amount of nursing care and fixed costs for equipment and supplies. Nursing care is determined by the number of days at midnight a patient has a status of admitted to the hospital. In other words, an admission in labor at 11:59 PM with birth at 12:01 AM has the same nursing care cost applied as an admission at 12:01 AM with birth the following day at 12:01 AM. As the pre-birth length of stay of the vast majority of women in labor at our institution is similar using this methodology, regardless of parity, nursing care costs during any type of labor are remarkably uniform.

Nonnursing costs for labor care and vaginal and cesarean births were also fairly consistent regardless of the woman's parity, the length of her labor, the type of vaginal birth and its complications, occurrence of previous cesarean births, or whether a cesarean was primary or repeat. The explanation lies in the nature of fixed costs: fetal heart rate monitor equipment cost is the same whether used for 10 minutes or 10 hours; a vaginal birth equipment pack is the same for nulliparous and multiparous women; and an operating room setup with equipment and personnel is the same for a primary or a repeat cesarean.

There were several costs that we were not able to estimate for this project. Although costs related to vaginal births with complications, such as fourth-degree laceration, were included in the analysis, we did not develop a cost calculation for the increased risk of maternal surgically-associated morbidity associated with repeat cesarean birth. There are also secondary costs to cesarean births that we were not able to consider, such as morbidity associated with lower breastfeeding success and decreased maternal satisfaction. Women who have a cesarean birth use more breastfeeding support resources and are less successful at exclusive breastfeeding than women who have a vaginal birth. This can have lifelong negative impacts on women and their children.[26]

Our model describes only inpatient costs. The true costs of birth extend well beyond the walls of the hospital.[27] Our estimates of cost savings of a lower cesarean birth rate likely underestimate the savings for several reasons. Only the cost impact of the second, not other, subsequent births was considered. This model was also not able to estimate costs of a woman's time out of work, time off for family members, and costs outside of the initial hospitalization period for any postpartum complications most often associated with surgery, such as deep venous thrombosis or ileus.

Of concern to continued promotion of RPC is the realization that professional payment is sometimes higher for cesarean birth than for vaginal birth. Although all providers are trained to do only what is in a patient's best interest, the pressures of the marketplace and payment incentives are sure to have at least unconscious influence. Some insurers are experimenting with single payment or bundled payment methods whereby a provider is not reimbursed more for a cesarean birth than for a vaginal birth.[6,28–30]

Although costs may differ by region and hospital, this basic approach to estimating cost savings for reduction of NTSV cesareans can be used by most hospitals. Most systems like Baystate Health have medical management programs with a standard template for hospital cost estimates that can be applied to any MS-DRG. It is not possible, given the complexities of health care, to completely account for every cost in a hospital admission. However, a hospital's standard cost template provides a tested process for estimating such costs. We used the same methods for this initiative as we have used for other quality improvement projects at Baystate, such as our CMS bundle projects for coronary artery bypass grafts, colorectal surgery, and total joint replacement.

It is especially important for hospitals participating in the ACNM-RPC Learning Collaborative to conduct cost impact analyses as part of their project evaluations. Senior hospital leaders should understand the true value of such quality improvement and patient safety initiatives so that resources can be continually deployed for these efforts. Understanding how patient care decisions impact health care finances is essential for future hospital success. Support for the needed reduction in NTSV cesareans will be enhanced if cost savings impact is promoted as part of the value equation.

ACKNOWLEDGMENTS

The authors wish to acknowledge Janice A. Mayforth, Senior Director, Clinical Financial Planning and Decision Support at Baystate Health, for her guidance and expertise in conducting this analysis.

CONFLICT OF INTEREST

The authors have no conflicts of interest to disclose.

REFERENCES

1.American College of Obstetricians and Gynecologists; Society for Maternal-Fetal Medicine. Obstetric care consensus no. 1: Safe prevention of the primary cesarean delivery. *Obstet Gynecol*. 2014; 123(3):693-711.

2.Buckley SJ. *Hormonal Physiology of Childbearing: Evidence and Implications for Women, Babies, and Maternity Care*. Washington, DC: Childbirth Connection Programs, National Partnership for Women & Families; 2015.

3.Supporting healthy and normal physiologic childbirth: a consensus statement by ACNM, MANA, and NACPM. *J Perinat Educ*. 2013;22(1):14-18.

4.Osterman MJ, Martin JA. Trends in low-risk cesarean delivery in the United States, 1990-2013. *Natl Vital Stat Rep*. 2014;63(6):1-16.

5.Martin JA, Hamilton BE, Osterman MJK, Driscoll AK, Drake P. Births: final data for 2017. *Natl Vital Stat Rep*. 2018;67(8):1-50.

6.Main EK, Morton CH, Hopkins D, Fuiliani G, Melsop K, Gould JB. *Cesarean Deliveries, Outcomes, and Opportunities for Change in California: Toward a Public Agenda for Maternity Care Safety and Quality*. Palo Alto, CA: California Maternal Quality Care Collaborative; 2011.

7.Marshall NE, Fu R, Guise JM. Impact of multiple cesarean deliveries on maternal morbidity: a systematic review. *Am J Obstet Gynecol*. 2011;205(3);262.e1-262.e8.

8.Kozhimannil KB, Law MR, Virnig BA. Cesarean delivery rates vary tenfold among US hospitals; reducing variation may address quality, cost issues. *Health Aff (Millwood)*. 2013;32(3):527-535.

9.Plough AC, Galvin G, Li Z, et al. Relationship between labor and delivery unit management practices and maternal outcomes. *Obstet Gynecol*. 2017;130(2):358-365.

10.Bell AD, Joy S, Gullo S, Higgins R, Stevenson E. Implementing a systematic approach to reduce cesarean birth rates in nulliparous women. *Obstet Gynecol*. 2017;130(5):1082-1089.
11.Kozhimannil KB, Hardeman RR, Alarid-Escudero F, Vogelsang CA, Blauer-Peterson C, Howell EA. Modeling the cost-effectiveness of doula care associated with reductions in preterm birth and cesarean delivery. *Birth*. 2016;43:(1):20-27.
12.Vadnais MA, Hacker MR, Shah NT, Jordan J, Modest AM, Siegel M, Golen TH. Quality improvement initiatives lead to reduction in nulliparous term singleton vertex cesarean delivery rate. *Jt Comm J Qual Patient Saf*. 2017;43(2):53-61.
13.Main EK, Chang SC, Cape V, Sakowski C, Smith H, Vasher J. Safety assessment of a large-scale improvement collaborative to reduce nulliparous cesarean delivery rates. *Obstet Gynecol*. 2019;133(4):613-623.
14.American College of Nurse-Midwives. Reducing primary cesareans. BirthTOOLS website. Birthtools.org/Reducing-Primary-Cesare ans-NEW. Accessed December 18, 2018.
15.DeJoy SA, Burkman RT, Graves BW, et al. Making it work: successful collaborative practice. *Obstet Gynecol*. 2011;118(3):683-686.
16.Javernick JA, Dempsey A. Reducing the primary cesarean birth rate: a quality improvement project. *J Midwifery Womens Health*. 2017;62(4):477-483.
17.Berwick DM, Nolan TW, Whittington J. The triple aim: care, health, and cost. *Health Aff (Millwood)*. 2008;27(3):759-769.
18.Kozhimannil KB, Sommerness S, Rauk P, et al. A perinatal care quality and safety initiative: are there financial rewards for improved quality? *Jt Comm J Qual Patient Saf*. 2013;39(8):339-348.
19.Henke RM, Wier LM, Marder WD, Friedman BS, Wong HS. Geographic variation in cesarean delivery in the United States by payer. *BMC Pregnancy Childbirth*. 2014;14:387.
20.Declercq E, Barger M, Cabral HJ, et al. Maternal outcomes associated with planned primary cesarean births compared with planned vaginal births. *Obstet Gynecol*. 2007;109(3):669-677.
21.Wakeam E, Molina G, Shah N, et al. Variation in the cost of 5 common operations in the United States. *Surgery*. 2017;162(3):592-604.
22.Gilbert SA, Grobman WA, Landon MB, et al; Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. Lifetime cost-effectiveness of trial of labor after cesarean in the United States. *Value Health*. 2013;16(6):953-964.
23.Wymer KM, Shih YC, Plunkett BA. The cost-effectiveness of a trial of labor accrues with multiple subsequent vaginal deliveries. *Am J Obstet Gynecol*. 2014;211(1): 56.e1-56.e12.
24.Grobman WA, Peaceman AM, Socol ML. Cost-effectiveness of elective cesarean delivery after on prior low transverse cesarean. *Obstet Gynecol*. 2000;95(5):745-751.
25.2018 ICD-10 CM and GEMS. Centers for Medicare & Medicaid Services website. https://www.cms.gov/Medicare/Coding/ICD10/2018-ICD-10-CM-and-GEMs.html. Updated August 11, 2017. Accessed December 18, 2018.
26.Hobbs AJ, Mannion CA, McDonald SW, Brockway M, Tough SC. The impact of caesarean section on breastfeeding initiation, duration and difficulties in the first four months postpartum. *BMC Pregnancy Childbirth*. 2016;16:90.
27.Truven Health Analytics. *The Cost of Having a Baby in the United States: Executive Summary Truven Health Analytics Marketscan Study*. Ann Arbor, MI: Truven Health Analytics; 2013. https://transform.childbirthconnection.org/wp-content/uploads/2013/01/Cost-of-Having-a-Baby-Executive-Summary.pdf. Accessed December 18, 2018.
28.Kazandijian VA, Chaulk CP, Ogunbo S, Wicker K. Does a cesarean section delivery always cost more than a vaginal delivery? *J Eval Clin Pract*. 2007;13(1):16-20.
29.Kozhimannil KB, Graves AJ, Ecklund AM, Shah N, Aggarwal R, Snowden JM. Cesarean delivery rates and costs of childbirth in a state Medicaid program after implementation of a blended payment policy. *Med Care*. 2018;56(8):658-664.
30.Transforming Maternity Care Vision Team; Carter MC, Corry M, Delbanco S, et al. 2020 vision for a high-quality, high-value maternity care system. *Womens Health Issues*. 2010;20(suppl 1):S7-S17.