INTRODUCTION

The optimal timing for umbilical cord clamping after the delivery of a baby has been debated for decades. In the middle of the 20th century, early umbilical cord clamping after birth became a standard practice. More recently, it has been determined that delayed cord clamping (DCC), usually defined as at least 30–60 seconds after birth, is beneficial for infants. DCC in preterm neonates is associated with increased hemoglobin and hematocrit levels with a corresponding decreased need for red blood cell transfusions. Furthermore, DCC in preterm babies is linked to a decreased risk of necrotizing enterocolitis and intraventricular hemorrhage. In term neonates, DCC increases hemoglobin levels and iron stores, which may lead to improved developmental outcomes.

In 2014, the World Health Organization recommended umbilical cord clamping greater than 60 seconds after birth for improved maternal and infant health and nutrition outcomes. The 2016 Textbook of Neonatal Resuscitation recommended umbilical cord clamping at 30–60 seconds for most vigorous term and preterm newborns. In January 2017, the American College of Obstetrics and Gynecology (ACOG) also recommended a delay in umbilical cord clamping for 30–60 seconds in vigorous preterm and term infants.

We observed 34 randomly chosen deliveries at our institution before the ACOG recommendation. Only 12% of those umbilical cords were clamped greater than or equal to 30 seconds after delivery. A quality improvement project was designed to rapidly incorporate the ACOG recommendation into the university obstetrical practice’s delivery room protocol at our hospital. The aim was for newborn umbilical cord clamping to take...
place 30 seconds or more after delivery in 80% or more of deliveries on the university obstetrical service within 3 months of our initial meeting.

METHODS
This QI work took place in a university-affiliated regional hospital with approximately 2,600 deliveries annually, of which around 1,000 are typically on the university service. Initially, a total of 34 randomly selected deliveries (baseline), regardless of delivery service, were observed to determine the percentage of deliveries with umbilical cord clamping delayed to 30 seconds or greater. These deliveries were witnessed by medical students who recorded the time from birth to cord clamping. These students did not tell the delivery room personnel they were timing cord clamping.

After determining the current (baseline) DCC rate was 12%, we formed an improvement committee. This committee consisted of a pediatrician, an obstetrician, a pediatric resident, an OB/GYN resident, and 2 medical students. Our AIM statement was umbilical cord clamping which will be performed at greater than or equal to 30 seconds in 80% or more of all deliveries on the university service within 3 months from the time of our initial meeting. We developed key drivers to help achieve the study aim (Fig. 1). The obstetrician on the committee discussed DCC at OB/GYN grand rounds and presented the ACOG recommendations for DCC. These recommendations were also discussed with the delivery room nurses and personnel at shift changes on the hospital’s obstetric unit. The pediatrician reviewed the DCC recommendations with staff neonatologists, including the neonatal intensive care unit medical director. Subsequently, the neonatal intensive care unit medical director informed the neonatal resuscitation team of the cord clamping recommendations. The pediatric resident on the committee discussed the project with the physician champion of the hospital electronic health record (EHR).

Additional changes included an addition to the delivery room note for documentation of cord clamping time. This addition was a statement “the cord was clamped” with a choice of either: (1) greater than or equal to 30 seconds after birth or (2) less than 30 seconds after birth. If choosing less than 30 seconds, an explanation of why the umbilical cord was clamped in less than 30 seconds was allowed in the EHR.

Furthermore, the team placed timers in all the delivery rooms. Immediately after a newborn’s birth, a delivery room nurse would set the timer to alarm in 30 seconds. This alarm signified to the obstetrician that the umbilical cord could be clamped.

Following the implementation of these interventions, which took 6 weeks to complete, the team reviewed cord clamping times on all university service deliveries weekly.

The project was deemed exempt by the hospital’s institutional review board chairman.

RESULTS
The results showed immediate improvement in the percentage of deliveries with DCC after the interventions (Fig. 2). Within 1 week of instituting the interventions, 15 of 16 deliveries (94%) on the university service used DCC. All 6 weeks studied after the interventions met the aim statement goal of 80% or greater rate of DCC. Overall, 65 of 68 (96%) total deliveries incorporated DCC. The last week study was 3 months after the first meeting for this quality improvement project. During that week, 18 of 19 (95%) deliveries involved DCC. The project aim was achieved within 3 months from the time of the initial meeting. Only 1 PDSA cycle was needed to achieve this goal.

The lowest percentage of DCC deliveries occurred in week 5 with 80%. However, there were only 5 deliveries on the university service that week. Only 3 of 68 total deliveries was umbilical cord clamping performed in less than 30 seconds. In all 3 of these deliveries, the obstetrician documented concern for immediate resuscitation for the newborn as the reason for early umbilical cord clamping.

DISCUSSION
After the institution of our interventions, the project aim was rapidly achieved. It took 6 weeks to institute all the quality project interventions and once those tasks were completed, the delayed umbilical cord clamping rate rapidly exceeded 80%, with an overall DCC rate of 96%.

Strength of our project was the involvement and input from various delivery room participants, including obstetric attending physicians, residents, delivery room nurses, and neonatal resuscitation team members. All of these team members were given education regarding DCC. Discussing the project with delivery room personnel at shift changes allowed us to speak directly to most important team members that provide delivery room patient care.

The timing of ACOGs DCC recommendation may have made it easier for us to meet our aim. Our preliminary observation of a 12% DCC rate came before the ACOG recommendation (but after the WHO and Textbook of Neonatal Resuscitation recommendations). We do not know the degree of impact the release of the ACOG recommendation alone would have on DCC rates.

The logical next step at our institution is expanding this project to involve the other delivery services (other than the university service). We are optimistic that this can be achieved relatively easily. Our project’s delivery room personnel are the same personnel involved in all deliveries at our hospital. The only additional step needed for this expansion of DCC would involve the education of nonuniversity obstetricians.

We found no previous quality improvement studies involving DCC in term newborns. However, 2
STUDY AIM

Umbilical Cord Clamping performed at ≥30 seconds in ≥80% of deliveries on university service within 3 months of our meeting

Fig. 1. Key driver diagram. NICU, neonatal intensive care unit.

INTERVENTIONS

- OB discussed benefits of delayed cord clamping at OB grand rounds
- Pediatrician discussed delayed cord clamping recommendations with staff
- Timers were placed in all delivery rooms
- OB discussed delayed cord clamping recommendations with delivery room personnel
- Medical Director of NICU informed neonatal resuscitation team of
- Pediatrics resident discussed modification of delivery room note with physician champion

KEY DRIVERS

- Physician awareness of ACOG guideline
- Staff awareness of ACOG guideline
- Physician and staff buy in
- Documentation of cord clamping times in EHR

Delayed cord clamping rates

Fig. 2. Control chart (p-chart). CL, control limit; LCL, lower control limit; UCL, upper control limit.
previously published studies used quality improvement interventions to incorporate DCC in preterm newborns.\textsuperscript{13,14} One study only evaluated infants weighing less than 1,500 g at birth, and their protocol called for DCC at 60 seconds.\textsuperscript{13} The other study exclusively selected newborns born at less than 34 weeks gestation, and their protocol involved cord clamping at 30 seconds.\textsuperscript{14} Both projects achieved greater than 70% DCC. In contrast, our study included all newborns and our aim was for cord clamping to occur at greater than or equal to 30 seconds after birth.

We believe our improvements are sustainable, and our interventions can be easily instituted at other hospitals. The monetary costs were negligible and limited to purchasing inexpensive timers for the delivery rooms. The other interventions were educational or through a simple modification of the EHR. The simplicity of the interventions and the weight of the ACOG recommendation should lead to DCCs sustainability. Ongoing data collection by periodic chart reviews of umbilical cord clamping times will allow us to determine if subsequent PDSA cycles will need to be implemented.

CONCLUDING SUMMARY

This quality improvement project successfully met the project aim of 80% or greater DCC in all deliveries by the university service at our hospital within 3 months of the initial organizational meeting. The interventions were simple, inexpensive, and we believe they are easily adoptable by other institutions.

DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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