BRIEF REPORT

Improving the Discharge Process for Opioid-Exposed Neonates

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ABSTRACT

OBJECTIVES: Opioid-exposed neonates (OENs) are a population at risk for postdischarge complications. Our objective was to improve completion of a discharge bundle to connect patients with outpatient resources to mitigate postdischarge risks.

METHODS: Team Hope, a hospital-wide initiative to improve the care of OENs, examined the completion of a discharge bundle from September 2017 through February 2019. A complete discharge bundle was defined as referral to a primary care physician, referral to early intervention services, referral to in-home nursing assessment and educational services, referral to the development clinic if diagnosed with neonatal abstinence syndrome, and referral to the gastroenterology or infectious disease clinic if exposed to hepatitis C virus. After obtaining baseline data, simple interventions were employed as education of providers, social workers, and case management; reminder notes in the electronic health record; and biweekly reminders to resident physicians. A statistical process control chart was used to analyze our primary measure, with special cause variation resulting in a shift indicated by 8 consecutive points above or below the mean line.

RESULTS: One hundred nineteen OENs were examined with an initial discharge bundle completion of 2.6% preimplementation. Referral to early intervention services and the development clinic were the least successfully completed elements before intervention implementation. After the development of the discharge bundle in July 2018, special cause variation was achieved, resulting in a mean-line shift with 60.3% now having a complete bundle for 83 OENs.

CONCLUSIONS: We implemented a standardized discharge bundle that improved our discharge processes for OENs.

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Neonatal abstinence syndrome (NAS) is a drug-withdrawal syndrome that some opioid-exposed neonates (OENs) develop shortly after birth. From 2000 to 2014, the incidence of NAS increased from 1.2 to 8.0 per 1000 hospital births in the United States.[1,2] By 2014, 1 infant with the syndrome was born every 15 minutes nationwide, resulting in an estimated $563 million in hospital costs.[1,2] Much of the recent emphasis on the care improvement for OENs focused on standardizing inpatient care processes, with few focusing on improvements in discharge processes.[3–10]

OENs, particularly those diagnosed with NAS, are at risk for immediate postdischarge adverse outcomes, including hospital readmission[11] and emergency department use.[12] Furthermore, these risks may extend beyond the perinatal period because OENs and infants with NAS may be at risk for adverse developmental outcomes.[13–17] The birth hospitalization is an optimal opportunity to connect OENs and their families to postdischarge services that may mitigate adverse outcomes; however, there are no standardized discharge guidelines for this population.

Referrals that are made predischarge from a hospital have been associated with increased show rates at follow-up.[18] For high-risk infants, referrals to early intervention services and development clinics remain underused.[19,20] A centralized process for referrals has been shown to increase use of early intervention and development services[21] and increases the likelihood of accessing these services when compared with outpatient referral alone.[22] Furthermore, when looking at infants with NAS, those discharged to foster care and those with shorter stays had decreased referral and enrollment rates with early intervention services, suggesting that referrals for this target population should be done during the initial birth hospitalization to enhance developmental support.[23] Thus, for a population at risk for developmental concerns, a lack of timely referrals may decrease the likelihood that necessary resources will be accessed.

To address the potential risks to OENs at our center, we sought to improve the care of OENs beyond the initial hospitalization by defining an improved discharge referral process, auditing compliance, and then implementing a discharge bundle using quality-improvement processes.

METHODS

The Monroe Carell Jr. Children's Hospital at Vanderbilt is a freestanding, 267-bed, tertiary-care children's hospital in the United States in a large, urban setting with patient referrals throughout the region and 4600 live births annually. In September 2017, an institution-wide initiative called Team Hope was implemented to improve the care of pregnant women and infants affected by the opioid crisis. Team Hope patients are identified by maternal history of opioid use and maternal or infant toxicology testing. Infants with a gestational age (GA) $<$35 weeks and/or NICU length of stay (LOS) $\geq$5 days were excluded from Team Hope and this study. The GA and LOS criteria were used to exclude OENs who require admission to the NICU for reasons other than management of opioid exposure (eg, respiratory distress and congenital anomalies). Since the inception of Team Hope, OENs have been cared for in the nursery with transfer to the acute-care floor as needed for further management or initiation of pharmacotherapy. Only out-born OENs who are transferred in are cared for in the NICU initially. This project was considered exempt from human subjects review by the Vanderbilt University Medical Center Institutional Review Board.

In an effort to maximize the quality of care for this population beyond the hospital setting, in July 2018, improving Team Hope's discharge process was identified as a target for improvement. A task force of key stakeholders, including providers, social workers, child life specialists, and case managers from the NICU, the pediatric ward, and the special care nursery, was assembled. The task force, through group consensus and clinical opinion, defined a "best practice discharge" for an OEN as consisting of the following: (1) scheduling a follow-up appointment with the primary care physician (PCP) before discharge; (2) referral to home-visiting services; (3) referral to early intervention services; (4) if diagnosed with NAS, referral to the pediatric development clinic; and (5) if exposed to hepatitis C virus (HCV), referral for follow-up with pediatric gastroenterology or the infectious disease clinic for testing of HCV.

To determine Team Hope's baseline adherence to these potentially better practices, the 10 most recent discharges from Team Hope were audited. This review found infrequent adherence to the best practice discharge, and it was therefore expanded to the 50 most recent discharges. After reviewing the initial data, a specific, measurable, applicable, realistic, and timely (SMART) aim and a key driver diagram were formulated (Supplemental Fig 2) in July 2018. A manual, retrospective chart review was then conducted for all Team Hope infants before July 2018 to serve as baseline data. A successfully completed discharge bundle was defined as all elements being completed before discharge, although individual elements were tracked for potential improvement. A series of

TABLE 1 Descriptive Statistics of Patients Meeting Team Hope Criteria

	N = 202
Male sex, % (*n*)	50 (101)
GA, completed wk, median (IQR)	39 (38–39)
Birth wt, g, median (IQR)	3060 (2740–3335)
Singleton, % (*n*)	100 (202)
In-born, % (*n*)	92 (186)
Polysubstance exposure,[a] % (*n*)	40 (80)

Team Hope criteria: positive opioid exposure, GA $\geq$35 weeks, and NICU LOS $<$5 days. IQR, interquartile range.

[a] Opioid plus exposure is defined as maternal or neonatal toxicology testing results that are positive for an opioid and at least 1 result of acetaminophen, amphetamines, barbiturates, benzodiazepines, cocaine, cannabinoids or tetrahydrocannabinol, phencyclidine, or tricyclic antidepressants.

interventions beginning with education of key stakeholders, including providers, residents, social workers, and case managers, was undertaken in September 2018. Additionally, an electronic "sticky note," a reminder of the elements of the discharge bundle, was created on the front page of the patient's electronic health record (EHR) by Team Hope's child life

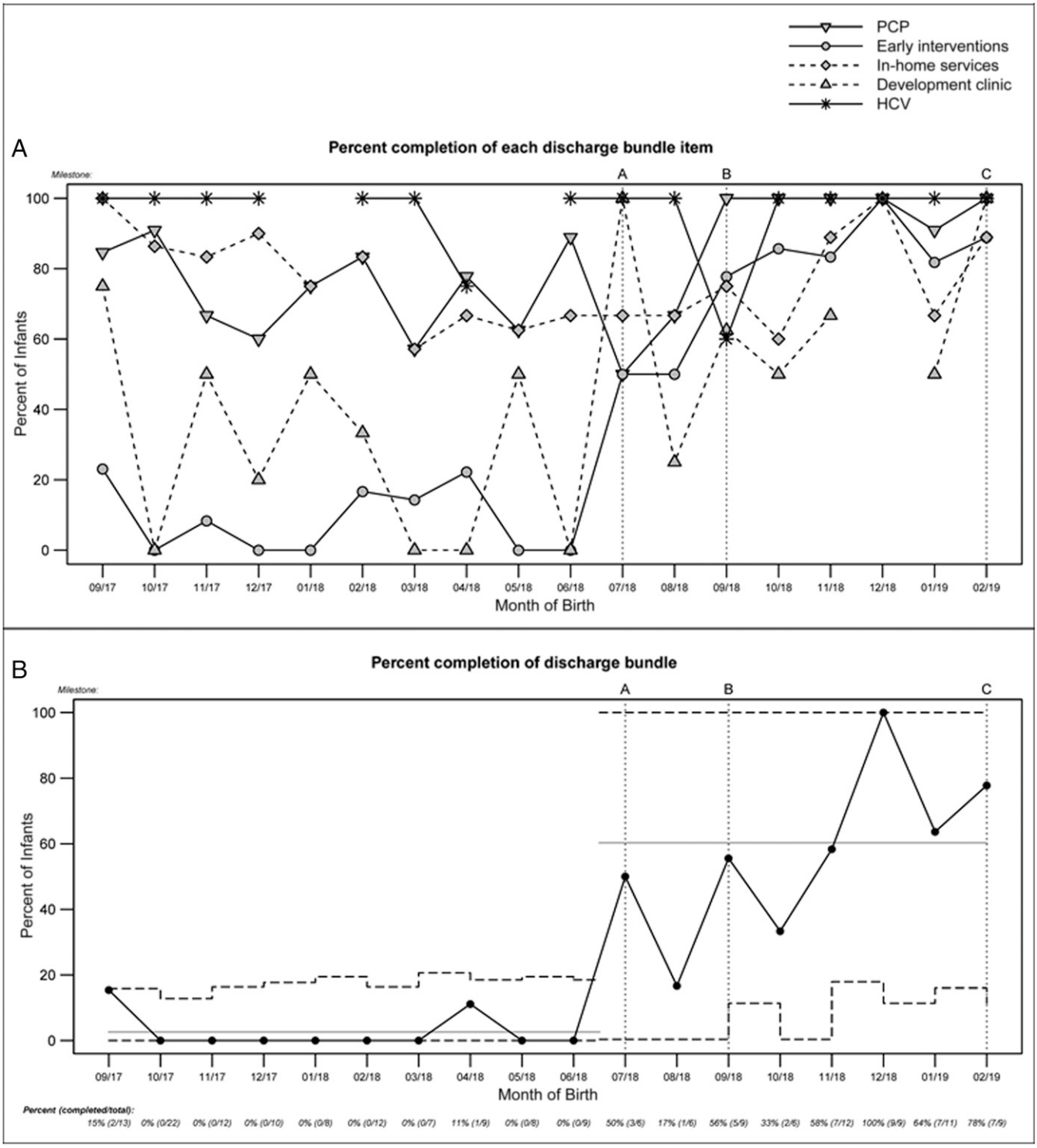

FIGURE 1 Run chart and p-chart for OEN discharge checklist completion by item completion percentage and total completion percentage. "A" indicates the identified discharge checklist; "B" indicates the formalized discharge checklist, resident education, and EHR sticky notes; and "C" indicates resident biweekly reminders. A, Percent completion of each discharge bundle item. B, Percent completion of discharge bundle.

specialist to serve as a guide for the discharge care plan. Starting in February 2019, residents were given biweekly updates on the overall discharge success rate by showing them active run charts at morning report with facilitated discussion on the latest trends to serve as both a reminder and a motivator for improvement.

Data for adherence to the best practice discharge bundle were gathered prospectively after the initiative began, and this was augmented by retrospective medical record review of all Team Hope infants before implementation of the bundle by manual chart review. Data were stratified by hospital location at discharge. Of note, patients with an incomplete record in the EHR, defined as those charts in which the data could not adequately determine if the referrals were made, were excluded from the study to prevent ambiguity in the interpretation of the data. A statistical process control chart (specifically, a p-chart) was used to analyze our primary measure, with special cause variation resulting in a shift indicated by 8 consecutive points above or below the mean line.[24]

RESULTS

Since Team Hope began in September 2017, 202 OENs have met Team Hope criteria (Table 1). One hundred nineteen OENs underwent retrospective chart review for discharge bundle completion prior to any intervention and 83 OENs underwent retrospective chart review for discharge bundle completion after interventions had been initiated. There have been an equal number of male and female patients with a median GA of 39 weeks. Only 8% of the patients were born at outlying hospitals and transferred into our facility, and all patients were singleton born. There were 78 OENs excluded from Team Hope, with 51 of those being due to prematurity (estimated GA <35 weeks), and the remainder were excluded because of comorbidities necessitating NICU care beyond treatment of NAS. Twenty-two records were incomplete, meaning the data from chart review could not adequately determine if the proper referral was made, for PCP identification, whereas 21 and 32 records were incomplete for early intervention services and in-home services, respectively.

At the beginning or our study period, discharge processes were left to the discretion of the outpatient PCP, and the completion of the discharge bundle on the initial birth hospitalization was not an expectation; therefore, initial completion of the discharge bundle was low. The preimplementation chart review revealed a successful completion of the discharge bundle at a baseline rate of 2.6% (Fig 1). The rates were similarly low in both the pediatric ward setting as well as the special care nursery. However, after the first discussion with key stakeholders that generated the elements of the best practice discharge bundle in July 2018 (annotation A, Fig 1), special cause variation was achieved with a point outside the control limits. In September 2018, the key driver was formalized, key stakeholder education was performed, and the sticky note in the EHR began (annotation B, Fig 1), resulting in a mean-line shift to a percentage of 60.3% in the subsequent months. The special care nursery was quicker to adopt and maintain improvement compared with the pediatric ward. In February 2019, to reinforce the discharge plan expectation, residents were reminded of the discharge bundle during morning report by showing real-time run charts reflecting their efforts every 2 weeks (annotation C, Fig 1).

In reviewing individual components of the discharge bundle, the 2 biggest areas for improvement were noted to be referral to early intervention services for all OENs and referral to the pediatric development clinic for infants diagnosed with NAS (Fig 1). Additionally, 56 infants of the 202 total OENs examined had an HCV exposure, and 3 failed to receive a referral for HCV follow-up before discharge. Of the 180 OENs who had a complete medical record in which the accuracy of referral data could be ascertained, 82.8% had a PCP follow-up scheduled before discharge (Table 2).

DISCUSSION

Despite an ongoing, institution-wide initiative to improve the care for OENs, standardized discharge processes were lacking in our institution. Getting buy-in by engaging key stakeholders to generate an improved discharge plan created immediate but transitory improvement in adherence to the discharge bundle. This initial success was not immediately maintained because there were lags in educational rollout to all key stakeholders and care providers. However, formalizing a standardized process and putting in several low-burden, potentially better practices increased completion of the discharge bundle and produced a sustained improvement. Although the interventions were rolled out simultaneously and in a uniform fashion to both the special care nursery and the acute-care floor, the smaller, more homogenous care coordination inherent in our special care nursery versus the more variable setting and coverage of social work and case management in the acute-care floors likely accounted for the difference in time to successful adoption of the discharge bundle. The implementation of several simultaneous interventions in the bundle makes it difficult to attribute process improvement to any single intervention.

Although the extent to which OENs are at risk for developmental delay remains controversial, it is a key area of concern for clinicians. In our institution, referral to the pediatric development clinic and early intervention services were the 2 most deficient categories in our bundle. At the initiation of the project, it was assumed

TABLE 2 Discharge Bundle Completion by Item and Hospital Location at Discharge

	Nursery, *n* of *N* (%)	Acute-Care Floor, *n* of *N* (%)	Combined, *n* of *N* (%)
Primary care appointment	99 of 114 (86.8)	50 of 66 (75.8)	149 of 180 (82.8)
Early intervention	33 of 115 (28.7)	33 of 66 (50)	66 of 181 (36.5)
In-home services[a]	94 of 113 (83.2)	41 of 57 (71.9)	135 of 170 (79.4)
Development clinic[b]	6 of 10 (60)	17 of 44 (38.6)	23 of 54 (42.6)
HCV referral[b]	29 of 31 (93.5)	24 of 25 (96)	53 of 56 (94.6)

[a] Help Us Grow Successfully or Nurses for Newborns or equivalent local service.
[b] Referral to the developmental clinic and HCV occurred only if an infant was eligible.

these referrals were being made by PCPs; however, on review, we found these referrals were being made inconsistently. Completing these referrals during the initial birth hospitalization connects OENs and their families with these vital services. Additionally, although there was a 94.6% success rate for referring all infants with HCV for further appropriate screening, it was deemed unacceptable to miss 1 such patient. This finding in itself has already sparked change at our institution through creating a work list and an internal referral review system to ensure no such infant is missed going forward.

Although the improvement of care for OENs has been a national concern, there are no clear guidelines or discharge bundles in the care of this patient population. Our discharge bundle offers a potential standardized follow-up process. By meeting our proposed discharge bundle, OENs and their families will have consistent referrals to necessary resources, which translate to an ability for those resources to intervene at an earlier age in an at-risk population or provide additional support in the first months of life.

Given the limited amount of published data regarding discharge processes for OENs and the difficulties faced by hospital systems tracking posthospitalization referrals, we believe that other institutions could successfully implement a similar bundle to formalize a discharge process and improve the care for this high-risk patient population. This is a gap in care that needs to be closed and can be done in a simple, low-resource manner by using a standardized discharge bundle.

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