RESEARCH ARTICLE

Parental Refusal of Standard-of-Care Prophylactic Newborn Practices: In One Center's Experience, Many Refuse One but Few Refuse All

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ABSTRACT

OBJECTIVES: Several interventions to reduce neonatal morbidity and mortality are universally recommended: intramuscular (IM) vitamin K (VK), erythromycin ophthalmic prophylaxis, and hepatitis B vaccine for newborns, and maternal pertussis vaccine. Despite robust efficacy and safety evidence, parental refusal of these practices is increasing. We sought to define the current declination rate and characterize the association between declination of 1 intervention and declination of the others.

METHODS: A retrospective cohort study was performed of all inborn singletons admitted to the well newborn nursery over a 12-month period (November 15, 2015 through November 15, 2016) at a large quaternary center.

RESULTS: In total, 3758 infants met inclusion criteria. 25% (n = 921) did not receive at least 1 of the 4 interventions. 13.6% (n = 511) did not receive the hepatitis B vaccine, 2.3% (n = 85) did not receive IM VK, 5.9% (n = 223) did not receive erythromycin, and 7.2% (n = 271) of mothers did not receive the prenatal tetanus, diphtheria, pertussis vaccine. Odds of refusal of IM VK were 6.2 times greater for infants delivered by a certified nurse midwife versus physician (95% confidence interval 3.3–11.6). Pattern of declination was variable; of 921 mother-infant dyads who did not receive at least 1 intervention, only 2 dyads received none of the interventions.

CONCLUSIONS: Our study is one of the first in which patterns of refusal of standard-of-care perinatal practices are characterized. Alarmingly, one-fourth of our cohort did not receive at least 1 core infant health intervention. Our finding of only modest overlap in declination of each intervention carries implications for the development of targeted interventions.

www.hospitalpediatrics.org
DOI:https://doi.org/10.1542/hpeds.2019-0029

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HOSPITAL PEDIATRICS (ISSN Numbers: Print, 2154-1663; Online, 2154-1671).

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: Funding was received from the Charles Woodson Fund for Clinical Research at Michigan Medicine.

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

Dr Danziger conceptualized and designed the study, coordinated and supervised data collection, and drafted the initial manuscript; Drs Skoczylas and Laventhal assisted with conceptualization and design of the study and critically reviewed the analyses and manuscript; and all authors approved the final manuscript as submitted.

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In the United States, several interventions to reduce neonatal morbidity and mortality are universally recommended for newborns after delivery: intramuscular (IM) vitamin K (VK) to prevent VK deficiency bleeding, ophthalmic antibiotic prophylaxis (erythromycin) to prevent gonococcal ophthalmia neonatorum, and hepatitis B vaccine to prevent perinatal transmission of hepatitis B.[1–3] Pregnant women are also recommended to receive pertussis immunization during the third trimester of each pregnancy to reduce incidence of infant pertussis.[4]

Despite a strong record of safety and efficacy for each of these practices, parental refusal of these interventions appears to be rising.[5–8] The reasons for parental declination largely parallel reasons cited in vaccine hesitancy and refusal, including concern about "toxic" ingredients and side effects; desire to avoid "unnatural" and/or painful intervention; and belief that the interventions are unnecessary.[1,5,9–12] As a result, more infants are at risk for developing the outcomes these interventions are intended to prevent, as evidenced by a sentinel case series of 5 infants, all previously healthy and none of whom received VK at birth, who presented with VK deficiency bleeding within an 8-month period.[7,13] While the overall incidence of many of these outcomes is low, each carries a significant risk of morbidity and mortality. For example, the late form of VK deficiency bleeding, which can occur between 2 weeks and 6 months of life, presents primarily with intracranial hemorrhage and carries up to a 22% risk of mortality and 67% risk of adverse neurologic sequelae for survivors.[1,14]

Despite growing concern in the medical and public health community regarding decreasing uptake of many core pediatric public health interventions, and over a decade of scholarly focus on childhood vaccine hesitancy and refusal, no headway has been made. Rates of childhood nonimmunization, which has been shown to be associated with refusal of prophylactic newborn interventions, continues to rise, and the majority of the interventions that have been designed to improve uptake have not been effective.[15–17] The objectives of our study are to quantify the rate of refusal of these 4 core newborn prophylactic practices, and to characterize the pattern of refusal among those mother-infant dyads who refuse at least 1 core intervention, to properly inform future targeted interventions.

METHODS

Study Population

A retrospective cohort study was performed at a single quaternary referral center that offers prenatal care through the departments of obstetrics and gynecology (physicians, certified nurse midwives [CNMs], and nurse practitioners) and family medicine, high-risk obstetrical care, and care for infants up through a level IV NICU. Patients can elect to receive prenatal care from CNMs, obstetricians, or family medicine physicians; unless parents choose otherwise, infants delivered on the CNM or obstetric service are admitted to the pediatric well newborn service, and those delivered on the family medicine service are admitted to the family medicine well newborn service.

All inborn infants delivered between November 15, 2015 and November 15, 2016, were eligible. Exclusion criteria included nonsingleton pregnancy and transfer of the infant at any point during their admission to a service other than the well newborn service, such as the NICU, to avoid medical illness as a potential confounder.

Data were extracted directly from linked mother and infant electronic medical records via institutional custom data extraction software. Initial data extraction was performed by the Data Office for Clinical and Translational Research at the authors' institution; results were manually reviewed by the authors and compared with a subset of study subjects' medical records by an employee of the Data Office. A final, expanded data extraction was performed, and a manual review of a random subset of subjects demonstrated 100% concordance between narrative physician documentation of whether an intervention was administered before hospital discharge, and administration data obtained from medication administration records.

Study Variables

The outcomes of interest were administration, before discharge, of IM VK or oral VK, erythromycin eye ointment, and hepatitis B vaccine, and maternal tetanus, diphtheria, pertussis (Tdap) vaccine in the 3 months before delivery. Independent variables included gestational age at delivery, maternal age, mode of delivery, professional title of the delivering provider (CNM or physician), and inpatient service providing care for the newborn (pediatrics or family medicine well newborn service).

Statistical Analysis

Statistical analysis was performed by using Stata 15.0 (Stata Corp, College Station, TX).[18] All study variables were categorical with the exception of gestational age and maternal age, which were continuous. χ^2 and Fisher's exact tests were performed to determine the association between each outcome measure and independent variable, as well as between the outcome measures themselves. We then conducted multiple logistic regression modeling. The study was approved by the institutional review board.

RESULTS

Three thousand seven hundred and fifty eight infants met inclusion criteria. Table 1 contains descriptive characteristics of the cohort. In total, 921 mother-infant dyads (24.5%) did not receive at least 1 of the 4 perinatal practices studied: IM VK, erythromycin, hepatitis B vaccine, and/or maternal Tdap vaccine. Before newborn nursery discharge, 2.3% of all infants (n = 85) did not receive IM VK, 5.9% (n = 223) did not receive erythromycin prophylaxis, and 13.6% (n = 511) did not receive the hepatitis B vaccine; 7.2% (n = 271) of mothers did not receive a prenatal Tdap vaccine. Twenty-two infants (0.6%) received oral VK before discharge from the newborn nursery.

Figure 1 displays each subset of patients who did not receive a particular intervention, and the percentage of the subset who did receive each other intervention. Of the 85 infants who did not receive IM VK, the majority of infant-mother dyads did receive hepatitis B and Tdap vaccines (82% and 78%), but only 16% received erythromycin eye prophylaxis

TABLE 1 Descriptive Characteristics of the Cohort

Characteristic	
Mean maternal age, mean (SD)	30.1 y (± 5.3 y)
Mean gestational age at delivery, mean (SD)	39 wk 0 d (± 9.1 d)
Delivery mode, % (*n*)	
Vaginal	69.5 (2612)
Cesarean	23.9 (897)
Unknown	6.6 (249)
Delivery provider, % (*n*)	
CNM	11.4 (430)
Physician	81.9 (3077)
Unknown	6.7 (251)
Newborn service, % (*n*)	
Family medicine	13.2 (496)
Pediatrics	86.8 (3262)

(Fig 1). Of the 511 infants who did not receive hepatitis B vaccine, however, the majority of infant-mother dyads did receive each of the other 3 interventions (IM VK 98%, erythromycin 94%, Tdap vaccine 94%) (Fig 1).

χ^2 and Fisher's exact tests demonstrated that infants delivered by CNMs, compared with those delivered by physicians, had a significantly higher rate of refusal of at least 1 intervention (40% CNM versus 22% physician, $P < .001$) and of refusal of each individual intervention (IM VK 7% CNM versus 1.3% physician, $P < .001$; erythromycin 21% CNM versus 2.9% physician, $P < .001$; Tdap 9.5% CNM versus 6.7% physician, $P = .04$), with the exception of hepatitis B vaccine (Table 2). Infants admitted to the family medicine newborn service had a higher rate of refusal of at least 1 intervention but a lower rate of refusal of VK prophylaxis (Table 2).

Multiple logistic regression modeling was performed, including delivery method, gestational age at delivery, delivery provider, maternal age, and newborn service as predictors. Our models showed that for infants delivered by a CNM, the odds of refusal of at least 1 intervention were 2.5 times greater than for infants delivered by a physician (95% confidence interval [CI] 2.0–3.2), whereas the odds of refusal of IM VK were 6.2 times higher for infants delivered by a CNM (95% CI 3.3–11.6) (Supplemental Tables 3 and 4). The previously seen association between newborn service and refusal of at least 1 intervention and refusal of VK became statistically insignificant in these regression models (Supplemental Table 3). As maternal age increased by 1 year, the odds of refusal of at least 1 intervention decreased (odds ratio 0.98, 95% CI 0.97–0.99) (Supplemental Table 3). There was no association between gestational age and intervention refusal.

DISCUSSION

In this sample of over 3600 newborns at a large academic medical center in the midwestern United States, we found that one-fourth of all mother-infant dyads in our cohort did not receive at least 1 of the 4 universal, standard-of-care perinatal prophylactic practices included in our study:

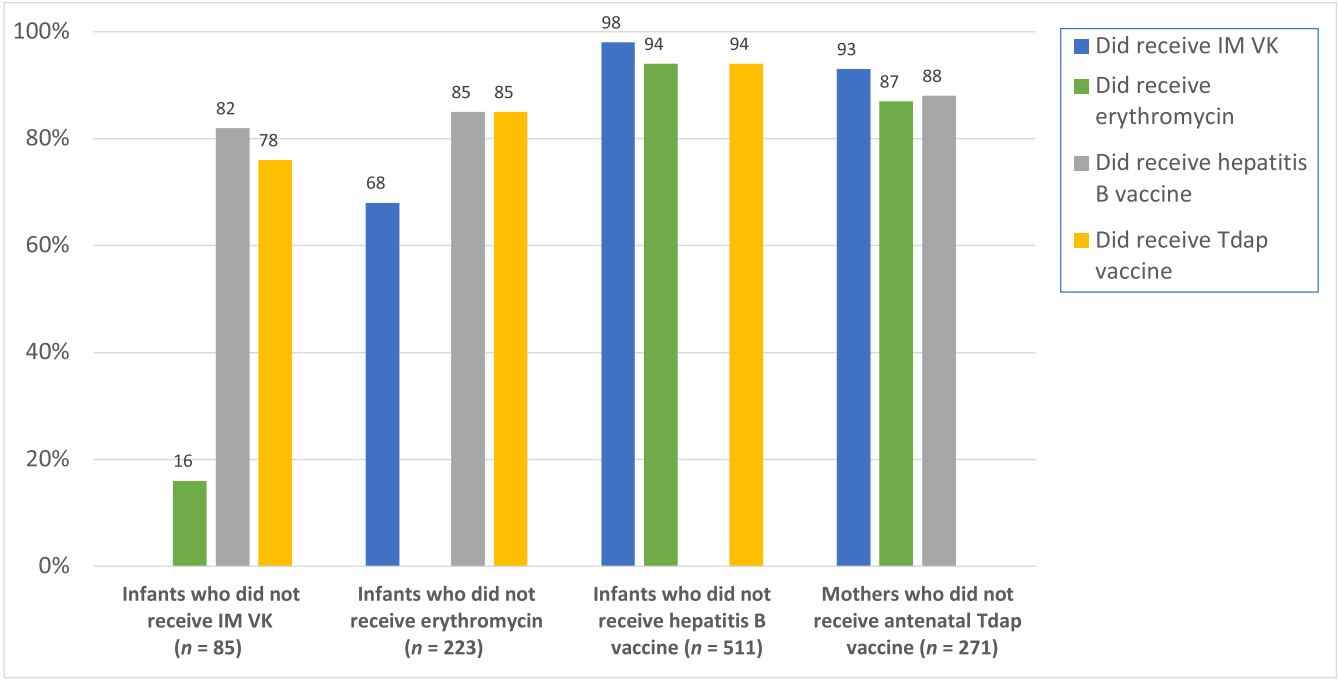

FIGURE 1 Among mother-infant dyads not receiving 1 intervention, percentage receiving the remaining 3 interventions.

TABLE 2 χ^2 and Fisher's Exact Tests

Outcome	CNM, % (*n*)	Physician, % (*n*)	*P*	Pediatrics, % (*n*)	Family Medicine, % (*n*)	*P*
Refusal of at least 1 intervention	40 (171)	22 (674)	<.001	23.8 (772)	30.2 (149)	.002
Refusal of IM VK	7 (30)	1.3 (40)	<.001	2.5 (83)	0.4 (2)	.001
Refusal of any VK	4.2 (18)	1.1 (34)	<.001	1.9 (61)	0.4 (2)	.013
Refusal of erythromycin	21.2 (91)	2.9 (91)	<.001	6.2 (202)	4.2 (21)	.102
Refusal of hepatitis B vaccine	14 (60)	13.6 (419)	.47	13.5 (442)	13.9 (69)	.9
Refusal of maternal Tdap vaccine	9.5 (41)	6.7 (207)	.04	6.2 (202)	13.9 (69)	<.001

VK, ophthalmic erythromycin, birth dose of hepatitis B vaccine, and antenatal maternal pertussis vaccine. Although this finding was driven largely by declination of hepatitis B vaccine, which 13.6% of infants in our cohort did not receive before hospital discharge, our results are particularly concerning in light of previous evidence linking refusal of newborn preventive practices with later refusal of other critical child and public health interventions such as routine childhood vaccination.[15,17] We also found that those families who declined 1 intervention were *not* necessarily more likely to decline the others. This finding carries significant implications for the development of effective, targeted interventions.

The overall rates of refusal identified in our cohort are generally consistent with existing literature. Our overall rate of IM VK declination, 2.3%, is similar to the 3% refusal rate reported in Tennessee but higher than the cumulative 0.5% rate reported by Loyal et al[10] in a network of newborn nurseries in the United States.[11] Our hospital is located in a midsized university city with a highly educated population and a robust community of alternative and nontraditional health providers; in our clinical experience, these local demographic characteristics underlie our relatively high rate of VK prophylaxis refusal. Although it is reassuring that the majority of infants in the United States do receive VK prophylaxis, the baseline incidence of VK deficiency bleeding in the absence of prophylaxis ranges from up to 1.7% for the combined early and classic forms of bleeding to 0.001% for the late form of bleeding, which carries a high risk of significant morbidity and mortality.[14] Thus, even small increases in prophylaxis refusal may translate into clinically significant outcomes for individual infants.

The refusal rate for the birth dose of hepatitis B vaccine in our cohort, 13.6%, is lower than the national rate of 39.2% identified in the 2009 National Immunization Survey.[19] Although many parents and clinicians consider prompt birth dose of hepatitis B vaccine relatively unimportant in the absence of no significant maternal risk factors for transmission, this may be misguided because there are still an estimated 1000 annual cases of perinatal hepatitis B transmission in the setting of many documented gaps in perinatal identification of risk factors and implementation of recommended interventions.[20,21]

The heterogeneity in refusal of interventions among our cohort was an unexpected finding and diverges from other reports of strong association between refusal of all interventions.[9–12] These results highlight the importance of evaluating local and community-specific patterns in uptake and acts as a cautionary tale against one-size-fits-all solutions. Specifically, our finding that the majority of infants in our cohort who did not receive VK prophylaxis did receive hepatitis B vaccine and had mothers who received Tdap vaccine raises the possibility that, at least among certain patients, refusal of VK and ophthalmic prophylaxis may be tied more to parental preferences surrounding the immediate labor and delivery period rather than broader disinclination toward vaccines or preventive practices.

Although our study was not designed for assessment of underlying reasons for refusal of the studied interventions, our results do provide some helpful clues. Our results redemonstrate the previously reported finding that delivery by a midwife rather than a physician is a predictor of refusal of newborn prophylactic practices.[10–12] Mothers in the United States who select delivery by midwives may represent a self-selected group of individuals more inclined toward low intervention in the perinatal period. Our findings add to the existing body of evidence suggesting that interventions focusing on this group of patients and providers may be of highest yield.

Our study is limited by its single center retrospective design and time period, which precludes evaluation of longitudinal trends and does not allow for generalizability. Our study is also limited by lack of additional demographic or clinical information about mother-infant dyads such as maternal race and/or ethnicity or infant feeding method, which may be associated with intervention refusal, as well as exclusion of multiple gestation pregnancies. Our data do not include postdischarge information about the infants, such as whether administration of any of the interventions occurred after discharge in the outpatient setting or during potential hospital readmissions, although it is important to note that VK is not readily available in most outpatient clinic settings in the United States.

Nevertheless, our findings represent an important addition to the currently sparse data available addressing declination of these core infant preventive health measures. Our study reaffirms that the refusal of safe and efficacious interventions that prevent serious, potentially fatal outcomes is occurring at rates that carry real implications for the health of American infants and lays important groundwork for future research and quality improvement initiatives, such as the development of

thoughtful, location-specific, evidence-based interventions to improve uptake of these core public health measures.

ACKNOWLEDGMENTS

The authors acknowledge Shayamala Nagaraj, PhD, Consulting for Statistics, Computing and Analytics Research, University of Michigan; and the Charles Woodson Fund for Clinical Research, Michigan Medicine.

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Hospital Pediatrics 2019;9;429
DOI: 10.1542/hpeds.2019-0029 originally published online May 6, 2019;

Hospital Pediatrics®

AN OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

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