Higher neonatal morbidity after routine early hospital discharge: Are we sending newborns home too early?

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Abstract

Background: A growing body of evidence suggests that the trend toward earlier discharge may affect newborn morbidity. The authors assessed how hospital readmission rates were affected by a clinical guideline aimed at discharging newborns from hospital 24 hours after birth.

Method: A retrospective before–after cohort study was conducted involving 7009 infants born by uncomplicated vaginal delivery at a large level II hospital in Toronto between Dec. 31, 1993, and Sept. 29, 1997. The primary outcome was a comparison of the rate of hospital readmission among newborns before (5936 infants) and after (1073 infants) the early-discharge policy was implemented (Apr. 1, 1997). The causes for readmission were secondary outcomes.

Results: Before the early-discharge guideline was implemented, the mean length of stay declined from 2.25 days (95% confidence interval [CI] 2.18–2.32) to 1.88 days (95% CI 1.84–1.92) ($p < 0.001$). After implementation there was a further decline, to 1.62 days (95% CI 1.56–1.67) ($p < 0.001$). A total of 126 infants (11.7%) in the early-discharge cohort required readmission by 1 month, as compared with 396 infants (6.7%) in the preguideline cohort (odds ratio 1.86, 95% CI 1.51–2.30). The main reason for early readmission was neonatal jaundice, with a higher rate among infants in the early-discharge cohort than among those in the preguideline cohort (8.6% v. 3.1%; odds ratio 2.96, 95% CI 2.29–3.84).

Interpretation: Decreases in newborn length of stay may result in substantial increases in morbidity. Careful consideration is needed to establish whether a reduction in length of stay to less than 24 to 36 hours is harmful to babies.

There has been a progressive move toward early discharge of newborns following uncomplicated vaginal delivery.[1] This behaviour reflects a change in attitude toward childbirth and outpatient care as well as declining fiscal resources. Furthermore, childbirth has been "demedicalized" and viewed as a natural process requiring minimal medical intervention if the delivery is uncomplicated. The establishment of out-of-hospital birthing centres and of midwifery programs are examples of this change. The medical community has further responded by decreasing the use of cesarean delivery and mandatory length of stay in hospital. As recently as the late 1980s, a stay of 4 to 6 days was not uncommon for women and their newborns.[1,2] Observational data from 1984 to 1995 confirm a trend toward earlier hospital discharge,[1] specifically within 48 hours after birth. In a joint statement published in 1996 the Canadian Paediatric Society and the Society of Obstetricians and Gynaecologists of Canada recommended that 12 to 48 hours of hospital stay is adequate for women and their newborns in the absence of maternal or neonatal illness or a lack of social supports.[3]

The American Academy of Pediatrics has expressed concern about early discharge and has developed guidelines emphasizing that early discharge be individualized and that stringent discharge criteria be used.[4] Such criteria aim to avoid the most common complications, namely, neonatal hyperbilirubinemia, sepsis and dehydration.[5] Other concerns include loss of follow-up of newborns with abnormal results of screening tests.[6]

The demand by practitioners and policy-makers for evidence-based and outcomes-based research has not produced a definitive answer to the question of

Evidence

Études

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length of stay.[7] Results from the 2 largest studies addressing the consequences of early discharge were published in July 1997.[8,9] Unfortunately the authors of these well-designed population-based studies arrived at apparently contradictory conclusions. Both studies also failed to describe the type of follow-up care that was available to the women. There is evidence that the type of follow-up and the type of caregiver support play an important part in morbidity.[10–12] At least 2 infant deaths have been attributed to early discharge without adequate follow-up.[13] Thus, clinicians continue to discharge patients earlier, uncertain of the consequences of their actions.

There are numerous publications documenting the success of clinical guidelines in reducing the length of stay for specific adult conditions.[14,15] Scarborough General Hospital, Toronto, was found to have one of the longest neonatal lengths of stay among its peer hospitals (Tina Mulvenna, Health Data Resource Manager, Scarborough General Hospital, Toronto: personal communication, 1998). In response, a clinical guideline was developed for the hospital using evidence-based techniques, with the aim of discharging newborns by 24 hours after delivery. However, a recent systematic review suggested that the implementation of guidelines does not necessarily lead to an improvement in clinical outcome.[16] Thus, we attempted to address this controversy with the following questions: Did the practice guideline, aimed at reducing the length of stay for neonates, actually accomplish this goal? Did the rate of readmission for newborns change with hospital length of stay? What were the main causes for readmission?

Methods

This study was a retrospective before–after cohort analysis of all uncomplicated vaginal deliveries at the Scarborough General Hospital. The primary outcome was the newborn readmission rate, defined as any readmission within 1 month after discharge. The reason for readmission was obtained from the *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM) codes[17] assigned at discharge. The length of stay was defined as the calendar admission date minus the calendar discharge date. If the patient was discharged on the same day as admission, this exception was coded as 1 calendar day. Thus, the minimum length of stay was 1 day.

All singleton neonates born by uncomplicated vaginal delivery at the hospital between Dec. 31, 1993, and Sept. 29, 1997, were included. The hospital provides level II obstetric care in an urban setting, with 2000 to 3000 births per year. We used site data prepared for the Canadian Institute for Health Information to ensure identification of all eligible subjects. Case-mix group (CMG) coding was then used to abstract uncomplicated vaginal births. The following codes were used: "vaginal delivery with sterilization procedure" (CMG code 606), "vaginal delivery with minor procedure" (CMG code 607), "vaginal delivery after cesarean delivery" (CMG code 610) and "vaginal delivery without other diagnosis" (CMG code 611).

An interdisciplinary study group consisting of an obstetrician-gynecologist, an expert in clinical pathways, a layperson, a social worker and a nurse developed the early-discharge guideline. Laboratory medicine, pediatric and home-care experts were also consulted. The guideline, which was implemented on Apr. 1, 1997, specified the frequency of monitoring, procedures, medications, nutritional intake, activity level, education, consultations and tests, represented in terms of the time after birth. Discharge was permitted if the parent(s) demonstrated knowledge of proper breast-feeding or bottle-feeding techniques, were able to safely perform infant care, were aware of the proper use of an infant car seat, were aware of physical and emotional changes (e.g., mood swings) in the woman and were aware of the need to attend follow-up appointments, and if the mother was able to perform self-care. Compliance with procedures was ensured by regular review of individual cases and direct discussions with staff regarding incorrectly assigned patients.

A postpartum clinic visit at 72 hours was available for all women after discharge. The clinic appointment was made before discharge, and the attendance rate was greater than 90%. The visit comprised a consultation with both a nurse lactation specialist and a pediatrician. A copy of the visit note was forwarded to the primary care physician. A home visit by a nurse was also available within 3 hours of a telephone call by the parent(s).

We analysed dichotomous outcomes using a crude odds ratio (OR). An unpaired *t*-test was used to analyse continuous data (e.g., length of stay). We analysed the change in length of stay over time with one-way analysis of variance. To determine at which period the difference in length of stay was statistically different, we performed a post hoc analysis using Tukey's honestly significant difference test. The change in newborn readmission rate over time was evaluated using the χ^2 test between 2 periods. A 2-sided p value of 0.05 or less defined statistical significance.

Results

A total of 7009 infants were included in the study, 5936 in the period before the guideline was implemented and 1073 in the period after implementation. The 2 groups were comparable in mean maternal age (27.8 [standard deviation 5.5] years and 28.5 [standard deviation 5.5] years respectively).

There was a decrease in length of stay before the guideline was implemented (Fig. 1). Specifically, between Dec. 31,

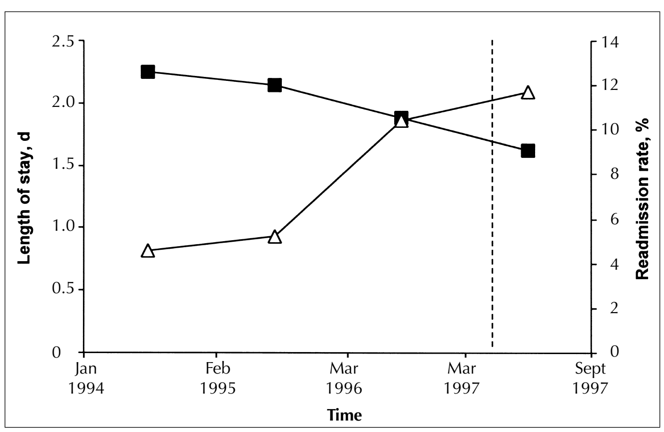

Fig. 1: Lengths of stay (n) and hospital readmission rates ( ) among 7009 infants born by uncomplicated vaginal delivery at a large level II hospital in Toronto between Dec. 31, 1993, and Sept. 29, 1997. Dashed line indicates implementation of early-discharge guideline (April 1997).

1993, and Jan. 31, 1995, the mean length of stay was 2.25 days (95% confidence interval [CI] 2.18–2.32), between Feb. 1, 1995, and Feb. 29, 1996, it fell to 2.14 days (95% CI 2.09–2.19), and between Mar. 1, 1996, and Mar. 31, 1997, it was 1.88 days (95% CI 1.84–1.92). In the period after the guideline was implemented (Apr. 1 to Sept. 29, 1997) the mean length of stay further declined to 1.62 days (95% CI 1.56–1.67). Analysis of variance showed a significant decline in length of stay across all periods ($p < 0.001$). The post hoc analysis revealed that this decline was apparent both before and after implementation of the guideline ($p < 0.05$).

The primary end point, the newborn readmission rate, was significantly higher after the early-discharge guideline was implemented ($p < 0.001$). However, there was a significant background increase in the readmission rate before implementation (Fig. 1). Specifically, between Dec. 31, 1993, and Mar. 31, 1997, the rate rose from 4.8% to 10.4% ($p < 0.001$). After the guideline was in effect, the readmission rate was 11.7%.

The overall readmission rate before implementation of the guideline was 6.7%, as compared with 11.7% after implementation (OR 1.86, 95% CI 1.51–2.30) (Table 1). In the early-discharge cohort most of the readmissions occurred within 7 days after discharge; relatively fewer were observed during the first week after discharge among the preguideline cohort (10.9% v. 4.7%; OR 2.48, 95% CI

Table 1: Risk for newborn readmission among neonates discharged from hospital before and after an early-discharge guideline was implemented

Outcome	Group: Preguideline *n = 5936*	Group: Postguideline *n = 1073*	Odds ratio (and 95% CI) for readmission
Mean no. of days initially in hospital (and 95% CI)	2.10 (2.06–2.13)	1.62 (1.56–1.67)	–
Total no. (and %) of readmissions up to 30 days after discharge	396 (6.7)	126 (11.7)	1.86 (1.51–2.30)
No. (and %) of readmissions from days 1 to 7 after discharge	279 (4.7)	117 (10.9)	2.48 (1.98–3.11)
No. (and %) of readmissions from days 8 to 30 after discharge	117 (2.0)* 117/5657 (2.1)†	9 (0.84)* 9/956 (0.94)†	0.42 (0.21–0.83)* 0.45 (0.23–0.89)†

Note: CI = confidence interval.
*Includes all patients in the study.
†Excludes patients who were readmitted from days 1 to 7.

Table 2: Cause for newborn readmission, according to period after initial discharge

Cause for readmission	Period after initial discharge, d	No. (and %) of readmissions before guideline implemented	No. (and %) of readmissions after guideline implemented	Odds ratio (and 95% CI) for readmission
Jaundice	1–7	177 (3.0)	92 (8.6)	3.05 (2.35–3.96)
	8–30	5 (0.08)	0	0.50 (0.03–9.09)
	1–30	182 (3.1)	92 (8.6)	2.96 (2.29–3.84)
Anatomic or metabolic	1–7	44 (0.74)	18 (1.7)	2.28 (1.32–3.97)
	8–30	32 (0.54)	3 (0.28)	0.52 (0.16–1.69)
	1–30	76 (1.3)	21 (2.0)	1.54 (0.95–2.51)
Feeding related	1–7	23 (0.39)	2 (0.19)	0.48 (0.11–2.04)
	8–30	12 (0.20)	1 (0.09)	0.46 (0.06–3.55)
	1–30	35 (0.59)	3 (0.28)	0.47 (0.15–1.54)
Infectious or respiratory	1–7	22 (0.37)	2 (0.19)	0.50 (0.12–2.14)
	8–30	56 (0.94)	5 (0.46)	0.49 (0.20–1.23)
	1–30	78 (1.3)	7 (0.65)	0.49 (0.23–1.07)
Other	1–7	13 (0.22)	3 (0.28)	1.28 (0.36–4.49)
	8–30	12 (0.20)	0	0.22 (0.01–3.73)
	1–30	25 (0.42)	3 (0.28)	0.66 (0.20–2.20)
Total	1–7	279 (4.7)	117 (10.9)	2.48 (1.98–3.11)
	8–30	117 (2.0)	9 (0.84)	0.42 (0.21–0.83)
	1–30	396 (6.7)	126 (11.7)	1.86 (1.51–2.30)

1.98–3.11). Conversely, during the period from 8 to 30 days after discharge, fewer infants in the early-discharge cohort than in the preguideline cohort were readmitted (0.84% v. 2.0%; OR 0.42, 95% CI 0.21–0.83).

The primary reason for readmission was neonatal jaundice, with a higher rate among infants in the early-discharge cohort than among those in the preguideline cohort (8.6% v. 3.1%; OR 2.96, 95% CI 2.29–3.84) (Table 2). Anatomic and metabolic causes were more common among infants discharged home early and readmitted within 7 days (OR 2.28, 95% CI 1.32–3.97). No other factors measured were significantly associated with readmission. We did not have follow-up data on illness or death among the infants beyond 30 days; however, there were no deaths in the early-discharge group during the 30 days following birth.

Interpretation

After extensive review of the pediatric literature, Britton and colleagues[18] found 8 studies dealing with early discharge and subsequent readmission. Only 2 studies had sufficient power to detect a change in readmission risk of 50% or more, and only 3 were methodologically sound. One publication, involving 1997 subjects,[19] showed a difference in the readmission rates similar to that in our study. However, the population studied consisted of women with low incomes who were followed for only 1 week after discharge. Since such a short interval may introduce bias, we chose a 30-day assessment for our study. We found that infants who were discharged early and were readmitted were generally readmitted within the first week, yet the relative number of subsequent readmissions declined thereafter. This trend may have been due to readily accessible, free health care, with earlier identification of certain problems (e.g., neonatal jaundice) and prevention of later complications (e.g., feeding problems and sepsis). Alternatively, the readmission rate during the first week may have been lower in the preguideline group than in the early-discharge group because a greater portion of that time was spent in hospital immediately after birth.

Although our study and that of Simon and associates[20] have shown that an early-discharge program may reduce length of stay, trend analysis reveals that there was a background progression to shorter length of stay well before any guidelines were formally implemented.[1,2,13] Thus, we cannot determine the degree to which the current guideline influenced the declining length of stay, but question what other factors were already in place that influenced physician and hospital discharge practice.[1,2]

As in our study, Liu and collaborators[9] observed a higher rate of readmission among healthy newborns discharged from hospital less than 30 hours after birth than among those discharged after 30 hours (adjusted OR 1.22, 95% CI 1.06–1.41). Edmonson and coworkers[8] found a nonsignificant trend for higher readmission among infants discharged within 48 hours than among those discharged after 48 hours (adjusted OR 1.05, 95% CI 0.71–1.53), although their study was considerably underpowered.[21]

Consistent with earlier studies,[5,7,13,22] we found that jaundice accounted for most readmissions. Other investigators have suggested that complications of early discharge would manifest principally as feeding-related problems that may be prevented with a longer stay.[9,23] However, our findings confirm the most recent population-based data[8] that the rate of feeding-related problems is not increased. One explanation for this disparity may be the degree of inpatient and outpatient support and training that was offered by our hospital. A more worrisome explanation is that there were unmeasured complications that a longer stay prevented. The identification of these variables should be a primary area of research.

There are several limitations to our study. Readmissions to other hospitals after initial discharge were not included in our data set. However, we see no reason why there would be a sizeable difference between the early- and late-discharge groups. Furthermore, we had few data on individual maternal or neonatal risk factors that might otherwise explain why some newborns required readmission. Similarly, we were not equipped to demonstrate equivalence of the 2 groups according to other factors, such as maternal education, income and parity. Finally, our study was large enough to detect differences in rates of neonatal illness but not rare events like neonatal death.

From our study, one question remains: What is the optimal length of stay that will minimize cost while maintaining (or even improving) quality of care? Previous studies have suggested that a difference of 1 to 2 days can make a substantial difference.[21] Lee and colleagues[13] found that with a decrease in length of stay from 4.5 to 2.7 days, there was an associated increase in the rate of hospital readmission, from 2.3% to 3.0%. Yet, in our study, a smaller change in length of stay, from 2.1 to 1.9 days, was associated with a more substantial rise in the readmission rate, from 5.2% to 10.4%. Hence, our findings support the notion that we may be practising on the steep part of the length-of-stay curve.[1,13] At this point, small decreases in length of stay may result in significant increases in morbidity. Studies that may help policy-makers and clinicians to arrive at a reasonable figure for length of stay are needed.

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