Abstract

Purpose. To determine whether there was a relationship between postpartum psychosocial support from healthcare providers and the rate of normal newborn readmissions (NNRs), and whether there was a cost benefit to justify an intervention.

Study Design and Methods. Data were abstracted for all normal newborn births from 1999 to 2006 (N = 14,786) at a community hospital in southern California at three different time periods: (1) at baseline prior to any intervention (1999–2000), (2) the 4 years during the comprehensive psychosocial support intervention (2001–2004), and (3) the 2 years during a limited psychosocial support intervention (2004–2006). A cost–benefit analysis was performed to analyze whether the financial benefits from the intervention matched or exceeded the costs for NNRs.

Results. There was a significantly lower readmission rate of 1.0% (p < .001) during the comprehensive intervention time period compared to baseline (2.3%) or to the limited intervention time period (2.3%). Although there was no significant difference in the average cost per newborn readmitted across the three study time periods, during the comprehensive intervention time period the average costs of a NNR were significantly lower ($4,180, p = .041) for the intervention group compared to those who received no intervention ($5,338). There was a cost benefit of $513,540 due to fewer readmissions during the comprehensive time period, but it did not exceed the cost of the intervention.

Clinical Implications. Providing comprehensive follow-up for new mothers in the postpartum period can reduce NNRs, thus lowering the average newborn readmission costs for those who receive psychosocial support. Followup for new mothers should be an accepted norm rather than the exception in postpartum care, but NNRs should not be considered the sole outcome in such programs.

Key Words: Postpartum follow-up; Social support; Newborn readmissions; Cost benefit.
Introduction

With the current economic realities facing healthcare, effective and comprehensive maternity care is becoming an increasingly difficult challenge for birthing hospitals (Borger, 2006). Currently there are over four million births per year in the United States (Martin et al., 2009), making childbirth the most common cause of hospitalization (Paul, Phillips, Widome, & Hollenbeak, 2004). These hospitalizations come at a significant cost, and attempts to reduce these costs have resulted in numerous efforts over the past two decades aimed at reducing postpartum length of stay. Shortened hospitalizations for mothers and infants have now become a trend in the healthcare industry, with women and their infants being discharged as soon as 24 hours after giving birth, leading to what some consider a lack of proper postpartum care (Gailbraith, Egerter, Marchi, Chavez, & Braveman, 2003; Stark & Lannon, 2009). Another issue causing increasing costs for maternal newborn care is newborn hospital readmissions, the most common cause of which is neonatal jaundice. Studies have found, however, that follow-up care 48 to 96 hours after initial mothers and their newborns are discharged from the hospital can provide an effective means of reducing jaundice by reinforcing breastfeeding practices (Blackwell, 2003; Gale, Seidman & Stevenson, 2001; Geiger, Petitti, & Yao, 2001; Goulet et al., 2007).

Researchers have predominantly focused on the importance of routine postpartum care following early discharge. Less attention has been given to recommendations or support for health-promoting activities for the mother and infant, or the development of service systems that provide social as well as health-focused services (Galbraith, Egerter, Marchi, Chavez, & Braveman, 2003). Research, policy, and legislation have concentrated primarily on the number of hours of postpartum hospital stay, rather than on the needs of the mother and newborn, or on the content and quality of the care they receive. This focus reflects limitations to the measures of effectiveness and quality of postpartum programs. We were interested in testing models of psychosocial support and their effects on normal newborn readmission (NNR) rates, and also examining the cost benefit of such models.

We examined normal newborn readmission rates for two different levels of psychosocial support by healthcare providers during the postpartum period and compared them to a baseline rate.

Intervention and Design

Design

We examined NNR rates for time periods involving two different levels of psychosocial support by healthcare providers during the postpartum period and compared them to a baseline rate. Table 1 details the services offered in both the comprehensive and limited interventions.

A cost–benefit analysis was performed to compare the costs of the intervention to the costs for NNRs. The costs of the comprehensive and limited interventions quantified whether the cost per patient enrolled in the intervention equated to a savings in healthcare dollars in terms of readmission costs.

This study relied on an interrupted time series design with a partial reversal of the intervention utilizing a retrospective analysis of a secondary dataset of NNRs at a community hospital. The analyses involved comparisons across three time periods: (1) baseline, the fiscal year prior to the onset of a psychosocial intervention for mothers and babies (1999–2000); (2) comprehensive, the 4 fiscal years during which the comprehensive intervention was offered (2000–2004); and (3) limited, the 2 fiscal years during which the limited intervention was offered (2004–2006). The data provided by the hospital finance department were summarized in fiscal years July 1 to June 30, to coordinate with the funding cycle of the grant and make appropriate cost comparisons across the study time periods.

Setting

The data were abstracted from the Family Care Center (FCC) program located in a private not-for-profit hospital. The FCC was created in the Maternity Department in response to a higher than expected newborn readmission rate of 2.9% in 1998 (94 normal newborn readmits per 3,572 births), shorter maternity hospitalizations (less than 24 hours for vaginal births), and a lack of hospital-based postpartum follow-up. The comprehensive psychosocial support program, referred to as the “comprehensive intervention,” offered support to new families in the form of developmental assessment and intervention, breastfeeding, infant and toddler nutrition, health promotion and education, and referrals to appropriate agencies when indicated. Overall utilization of the support services during the comprehensive time period was 30% of the births, but during the last year of the comprehensive intervention the utilization rate reached 46%.
In 2004, when funding was significantly reduced, a limited intervention consisting of breastfeeding support was sustained through the hospital and other grant funding. This intervention was staffed with registered nurses and lactation educators and offered support three mornings per week with no appointments necessary. Social support came primarily through other mothers visiting the center, with limited psychosocial support from healthcare providers. Mothers received lactation support in group settings, which limited the father’s involvement. In this study, this is termed the “limited” intervention, meaning limited psychosocial support. The overall utilization rate for the limited intervention was 50% with an increased utilization of 62% in 2006. The increased utilization rate for the limited intervention was most likely due to an overall acceptance of the program by hospital physicians.

Participants
Participants included normal newborn births labeled with a Diagnosis-Related Group of 391 and classified as a normal newborn from July 1, 1999 through June 30, 2006. Data from births ≤36 weeks gestation or newborns admitted to the Neonatal Intensive Care Unit following birth were excluded from the study, and thus not included in the newborn readmission rates. NNRs are defined as a newborn being readmitted into the hospital in which they were born within 28 days of birth (California Office of Statewide Health Planning and Development, 2002).

Data Collection and Abstraction
Live birth and NNR data were abstracted from the database collected by the hospital’s finance department and from the FCC database. Additional demographic characteristics of the mother and newborn were only available for the limited intervention time period and were abstracted from the FCC database to determine whether there were differences between those who participated in the intervention during that study period and those who did not. Comparable data for baseline and the comprehensive time period were not available because demographic data were not collected on all deliveries prior to 2004.

Data Analyses
Newborn readmission rates during the baseline period were compared to the newborn readmissions during the comprehensive and the limited intervention time periods. The analyses included 14,786 eligible births across the three groups. The baseline group prior to any intervention (1999–2000) included 2,738 births; the comprehensive intervention group (2001–2004) included 8,288 births with an average of 1,893 births per year, and the limited intervention (2004–2006) consisted of 3,760 births with an average of 1,880 births per year. One NNR in the comprehensive time period was deleted from the analyses due to a missing charge for NNRs. Given the sample size at baseline of 2,738 and a readmission rate of 2.3%, compared to 1.0% during the comprehensive time period, we had 85% power to detect a significant difference at $p = .05$ and 95% power to detect a difference between comprehensive and limited time periods, based on a sample size of 3,760 (for the limited time periods). Within each of the two intervention time periods, $\chi^2$ analyses were conducted to determine whether the NNR rates were lower for mothers who received the intervention compared to those who did not. The utilization patterns for the intervention were also calculated for each year to examine if there were variations and account for start-up times for each intervention.

A two-way ANOVA was performed to identify whether there was a statistically significant difference in the average cost per NNR across the three study time periods (baseline, comprehensive, and limited) and for those who did versus did not receive the intervention. The cost–benefit analysis computed the total costs of the program and compared them to any benefits seen for reduced NNR charges for the

<table>
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<tr>
<th>Table 1. Description of Postpartum Interventions at Two Time Periods</th>
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<td><strong>Services provided</strong></td>
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<td>Telephone follow-up 24–48 hours following discharge</td>
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<td>Walk-in breastfeeding clinics</td>
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intervention study periods. Figures were not adjusted for inflation because the numbers utilized in the analysis were actual costs. The cost benefit of the reduced charges in NNRs were calculated by using the 1.3% reduction in the NNRs during the comprehensive intervention, compared to base-

\[
\text{Cost savings} = \text{reduction in NNR (1.3\%)} \times \text{normal births during the comprehensive time period (8,288)} \times \text{average cost of NNR ($4,755)}
\]

Thus, the equation used was \( \text{reduction in NNR (1.3\%)} \times \text{normal births during the comprehensive time period (8,288)} \times \text{average cost of NNR ($4,755)} \) = [cost savings ($513,540)]. During the limited intervention there were no reductions in newborn readmissions; therefore, no cost–benefit calculations were performed.

### Results

#### Demographics

Table 2 displays the demographic characteristics for those receiving the limited intervention and those who did not. The detailed demographic data for births only became available during the limited intervention. The utilization of the comprehensive intervention may have different characteristics due to the program targeting mothers with social risk factors, not just those in need of breastfeeding support, but this cannot be verified given the lack of demographic data for that group.

The mean age of mothers was 29 years. The mothers receiving the limited intervention were more likely to be White, speak English as their primary language, breastfeed, be nonsmokers, and have less than two previous pregnancies or births \((p < .001)\).

#### Readmissions

During the comprehensive intervention time period, newborns were less likely to be readmitted (1.0%) than during the limited intervention (2.3%) or at baseline (2.3%) \((p < .001)\). The decrease from 2.3% (baseline) to 1.0%
(comprehensive) represents a 55% reduction in NNRs. There was no significant difference in the readmission rate between baseline (2.3%) and the limited intervention (2.3%) time periods. The differences in NNR rates for those who received the intervention and those who did not within the limited and comprehensive time periods was not significant. The comprehensive intervention had a readmission rate of 1.0% for those who received the intervention while the rate for those who did not receive the intervention was 0.9%. During the limited intervention, those receiving the intervention had a readmission rate of 2.6%, whereas those not receiving the intervention had a rate of 1.9%.

As shown in Table 3, those in the comprehensive group who received the intervention were significantly less likely to be readmitted more than once (0.0%) compared to those who did not receive the intervention in the same time period (24.9%, \( p = .021 \)). In contrast, the individuals who received the limited intervention were significantly more likely to be readmitted more than once (26.0%) compared to those who did not receive the intervention (8.6%, \( p = .003 \)). The baseline rate for those being readmitted more than once was 19%.

**Costs**

Table 4 shows the costs and charges affiliated with NNRs. As there were 8,288 patients during the comprehensive time period, it was projected that the comprehensive intervention reduced the total number of newborn readmissions by 108 \( (8,288 \times 1.3\%) \). A reduction of 108 newborn readmissions with an average NNR cost during the comprehensive study period of $4,755 resulted in a savings of $513,540. However, $2,959,000 ($1,183,600 for the first 28 days postpartum), was spent on the intervention over the 4 years; thus, no overall cost reduction was achieved in NNRs.

There was no significant difference in the average cost per newborn readmitted across the three study time periods. The two-way ANOVA comparing the average costs per newborn readmission across all three time periods showed a significant interaction \( (p = .04) \) across limited and comprehensive time periods and whether or not the individual received the intervention. The average costs of NNRs for those receiving the intervention in the comprehensive time period was significantly lower ($4,181) compared to those not receiving the intervention ($5,328), indicating that the newborns of mothers who received the intervention had fewer charges on average than those who did not. The average costs of NNRs for those receiving the intervention during the limited time period was $4,845 compared to those not receiving the intervention ($3,785).

**Clinical Implications**

The results of this study show a positive relationship between providing comprehensive psychosocial support as part of a postpartum program and fewer readmissions among healthy infants. Providing comprehensive follow-up for new mothers after the birth of their babies is a critical component of maternity care and should be an accepted norm rather than the exception. Readmission rates during the comprehensive time period decreased overall, not just among those who officially received the intervention. During the comprehensive time period a continuum of care was created within the entire maternity service line. The mother may not have officially received the complete intervention but all mothers did receive, at minimum, a visit from a FCC nurse while in the hospital or a phone call following discharge. The fact that support was available, even if it

<table>
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<tr>
<th>Study Time Period</th>
<th>Baseline ((N = 2,738))</th>
<th>Comprehensive Intervention ((N = 8,288))</th>
<th>Limited Intervention ((N = 3,760))</th>
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<tbody>
<tr>
<td></td>
<td>Received ((n = 2,458))</td>
<td>Did not Receive ((n = 5,830))</td>
<td>Received ((n = 1,894))</td>
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<td>Readmit variable</td>
<td>(n) (n%) (n%)</td>
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<td>NNR rates</td>
<td>62 (2.3^a) 24 (1.0^b) 55 (0.9^b)</td>
<td>50 (2.6^a) 35 (1.9^a)</td>
<td>13 (26.0^c) 3*</td>
</tr>
<tr>
<td>Multiple NNR</td>
<td>12 (19.4^c) 0 (0.0^d) 13 (23.6^c)</td>
<td>13 (26.0^c) 3*</td>
<td>8.8*</td>
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\(a, b\) Based on Pearson \(\chi^2\) analyses, rates with different superscripts differed at \( p < .0001 \).

\(c, d\) Based on Pearson \(\chi^2\) analyses, rates with different superscripts differed at \( p < .05 \).

\* Out of 34 who were readmitted one case was dropped due to missing charge data.
was not utilized, may have been an important factor in explaining the overall reduction in NNR rates regardless of whether the mother officially received the program.

Although important, reducing newborn readmissions is likely only a fraction of the benefits the comprehensive postpartum follow-up provided to mothers, families, and communities. When we examined different levels of psychosocial support, we found that the comprehensive psychosocial intervention was more effective in reducing NNRs than breastfeeding support only. When applying these results to clinical practice, healthcare providers should consider the comprehensiveness of postpartum programs they develop. Postpartum programs should include assessment, education, and intervention to address the complex problems facing mothers and infants following birth, and not just address the issues that resources and reimbursement permit (Keppler & Roudebush, 1999; Nassen, Baird, Van Houten, Vanness, & Campbell, 2005).

There was no difference in NNRs between the baseline and limited time periods, although rates were significantly lower during the comprehensive time period. This suggests that providing limited psychosocial support focused solely on breastfeeding education resulted in the same outcome in terms of readmissions as no intervention. The mothers receiving the limited intervention were more likely to be White, speak English as their primary language, breastfeed, be nonsmokers, and have less than two pregnancies or births. These characteristics do not fit the mold of a typical “high-risk” mother often identified as the ideal target for intervention. There were likely other reasons mothers utilized the limited intervention, and future postpartum programs should consider broadening their definition of “high risk” for the postpartum period to include mothers with limited social support.

The purpose of a community-wide program such as the FCC was to prevent developmental delays from becoming costly interventions, assess and treat mothers experiencing varying levels of postnatal illness, validate and support new mothers when nothing was wrong, and channel mothers into appropriate care when needed. Although the data collected in this study did not address these processes, further research could include these parameters in a cost analysis to determine which are most effective. Programs such as the FCC can be utilized as a triage for patients to receive care when appropriate and to receive reassurance through psychosocial support when everything is fine. Unfortunately there is no reimbursement code available to bill for all of the benefits associated with comprehensive postpartum follow-up care. In a time when healthcare is experiencing financial constraints and pressures to improve quality and access, it is worthwhile to consider alternative approaches and successful models providing effective postpartum care. This model was an example of collaboration between the hospital and physicians, with parties working together to improve quality outcomes for each patient. The center was a resource for the physicians and the physicians were a resource for the center when medical interventions were necessary.

Goulet, Fall, D’Amour, and Pineault (2007) found that an effective coordination between community-based perinatal services and hospital-linked home phototherapy was a critical component for reducing the costs of newborn readmissions, whereas other studies showed no benefit when all moms were targeted (Shaw, Levitt, Wong, & Kaczorowski, 2006). The integrated network of community-based services was an essential condition for improved monitoring for both mother and baby. Effective coordination with community-based social support services along with case management for high-risk mothers may be a more cost-beneficial

| Table 4. Cost–Benefit Analysis and Normal Newborn Readmissions (NNR) Across Study Time Periods |
|-----------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| Study Time Period                             | Baseline (N = 2,738)                          | Comprehensive Intervention (N = 8,288)         | Limited Intervention (N = 3,760)               |
|                                               | Received (n = 2,458)                          | Did not Receive (n = 5,830)                    | Received (n = 1,894)                          | Did not Receive (n = 1,866) |
| **Average charge per NNR**                    | $4,149                                        | $4,181**                                      | $5,328**                                      | $4,845**                       | $3,785**               |
| **Average charge NNR/study time periods**     | $4,149                                        | $4,755                                        | $4,181**                                      | $5,328**                                      | $4,845**                       | $3,785**               |
| **Costs of intervention for 28 days postpartum per time period** | $1,183,600                                    | $1,183,600                                   | $1,183,600                                   | $1,183,600                                   | $1,183,600                                   |
| **Savings/benefit**                           | $513,540*                                     | No cost saving                                | $513,540*                                     | No cost saving                                | $513,540*                                     |

* Reduction of 108 NNR times $4,755 (mean charges for NNR during comprehensive time period).

** Interaction between comprehensive and limited time periods and intervention utilization (p = .04)
means of providing the important services needed in the postpartum period (Goulet et al.). In our study, comprehensive psychosocial support appeared to reduce newborn readmissions but was not a cost benefit to the hospital if looking solely at NNRs as the outcome. Unfortunately, the financial value of intangible benefits, such as a decrease in family stressors that occur due to newborn readmissions, possible benefits to maternal mental health, the health benefits of breastfeeding, or reduced utilization in the emergency room or physicians offices, were not measured or factored into the analyses because of the subjective nature of measuring health and well-being factors.

Due to the structure of the limited intervention that provided only breastfeeding support, fathers were not included in the educational and support process. Scott, Binns, Graham, and Oddy (2006), however, found that including the fathers in the educational process and providing psychosocial support as a family unit provides opportunities to monitor the skills of new parents, solve issues that may not be directly related to breastfeeding, and increase self-assurance that may improve breastfeeding skills. The comprehensive intervention that included fathers and other family members in the education process was more effective, but it is still unclear which component accounted for the success of the program.

Further studies should include cost–benefit analyses that are proportional with the size, complexity, and cost of the intervention. A better alternative to a cost–benefit analysis may be a cost–effectiveness analysis in which dollars can be assigned to benefits where market prices do not exist, such as a person’s life (Graham, 2003). Although the comprehensive program was not cost-beneficial in preventing NNRs based on costs of readmissions alone, the advantages of psychosocial support provided by healthcare professionals during the postpartum period may contribute to society and the healthcare institution beyond the simple cost analysis conducted in this study.

Conclusion

Comprehensive psychosocial support in postpartum programs was successful in reducing NNRs, lowering the average costs of newborn readmissions, and improving quality of both inpatient and outpatient services. Reducing readmissions is a leading indicator of quality healthcare services. The key to sustainability of this type of program in the future is to identify cost-effective means of implementing these critical services so we can have healthy beginnings for all families. 

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