ABSTRACT

The Ontario Mother and Infant Survey examined health and social service utilization of postpartum women and newborn infants from five hospital sites. A cross-sectional multi-language survey design with longitudinal follow-up was used: 1,250 eligible, consenting women completed a self-report questionnaire in hospital and 875 women participated in a structured telephone interview at four weeks post-discharge. Rates of newborn infant readmission ranged from 2.4% to 6.7%. The best predictors of readmission were: main source of household income was other than employment; maternal self-rating of health was poor; mother anticipated inadequate help and support at home following discharge; mother received help from friends/neighbours following discharge; and mother had concern about infant care and behaviour. Readmission was not associated with length of postpartum hospital stay. The study findings suggest that there is a complex relationship between infant health care needs, family resources and provider practices that produces clinically important, site-specific readmission patterns.

ABRÉGÉ

Le Sondage sur la mère et l'enfant en Ontario a examiné, dans cinq hôpitaux, l'utilisation des services sociaux et de santé par les femmes qui venaient d'accoucher et leurs nouveau-nés. Nous nous sommes servis d'un sondage trans-sectoriel en plusieurs langues avec un suivi longitudinal : 1 250 femmes admissibles ont consenti à remplir soi-même un questionnaire à l'hôpital. De ce groupe, 875 femmes ont participé à une entrevue téléphonique structurée quatre semaines après leur sortie de l'hôpital. Les taux de réadmission des nouveau-nés variaient de 2,4 % à 6,7 %. Les principaux prédicteurs de réadmission étaient les suivants : l'emploi n'était pas la source principale de revenu du foyer; la mère percevait son propre état de santé comme étant médiocre; la mère prévoyait ne pas recevoir d'aide et de soutien adéquats à domicile à sa sortie de l'hôpital; la mère avait reçu l'aide d'amis et de voisins à sa sortie de l'hôpital; ou la mère était préoccupée par le comportement du nouveau-né et les soins à lui donner. La réadmission n'était pas associée à la durée du séjour à l'hôpital après l'accouchement. Les résultats de l'étude font état de liens complexes entre les besoins en soins de santé du nouveau-né, les ressources familiales et les pratiques des intervenants et montrent que ces liens mènent à des modèles de réadmission, propres à chaque hôpital, qui présentent des variantes importantes sur le plan clinique.

Understanding Newborn Infant Readmission: Findings of the Ontario Mother and Infant Survey

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The implications of shortened postpartum hospital stay for maternal and infant health as well as for community-based care have received considerable attention over the past two decades. In the 1980s, literature on early postpartum discharge, often defined as discharge within 48 hours of birth, emphasized the need for careful screening and adequate follow-up after discharge.¹⁻³ By 1998, a postpartum length of stay of 48 hours or less following vaginal delivery had become common practice in Ontario, yet there was lack of standardized postpartum programs in various regions.⁴

A concern raised in recent publications is that there has been an increase in neonatal hospital readmission rates associated with shortened length of stay. Lock and Ray⁵ reported that rates rose from 6.7% to 11.7% following the implementation of an early discharge program that reduced the mean length of stay to 1.62 days at one Ontario hospital. Liu et al.⁶ found an increased rate of readmission associated with decreased lengths of post-birth hospitalization using Canadian Institute for Health Information data but excluding data from Nova Scotia, Quebec and Manitoba. Both studies found jaundice to be the leading reason for readmission. However, in determining the relevance of these research findings, study methodology needs to be carefully examined, as does the assumption that increased readmission rates are necessarily a *negative* clinical or policy outcome, or a reflection of increased infant morbidity.

The Ontario Mother and Infant Survey (TOMIS) examined health outcomes and patterns of health and social service utilization for postpartum women and newborn infants. As part of this survey, information about newborn infant readmission to hospital in the first month was gathered. This paper describes the study design, methods of data collection and findings related to neonatal readmission. The implications of these findings in relation to the results of other studies are discussed.

METHODS

Study setting

Ontario has a population of 11.25 million and approximately 146,310 births annually (Statistics Canada, 1997). Five sites across the province were selected to provide a cross-section of mothers and newborn infants with diverse characteris-

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tics and access to varying health and social services. The sites are described in Table I.

Study design

This was a quantitative study based upon methodology tested in a pilot study in Hamilton-Wentworth.^{7,8} The design was cross-sectional with longitudinal follow-up at four weeks after postpartum discharge from hospital. Consenting mothers completed a self-administered questionnaire prior to discharge and a structured telephone interview at four weeks post-discharge.

Study sample

The sample for the study included the first 250 eligible, consenting women from each site for a total of 1,250 subjects. Women were eligible to take part in the study if they: 1) had given birth vaginally to a single live infant; 2) were being discharged from hospital at the same time as their infant; 3) were assuming care of their infants at the time of discharge; 4) were competent to give consent to participate; and 5) had access to a telephone for interview. Women were excluded from participation if they: 1) had an infant who required admission to a neonatal intensive care or special care nursery for more than 24 hours; or 2) were unable to communicate in a language for which translation was available. The sample size was adequate to allow for simultaneous examination of multiple variables.

Sample recruitment

Recruitment for the study began in November 1998 and was staggered across the five sites. Data collection was completed in June 1999. Study information sheets were posted in outpatient and inpatient settings to alert potential participants to the fact that they might be approached to participate. During the recruitment periods, a site research assistant hired at each hospital or nursing staff approached all eligible women for consent while in hospital.

Data collection

The questionnaire completed prior to hospital discharge included items related to: sociodemographics; use of prenatal services; maternal medical problems since giv-

TABLE I The Ontario Mother and Infant Survey Site Characteristics		
Site	Characteristics	Annual Births*
Site 1	Metropolitan teaching centre, suburban catchment area	3900
Site 2	Small central east regional centre, urban and rural catchment area	1500
Site 3	Large central west regional centre, urban and rural catchment area	4500
Site 4	Metropolitan teaching hospital, urban catchment area	2700
Site 5	Small central north regional centre, urban and rural catchment area	2000

* 1997

TABLE II Profile of Participants (n=250 per site)					
Characteristic	Site 1 %	Site 2 %	Site 3 %	Site 4 %	Site 5 %
Marital status					
Married	87.6	71.9	88.4	82.4	62.0
Common-law/living with partner	8.4	18.5	9.2	12.0	21.6
Single/widowed/separated/divorced	4.0	9.6	2.4	5.6	16.4
Family income before taxes					
<\$20,000	13.2	19.2	7.2	20.8	21.2
\$20,000 to \$39,999	18.0	23.7	10.8	21.2	20.0
\$40,000 to \$59,999	14.0	28.9	25.2	19.2	20.4
\$60,000 to \$79,999	14.4	12.9	24.8	16.4	14.8
\$80,000+	32.4	11.2	28.8	13.2	11.2
Cultural group					
Canadian	34.4	90.0	84.4	31.2	87.2
Other than Canadian	65.2*	10.0	15.6	68.8†	12.8
Language spoken most often at home					
English	62.0	96.8	96.4	66.0	88.8
Other than English	38.0‡	3.2	2.6	34.0¶	11.2§
Highest level of education					
Elementary school or less	1.6	0.8	0.0	1.2	1.2
Some high school	5.2	14.1	3.2	9.6	13.6
Completed high school	13.1	13.3	15.2	19.6	11.2
Some community college/technical school	11.6	12.0	7.2	10.4	13.2
Completed community college/technical school	16.8	36.1	26.8	18.0	32.8
Some university	8.4	3.6	6.8	8.0	6.0
Completed bachelor's degree	29.5	14.1	25.6	21.2	16.4
Graduate degree	13.5	6.0	11.6	8.4	4.8
Mother's age					
Mean	32.3	29.2	30.7	30.2	27.4
Std. Deviation	4.5	5.6	4.6	5.3	5.2
Min/Max	17/43	17/43	18/42	16/44	16/42
Baby's birthweight					
Mean	3409	3626	3552	3418	3509
Std. Deviation	472	464	449	452	473
Min	2381	2410	2381	2200	2005
Max	4876	5021	4835	4700	4876
Gestation					
Mean	39.5	39.9	39.8	39.4	39.6
Std. Deviation	1.4	1.2	1.4	1.7	1.4
Min/Max	35/42	36/42	34/42	29/42	33/42
Infant health status as reported by mother					
Excellent	55.5	68.8	61.2	52.2	69.1
Very good	27.4	17.6	23.9	27.2	17.6
Good	12.8	10.1	13.9	17.6	10.9
Fair	2.4	3.5	1.0	2.9	1.8
Poor	1.8	0	0	0	0.6

* 35.6% Chinese
† 18.0% Portuguese
‡ 55.8% Chinese speaking
¶ 22.4% Portuguese speaking, 12.9% Polish speaking, 11.8% Spanish speaking
§ 89.3% French speaking

ing birth; chronic health problems; mother's concerns at time of discharge; infant birthweight and gestation; infant feeding; infant health problems; infant's medical care provider in hospital; services or supports mother expected to rely on after dis-

charge; scheduled follow-up appointments; readiness for discharge; and perceived adequacy of help available at home.

Trained interviewers administered the structured telephone interview at four weeks post-discharge. It incorporated ques-

TABLE III
Length of Postpartum Stay

Length of Stay	Site 1 (n=164) %	Site 2 (n=200) %	Site 3 (n=209) %	Site 4 (n=137) %	Site 5 (n=165) %
≤24 hours	59.1	11.0	32.5	45.3	23.6
25-48 hours	39.7	67.5	59.3	49.9	40.6
> 48 hours	1.2	21.5	8.1	5.8	35.8

TABLE IV
Characteristics of Newborn Infant Readmissions

Characteristic	Site 1 (n=164) #	Site 2 (n=200) #	Site 3 (n=209) #	Site 4 (n=137) #	Site 5 (n=165) #
Number of days infants were readmitted to hospital					
1 day	6	0	3	0	2
2-3 days	2	1	1	2	6
4-5 days	1	3	0	3	1
6-8 days	1	2	1	1	0
21 days*	1	0	0	0	0
Total readmissions	11 (6.7%)	6 (3.0%)	5 (2.4%)	6 (4.4%)	9 (5.5%)
Reason for readmission†					
Jaundice	7	1	1	2	1
Dehydration	1	0	0	0	0
Respiratory problem‡	1	1	1	1	3
Infection	3	3	1	1	0
GI problem¶	1	0	0	0	6
Other§	3	1	0	2	0

* Colostomy for bowel obstruction

† Up to 2 reasons reported by mother for each readmission

‡ Included respiratory distress, congestion

¶ Included constipation, blood in stool, possible lactose intolerance, gastroesophageal reflux, vomiting and diarrhea, distended abdomen

§ Examples of other reasons were colostomy, low temperature, fever

tions regarding postpartum length of stay, satisfaction with length of stay, information needs, maternal and infant health (including the Edinburgh Postnatal Depression Scale),⁹ social support (Duke-UNC Functional Social Support Questionnaire),¹⁰ infant feeding (taken primarily from the 1990 Ontario Health Survey),¹¹ service use (Health and Social Service Utilization Questionnaire),¹² service accessibility, and satisfaction with services in hospital and in the community. Both instruments were available in seven languages: English, French, Spanish, Italian, Portuguese, Cantonese and Farsi.

Data analysis

All data were directly entered from the instruments into SPSS 10.0 for Windows data entry system. Women who completed the interview were compared with women who were lost to follow-up at four weeks post-hospital discharge. Descriptive statistics were used to portray the characteristics of participants and services used.

Frequency counts and percentages, means and standard deviations, or medians for skewed distributions were calculated as appropriate. Inferential statistics were used to compare proportions and means among identified subgroups. Outcome variables for this study were predominantly categorical variables, as were most of the independent variables. Chi-square analyses, and when appropriate, Fisher exact tests were used to identify statistical associations between these variables. Unadjusted odds ratios, p-values and 95% confidence intervals for associations are reported.

The decision about which variables to include in multivariate analyses were made *a priori* based on the literature and clinical judgement. Logistic regression analyses were then used to identify the best predictors for each outcome after adjusting for all other variables in the final model. These results are reported as adjusted odds ratios. The final step in the modelling procedure was to test for the significance of interaction terms, representing possible effect

modifiers. For all analyses, a p-value of < 0.05 was used to determine statistical significance.

Following preliminary data analysis, two sets of focus groups were held at each site. The purpose of the first focus groups was to present site-specific data for initial feedback on the survey results for mother/infant dyads recruited through each local institution. These focus groups also assisted the research team with interpretation of data. At the second focus groups, the data for all five sites were presented, thereby providing an opportunity for practitioners and decision makers to compare and contrast the findings specific to their site to the findings in other locales. Participants in the focus groups included hospital personnel (e.g., nurses, physicians), community care providers (e.g., public health nurses, midwives, Victorian Order of Nurses) and institutional (e.g., unit administrators, chiefs of service) and local service policy makers (e.g., Healthy Babies, Healthy Children Program managers).

RESULTS

A total of 1,250 women were recruited with 875 (54.8% to 83.3% per site) completing the follow-up interview. A profile of women who took part in the interview and their infants is presented in Table II. There were no statistically significant differences between those who completed the interview and those lost to follow-up on any of the variables reported.

Length of hospital stay following vaginal delivery varied, but generally reflected the trend towards a 24- to 48-hour length of stay (Table III). Less than 2.5% of women and infants at any of the sites stayed in hospital for more than 60 hours. Newborn infant readmission rates ranged from 2.4% to 6.7%, and number of readmission days was variable across sites (Table IV). Most readmissions were for five days or less. Reasons for readmission as reported by mothers also are displayed in Table IV.

Chi-square analyses revealed that 31 variables were statistically associated with infant readmission to hospital. Length of hospital stay and site were not among these variables. Logistic regression analysis

(Table V) revealed that the most important predictors of readmission were: main source of household income other than salary/employment; mother's self-rating of health as poor; mother anticipated lack of help and support at home to meet needs; mother received help from friends/neighbours; and mother had concern about infant care and behaviour at time of discharge. Corresponding odds ratios and 95% confidence intervals are adjusted for all other variables in the final logistic regression model. No interaction terms were found to be statistically significant.

DISCUSSION

The readmission rate of newborn infants was highly variable among the five study sites. Although there were no statistically significant differences, this variation has clinical importance. Differences may be related, in part, to the practices of care providers at particular hospitals. In focus groups, providers discussed the need to be hyper-vigilant when responding to infants who presented with symptoms. When there was any question about the risk of sending the infant home, some providers tended to admit to hospital. In Site 1 where this was an identified practice, 55% of readmitted infants stayed for 24 hours or less, suggesting that readmission was used for assessment rather than treatment.

For the most part, infants were readmitted for problems common in the neonatal period. Moreover, most readmissions were for three days or less, suggesting that any identified problems responded quickly to intervention. Prior to shortened lengths of stay, health concerns arising in the initial days following birth might have been identified and treated prior to discharge. Thus, total hospital days for newborn infants with identified health problems may not have increased. This premise requires exploration in future research. Readmission rates alone should not be used as proxies for newborn infant morbidity and details of the readmissions are important. Although other studies have reported major morbidity,¹³⁻¹⁵ outcomes such as severe breastfeeding malnutrition and hypernatremic dehydration are so rare that even a sample size as large as that of

TABLE V
Final Logistic Regression Model of Best Predictors of Infant Readmission to Hospital in the First Four Weeks Post-discharge (n=872*)

Predictors of Infant Readmission	Adjusted Odds Ratio [†]	95% Confidence Interval
Main source of income for all household members‡		
Salaries/self employment	1.00	—
Other sources¶	4.26	(1.94, 9.35)
Mother's rating of own health§		
Excellent/very good/good/fair	1.00	—
Poor	5.17	(1.70, 15.73)
Mother thinks the help and support at home will meet the needs of her infant‡		
Definitely or probably yes	1.00	—
Don't know/Probably or definitely not	3.17	(1.48, 6.82)
Mother received unpaid, informal help from friends/neighbours§		
No	1.00	—
Yes	2.70	(1.26, 5.79)
Mother had concerns about infant care and behaviour‡		
No	1.00	—
Yes	2.35	(1.12, 4.91)

Final Logistic Regression Model Statistics:†† Rho-square = 0.14 (a pseudo R², values between 0.2 and 0.4 suggest a very good fit)

Hosmer and Lemeshow Goodness-of-fit test = 0.42 (values greater than 0.25 indicate good fit)

96.2% correctly classified

* Three members had missing values for one or more of the variables included in the final model.

† Odds ratios for categorical variables represent comparisons with the referent group (OR=1.00) after adjustment for all other variables in the model.

‡ Information collected from mother prior to discharge from hospital.

¶ Includes provincial or municipal social assistance or welfare, employment insurance, child support, spousal support (alimony) and other.

§ Information collected from mother four weeks after discharge from hospital.

†† The 26 variables that were statistically associated with readmission but were not main predictors included 9 items from the questionnaire completed prior to hospital discharge: infant birthweight <2500 grams; mother had concern about signs of illness in infant; mother expected to rely on services or support from a paediatrician; mother expected to rely on services or support from nurses in postpartum unit; mother expected to rely on services or support from a visiting nurse other than a public health nurse; mother had a date set for seeing a pediatrician; mother had a date set for seeing a visiting nurse other than a public health nurse; mother non-partnered; and mother thinks she and infant are ready to be discharged from hospital. The other 17 items were from the structured telephone interview at four weeks post-discharge: mother perceived that length of stay was not the right length; mother wanted to stay in hospital longer; mother would have liked to have learned more about hospital routines while in hospital; mother would have liked to have learned more about signs of illness in infant; mother identified 8-11 learning needs; mother visited an obstetrician/gynecologist; infant had one or more visits to a family physician; infant 8+ days old at first visit; mother received unpaid, informal help related to transportation; mother received unpaid, informal help from husband/partner; mother received unpaid, informal help from immediate family; mother needed help with a physical health problem; mother gets invitations to go out and do things with other people less than liked; mother gets useful advice about important things in life much less than liked; mother has enough people who care what happens to her less than liked; Duke-UNC confident support score 5-15; and mother rated infant health since discharge as good/fair/poor.

TOMIS may not have been sufficient to detect such outcomes.

In contrast to the findings of previous Ontario studies,^{5,6} length of stay was not a predictor of newborn infant readmission to hospital. TOMIS revealed that newborn infants readmitted to hospital were likely to come from families with fewer financial, personal and social resources. This finding, along with the reported variability in clinical practice, suggests that there is a complex relationship between infant health care needs, family resources, and provider practices that produces site-specific readmission patterns.

Infant readmission rates in this study are generally higher than the 3.8% reported from national data sources⁶ but lower than that reported in the single site Ontario study.⁵ Given the eligibility criteria, readmission rates in TOMIS may reflect the lower limit of provincial rates. Similar to the other Ontario study,⁵ TOMIS was concerned only with babies born by uncomplicated vaginal delivery. The national statistics included all infants, regardless of method of delivery and infant health status. All three studies used approximately the same follow-up periods for readmission. However, the national study

failed to address factors other than decreased length of stay that might have affected readmission rates; the single site study failed to address variability in provider practice. In TOMIS, although there were no known differences between those who completed the interview and those who did not, it is possible that other unmeasured variables might also have influenced readmission rates. Examination of multiple factors in multiples sites is essential to adequately understand newborn infant readmission.

The expansion of the Healthy Babies, Healthy Children (HBHC) Program in Ontario beginning in late 1999 provides all mothers of newborn infants the option to stay in hospital for 60 hours following vaginal birth and to receive a telephone call from a public health nurse within 48 hours of discharge. Women also are offered a home visit with the intention of early screening for problems experienced by the mother or infant. Evidence from TOMIS suggests that extending length of stay for mothers and newborn infants will not have an impact on readmission rates or overall

infant morbidity. To the extent that community support programs are able to meet family resource needs, there is the potential for the HBHC Program to bring about a decrease in newborn infant readmission rates.

REFERENCES

1. Braveman P, Egerton S, Pearl M, et al. Early discharge of newborns and mothers: A critical review of the literature. *Pediatrics* 1995;96(4):716-26.
2. Britton JR, Britton HL, Beebe S. Early discharge of the term newborn: A continued dilemma. *Pediatrics* 1994;94(3):291-95.
3. Fetus and Newborn Committee. Policy Statement: Early Discharge and Length of Stay for Term Birth. A Joint Policy Statement by the Canadian Paediatric Society and the Society of Obstetricians and Gynaecologists of Canada. *Journal SOGC* 1996;18:1281-85.
4. Ontario Public Health Association. Early Postpartum Discharge Position Paper. Ontario Public Health Association Child Health Workgroup, 1998.
5. Lock M, Ray JG. Higher neonatal morbidity after routine early hospital discharge: Are we sending newborns home too early? *CMAJ* 1999;161(3):249-53.
6. Liu S, Wen SW, McMillan D, et al. Increased neonatal readmission rate associated with decreased length of hospital stay at birth in Canada. *Can J Public Health* 2000;91(1):46-50.
7. Hayward S, Lee K, Krueger PD, et al. Routine and non-routine health and social service utilization of infants in the first six weeks of life. *CMAJ* under revision.
8. Sheehan D, Bridle B, Hillier T, et al. Breastfeeding outcomes of women following uncomplicated birth in Hamilton-Wentworth. *Can J Public Health* 1999;90(6):408-11.
9. Cox J, Holden J (Eds). *Perinatal Psychiatry: Use and Misuse of the Edinburgh Postnatal Depression Scale*. London: Gaskell, 1994.
10. Broadhead WE, Gehlbach SH, Gruy FV, Kaplan BH. Duke-UNC Functional Social Support Questionnaire. *Medical Care* 1988;26:709-23.
11. Ministry of Health. Ontario Health Survey. Regional Report. Ottawa: Ministry of Health, Premiers Council on Health, Well-Being and Social Justice, 1992.
12. Brown G, Gafni A, Roberts J, et al. Approach to the Measurement of Costs (Expenditures) When Evaluating Health and Social Programmes. Hamilton: The System-Linked Research Unit, 1995.
13. Lee KS, Perlman M, Ballantyne M, et al. Association between duration of neonatal hospital stay and readmission rate. *J Pediatrics* 1995;127:758-66.
14. Cooper WO, Atherton HD, Kahana M, Kotagal UR. Increased incidence of severe breastfeeding malnutrition and hypernatremia in a metropolitan area. *Pediatrics* 1995;96:957-60.
15. Maisels MJ, Newman TB. Kernicterus in otherwise healthy, breast-fed term newborns. *Pediatrics* 1995;96:730-33.

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