The final version of this paper was published in: *Med J Aust* 2014, 201(1):40-43.

Lain SJ, Roberts CL, Bowen JR, Nassar N: Trends in New South Wales infant hospital readmission rates in the first year of life: a population-based study.

Trends in New South Wales infant hospital admission rates in the first year of life: population-based study

Samantha J Lain, Natasha Nassar, Jennifer Bowen, Christine L Roberts

Kolling Institute, University of Sydney, St Leonards, New South Wales, Australia 2065.

Royal North Shore Hospital, St Leonards, New South Wales, Australia 2065.

Samantha Lain, Perinatal Research, Kolling Institute

Natasha Nassar, Perinatal Research, Kolling Institute

Jennifer Bowen, Neonatal Department, Royal North Shore Hospital

Christine L Roberts, Perinatal Research, Kolling Institute

Correspondence to: S Lain Samantha.lain@sydney.edu.au

Keywords: infant, hospitalization, health services research, trends

Abstract

Objective: To examine the trends in hospital admissions in the first year of life and identify whether changes in maternal and infant risk factors explain any changes

Design: Population-based study using de-identified linked health data.

Participants: All 795,855 liveborn infants delivered in New South Wales from 2001 to 2009 with a linked birth and hospital record.

Main outcome measures: The number of infants readmitted to hospital at least once, up to one year of age, per 100 livebirths each year; changes in maternal and infant risk factors were assessed using logistic regression.

Results: The number of infants admitted to hospital up to age one decreased 9.2%, from 18.3 per 100 births in 2001 to 16.6 in 2009. Two thirds of this decrease could be explained by changes in factors that are associated with likelihood of hospitalisation; length of birth admission, maternal age and maternal smoking. The rate of admissions for jaundice and feeding difficulties increased significantly over the study period, while admissions for infections decreased. In 2009, infants born at term (37-41 weeks gestation) with neonatal morbidity were most likely to be readmitted to hospital.

Conclusions: There has been a decrease in the rate of infants admitted to hospital in the first year of life, which can be partly explained by increasing maternal age, decreasing maternal smoking and increasing number of infants discharged within two days of birth, potentially receiving postnatal midwifery care at home. The introduction of government policies may explain the rest of the decrease.

Introduction

In Australia almost 300,000 babies are born annually,[1] and significant health services are devoted to neonatal and infant health. Improvements in neonatal technology in recent decades have significantly improved survival prospects for infants, but at a high cost as neonatal intensive care unit admissions are amongst the most expensive hospitalisations.[2] In New South Wales, total costs per year for neonatal and infant hospital admissions are approximately $380 million.[3] This cost does not include outpatient care, or non-admitted emergency department (ED) presentations, which are a large additional burden on the healthcare system as children up to age four contribute 12% of all ED presentations.[4]

Analysis of trends of health services utilisation provides information about the healthcare needs of the population and can lead to improvements in health service delivery and efficient allocation of healthcare resources. From 2001 to 2010, the overall rate of hospital separations for the Australian population has increased on average 2.7% a year for public hospitals and 3.5% per year for private hospitals,[4] however trends in infant hospital separations have not been investigated. Over the last decade there has been an increase in births and a number of changes in the frequency of maternal and birth risk factors; decrease in the proportion of young mothers, decrease in mothers who smoke, and a gradual shift to planned births at earlier gestations.[5] Potential factors that may impact rates of infant hospitalisations include changes in demographics of the child-bearing population, the introduction of government policies, and changes in clinical practice. The aim of this study was to examine the trends in hospital admissions

in the first year of life and investigate whether changes in the frequency of maternal and infant risk factors affected infant hospital admissions at a population level.

Methods:

(i) Study population and Data Sources

The study population included all livebirths in NSW from January 2001 through December 2009. Data were obtained from two linked population health databases. Births were obtained from the NSW Perinatal Data Collection (PDC), a legislated population-based surveillance system of all births in NSW of $\geq$ 20 weeks gestation or a baby $\geq$ 400 grams birth weight. Infant hospitalisations were obtained from the Admitted Patient Data Collection (APDC), an administrative database of all hospital admissions in NSW based on information from hospital discharge summaries. The two databases, the PDC and APDC, were linked by the Centre for Health Record Linkage using probabilistic linkage. The proportion of missing data was small; gestational age 0.02%, maternal age 0.02%, and marital status 0.06%.

(ii) Study outcome

To examine trends in infant hospital admissions, we calculated the number of infants readmitted to hospital at least once after discharge home from the birth admission, up to one year of age, per 100 livebirths each year. Inter-hospital transfers were included as part of the admission in which they occurred, and not counted as a new admission. Hospital admissions for routine circumcision were excluded as a NSW Health policy was mandated that these were no longer to be performed in public hospitals during the study period.

(iii) Explanatory variables

Explanatory variables available for analysis were identified from a previous study[6] and included; maternal age, previous pregnancy history, maternal smoking, hospital type at birth, baby's length of stay at birth admission, gestational age, birth order, multiple births and residential postcode which were all obtained from the PDC. Maternal marital status was obtained from the mother's APDC record. Maternal residential postcode was used to determine socioeconomic status (SES) and geographical region of residence. SES was derived based on scores from the Socio-Economic Indexes for Areas Index of Relative Disadvantage[7] produced by the Australian Bureau of Statistics and categorised into low, average and high SES ($<20^{th}$, $20\text{-}80^{th}$ and $\geq 80^{th}$ centile respectively). Geographical area of residence was based on the Accessibility/ Remoteness Index of Australia and dichotomized (large metropolitan, and small metropolitan or rural area).[8] Infants born with severe neonatal morbidity were identified using the Neonatal Adverse Outcome Indicator (NAOI) .[9] This composite variable uses reliably reported information from the PDC and APDC to identify infants diagnosed with severe morbidity in the first 28 days of life.

(*iv) Data Analysis*

We compared the rate of infants admitted per 100 births in 2001 through 2009 for each of the maternal and infant risk factor of interest, and calculated the percentage change in admission rate. Association with, and impact of changes in risk factors over time on the number of infants admitted to hospital at least once, was assessed using predictive logistic regression models. A predictive model was developed to estimate the infant admission rate using 2001 and 2002 data, adjusted for previously identified risk

factors.[6] Due to significant interactions, gestational age and severe neonatal morbidity were combined into one variable, and socioeconomic status and rural area were also combined into one variable. This model was then applied to each subsequent year's data to determine the predicted number of infants admitted to hospital in each year. If the predicted number of admissions was similar to the number observed, then this would suggest that the change in infant admissions could be accounted for by changes in prevalence of risk factors. Conversely, any difference between the observed and predicted numbers would be due to factors not included in the model.

The top seven principle diagnosis groups of infant admissions were identified and the total number of admissions for each diagnosis group per 100 births was calculated each year. Negative binomial regression was then used to estimate the annual percentage change in admission rates for each diagnosis group. This study had ethics approval from the NSW Population and Health Services Research Ethics Committee. All analyses were performed using the statistical software SAS version 9.3.

Results:

From 2001 to 2009 there were 795,855 liveborn infants in NSW with a linked PDC and APDC record. Over the 9 year study period the number of infants admitted to hospital up to age one decreased from 18.3 per 100 births in 2001 to 16.6 admissions per 100 births in 2009 (Table 1), a relative reduction of 9.2%. The admission rate decreased sharply from 2003 to 2004, followed by a substantial increase in 2005 (Figure 1, solid line). This increase in admissions in 2005 coincided with a dramatic increase in total births, from approximately 83,000 births in 2004 to 88,000 in 2005.

Over the study period, the proportion of infants born to mothers over the age of 35 increased (from 18% to 24%), infants born to mothers who smoked decreased (from 17% to 12%) and infants born at 37 to 38 weeks gestation increased (from 20% to 24%). The biggest change in a factor associated with infant hospitalisation was length of stay at birth; the proportion of infants discharged in the first two days after birth increased 30% over the study period (Table 1). The groups that had the largest relative decrease in readmission rate during the study period were infants with mothers aged <30 years, mothers that smoked, were discharged from hospital 3 to 4 days after birth, were born in a private hospital, or had a small regional/rural residence (Table 1).

The factors whose risk for infant admission changed significantly over the study period were length of stay at birth and infants born at 39-41 weeks gestation with severe neonatal morbidity (Table 2). In 2001/2002, infants that were discharged from hospital in the first 2 days after birth were less likely to be readmitted from hospital in the first year compared to those discharged 3 to 4 days after birth. However in 2009, there was no difference in the odds of infant readmission between these groups. In 2009, infants born at 39-41 weeks gestation with neonatal morbidity had the highest risk for readmission to hospital, higher than preterm infants born with or without neonatal morbidity (Table 2).

Figure 1 presents the observed and predicted number of infants admitted per 100 births from 2001 to 2009. The observed trend (solid line) decreased from 18.3 in 2001 to 16.6 in 2009. When the predictive model using 2001/2002 data is applied to the following

years data, the predicted hospital admission rate decreased to an expected rate of 17.2 infants per 100 births admitted in 2009 (dashed line). This suggests that changes in these factors explained 66% of the decrease in infant admissions. The factors that accounted for most of this decrease were; an increase in the proportion of infants discharged in the first two days after birth (explaining 21%), increase in maternal age (11%) and decrease in maternal smoking (7%).

The diagnosis groups that had a significant decrease in the rate of admissions over the study period were: upper respiratory infections (-1.6% per year, 95% CI -2.8% to -0.3%), intestinal infectious diseases (-3.2% per year, 95% CI -9.3% to -0.5%) and viral infections (-3.2% per year, 95% CI -5.4% to -1.0%). Hospital admissions for the following principal diagnosis groups significantly increased from 2001 to 2009; jaundice (8.1% per year, 95% CI 5.9% -10.3%) and feeding problems (3.5% per year, 95% CI 1.0% – 5.6%). Admissions for acute lower respiratory infections and excessive crying did not significantly change.

Discussion:

We have demonstrated that the rate of infants admitted to hospital up to age one has decreased by 9.2% from 2001 to 2009. Factors associated with infant hospital admissions include maternal smoking, maternal age less than 25 years, gestational age less the 39 weeks and length of stay at birth. Two thirds of the total decrease can be explained by changes in the frequency of maternal and infant risk factors, predominantly an increase in the proportion of infants discharged from hospital up to two days after birth and an increase in maternal age. The rate of infant admissions with

a principle diagnosis of jaundice or feeding difficulties increased over the study period, while the rate of admissions for upper respiratory, intestinal and viral infections decreased.

During the study period the proportion of mothers and infants being discharged from hospital less than two days after birth increased substantially, a trend seen in Australia and internationally over the past three decades.[10] In NSW one of the driving forces behind the trend to shorter length of stay is the Early Postnatal Discharge programme. Introduced in the 1980's, this programme is designed for mothers leaving the hospital within 48 hours of giving birth who are then visited by a midwife at home during the first week.[11] Follow-up midwifery visits have been shown to reduce hospital readmissions and presentations to emergency departments.[12 13] However there are many variations of Early Postnatal Discharge criteria and protocols across NSW hospitals which may have changed during the study period.[14] Changes to the number or frequency of visits may explain the change in the risk of readmission for infants discharged early during the study period.

We also found rates of admission for jaundice and feeding difficulties increased over the study period. It has been shown that admissions to hospital for these conditions are associated with early discharge from hospital.[15] There has also been a gradual increase in the rate of infants born late preterm (34-36 weeks) and early term (37-38 weeks) in Australia in the last decade, and these infants have an increased risk of admission to hospital for these conditions.[15] Late preterm and early term infants may seem to be doing well immediately following delivery however conditions may develop following

discharge,[16] while infants with a lower gestational age may remain in hospital for longer during the birth admission. A shorter length of stay at birth may also be the reason that term infants with morbidity have a higher risk of being readmitted than preterm infants.

Another government policy was introduced during the study period that may have affected infant hospital admissions. The Families First policy was introduced to the whole of NSW from 1999 to 2004, and included the offer of a home visit by a child and family health nurse to all women following the birth of a child.[17] One aim of the home visits is to identify families that require ongoing support and facilitate access to other health and support services.[18] This additional support for new mothers may help to explain the large relative decrease in readmission rates for infants of young mothers and smokers, and may have provided a service that was not previously available for mothers in small regional and rural areas.

We found admissions for infections significantly decreased over the study period. Increased contact with community healthcare may have directed these infants away from hospital or they may have presented at the Emergency Department (ED) but not been admitted. We do not have access to ED data however there were a number of changes to ED policy and practice in NSW over this period that may have reduced hospital admissions from the ED. For example, in 2002, to help reduce 'access block' in EDs the NSW Department of Health funded senior ED nurses that had a wider scope of practice including; assessment of patients with gastroenteritis, fever and upper respiratory tract infection, and ordering radiological examinations, medications and laboratory investigations.[19] During the study period there were also a number of after-

hours General Practice (GP) clinics that opened at or near EDs.[20] One study has shown that the opening of a clinic in rural NSW was associated with a reduction in low-urgency presentations to the ED.[21]

One of the interesting findings from our study was a significant decrease in the observed rate of infants admitted to hospital in 2004, followed by an increase in 2005 and 2006 higher than the predicted rate for those years. When investigated, the decrease in admission rate in 2004 could not be attributed to changes in reporting or changes in admissions at specific hospitals or by specific diagnosis type. However as mentioned above, a number of policies were introduced prior to 2004 that may have affected infant admissions. The increase in admissions in 2005 and 2006 coincided with a large increase in the number of births in NSW following the introduction of the National 'Baby Bonus' policy in July 2004.[22] This large, unplanned increase in births put added pressure on maternity services[23] and would have placed an increased burden on non-hospital forms of healthcare such as; postnatal midwifery care, community child health nurses and general practitioners, possibly leading to vulnerable families taking infants back to hospital emergency departments.

The main strength of the study is the use of a large linked population health database that allows examination of trends in infant hospitalisations at a population level. Validation studies of birth and hospital records show high levels of agreement with medical records.[24] Individual data about other health service utilisation, such as postnatal home visits, GP visits or ED presentations, or hospital bed availability were

not available in our dataset, however the average number of general hospital beds in NSW increased approximately 20% over the study period.[25]

In conclusion we have demonstrated that the rate of infants admitted to hospital each year has been decreasing in NSW and changing maternal and infant risk factors can explain most of this decrease. A number of policies introduced during the study period, such as home visits and changes to the ED pathway of care, may explain the rest of the decrease. Future research should investigate strategies for further reducing the burden on the health system of infant admissions, such as strategies to target specific groups of infants.

References

1. Li Z, McNally L, Hilder L, et al. Australia's mothers and babies 2009. Sydney: AIHW National Perinatal Epidemiology and Statistics Unit., 2011.
2. Martens PJ, Derksen S, Gupta S. Predictors of hospital readmission of Manitoba newborns within six weeks postbirth discharge: a population-based study. *Pediatrics* 2004;114(3):708-13.
3. Lain SJ, Nassar N, Bowen JR, et al. Risk Factors and Costs of Hospital Admissions in First Year of Life: A Population-Based Study. *J Pediatr* 2013.
4. Australian Institute of Health and Welfare. Australian hospital statistics 2009–10. Canberra: AIHW, 2011.
5. Morris JM, Algert CS, Falster MO, et al. Trends in planned early birth: a population-based study. *Am J Obstet Gynecol* 2012;207(3):186 e1-8.
6. Lain SJ, Nassar N, Bowen JR, et al. Risk factors and costs of hospital admissions in the first year of life: a population based study. *Journal of Pediatrics* IN PRESS;Accepted 25 April 2013.
7. Trewin D. Socio-Economic Indexes for Areas: Australia 2001. *Census of Population and Housing Information Paper*. Canberra: ABS, 2003.
8. Australian Institute of Health and Welfare. Rural, regional and remote health: a guide to remoteness classification. *Rural Health Series Number 4*. Canberra: Australian Institute of Health and Welfare, 2004:http://www.aihw.gov.au/publications/index.cfm/title/9993 (Accessed May 4 2008).
9. Lain SJ, Algert CS, Nassar N, et al. Incidence of Severe Adverse Neonatal Outcomes: Use of a Composite Indicator in a Population Cohort. *Matern Child Health J* 2011;16(3):600-08
10. Ford JB, Algert CS, Morris JM, et al. Decreasing length of maternal hospital stay is not associated with increased readmission rates. *Aust N Z J Public Health* 2012;36(5):430-4.
11. Lock L. Early postnatal discharge: what the mothers say. *Community Paediatr Rev.* 2000;9(2):1-2.
12. Meara E, Kotagal UR, Atherton HD, et al. Impact of early newborn discharge legislation and early follow-up visits on infant outcomes in a state Medicaid population. *Pediatrics* 2004;113(6):1619-27.
13. Paul IM, Phillips TA, Widome MD, et al. Cost-effectiveness of postnatal home nursing visits for prevention of hospital care for jaundice and dehydration. *Pediatrics* 2004;114(4):1015-22.
14. NSW Health. The NSW Framework for Maternity Services. In: Branch N, editor. Sydney, 2000.
15. Maisels MJ, Kring E. Length of stay, jaundice, and hospital readmission. *Pediatrics* 1998;101(6):995-8.
16. Escobar GJ, Joffe S, Gardner MN, et al. Rehospitalization in the first two weeks after discharge from the neonatal intensive care unit. *Pediatrics* 1999;104(1):e2.
17. Fisher K, Thomson C, valientine k. The Implementation of Families First NSW: Process lessons from the first four years. *Australian Journal of Early Childhood* 2006;31(1):11-19.

18. Schmied V, Mills A, Kruske S, et al. The nature and impact of collaboration and integrated service delivery for pregnant women, children and families. *J Clin Nurs* 2010;19(23-24):3516-26.
19. Hudson PV, Marshal AP. Extending the nursing role in Emergency Departments: Challenges for Australia. *Australas Emerg Nurs J* 2008;11:39-48.
20. Haas M. After-hours GP Clinics in Emergency Departments. *Health Policy Monitor*, 2007.
21. Buckley DJ, Curtis PW, McGirr JG. The effect of a general practice after-hours clinic on emergency department presentations: a regression time series analysis. *Med J Aust* 2010;192(8):448-51.
22. Lain SJ, Ford JB, Raynes-Greenow C, et al. The impact of the Baby Bonus payment: who is having 'one for the country'? *Medical Journal of Australia* 2008;Accepted 16th October, 2008(To be published December 2008 issue).
23. Lain SJ, Roberts CL, Raynes-Greenow CH, et al. The impact of the baby bonus on maternity services in New South Wales. *Aust N Z J Obstet Gynaecol* 2010;50(1):25-9.
24. Lain SJ, Hadfield RM, Raynes-Greenow CH, et al. Quality of Data in Perinatal Population Health Databases: A Systematic Review. *Med Care* 2011;50(4):e7-e20
25. NSW Department of Health. Annual Report 2009-10. Sydney, 2011.

Acknowledgements

We thank the NSW Ministry of Health for access to the population health data and the NSW Centre for Health Record Linkage for linking the data sets.

Author's contributions

Ms. Samantha Lain participated in the study design, took primary responsibility of the data analysis, drafted the initial manuscript and approved the final manuscript as submitted.

Dr. Natasha Nassar participated in the study design, data analysis and interpretation, reviewed and revised manuscript, and approved the final manuscript as submitted.

Dr. Jennifer Bowen participated in interpretation of data, provided clinical expertise and edited the manuscript

Associated Professor Christine Roberts participated in the study design, data analysis and interpretation, reviewed and revised manuscript, and approved the final manuscript as submitted.

All authors had full access to all of the data (including statistical reports and tables) in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Funding

Linkage was funded through a National Health and Medical Research Council (NHMRC) Project Grant (#457302). Samantha Lain is supported by a NHMRC Post-graduate Scholarship (#571227) and a Capacity Building Grant (#573122). Natasha Nassar is supported by a NHMRC Career Development Award (#632955). Christine Roberts is supported by a NHMRC Senior Research Fellowship (#1021025).

The researchers undertaking this study work independently from the funding body NHMRC.

Table 1. Annual number of infants hospitalised in 2001 and 2009, and percentage change in hospitalisation rate from 2001 to 2009 for maternal and infant characteristics

	Total number of infants 2001	Infants readmitted Row % 2001	Number of infants 2009	Infants readmitted Row % 2009	Relative difference 2001-2009*
Total	84086	18.3	93,834	16.6	-9.2
Maternal characteristics					
Age group					
<20 years	3735	26.2	3217	23.4	-10.7
20-24 years	12912	20.8	12372	19.1	-8.2
25-29 years	25438	18.7	25395	16.6	-11.2
30-34 years	26725	16.6	30329	15.6	-6.0
≥ 35 years	15276	16.4	22521	15.6	-4.9
Hospital type at birth					
Public hospital	64806	18.8	70398	17.3	-8.0
Private hospital	19280	16.7	23434	14.6	-12.6
Length of stay at birth					
0-2 day	23630	16.8	34332	16.2	-1.2
3-4 days	33071	16.5	37580	14.9	-9.7
5 days or more	27375	21.7	21921	20.3	-6.5
Smoking status					
Non-smoker	69840	17.2	82609	16.0	-7.0
Smoker	14246	23.4	11225	21.1	-9.8
Geographical area/SES					
Large metro/lowest SES	7680	18.7	8515	18.3	-2.1
Large metro/mid SES	28124	17.9	31788	16.9	-5.6
Large metro/highest SES	11404	17.4	14734	15.3	-12.1
Small regional/rural-lowest SES	10596	21.0	10630	17.7	-15.7
Small regional/rural-mid SES	22643	17.9	24218	16.3	-8.9
Small regional/rural-highest SES	3639	18.0	3949	14.7	-18.3
Marital status					
Married/de facto	65594	17.3	78263	15.85	-8.4
Not married	18492	21.7	15570	20.4	-6.0
Infant characteristics					
Neonatal morbidity/GA					
With morbidity: ≤33 weeks	1396	39.0	1319	36.2	-2.8
With morbidity: 34-36 weeks	801	34.5	628	35.7	1.2
With morbidity: 37-38 weeks	698	41.5	622	37.5	-4.0
With morbidity: 39-41 weeks	1726	37.7	1197	38.1	0.4
With morbidity: >41 weeks	76	31.6	23	34.8	3.2
No morbidity: ≤33 weeks	271	31.4	427	26.0	-5.4
No morbidity: 34-36 weeks	3222	27.0	4099	24.3	-2.7
No morbidity: 37-38 weeks	16388	19.9	21647	17.9	-2.0
No morbidity: 39-41 weeks	57519	15.8	63150	14.4	-1.4
No morbidity: >41 weeks	1979	15.2	721	15.5	0.3

Birth order					
First born	35026	17.9	39574	16.3	-8.9
2nd born or >	49060	18.5	54260	16.8	-9.2
Multiple birth					
Singleton	81245	17.9	91183	16.3	-8.9
Twins/triplets	2828	28.6	2651	25.9	-9.4

*Relative difference = (rate per 100 births in 2009- rate per 100 births in 2001)/(rate per 100 births in 2001)

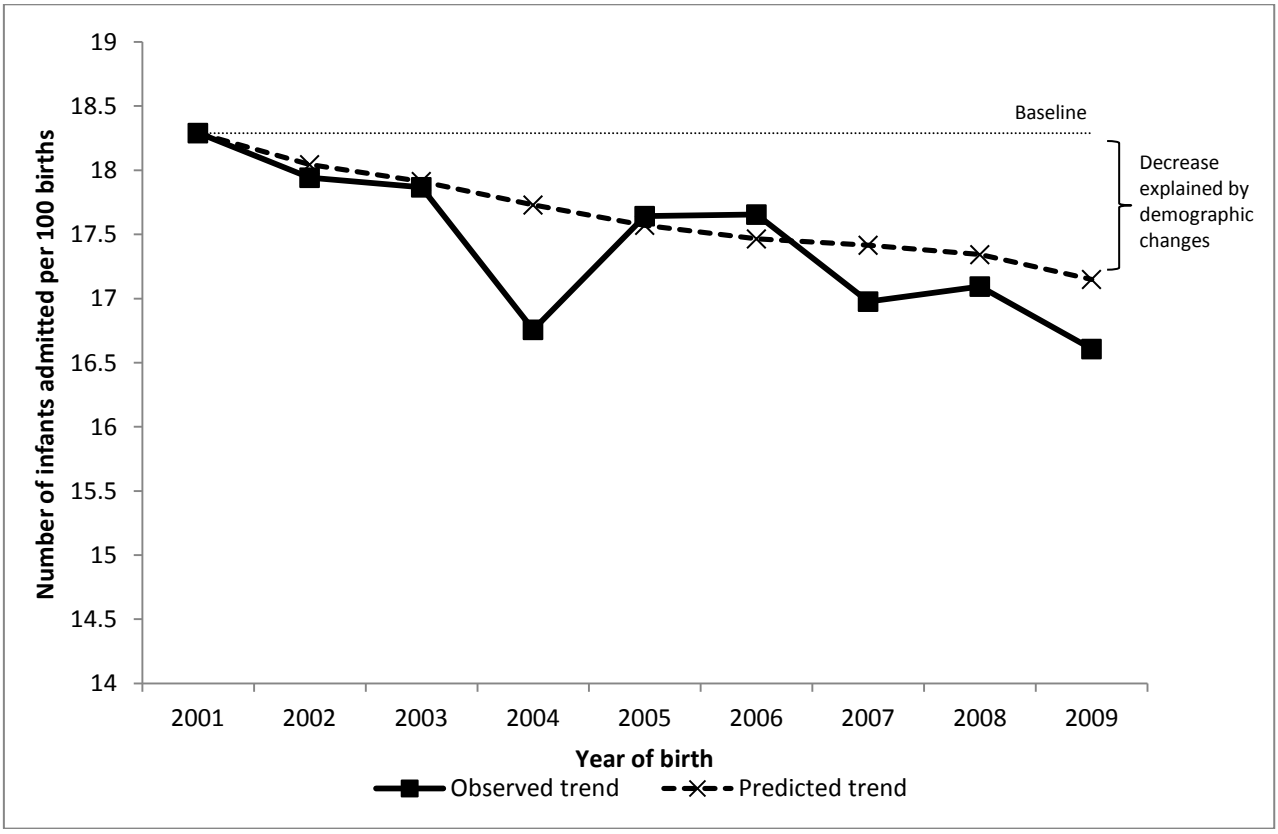
Table 2. Univariate and multivariate analysis of infants readmitted to hospital at least once up to age one compared to infants not admitted, in NSW 2001-2002 and 2009

	Adj OR* 2001-2002 (95% CI)	Adj OR* 2009 (95% CI)
Maternal characteristics		
Age group		
<20 years	1.43 (1.35-1.53)	1.43 (1.30-1.57)
20-24 years	1.14 (1.09-1.19)	1.14 (1.07-1.20)
25-29 years	ref	ref
30-34 years	0.89 (0.86-0.92)	0.93 (0.89-0.98)
≥ 35 years	0.83 (0.79-0.86)	0.89 (0.85-0.94)
Hospital type at birth		
Public hospital	ref	ref
Private hospital	0.96 (0.93-0.99)	0.89 (0.85-0.95)
Length of stay at birth		
0-2 day	0.92 (0.89-0.95)	1.00 (0.96-1.05)
3-4 days	ref	ref
5 days or more	1.21 (1.18-1.25)	1.20(1.15-1.27)
Smoking status		
Non-smoker	ref	ref
Smoker	1.24 (1.20-1.29)	1.19 (1.12-1.25)
Geographical area/SES		
Large metro-lowest SES	1.02 (0.98-1.08)	1.03 (0.96-1.09)
Large metro-mid SES	ref	ref
Large metro-highest SES	1.06 (1.01-1.10)	0.99 (0.94-1.05)
Small regional/rural-lowest SES	1.03 (0.98-1.06)	0.94 (0.89-1.0)
Small regional/rural-mid SES	0.92 (0.89-0.95)	0.92 (0.87-0.96)
Small regional/rural-highest SES	1.03 (0.96-1.09)	0.94 (0.85-1.03)
Marital status		
Married/de facto	ref	ref
Not married	1.14 (1.10-1.18)	1.17 (1.11-1.23)
Infant characteristics		
Neonatal morbidity/GA		
With morbidity: ≤33 weeks	2.77 (2.55-3.01)	2.76 (2.44-3.12)
With morbidity: 34-36 weeks	2.29 (2.06-2.55)	2.76 (2.33-3.27)
With morbidity: 37-38 weeks	3.32 (2.98-3.69)	3.22 (2.73-3.81)
With morbidity: 39-41 weeks	2.83 (2.63-3.04)	3.47 (3.07-3.92)
With morbidity: >41 weeks	2.07 (1.46-2.94)	2.91 (1.23-6.89)
No morbidity: ≤33 weeks	1.67 (1.40-2.04)	1.68 (1.34-2.10)
No morbidity: 34-36 weeks	1.61 (1.51-1.71)	1.66 (1.53-1.81)
No morbidity: 37-38 weeks	1.26 (1.22-1.30)	1.27 (1.22-1.33)
No morbidity: 39-41 weeks	Ref	Ref
No morbidity: >41 weeks	0.93 (0.85-1.01)	1.10 (0.90-1.35)
Birth order		
First born	ref	ref
2nd born or >	1.16 (1.13-1.20)	1.14 (1.09-1.18)

Multiple birth		
Singleton	ref	ref
Twins/triplets	1.24 (1.15-1.32)	1.18 (1.07-1.30)

Ref = referent, SES = socioeconomic status
*Adjusted for all variables in tables

Figure 1. Observed trend, predicted trend accounting for changes in maternal and infant risk factors*, for infants admitted to hospital per 100 births, NSW 2001-2009.



*Predicted trend is adjusted for maternal age, smoking, birth in private hospital, length of hospital stay at birth, marital status, geographic area/socio-economic status, neonatal morbidity, gestational age, birth order, and multiple pregnancy