THE EPIDEMIOLOGY OF RESPIRATORY SYNCYTIAL VIRUS INFECTIONS IN NSW CHILDREN, 1992–1997

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This paper evaluates the data describing respiratory syncytial virus (RSV) infection in infants and children aged less than five years in NSW, and in particular children aged less than one year. This younger age group forms the primary target group for immunisation against RSV and vaccine development is now well advanced. The data outlined in this paper provide a baseline for evaluating the burden of disease before and after the introduction of a vaccine.

BACKGROUND

RSV is the most important cause of viral lower respiratory tract disease in infants and children throughout the world.[1] RSV is estimated to cause up to 80 per cent of hospital admissions for bronchiolitis in infants under one year of age and is characterised by wheezing and hypoxia. RSV is also associated with pneumonia, croup, bronchitis, otitis media and upper respiratory tract infections.[2,3,4] Acute bronchiolitis and bronchitis are the sixth most common causes of hospital admissions in Australian children.[5]

Overseas literature suggests that infants aged 2–6 months are most severely affected by RSV infection, and mortality rates are higher among those with underlying respiratory and cardiac conditions.[2,6] Despite the considerable effect on public health of this disease, there are very little recent epidemiological data available in Australia. Treatment options remain limited but vaccine development is proceeding and clinical trials have commenced.[7]

METHODS

As RSV infection is not a notifiable disease, a number of sources of data were used to build a picture of the age distribution, seasonality and incidence of RSV infection in NSW. Three data sources, each identifying the most severe outcomes of RSV disease (that is, cases resulting in hospitalisation) were used.

The Virology and Serology Laboratory Reporting Scheme (LabVISE)

This is a national sentinel surveillance database reporting a range of virologic and serologic identifications and is co-ordinated by the National Centre for Disease Control.[8] The scheme comprises sentinel laboratories across Australia. However the laboratories included can vary over time, and not all hospitals submit diagnostic specimens to the collection. Data items analysed in our study for RSV were collection date, laboratory code, age, sex and postcode of residence.

NSW Inpatient Statistics Collection

This database provides information on all hospital admissions in private and public hospitals in NSW. Data were accessed via the Public Health Division's HOIST data warehouse. It includes the principal diagnosis responsible for the hospital admission, which is classified as an ICD-9 code.[9] As there was no specific ICD-9 code for RSV infection during the study period, alternative codes were investigated, which we understood would cover most RSV infections in young children. Consequently, patient records with ICD-9 codes 466.1 ('acute bronchiolitis') and 079.89 ('other specified viral infections') as the principal diagnosis for admission (mutually exclusive) were extracted.[9] Records for young children (aged less than one year) coded under 079.89 were called 'presumed RSV' in this study. Data for acute bronchiolitis were available for analysis from 1990 to 1995, and for 'presumed RSV' from June 1994 to December 1995. Data items analysed were age, sex, hospital admission date and Area Health Service of residence.

Australian Bureau of Statistics (ABS) Mortality Data

This collection provides information on all deaths in Australia as collected from registration of deaths provided by the Registrars of Births, Deaths and Marriages in each State and Territory. Data were accessed via the Public Health Division's HOIST data warehouse. The underlying cause of death is classified according to ICD-9 codes and deaths due to acute bronchiolitis (ICD-9 code 466.1) from 1992 to 1996 in NSW were analysed. Data items were age and year of death.

RESULTS

Laboratory Reports

Between January 1993 and December 1997 a total of 4,665 cases of RSV infection were reported to LabVISE for all ages where either postcode of residence or the notifying laboratory was in NSW. Between 770 and 1,131 cases were reported annually, with numbers peaking in 1997. Of all cases, 98.5 per cent were for children aged less than five years, 78 per cent for children less than one year of age, 53 per cent for children less than six months of age and 29 per cent for children less than three months of age.

There were more reports of RSV infection in males (male:female ratio = 1.4:1) for both all ages and children aged less than one year. A distinct seasonal pattern was found for the period 1993 to 1997, with

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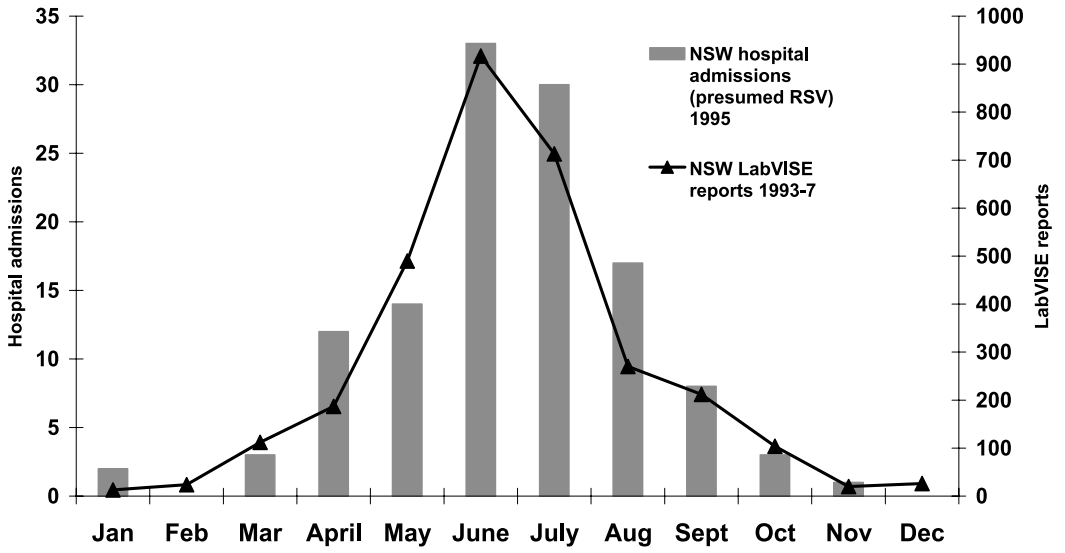
FIGURE 2

COMPARISON OF HOSPITAL ADMISSIONS FOR 'PRESUMED RSV' INFECTION AND LABVISE REPORTS BY MONTH FOR CHILDREN AGED LESS THAN ONE YEAR, NSW



reports increasing in May and peaking in June each year with little annual variability. Most cases (84 per cent) in children aged less than one year of age were reported between May and September (see Figure 2).

NSW Inpatient Statistics Collection (ISC)

Between 1990 and 1995 there were 22,969 admissions to hospital in NSW for all ages with acute bronchiolitis as the principal diagnosis. Of all cases, most (86 per cent) were children less than one year of age and a further 12 per cent were aged between 1–5 years. There were 375 admissions for other specified viral infections between June 1994 and December 1995. Of these, 66 per cent were children aged less than one year and a further 17 per cent were aged between 1–5 years.

Three-quarters (75.5 per cent) of admissions for acute bronchiolitis, and 78 per cent of those for 'presumed RSV' infection, were children aged six months or less. Admissions for acute bronchiolitis and 'presumed RSV' infection were similar in pattern to the LabVISE reports and peaked at between one and two months of age (see Figures 3 and 4 respectively).

A seasonal pattern was found, with a peak in June for 'presumed RSV' infection, and July for acute bronchiolitis. Both are compared with LabVISE reports in Figures 2 and 5.

Age-specific rates for acute bronchiolitis showed an overall increase in the six-year period from 1990 to 1995 with some variability on a year-to-year basis. Comparable data for 'presumed RSV' infection over this time frame were not available for analysis.

The annual incidence of hospitalisation for children less than one year of age for both conditions was significantly higher in rural than metropolitan (all health regions in Sydney, the Illawarra and Hunter districts) NSW. Rates for acute bronchiolitis in children less than one year of age were 56 per 1,000 population for rural NSW compared to 41 per 1,000 for metropolitan NSW ($P<0.0001$). For 'presumed RSV' infection the rates were three per 1,000 population for rural NSW compared to 1.5 per 1000 for metropolitan NSW ($p<0.0001$). Rates of hospital admission for all causes in this age group in 1995 were marginally higher in rural infants (1,372 per 1000) than metropolitan (1,340 per 1,000).

Mortality

From 1992 through 1996, seven children aged less than one year from NSW were reported to the ABS Cause of Death register with a diagnosis of acute bronchiolitis. Five of these deaths were in infants aged three months or less. The other two deaths were children aged between one and two years. One or two deaths occurred each year from 1992 to 1996, with boys more likely to die of acute bronchiolitis (male:female ratio = 1.5:1) in children aged one year or less. Children in this age group represented 56 per cent of deaths for all ages due to acute bronchiolitis in NSW.

DISCUSSION

Large numbers of children are admitted each winter to NSW hospitals with acute bronchiolitis, most of which is caused by RSV infection. Hospital data on RSV infection have been incomplete until recently. However, in July 1998 an ICD-10 code for RSV infection was introduced, so specificity of diagnoses should improve, subject to coding practices. LabVISE reports for RSV infection are likely to represent hospitalised cases, as laboratory tests

FIGURE 3

HOSPITAL ADMISSIONS FOR ACUTE BRONCHIOLITIS AND LABVISE (RSV) REPORTS IN CHILDREN AGED LESS THAN ONE YEAR, NSW

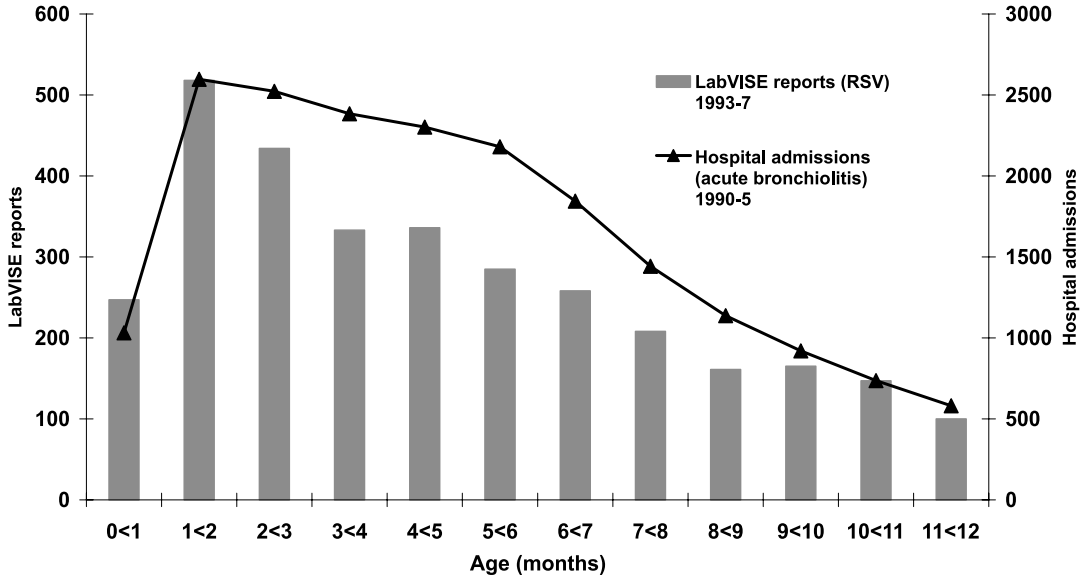


FIGURE 4

HOSPITAL ADMISSIONS FOR 'PRESUMED RSV' INFECTION AND LABVISE (RSV) REPORTS IN CHILDREN AGED LESS THAN ONE YEAR, NSW

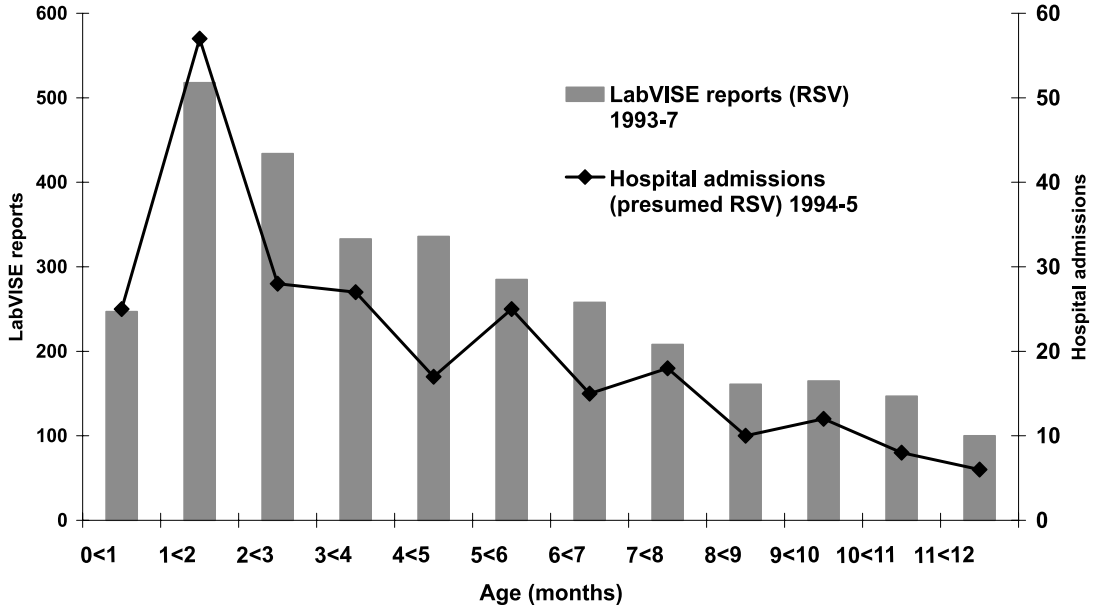
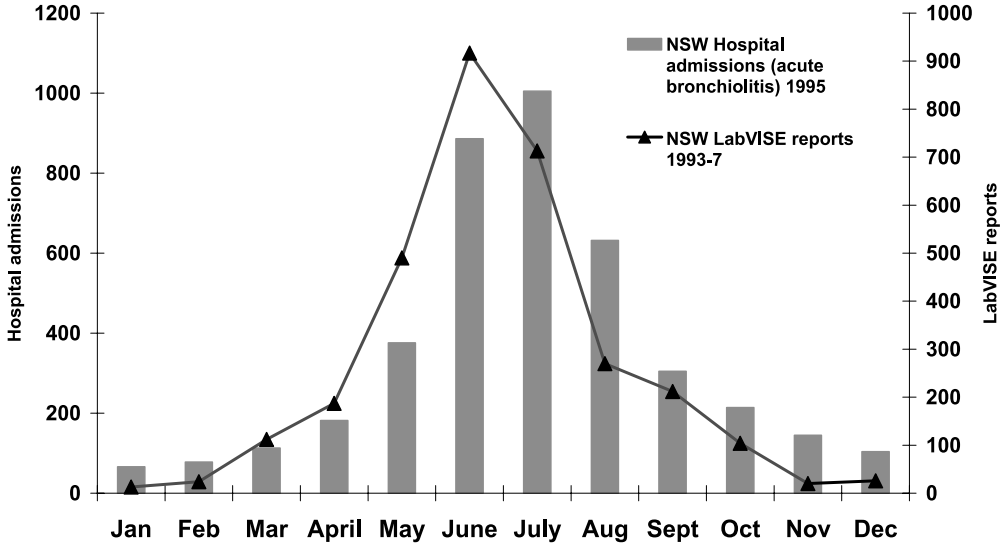


FIGURE 5

COMPARISON OF HOSPITAL ADMISSIONS FOR ACUTE BRONCHIOLITIS WITH LABVISE (RSV) REPORTS BY MONTH OF YEAR FOR CHILDREN AGED LESS THAN ONE YEAR, NSW



are almost exclusively done in these cases, particularly for young children. The data reported here thus reflect the pattern of hospitalised cases rather than RSV infection in the community.[10]

The increased reports of RSV from 1993–97 in LabVISE are likely to be due to increases both in testing and in the number of participating laboratories rather than a real increase in overall incidence of disease.[10] Hospital admission data also show a marked increase in 1995, reflecting year-to-year variation in RSV activity in NSW.

Admissions to hospital for 'presumed RSV' infection show a distinct seasonal pattern very similar to the pattern of reports from LabVISE, with the peak for admissions in June and most occurring between May and September (see Figures 2 and 5). Hospital admissions by age for both ICD-9 codes also show a very similar pattern to the LabVISE reports (see Figures 3 and 4). This close correspondence increases confidence that the two data sets are capturing similar populations. The analyses undertaken in this study suggest a slightly closer correspondence between 'presumed RSV' infection and LabVISE than for acute bronchiolitis, indicating that ICD-9 code 079.89 may be more specific for RSV infection in children aged less than one year.

Our study shows that children in rural areas have higher admission rates for acute bronchiolitis and RSV infection than urban children, but as rates of admission in young children for all causes are marginally higher in rural NSW, differences in medical and coding practices could partially explain this.

Hospitalisation in NSW occurred mainly in infants aged six months or less, particularly those aged one to two months. This is consistent with overseas and interstate findings.[1, 6] Overall, NSW hospitalisation rates for acute bronchiolitis in children less than one year of age are higher than those reported from Western Australia,[11] the USA, [12] and Denmark, [13] but these differences could be explained by annual variation in RSV occurrence and hospitalisation practices.

Mortality due to acute bronchiolitis shows a similar pattern to hospital admission and LabVISE data, with infants aged three months or less most severely affected. Again, these data are consistent with findings from overseas.[2,6]

Worldwide, RSV infection is a major cause of morbidity and an important priority for vaccine development. With up to two-thirds of infants infected with RSV by one year of age of whom 2.5 per cent are hospitalised, prevention of severe disease-causing hospitalisation in this age group is the primary objective of childhood immunisation.[1, 7] In NSW, prevention of RSV-related hospitalisation would result in a significant decrease in the absolute number of hospitalised infants, with potentially large cost savings. These data provide a baseline for assessment of the effect of RSV in NSW and for following annual trends to evaluate the burden of disease before and after the introduction of vaccine to prevent RSV infection.

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