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Oral health in NSW

# Improved oral health information for NSW

**GUEST EDITORS**

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Oral health services are an integral part of the New South Wales (NSW) health care system.[1] A population approach to the prevention of dental decay through water fluoridation and a systematic prioritisation of access to public dental health services on the basis of need have been the foundations of policy and provision of oral health services in NSW for more than half a century.

Oral health information collected on a population basis is used for a variety of planning purposes: monitoring trends and patterns in oral health and disease; assessing treatment needs across populations; identifying and prioritising implementation programs; and evaluating the outcomes of programs and approaches. Planning information is collected in various ways: randomised monitoring surveys either of the clinical status of populations or their use and perceptions of oral health and oral health services; aggregate routine data collected from service users; service-mix profiling from either questionnaire surveys or routine data collection analyses; special ad hoc surveys which investigate specific population groups or geographical areas; and longitudinal evaluation of specific programs and intervention regimens.[2] No single method provides the full picture of a population's needs, expectations or priorities, but each approach contributes significantly to providing more comprehensive evidence to underpin public policies and decision-making.

Policy changes and implementation of innovative approaches to prevention and provision of oral health services must make best use of limited resources and be based on sound evidence and research evaluation. Changes are occurring in the directions for prevention and service delivery in NSW, led largely by national and state strategic planning and funding opportunities. These developments must be evaluated against best practice and best investment opportunities in public oral health provision.[3–5]

This special issue of the *Bulletin* provides the most recent objective oral health information on the people of NSW. It builds upon the previous *National Oral Health Survey of Adults of 1987–88*, data collections from School Dental Service compilations dating back to the 1970s and the recent collaborative research with the Australian Research Centre for Population Oral Health.[6–8]

Between 1996 and 2000, NSW adopted a screening approach to reporting the prevalence and severity of dental decay in children. The Save Our Kids Smiles (SOKS) program systematically under-reported the extent of dental caries in NSW children.[9] Further, the introduction of a more targeted school dental service program in 2001 only collected information from school children at designated schools within disadvantaged populations, and only reported oral health data on those children who required dental treatment. Consequently, since 2001, with the lack of representative clinical data, oral health information on NSW children has not been included in national datasets by the Australian Institute of Health and Welfare.[10] The randomised selection of schools and children for the current child dental survey is thus a milestone in NSW and Australia. Rather than relying on routine data collection from an increasingly biased sample of public service users, this current survey provides a more representative sample on which to base sound future goals and targets. The child dental survey described by Phelan et al. in this issue of the *Bulletin*

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also provides adequate numbers of children in the key age groups, 5–6 years and 11–12 years, for area health service level monitoring and planning. This too is the first time such information has been available for rational local planning purposes.

There are gaps still in the objective randomised oral health data available. For example, the age ranges in the child dental survey do not include preschool children, some adolescent groups and populations with special needs. However, the data now available for NSW children 5–12 years of age are of sufficient dimension and robustness to provide area health services and the NSW Department of Health with strong markers for child oral health status. Changes can be measured against such markers as decay experience and enamel fluorosis as both population-based and specific preventive programs and different service modalities are implemented.

The Child Dental Health Survey also confirms the need for policy and planning directions to focus on reducing inequalities in oral health. A more complete picture is emerging on who and where the most advantaged children are with respect to oral health gains. This complete overview raises the question of what oral health services can do to address the determinants of this inequality and what they can do to provide a better framework for intervention programs.

Sivaneswaran's analysis of the adult oral health survey findings in NSW show that NSW data are consistent with trends across Australia.[8] In many aspects, the NSW population has achieved a higher level of oral health gain (for example, lower than average rates of total tooth loss) since the previous adult oral health survey than Australia overall. Again, however, it is the inequity in both access to dental services and the oral health outcomes that are the striking findings. The question the findings pose is how can we reduce the higher burden of oral diseases carried by those on low-incomes, those living in rural and remote NSW, and those without private dental health insurance.

The paper by Skinner et al., also published in this issue of the *Bulletin*, provides an insight into the oral health workforce in rural NSW and current initiatives that aim to meet the challenges of access, especially for rural and low-income communities.

Unlike the child dental survey, the NSW section of the adult oral health survey does not provide a sufficiently large sample to break down the oral examination information by area health service. There is therefore an ongoing need to both complement the data already gained with additional ad hoc surveys and establish a cycle of repeat randomised oral epidemiological surveys. However, the representative nature of the data collected at the state level, and their use in a sound and exploratory fashion, provide one of the first opportunities in NSW to evaluate exactly how well the NSW oral health system has been moving toward its stated strategic goals and objectives: for example, assessing the levels of oral health gain; setting reasonable targets for the next decade; identifying equity issues that have been disclosed to permit policy changes to reshape investment; recognising which efforts are required to reduce inequalities in access to dental services and oral health outcomes; and determining which public-private partnerships could be considered to find better geographical distributions to access problems.

Clinical oral health data collected through randomised surveys do not exist in a vacuum. Highly valuable information collected through the NSW Population Health Survey Program can be viewed in parallel with the present data to provide a more complete picture of the links between oral health activities and population perceptions of oral health. For example, the *2005–2006 Report on Child Health*, the *1997–2007 Report on Young Adults* and the *1997–2007 Report on Older People* supplement information from the oral health clinical data sets to permit more robust analyses of changing patterns and dental service usage in relationship to what is being measured at the clinical level.[11–13]

About 50% of 5–12-year-old children are reported to be caries free in the present survey, while the *2005–2006 Report on Child Health* found that 66.3% of 5–15-year-old children did not report any oral health problem within the previous 12 months. The perception of oral health need at a population level is therefore lower than suggested by the objective (clinical) data. In the younger aged population therefore, health planners should be vigilant to ensure that the overall trend toward improved oral health in children and adolescents does not lead to a lessening of advocacy for population prevention of dental disease or early childhood interventions.

Similarly, the somewhat static proportion of those aged over 65 who have visited a dental professional within the previous 12 months between 2002 and 2007 should be weighed against the objective evidence of the massive decline in the rates of edentulism (total tooth loss) and increased retention of more natural teeth in older people than was previously the case in 1987–1988.[13]

With one clear exception, what is evident in both sets of clinical data, and what runs through the NSW Population Health Survey Reports, is the low impact that our current clinical and preventive practices are having on reducing inequalities in oral health outcomes. The exception relates to water fluoridation.

While Blinkhorn, reassures us that the oral health of children and adults in NSW is 'as good as and in some cases better than' comparative populations from the United

States and the United Kingdom, both the current reports on NSW oral health information give us no reason for complacency.

The question that should therefore be at the forefront of our minds from the information presented in the following papers is whether we have the right preventive and early intervention systems in place, and the right assessment tools for tackling the major issue of inequalities in oral health. Wealth, ethnicity, access to private insurance and geography are key modifiers in the prevalence and distribution of dental disease and in access to dental services. Programs and methods to reduce inequities and inequalities should be the focus of intensive evaluation and investment. This approach should be accompanied by the development of an oral health equity assessment process to ensure that both initiatives and traditional dental practices are appropriately evaluated for inequity reductions as well as overall oral health gains for the NSW community.

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# Child Dental Health Survey 2007: a snapshot of the oral health status of primary school-aged children in NSW

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**Objectives:** The Child Dental Health Survey 2007 was commissioned to establish the oral health status of school children in NSW aged 5–12 years, to provide reliable regional oral health statistics and contribute to national population-based data collections. **Methods:** A total of 7975 children were clinically examined at 107 public, catholic and independent schools across NSW. **Results:** Key findings from the survey include: mean dmft for 5–6-year-olds of 1.53; mean DMFT for 11–12-year-olds of 0.74; 61.2% of 5–6-year-olds and 65.4% of 11–12-year-olds have never experienced decay in their primary and permanent teeth, respectively. These figures compare favourably to national benchmarks set in 2001. **Conclusions:** Data from the survey will be used as a baseline to measure the success of early intervention and prevention programs, for international comparisons, to provide solid evidence to support population oral health planning and for ongoing surveillance of populations of interest.

In 2001, the National Oral Health Monitoring Group proposed key indicators for assessment of oral health over time in Australia.[1] Two signature age groups were chosen as benchmark age groups. These were 5–6 and 11–12-year-old children. These age groups are used by the World Health Organization (WHO) in order to allow international comparisons of children's oral health status.[2] Children's dental caries (decay) is measured for primary (baby) teeth using the dmft (decayed, missing due to caries, filled teeth) index and for permanent teeth using the DMFT (Decayed, Missing due to caries, Filled Teeth) index. The lower the index, the better the dental health of the population. In addition, the proportion of children free from decay is also recorded. This measurement is critical to assess the impact of preventive programs and the need for clinical dental services.

In New South Wales (NSW), recent epidemiological data about children's oral health were based on those seeking treatment in the public dental system and therefore were biased towards populations with high disease levels. In order to provide meaningful data that would allow interstate and international comparisons, a scientifically based Child Dental Health Survey was commissioned by the Chief Dental Officer for NSW in 2007.

The survey was conducted in conjunction with NSW area health services, the Australian Research Centre for Population Oral Health (ARCPOH) at the University of Adelaide and the University of Sydney. Ethics approval for the survey was granted from the NSW Population and Health Services Research Ethics Committee and from the State Education Research Approvals Process, NSW Department of Education and Training.

The aim of the survey was to assist in planning oral health services by providing reliable regional oral health statistics for primary school-aged children while also contributing to national population-based data collections. The survey represents a more efficient approach to oral health data collections than those available through public dental system collections or through previous risk assessment programs undertaken in NSW.[3] It is the first survey in 20 years to use a randomised sample to investigate and report on various groups within the NSW child population. The aim of this paper is to present a snapshot of regional statistics and to provide evidence on the distribution of dental disease in children from populations of interest.

Note that within NSW Health, the term 'Aboriginal' is generally used in preference to 'Aboriginal and Torres Strait Islander', in recognition that Aboriginal people are the original inhabitants of NSW.



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## Methods

The survey covered a representative sample of children aged 5–12 years from metropolitan and non-metropolitan public, Catholic and independent schools in NSW. A two-stage sampling design was employed, with schools defined as the primary sampling units. First, schools were stratified by area health service region and a sample of schools was selected from each region to ensure adequate regional sample sizes. Prior to selection, schools within each region were sorted by the Index of Relative Socio-Economic Disadvantage, which is one of the Socio-Economic Indexes for Areas (SEIFA), to ensure a spread of schools from regions with various socio-economic backgrounds. Second, a random sample of children enrolled at each of these schools was selected ($n = 76$). Lists of student names were created and sorted by date of birth. Age was calculated as date of examination minus date of birth. Skip intervals were then applied for each age group to generate the required sample.

Children aged 5–6 and 11–12 years were over-sampled to allow area health service comparisons of disease status. These data have been identified by NSW Health as key data to support state and area health service planning, reporting and performance indicators.

Twenty teams of calibrated dental therapists and dental assistants collected the information during the 2007 calendar year. Standard equipment, including portable air syringe compressors, lighting and dental instruments were used to maximise inter-examiner reliability. A principal survey examiner conducted the training and calibration of examination teams, and also completed inter-examiner reliability testing on a sub-sample of children. The reliability of each of the examiners relative to the principal survey examiner was determined by calculating the intra-class correlation coefficient (ICC) of count data for each replicate pair and the Kappa values for categorical coding of individual tooth and surface status. The ICC was calculated using the method of Shrout and Fleiss, and Kappa statistics were calculated using the method of Cohen.[4,5]

Data were recorded on optical mark recognition forms developed by ARCPOH. These forms were retrofitted to TeleForm version 10 for scanning and verification. Data were then exported to Microsoft Access for further cleaning, following which data analysis was performed in SAS for Windows version 9.1.3.

Basic demographic data were collected, including date of birth, sex, postcode of residence and Aboriginality. Country of mother's birth and Centrelink concession card status were also collected. The level of dental caries in an individual was recorded by tooth surface and used to calculate tooth-level status. The average decay experience (mean number of dmf/DMF teeth) is an expression of the severity of the disease in the population. Need for immediate treatment (defined as requiring dental treatment for pain, abscessed teeth, grossly decayed teeth, avulsed or fractured teeth, or other severe conditions with oral manifestations) was recorded as was dental fluorosis using the Thylsrup and Fejerskov (T-F) Index.[6]

For each child, the postcode of residence was used to determine the area health service, fluoridation status of the reticulated water supply using the database maintained by the Centre for Oral Health Strategy, socioeconomic status using the SEIFA index and remoteness categories using the Accessibility/Remoteness Index for Australia. The estimated residential population at 30 June 2007 of 5–12-year-old children within each area health service region and age-specific class sizes in each school, were used to calculate sampling weights for each child.[7] These weights were applied when calculating regional age-specific indices and indices for population subgroups, to obtain estimates that were representative of 5–12-year-old children in NSW (Tables 1–3). NSW Health consulted closely with ARCPOH throughout the survey to ensure high reliability and validity of data so that national comparisons would be possible.

## Results

### *Assessment of inter-examiner reliability*

To assess the reliability of clinical measurements between examiners, replicate pairs of examinations were conducted with 131 children, who were examined by the principal survey examiner and by one of 20 clinical examiners. The number of replicate pairs for each examiner ranged from five to eight and examinations were conducted at nine different schools, with the number of examiners per school ranging from one to six.

High levels of agreement were obtained for tooth presence, missing, decayed or filled teeth (ICC values ranged 0.89 to 1.00; Table 4). Excellent agreement was obtained for decayed, missing or filled status of individual teeth or surface (Kappa values were 0.86 and 0.89, respectively; Table 5).

### *Child dental health status*

A total of 7975 children were examined from 107 schools. There were 3923 male and 4052 female respondents. In the two key indicator age groups, there were 2095 in the 5–6-year-old group and 2418 respondents in the 11–12-year-old group. The mean ages of these groups were 6.1 years and 11.8 years respectively.

### *Five–six-year-old age group*

The mean dmft for 5–6-year-olds was 1.53 and the mean decayed teeth (d) component was 1.1 (Table 1). Among 5–6-year-old children with untreated decay in their primary teeth ($d > 0$), mean dmft was 3.94 with an average of 2.8 decayed primary teeth. Table 1 shows that the mean dmft index

**Table 1. Weighted oral health indicators in primary teeth of 5–6-year-old children by NSW area health service**

| Area Health Service | No. of children* | Mean dmft | | Mean no. decayed teeth | | Caries free (%) |
|---|---|---|---|---|---|---|
| | | All children | d > 0 | All children | d > 0 | |
| Sydney South West | 313 | 1.48 | 3.80 | 1.1 | 2.8 | 61.1 |
| South Eastern Sydney Illawarra | 257 | 0.91 | 3.14 | 0.5 | 1.8 | 71.1 |
| Sydney West | 323 | 1.77 | 4.31 | 1.4 | 3.3 | 59.1 |
| Northern Sydney Central Coast | 304 | 0.99 | 3.52 | 0.7 | 2.5 | 71.8 |
| Hunter New England | 256 | 1.20 | 3.24 | 0.9 | 2.5 | 62.9 |
| North Coast | 215 | 2.75 | 4.64 | 1.9 | 3.3 | 40.7 |
| Greater Southern | 236 | 2.16 | 4.40 | 1.6 | 3.2 | 50.8 |
| Greater Western | 192 | 2.66 | 4.87 | 1.8 | 3.3 | 45.4 |
| **NSW** | **2095** | **1.53** | **3.94** | **1.1** | **2.8** | **61.2** |

dmft: decayed, missing due to caries, filled teeth index for primary teeth; d: decayed primary teeth. Source: The Child Dental Health Survey, NSW 2007. Centre for Oral Health Strategy.
*The number of children were rounded to the next whole integer for ease of interpretation and hence the sum may differ due to rounding.

**Table 2. Weighted oral health indicators in permanent teeth of 11–12-year-old children by NSW area health service**

| Area Health Service | No. of children* | Mean DMFT | | Mean no. decayed teeth | | Caries free (%) | Fissure sealant (%) |
|---|---|---|---|---|---|---|---|
| | | All children | D > 0 | All children | D > 0 | | |
| Sydney South West | 345 | 0.69 | 2.14 | 0.5 | 1.4 | 67.9 | 12.5 |
| South Eastern Sydney Illawarra | 299 | 0.66 | 2.12 | 0.3 | 0.9 | 68.8 | 10.9 |
| Sydney West | 381 | 0.88 | 2.24 | 0.5 | 1.4 | 60.6 | 16.2 |
| Northern Sydney Central Coast | 364 | 0.68 | 2.03 | 0.3 | 0.9 | 66.7 | 33.7 |
| Hunter New England | 292 | 0.44 | 1.81 | 0.2 | 0.8 | 75.9 | 8.9 |
| North Coast | 254 | 1.07 | 2.39 | 0.7 | 1.5 | 55.2 | 28.8 |
| Greater Southern | 264 | 0.83 | 2.11 | 0.3 | 0.9 | 60.5 | 16.8 |
| Greater Western | 219 | 0.96 | 2.13 | 0.5 | 1.1 | 54.8 | 24.8 |
| **NSW** | **2418** | **0.74** | **2.13** | **0.4** | **1.2** | **65.4** | **17.9** |

DMFT: Decayed, Missing due to caries, Filled Teeth index for permanent teeth; D: decayed permanent teeth. Source: The Child Dental Health Survey, NSW 2007. Centre for Oral Health Strategy.
*The number of children were rounded to the next whole integer for ease of interpretation and hence the sum may differ due to rounding.

varied widely between area health services. The levels of untreated decay (the d component of the index), showed similar area health service differences. North Coast, Greater Southern and Greater Western all recorded high levels of untreated decay: 1.9, 1.6 and 1.8, respectively.

These marked differences in mean dmft and d scores were also reflected in the proportions of children in the different area health services who were caries free. The proportions varied from 71.8% to 40.7%.

### *Eleven–twelve-year-old age group*

The mean DMFT for 11–12-year-old children was 0.74 and the mean D value was 0.4 (Table 2). Among 11–12-year-old children with untreated decay in their permanent teeth (D > 0), mean DMFT was 2.13, with an average of 1.2 decayed permanent teeth. Again, large differences were found between area health service regions, with Hunter New England having the lowest mean DMFT score of 0.44 and North Coast having the highest at 1.07.

Table 2 also shows that the differences in untreated decay rates were considerable: 0.2 in Hunter New England and up to 0.7 in the North Coast. The overall proportion of 11–12-year-old children free from dental decay in their permanent teeth was 65.4%; however, these proportions varied from 54.8% to 75.9%.

The survey collected data on the presence of fissure sealants in each child. The proportion of children in the 11–12-year-old age group with at least one fissure sealant present in their permanent teeth was 17.9% statewide and varied from 33.7% in Northern Sydney Central Coast to 8.9% in Hunter New England (Table 2).

### *Subpopulation statistics for the whole sample*

Four-hundred and fifty-eight Aboriginal children were surveyed, comprising 5.7% of the survey population This is higher than the statewide proportion of Aboriginal children in NSW (4.0%); however, any over-sampling was unintentional.[8] These children had considerably higher

**Table 3. Weighted oral health indicators for 5–12-year-old children by NSW population subgroups**

| Population subgroup | No. of children | Mean dmft/DMFT | Mean no. of decayed teeth | Caries free (%) |
|---|---|---|---|---|
| **Aboriginality** | | | | |
| Aboriginal | 458 | 2.64 | 1.8 | 36.2 |
| Non-Aboriginal | 6591 | 1.54 | 0.9 | 52.8 |
| **Centrelink Concession Card holder** | | | | |
| Yes | 2807 | 2.14 | 1.4 | 42.5 |
| No | 4959 | 1.34 | 0.7 | 56.6 |
| **Immediate treatment needed** | | | | |
| Yes | 414 | 5.11 | 4.1 | 3.6 |
| No | 7470 | 1.43 | 0.8 | 54.3 |
| **Fluoridated areas** | | | | |
| Fluoridated | 6815 | 1.56 | 0.9 | 52.7 |
| Non-fluoridated | 1160 | 2.01 | 1.2 | 44.0 |
| **Socioeconomic status*** | | | | |
| 1st quintile (highest) | 1132 | 1.09 | 0.5 | 61.0 |
| 2nd quintile | 1375 | 1.37 | 0.8 | 57.7 |
| 3rd quintile | 1859 | 1.86 | 1.1 | 46.2 |
| 4th quintile | 2128 | 1.62 | 1.0 | 51.7 |
| 5th quintile (lowest) | 1481 | 2.02 | 1.3 | 44.3 |
| **Remoteness**** | | | | |
| Major cities | 4992 | 1.48 | 0.9 | 53.9 |
| Inner regional | 2135 | 1.85 | 1.1 | 48.1 |
| Outer regional | 711 | 2.21 | 1.3 | 42.2 |
| Remote and very remote | 137 | 2.27 | 1.4 | 40.9 |
| **NSW** | **7975** | **1.61** | **1.0** | **51.7** |

DMFT: Decayed, Missing due to caries, Filled Teeth index for permanent teeth; dmft: decayed, missing due to caries, filled, teeth index for primary teeth. *SEIFA: Australian Bureau of Statistics Socio-Economic Indexes for Areas. **ARIA: Accessibility/Remoteness Index of Australia. Source: The Child Dental Health Survey, NSW 2007. Centre for Oral Health Strategy.

**Table 4. Intra-class correlations (ICC) for assessment of inter-rater reliability* of the Child Dental Health Survey, NSW 2007**

| Index per child | No. of examiners | No. of children | ICC |
|---|---|---|---|
| Number of teeth present | 20 | 131 | 1.00 |
| Number of teeth missing due to pathology | 4 | 6 | 0.96 |
| Number of decayed teeth | 20 | 70 | 0.97 |
| Number of filled teeth | 19 | 46 | 0.89 |
| Number of decayed, missing or filled teeth | 20 | 82 | 0.99 |
| Number of decayed, missing or filled surface | 20 | 82 | 0.99 |

*For some indicators, not all examiners were able to be assessed or some children were excluded from the assessment as the relevant conditions were not present. Source: The Child Dental Health Survey, NSW 2007. Centre for Oral Health Strategy.

**Table 5. Kappa statistics for assessment of inter-rater reliability of the Child Dental Health Survey, NSW 2007**

| Index | No. of examiners | No. of children | % agreement | Kappa |
|---|---|---|---|---|
| Decayed, missing or filled category of individual teeth | 20 | 82 | 93.0 | 0.86 |
| Decayed or filled category of individual surface | 20 | 80 | 94.7 | 0.89 |

Source: The Child Dental Health Survey, NSW 2007. Centre for Oral Health Strategy.

dental disease experience than non-Aboriginal children in the survey (2.64 versus 1.54 dmft/DMFT; Table 3) and had on average twice as many decayed teeth (1.8 versus 0.9).

The Centrelink Concession Card holder status of children's parents or guardians was collected in order to determine socioeconomic status. Data on children for 2807 Centrelink Health Care Card, Pensioner Concession Card and Commonwealth Seniors Health Card holders in NSW were collected in the survey. These children experienced substantially higher rates of dental disease than the remainder of the survey population (2.14 versus 1.34 dmft/DMFT; Table 3) and had on average twice as many decayed teeth (1.4 versus 0.7).

The survey identified 414 children in NSW (5.2% of the survey population) who required immediate treatment. Those that required immediate treatment had a mean dmft/DMFT rate of 5.11 and had 4.1 decayed teeth on average (Table 3). Only 3.6% of children requiring immediate treatment had never experienced decay.

In 2007, children living in fluoridated areas of NSW had lower mean dmft/DMFT rates than those living in non-fluoridated areas (1.56 versus 2.01; Table 3) and there were a higher proportion of children who had never experienced decay compared with children in non-fluoridated areas (52.7% versus 44%).

The mean dmft/DMFT rate by socioeconomic status was also compared using the SEIFA index of relative socioeconomic disadvantage, with the mean dmft/DMFT rate increasing from 1.09 in the highest socioeconomic status quintile to 2.02 in the lowest quintile (Table 3). Similarly, the mean number of decayed teeth increased from 0.5 in the highest quintile to 1.3 decayed teeth in the lowest quintile. The proportion of children aged 5 to 12 years with no caries experience decreased from 61.0% in the highest quintile to 44.3% in the lowest quintile.

Oral health status deteriorated with increased remoteness. In NSW in 2007, mean dmft/DMFT increased from 1.48 in the major cities to 2.27 in the remote and very remote areas (Table 3). The number of decayed teeth also increased with remoteness, from an average of 0.9 decayed teeth in the major cities to 1.4 in the remote and very remote areas. The proportion of children with no decay experience decreased with increasing remoteness, falling from a proportion of 53.9% in the major cities to 40.9% in the remote and very remote areas.

## Discussion

The data from the survey provide an important snapshot of the oral health status of primary school-aged children in NSW. While statewide data show disease levels comparable to national rates, there are still large variations in NSW particularly in terms of remoteness, Aboriginality, access to water fluoridation and socioeconomic status.

The mean dmft in 5–6-year-old children in NSW is 1.53, which compares favourably to the national benchmark in 2001 of 1.89. Children aged 5–6 years in NSW had on average 1.1 primary teeth that were decayed. The mean dmft varied from 0.91 in South Eastern Sydney Illawarra to 2.75 in the North Coast and the mean number of decayed primary teeth varied from 0.5 in South Eastern Sydney Illawarra to 1.9 in the North Coast, reflecting both rural/urban differences in disease status as well as access to fluoridated water supplies.

The mean DMFT of 11–12-year-old children in NSW is 0.74, which compares favourably to the national benchmark in 2001 of 0.95. Children aged 11–12 years in NSW had, on average, 0.4 permanent teeth that were decayed. The mean DMFT varied from 0.44 in Hunter New England to 1.07 in the North Coast and the mean number of decayed permanent teeth varied from 0.2 in Hunter New England to 0.7 in the North Coast.

The high level of dental disease detected in Aboriginal children in this survey is consistent with the findings of previous child dental health surveys.[9] In NSW, 16 Aboriginal Community Controlled Organisations provide dental services to local communities using a combination of Commonwealth and NSW Government funding. These services are often in rural and remote communities that do not have access to fluoridated water supplies.

The NSW Government, via the NSW Department of Health and the Centre for Oral Health Strategy, have implemented a range of programs to prevent dental decay in children and to identify disease early and intervene where appropriate. These programs include initiatives to encourage water supply authorities to introduce water fluoridation, the Early Childhood Oral Health Program and various oral health promotion initiatives.[10] These health promotion activities are related to the priorities of both the State Health Plan and NSW State Plan with the latter describing the state oral health strategy as being '...to design and implement new models of care with a focus on prevention and early intervention'.[11] The State Health Plan also includes the expansion of the '…availability of fluoridated water to the State's population' and the need for better oral health promotion programs'.[12] In order to monitor the progress of these programs, surveys of child dental disease status will be required on an ongoing basis.

The use of pit and fissure sealants among children at high risk of dental caries has been proven to be a cost-effective intervention for public oral health services.[13,14] This strategy is mandated by a NSW Health Policy Directive.[15] NSW Health has developed draft targets in response to the

finding of the Child Dental Health Survey 2007 that statewide only 17.9% of children aged 11–12 years had one or more fissure sealants present in their permanent teeth. It has been proposed that the target coverage should be 25% by 2012.

The Child Dental Health Survey 2007 has provided high quality data that encourages area health services to make the shift to an evidence-based population health approach and allows NSW Health to set targets for proven preventive strategies and to evaluate preventive programs. Area health services have further benefited through the development of local expertise in epidemiological survey methods and through having access to updated scanning and data processing technology at the state-level. The usefulness of the survey data has been enhanced by the timeliness of data processing, the analysis and release of which took approximately 8 months. The survey has established baseline data that will be comparable with data to be collected by the National Child Dental Health Survey planned for 2010 and 2011.

## Conclusions

- NSW Health has demonstrated that it is possible to undertake a statewide survey of school children's dental disease status with a minimum of disruption to schools and to the ongoing provision of clinical oral health services.
- Data from the Child Dental Health Survey 2007 provide solid evidence to support population oral health planning at both regional and state levels, and facilitate ongoing surveillance of populations of interest.
- The rate of dental disease in Aboriginal children is a continuing cause for concern, being almost twice that of the NSW child population.

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# The oral health of adults in NSW, 2004–06

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**Abstract: Objectives:** The *2004–06 National Survey of Adult Oral Health* was Australia's second oral examination survey of a nationally representative sample of adults. The aim of this paper is to provide a brief overview of oral health in the NSW adult population from the findings of the survey. **Methods:** A three-stage, stratified, clustered sampling design was used to select NSW residents aged 15 years and over. Self-reported information about oral health was obtained through telephone interviews. People with natural teeth were offered clinical examinations. **Results:** 3630 people were interviewed and 1099 underwent a clinical examination. Only 5.5% of the study population were edentulous (all natural teeth missing) compared with the national estimate of 6.4%. The Decayed, Missing, Filled Teeth (DMFT) caries severity index was 12.8, equal to that of the Australian population; prevalence of untreated decay was 27.1%, which was not significantly different to the national estimate of 25.5%. Some 60.3% of the NSW survey sample had visited a dentist within the last 12 months (nationally 59.4%) and 56.8% visited for a check-up (56.2% nationally). Oral health, use of dental services and perceptions of need varied significantly by geographic location, private insurance patronage and eligibility for public dental care. **Conclusions:** The oral health of the NSW adult population and patterns of dental care are similar to that estimated nationally. The prevalence and severity of dental diseases and oral health behaviours are influenced by social and geographic factors.

In New South Wales (NSW), the lack of representative clinical data on the oral health of adults has curtailed a comprehensive and co-ordinated approach to planning for oral health services, policy and program development. Although clinical data have been collected on the oral health of patients who attended public dental care in 1995–96 and 2001–02, the *1987–88 National Oral Health Survey* remained the only survey that had collected oral examination data on a representative sample of NSW residents.[1–4]

In 2004, the Centre for Oral Health Strategy was responsible for conducting the NSW component of the *National Survey of Adult Oral Health 2004–06* in accordance with methods developed by the Australian Research Centre for Population Oral Health (ARCPOH) at the University of Adelaide, South Australia. The survey was a cross-sectional study of a representative sample of people aged 15 years and over across each state and territory, and described levels of oral disease, perceptions of oral health and patterns of dental care. Detailed methodology of the survey, national findings and NSW findings have been reported elsewhere.[5,6] The aim of this paper is to provide an overview from the findings of the survey of oral health in the NSW adult population, by using key indicators to compare NSW data between population subgroups and with national estimates. Data presented here were drawn from the national report and the NSW publication.[5,6]

## Methods

A three-stage, stratified, clustered sampling design was used to select people from the target population of NSW residents aged 15 years and over. The sampling frame was households with telephone numbers listed in the electronic white pages database. Self-reported information about oral health and characteristics associated with it were obtained through telephone interviews. People with natural teeth were invited to attend a dental clinic for a clinical examination. Standardised clinical oral examination was carried out by 11 dentists trained and calibrated in the survey procedures by ARCPOH. Reliability testing was carried out against an ARCPOH principal survey examiner. Inter-examiner reliability was similar to benchmarks reported in the United States and United Kingdom national oral health surveys.

Data were weighted to compensate for individuals' different probabilities of selection and survey participation rates. Additional data on height, weight and waist measurements were collected in NSW. Data collection began in July 2004 and was completed in September 2006. Statistical significance in the survey was reported using 95% confidence intervals (95% CIs). This criterion for judging statistical significance is more conservative than


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**Table 1. Key indicators of oral health status of NSW adults and comparison with national estimates**

| Oral health status | NSW (95% CI) | Australia (95% CI) |
|---|---|---|
| Percentage of adults with complete tooth loss | 5.5 (4.8–6.3) | 6.4 (6.0–6.9) |
| Percentage of adults with fewer than 21 natural teeth | 11.7 (10.5–13.1) | 11.4 (10.7–12.1) |
| Percentage of dentate adults who wear dentures | 15.9 (14.5–17.4) | 14.9 (14.2–15.7) |
| Percentage of adults with untreated coronal decay* | 27.1 (23.6–30.9) | 25.5 (23.7–27.3) |
| Average number of teeth per person missing due to pathology | 4.9 (4.4–5.4) | 4.5 (4.3–4.8) |
| Average number of decayed, missing or filled teeth per person | 12.8 (11.9–13.7) | 12.8 (12.4–13.3) |
| Percentage of adults with >4 mm periodontal pocket depth** | 21.4 (17.8–25.5) | 19.8 (17.9–21.8) |

95% CI: 95% confidence interval for estimated percentage/estimated mean.
*Percentage of people who have at least one or more decayed surface on the crowns of their teeth.
**An indicator for the severity of periodontal disease is measurement of periodontal pocket depths more than 4 mm.
Source: The National Survey of Adult Oral Health 2004–06. New South Wales.[6]

the alternative method of calculating P-values because 95% CIs that overlap to a small degree could be found to differ to a statistically significant degree (at $P < 0.05$) using a hypothesis test. Data analysis was carried out by ARCPOH and, at the time of writing, no secondary analysis of the NSW unit record files made available to the Centre for Oral Health Strategy has been carried out.

## Results

### *Socio-demographic characteristics of NSW participants*

Out of 3630 NSW adults interviewed, 1099 underwent a clinical examination. One-half of the survey sample was female (49.8%), two-thirds lived in the capital city (64.1%), one-half had dental insurance (48.6%) and a quarter were government Health Care Card holders (26.4%).

### *Oral health status of NSW adults*

Complete loss of teeth (edentulism) is a marker of dental mortality. It is a consequence of both extensive dental disease and a surgical approach to its treatment. In NSW, only 5.5% of the population were edentulous compared with the national estimate of 6.4%. In the National Survey of Adult Oral Health, a threshold of 21 teeth was used as an indicator of professionally defined inadequacy of the natural dentition. The percentage of NSW adults who had fewer than 21 teeth (11.7%) was similar to the national figure of 11.4%. There was no statistically significant difference between NSW dentate (people with teeth) adults who wear dentures in the upper or lower jaws (15.9%) compared with the national estimate of 14.9%. The prevalence of untreated coronal decay was reported as the percentage of dentate people who had at least one or more decayed surfaces on the crowns of their teeth. In NSW the prevalence of untreated coronal decay was 27.1% compared with the national estimate of 25.5%. There was no significant difference in the number of teeth missing due to pathology between dentate persons in NSW and those in the whole of Australia. The DMFT index reflects a person's lifetime experience of dental caries. The DMFT for NSW (12.8) is the same as that for the Australian population. An indicator for the severity of periodontal disease is a measurement of periodontal pocket depths more than 4 mm. The percentage of NSW adults who had at least one site with a periodontal pocket depth of 4 mm or more (21.4%) was not significantly different to the national estimate of 19.8% (Table 1).

### *Utilisation patterns of dental services by NSW adults*

Time since last visiting a dentist is a key indicator of access to dental care. In NSW, 60.3% of adults visited a dentist within the last 12 months, which was not significantly different from the national estimate of 59.4%. The majority of adults visited a private dental practice (80.8%), which was not significantly different to the whole Australian population (83.1%). The visiting behaviours of NSW adults was not different from that of all Australian adults with 54.9% of NSW adults visiting at least once a year compared with the national estimate of 53.1%. Usual attendance at the same dentist implies continuity of care and again there are no significant differences between NSW and all Australian adults. Approximately half of NSW adults visited a dentist for a check-up, which was similar to the figure for all Australian adults (Table 2).

### *Oral health perceptions of NSW adults*

In addition to clinical examination, self-reported oral health, rates of pain and perceived needs for the most common dental treatments were collected to provide additional indicators of subjective oral health. There was no significant difference between NSW and all Australian adults in self-reporting of oral health, experiencing toothache and orofacial pain. Similarly, there was no difference in rates of the perceived need for extraction or filling. Those who perceived a need for extraction or filling were asked about the urgency of needed dental treatment. There was no difference in perceived urgency for treatment, with 71.6% of NSW adults reporting a need for treatment within 3 months, which is not significantly different to the national estimate of 69.3% (Table 3).

**Table 2. Key indicators of utilisation patterns of dental services by NSW adults and comparisons with national estimates**

| Utilisation patterns | NSW (%) (95% CI) | Australia (%) (95% CI) |
|---|---|---|
| Adults visiting dentist within last 12 months | 60.3 (58.3–62.2) | 59.4 (58.2–60.5) |
| Adults who attended a private dental practice at last dental visit | 80.8 (78.6–82.7) | 83.1 (82.0–84.2) |
| Adults who visit a dental professional at least once a year | 54.9 (52.5–57.2) | 53.1 (51.8–54.5) |
| Adults who have a dentist they usually attend | 81.4 (79.3–83.3) | 78.6 (77.3–79.8) |
| Adults who usually visit a dentist for a check-up | 56.8 (54.4–59.2) | 56.2 (54.8–57.5) |

95% CI = 95% confidence interval for estimated percentage.
Source: The National Survey of Adult Oral Health 2004–06. New South Wales.[6]

**Table 3. Key indicators of oral health perceptions of NSW adults and comparisons with national estimates**

| Oral health perceptions | NSW (%) (95% CI) | Australia (%) (95% CI) |
|---|---|---|
| Adults rating their oral health as fair-to-poor | 16.9 (15.1–18.8) | 16.4 (15.5–17.4) |
| Adults experiencing toothache | 16.2 (14.5–18.2) | 15.1 (14.2–16.1) |
| Adults experiencing orofacial pain* | 23.3 (21.5–25.1) | 22.6 (21.6–23.6) |
| Adults perceiving a need for an extraction or filling | 31.1 (29.3–32.9) | 32.9 (31.7–34.0) |
| Adults perceiving urgency for treatment (within 3 months) | 71.6 (67.7–75.2) | 69.3 (67.4–71.3) |

95% CI = 95% confidence interval for estimated percentage.
*Percentage of participants who reported pain in the face, jaw, temple, in front of the ear or in the ear during the last month.
Source: The National Survey of Adult Oral Health 2004–06. New South Wales.[6]

### *Oral health of NSW adults by population subgroup*

The oral health of NSW adults by major socio-demographic subgroup were defined according to residential location, dental insurance status and by government Health Care Card status. A government Health Care Card is a concession card issued by the Australian Government that entitles the holder to services, including public dental care. Eligibility for a Health Care Card is determined by a means test based primarily on income, assets and family composition.

The frequency of oral disease and its consequences (complete tooth loss, fewer than 21 natural teeth and untreated coronal decay) is significantly higher among those who reside outside of the capital city, Health Care Card holders and those without dental insurance (Table 4). For example, Health Care Card holders are more than seven times more likely to be edentulous compared with non-Health Care Card holders and more than five times more likely to have fewer than 21 natural teeth. Untreated coronal dental decay reflects both the prevalence of dental decay and access to dental care for treatment; this marker of prevalence and access was significantly higher in Health Care Card holders, those without dental insurance and those living outside of the capital city. Oral disease is significantly more widespread among Health Care Card holders and those without insurance on all indicators of oral health except in the occurrence of periodontal deep pockets.

Health Care Card holders and those without insurance also have significantly less favourable patterns of utilisation on all indicators of dental care (Table 5). All three aspects of usual dental attendance patterns (attending at least once a year, usually attend the same dentist and attending for a check-up) were also significantly lower among residents outside of the capital city.

It was therefore not surprising that significantly more Health Care Card holders rated their oral health as fair-to-poor, reported experiencing more toothache and perceived a need for treatment. Significantly more uninsured adults also reported their oral health as poor and perceived a need for treatment (Table 6).

## Discussion

The major findings from this study indicate that generally, the oral health of the NSW adult population is similar to the whole of the adult population in Australia. Since the 1987–88 survey, the proportion of NSW adults who had no natural teeth more than halved to 5.5%, which is consistent with the figure of 5.1% reported in the *2007 NSW Adult Health Survey*.[7] In dentate adults, there were similar reductions in the percentage with an inadequate natural dentition. Improvements were also reported in the decay experience since the last survey, with a fluoride generation (those born since the 1950s and 1960s) of NSW residents who have now

**Table 4. Oral health status of NSW adults by population subgroup**

| Oral health status | All NSW adults (95% CI) | Capital city/other locations (95% CI) | Non Health Care Card holders/Health Care Card holders*** (95% CI) | Insured/uninsured (95% CI) |
|---|---|---|---|---|
| Percentage of adults with complete tooth loss | 5.5 (4.8–6.3) | 4.0 (3.3–4.8)<br>8.1 (6.6 –9.8) | 2.0 (1.6–2.5)<br>15.4 (13.3–17.8) | 2.3 (1.7–3.0)<br>8.4 (7.2–9.8) |
| Percentage of adults with fewer than 21 natural teeth | 11.7 (10.5–13.1) | 10.3 (8.7–12.1)<br>14.3 (12.4–16.4) | 6.0 (5.1–7.1)<br>31.3 (27.9–34.8) | 7.3 (6.0–8.8)<br>16.2 (14.2–18.4) |
| Percentage of adults with untreated coronal decay* | 27.1 (23.6–30.9) | 21.4 (17.6–25.6)<br>37.4 (30.7–44.6) | 23.8 (19.8–28.3)<br>36.9 (30.0–44.3) | 20.7 (15.6–26.8)<br>33.2 (28.6–38.2) |
| Average number of decayed, missing or filled teeth per person | 12.8 (11.9–13.7) | 12.2 (11.1–13.3)<br>13.9 (12.3–15.5) | 11.5 (10.6–12.5)<br>16.6 (14.9–18.3) | 12.8 (11.5–14.1)<br>13.1 (11.9–14.2) |
| Average number of teeth per person missing due to pathology | 4.9 (4.4–5.4) | 4.4 (3.7–5.0)<br>5.9 (4.9–6.8) | 3.7 (3.2–4.2)<br>8.4 (7.2–9.7) | 4.1 (3.4–4.8)<br>5.7 (5.0–6.5) |
| Percentage of adults with >4 mm periodontal pocket depth** | 21.4 (17.8–25.5) | 25.1 (20.2–30.7)<br>14.5 (9.8–21.0) | 21.0 (17.0–25.5)<br>35.5 (23.4–49.7) | 21.7 (16.8–27.6)<br>21.6 (17.1– 27.0) |

95% CI = 95% confidence interval for estimated percentage/estimated mean.
*Percentage of participants who have at least one or more decayed surfaces on the crowns of their teeth.
**An indicator for the severity of periodontal disease is measurement of periodontal pocket depths more than 4 mm.
***A Health Care Card is a concession card issued by the Australian Government that entitles the holder to services including public dental care.
Source: The National Survey of Adult Oral Health 2004–06. New South Wales.[6]

**Table 5. Utilisation patterns of dental health services by NSW adults by population subgroup**

| Utilisation patterns | All NSW adults (%) (95% CI) | Capital city/other locations (%) (95% CI) | Non Health Care Card holders/Health Care Card holders (%) (95% CI) | Insured/uninsured (%) (95% CI) |
|---|---|---|---|---|
| Adults visiting dentist within last 12 months | 60.3 (58.3–62.2) | 63.3 (60.9–65.7)<br>55 (51.7–58.2) | 63.5 (61.3–65.7)<br>51.4 (47.9–54.8) | 74.2 (71.8–76.6)<br>48.3 (46.0–50.7) |
| Adults who attended a private dental practice at last dental visit | 80.8 (78.6–82.7) | 82.0 (79.3–84.5)<br>78.6 (74.9–81.8) | 86.3 (84.2–88.1)<br>65 (61.2–68.7) | 88.0 (85.7–90.0)<br>74.4 (71.3–77.2) |
| Adults who visit a dental professional at least once a year | 54.9 (52.5–57.2) | 58.8 (55.6–62.0)<br>47.8 (44.7–50.9) | 58.1 (55.4–60.7)<br>44.4 (40.3–48.5) | 69.3 (66.2–72.3)<br>41.1 (38.4–43.8) |
| Adults who have a dentist they usually attend | 81.4 (79.3–83.3) | 82.9 (80.5–85.0)<br>78.8 (74.8–82.2) | 83.4 (81.1–85.5)<br>74.8 (71.1–78.2) | 90.2 (88.3–91.8)<br>72.3 (69.1–75.2) |
| Adults who usually visit a dentist for a check-up | 56.8 (54.4–59.2) | 61.1 (57.9–64.3)<br>49.2 (45.6–52.7) | 61.6 (59.1–64.1)<br>40.4 (36.7–44.1) | 71.3 (68.3–74.1)<br>42.6 (39.7–45.6) |

95% CI = 95% confidence interval for estimated percentage.
Source: The National Survey of Adult Oral Health 2004–06. New South Wales.[6]

reached adulthood and who have been exposed to fluoridated water and fluoride in toothpaste since childhood.

Despite marked reductions in tooth loss and dental decay experience, the burden of oral disease persists with one in four NSW adults having at least one tooth with untreated dental decay and a similar proportion having destructive periodontal disease and oral facial pain. The pervasive nature of oral disease, together with the dramatic increase in retention of natural teeth in adults, has implications for the state dental care system and dental workforce.

Virtually all aspects of oral health measured in this survey were significantly more frequent and severe in Health Care Card holders. Findings from the NSW component of the National Survey of Adult Oral Health also indicate a population divided in its pattern of dental care. Patterns of attendance consistent with a more preventive approach with continuity of care were seen in one-half of the population who visit the same dentist annually and for a check-up, a predominant pattern for people with dental insurance. The findings from NSW are similar to the findings for Australia overall. This survey therefore furnishes strong evidence supporting the goals of the *NSW Oral Health Strategic Directions 2005–2010* and a strong focus to reduce inequalities in oral health outcomes and inequitable access to oral health services.[8] It also suggests that despite variation in public health expenditure between

**Table 6. Oral health perceptions of NSW adults by population subgroup**

| Oral heath perceptions | All NSW adults (%) (95% CI) | Capital city/other locations (%) (95% CI) | Non Health Care Card holders/Health Care Card holders (%) (95% CI) | Insured/uninsured (%) (95% CI) |
|---|---|---|---|---|
| Adults rating their oral health as fair-to-poor | 16.9 (15.1–18.8) | 16.0 (14.0–18.3)<br>18.4 (15.2–22.2) | 13.2 (11.7–14.9)<br>29.6 (25.5–34.1) | 11.8 (10.1–13.7)<br>21.9 (19.4–24.7) |
| Adults experiencing toothache | 16.2 (14.5–18.2) | 16.2 (13.9–18.7)<br>16.3 (13.8–19.2) | 14.4 (12.7–16.2)<br>22.6 (19.1–26.6) | 14.0 (11.8–16.4)<br>18.4 (16.2–20.9) |
| Adults experiencing orofacial pain | 23.3 (21.5–25.1) | 22.9 (20.7–25.3)<br>23.9 (21.2–26.8) | 22.9 (20.8–25.0)<br>24.7 (21.7–28.0) | 21.8 (19.5–24.3)<br>24.9 (22.5–27.5) |
| Adults perceiving a need for an extraction or filling | 31.1 (29.3–32.9) | 29.6 (27.4–31.9)<br>33.8 (30.9–36.8) | 28.7 (26.6–30.9)<br>39.4 (35.6–43.4) | 26.3 (24.0–28.9)<br>35.9 (33.4–38.5) |
| Adults perceiving urgency for treatment (within 3 months) | 71.6 (67.7–75.2) | 70.6 (65.8–75.0)<br>73.1 (66.3–78.9) | 71.1 (66.4–75.3)<br>73.4 (67.1–78.9) | 73.7 (68.5–78.4)<br>69.8 (64.7–74.5) |

95% CI = 95% confidence interval for estimated percentage.
Source: The National Survey of Adult Oral Health 2004–06. New South Wales.[6]

different Australian jurisdictions, the social gradients and oral health outcomes observed for the NSW population are consistent across Australia.

The *NSW Oral Health Strategic Directions* sets the platform for oral health action in NSW into the next decade and calls for a range of interventions to tackle fundamental causes of disadvantage. Linkages with the National Oral Health Plan, in a nationally coherent approach to dental services priorities and prevention, is supported by this state survey and the national report.[9] This approach includes a strong emphasis on water fluoridation, one of the few public health measures that reduce the social inequalities in caries experience.[10]

Providing more equitable access to dental care in the public sector and outside of Sydney remains a challenge. In NSW, holders of Health Care Cards Pensioner Concession Cards and Commonwealth Seniors Health Cards are eligible for public dental care.[11] Data from Centrelink indicate approximately 1.6 million NSW residents are eligible for public dental care, of which 441 385 are Health Care Card holders and the remainder are Pensioner Concession Card and Commonwealth Seniors Health Card holders. However, only 16% (approximately 457) of the 3472 practicing dentists in NSW are working in the public dental sector.[12]

In 2008, new dental awards were gazetted with salary enhancements for dental clinicians and a new career structure that emphasises clinical skills and career pathways to attract and retain clinical staff in the public sector. NSW Health has strategies in place to attract new graduates and dentists to regional areas of NSW to reduce the inequitable distribution of dentists across the state. A new regional dental school training dentists and oral health therapists has been established at Charles Sturt University in Orange.

Although this latest survey provides current information on oral health for a representative sample of the NSW adult population, the small number of people from rural and remote areas enrolled in the survey does not allow specific insight into these localities.[6] Similarly, the small number of Aboriginal and Torres Strait Islander Australians included in this survey calls for further surveys with different sampling frames. Data collected from such surveys would permit policy development aimed at reducing the inequalities in access to dental services and oral health outcomes for Aboriginal and Torres Strait Islander Australians and residents of rural and remote NSW.

## Conclusions

Oral health of the NSW adult population and patterns of dental care are similar to national estimates. Oral disease is disproportionately more frequent among Health Care Card holders, the uninsured and those living outside of Sydney. These groups also have significantly less favourable patterns of dental care.


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# Comparison of the dental health of adults and children living in NSW with their counterparts in the US and UK

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**Abstract:** This paper aims to place the findings of the NSW Adult and Child Dental Health Surveys in an international context. The comparator countries are the US and the UK, both of which have well-documented epidemiological dental health data. The US has a mainly private system of dental care, similar to NSW, whereas the UK has primarily a government-funded dental care program. The adult data collected in the last 20 years in all three locations indicates greatly improved oral health with a decline in the proportions of people with no natural teeth. The majority of children have few dental problems but inequality remains with some children in lower socioeconomic groups still having high levels of dental ill health, which contributes to a lower quality of life. Improving population levels of oral health in all three countries will require collective decision-making by stakeholders and politicians to finance plans for action and manage change to help those individuals for whom dental disease is still a major problem.

Over the past two decades there has been a considerable decline in the dental caries experience of 5- and 12-year-old children in most industrialised countries.[1,2] However, the quality of much of the dental epidemiological data is somewhat dubious making comparisons difficult. Australia, the United States (US) and the United Kingdom (UK) have well-established epidemiological programs recording the dental health of both adults and children.

A number of host and environmental factors are related to an individual's caries experience.[3] These factors include age, gender, dietary intake, fluoride exposure, dental attendance patterns, socioeconomic status and rural or urban location. There is evidence from longitudinal studies in the UK that the rapid market penetration of fluoride toothpaste changed the caries experience of children as did the fluoridation of public water supplies in Australia.[4]

The objective of this paper is to compare the dental health of children and adults living in New South Wales (NSW), the US and the UK using data from well-described epidemiological studies.

## Methods

Data from national adult and child surveys in the UK were extracted and compared with NSW data collated by the Australian Research Centre for Population Oral Health (ARCPOH) at the University of Adelaide and data from the US National Health and Nutrition Examination Survey 2003–2004.[5–8]

Details of the UK and US studies have been well documented elsewhere. NSW data were drawn from the Australian National Survey of Adult Oral Health, which was undertaken from 2004 to 2006 and the NSW Child Dental Health Survey that examined children in 2007.[7–9]

## Results

### *Adults*

The proportions of people who were classified as having lost all of their natural teeth (edentulous) are presented in Table 1. Levels of total tooth loss were of little clinical significance for people aged under 35 years. NSW had the lowest prevalence of total tooth loss within every age category except for adults aged 75 years and over. Both the US and NSW fared much better than the UK.

Table 2 presents the mean number of missing teeth per person in each location according to age. The NSW and US participants have similar levels of tooth loss, much lower than that recorded by the UK. The NSW and US surveys had similar proportions of participants with one or more decayed (carious) teeth; the percentages were approximately half that reported by the UK Adult Dental Health Survey (Table 3).[6,8]

### *Children*

The data for children were confined to 5–6-year olds and 11–12-year olds as these age groups are used by the World

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**Table 1. Proportion of adults in the UK, NSW and US who are edentulous, according to age**

| Age | United Kingdom* % | Age | New South Wales % | United States % |
|---|---|---|---|---|
| 16–24 | 0 | | | |
| 25–34 | 0 | 20–34 | 0 | 0 |
| 35–44 | 1 | 35–49 | 1 | 3 |
| 45–54 | 6 | | | |
| 55–64 | 20 | 50–64 | 8 | 10 |
| 65–74 | 36 | 65–74 | 20 | 24 |
| 75+ | 58 | 75+ | 36 | 31 |

* More age categories were used in United Kingdom.
Sources: Adult Dental Health Survey. London: Office for National Statistics; 2000.[6] The National Survey of Adult Oral Health 2004–06. Canberra: AIHW; 2007.[7] Trends in oral health status: United States 1988–1994 and 1999–2004.[8]

**Table 2. The mean number of missing teeth of adults in the UK, NSW and US, according to age**

| Age | United Kingdom % | New South Wales % | Age* | United States % |
|---|---|---|---|---|
| 16–24 | 4.1 | 0.6 | 16–19 | 0.1 |
| 25–34 | 3.9 | 1.0 | 20–34 | 0.6 |
| 35–44 | 5.3 | 2.1 | 35–49 | 2.4 |
| 45–54 | 8.0 | 5.9 | 50–64 | 5.3 |
| 55–64 | 12.1 | 9.1 | | |
| 65+ | 14.7 | 12.8 | 65–74 | 8.3 |

*United States age categories are not a direct match.
Sources: Adult Dental Health Survey. London: Office for National Statistics; 2000.[6] The National Survey of Adult Oral Health 2004–06. Canberra: AIHW; 2007.[7] Trends in oral health status: United States 1988–1994 and 1999–2004.[8]

**Table 3. Proportion of adults in the UK, NSW and US with one or more carious teeth, according to age**

| Age | United Kingdom % | New South Wales % | Age* | United States % |
|---|---|---|---|---|
| 16–24 | 51 | 24 | 16–19 | 18 |
| 25–34 | 60 | 27 | 20–34 | 28 |
| 35–44 | 51 | 30 | 35–49 | 26 |
| 45–54 | 57 | 24 | | |
| 55–64 | 54 | 23 | 50–64 | 22 |
| 65+ | 54 | 22 | 65–74 | 20 |

*United States age categories are not a direct match.
Sources: Adult Dental Health Survey. London: Office for National Statistics; 2000.[6] The National Survey of Adult Oral Health 2004–06. Canberra: AIHW; 2007.[7] Trends in oral health status: United States 1988–1994 and 1999–2004.[8]

Health Organization (WHO) in their pathfinder database. The US data are more difficult to unravel as 2–5-year-olds are grouped, which is a disadvantage as dental caries increases over time. Including younger children in the age group will lower the mean dmft (decayed, missing due to caries, filled teeth) index.

Table 4 shows that the UK and NSW have similar mean dmft scores, with the US slightly lower at 1.1; for reasons already stated, this score may be an underestimate.

The data presented in Table 5 detail the mean DMFT scores for 11–12-year-old children. Once again, comparisons

**Table 4. Mean dmft and caries experience of 5–6-year-old children in NSW, the UK and the US**

| | dmft | % caries free |
|---|---|---|
| New South Wales | 1.6 | 60 |
| United Kingdom | 1.5 | 57 |
| United States (2–5-year-olds)* | 1.1 | 70 |

*A different age range was used in the United States.
dmft = decayed, missing due to caries and filled teeth index for primary (baby) teeth.
Sources: The Child Dental Health Survey, NSW 2007. Centre for Oral Health Strategy.[9] Trends in oral health status: United States 1988–1994 and 1999–2004.[8] Children's Dental Health in the United Kingdom. London: The Stationery Office; 2003.[13]

**Table 5. Mean DMFT and caries experience of 11–12-year-old children in NSW, the UK and the US**

| | DMFT | % caries free |
|---|---|---|
| New South Wales | 0.80 | 64 |
| United Kingdom | 1.00 | 69 |
| United States (12–15-year-olds)* | 1.67 | 49 |

*A different age range was used in the United States.
DMFT = Decayed, Missing due to caries, Filled Teeth index for permanent (adult) teeth.
Sources: The Child Dental Health Survey, NSW 2007. Centre for Oral Health Strategy.[9] Trends in oral health status: United States 1988–1994 and 1999–2004.[8] Children's Dental Health in the United Kingdom. London: The Stationery Office; 2003.[13]

cannot easily be made with the US data due to differences in the age categories used. The inclusion of older children in the age group will inflate the DMFT score. NSW has achieved a mean score of under 1, which is less than the UK and the US.

## Discussion

International comparisons of dental data are fraught with difficulty, but Australian, UK and US researchers use similar systems and dental epidemiology, as an academic specialty, is well developed in each of these countries. Therefore, broad conclusions about dental health can be made with some confidence. Earlier epidemiological studies have shown that there have been international improvements over time in dental health in all age groups.[8] For example, since 1974–1994 there was a decrease of 44% in the carious surfaces of 18–25-year-old US adults. Milgrom and Reisine have reviewed improvements in dental health in the US but warn of the difficulties in overcoming the dental problems of poor communities.[10,11] Changes in total tooth loss over time in Australia have also showed considerable improvement.[12]

In the UK, for example, the mean DMFT in 12-year-olds declined from 3.1 in 1973 to 0.8 in 2003 and in Australia from 4.8 in 1977 to 1.1 in 1993.[13,14] This reduction in decay (caries) levels has been accompanied by a change in the distribution of carious lesions; the relative contribution of pit and fissure caries to overall disease levels has increased.[1,15] Dental caries appears to have changed from a rapidly progressing disease of childhood to a slowly progressing disease in adulthood.[16] There is an argument that these improvements may be transitory, with a possibility that the situation could reverse. Declines in dental caries among young children may have stabilised and there may even be a marginal increase in prevalence. This situation may be simple biological variation, but it does mean that countries with water fluoridation should ensure it continues to operate efficiently and the UK will need to speed up its plans for more widespread fluoridation schemes.

The improvements in dental health are also linked to changes in how the public perceive the health of their teeth. White smiles and teeth in regular alignment are now seen as crucial social attributes. This has put pressure on orthodontic services and seen an explosion in cosmetic dentistry. A greater number of natural teeth also means people need more regular maintenance therapy. The improvement in dental health has therefore not reduced the need for treatment services.

The resources spent by governments on dental care in the three comparator locations are different because of the split between private and public funding. The UK has developed a model of care linked closely to government funding while NSW and the US have a predominantly private sector system of care. However, both the US and Australia have to recognise that their systems disenfranchise many people from dental care. The public dental services in both countries do not have the resources to offer continuing oral health care to patients, which denigrates dental professionals who become emergency-only operators rather than highly trained and skilled clinicians. While the dental health of all three locations is similar, the epidemiological snapshot hides an iceberg of patient discontent and inequality of care among deprived communities.[17,18]

The data presented show that the dental health of adults and children in NSW is as good as their counterparts in the US and UK, while the data on total tooth loss highlights a revolution in NSW dental health with the loss of all teeth and the need for a full set of dentures becoming a historical quirk of fate rather than a common occurrence for the rising generations of younger Australians (Table 1).

## Conclusion

The dental health of children and adults in NSW is as good as, and in some cases better than, similar populations in the US and the UK. However, any improvements are fragile and need nurturing, especially in terms of maintaining the highly successful water fluoridation program,

which has done much to help the majority of NSW residents have healthy mouths.[19,20]

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# Rural oral health workforce issues in NSW and the Charles Sturt University Dentistry Program

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**Abstract:** Adequate numbers of dental, medical and allied health professionals in rural and regional areas of NSW are vital for the health of these populations and supporting local community structures and economies. Well-documented shortages of health professionals are a major social and political issue in rural and regional communities and this workforce shortfall is recognised by both the NSW Government State Plan and the State Health Plan. This paper outlines rural and regional dental workforce shortages in NSW and describes current rural oral health workforce initiatives, including the new Charles Sturt University Dentistry Program.

Dental workforce shortages in rural and regional areas of Australia and, in particular, New South Wales (NSW), are well documented, most recently by the Parliamentary Inquiry into Dental Services in NSW, which resulted in a number of recommendations directly related to workforce issues.[1] These recommendations included new public dental awards, dental award increases, incentives for rural practice and the review of dental education programs. In addition, the NSW State Plan includes a priority to provide 'Better access to training in rural and regional NSW to support local economies', while the State Health Plan acknowledges the need to 'Build regional and other partnerships for health' and 'Build a sustainable health workforce'.[2,3]

## NSW dental labour force profile

The NSW Department of Health utilises data from the 2006 Labour Force Survey of dentists and dental auxiliaries registered with the NSW Dental Board to monitor the status of the NSW dental workforce.[4,5] The *Profile of the Dentist Workforce in NSW, 2006* found that 82% of respondents or 3342 dentists were working in NSW with the majority working in the private sector.[4] The average age of dentists was 44.9 years; on average, males were aged 49 years and females were aged 41 years.[4]

The *Profile of the Dental Auxiliaries Workforce in NSW, 2006* found that the majority of dental auxiliaries in NSW were dental therapists working in the public sector and were female with an average age of 45 years.[5]

These reports also provide a snapshot of the distribution of the dental workforce in NSW. While it is estimated that there are 45.6 working dentists per 100 000 population in NSW, there are substantial intrastate variations with a high degree of urban concentration (Table 1). Between 1998 and 2006, the proportion of dentists working in rural and regional NSW declined from 14.4% to 12% and the proportion working in inner Sydney rose from 66.7% to 68.2%.[4]

This uneven distribution will be further exacerbated by the shrinking of the dental workforce in both the private and public sectors as professionals reach retirement age. Proportionally, retirement intentions within the next 5 years are greatest among males within rural area health services, particularly the Greater Southern Area Health Service.[4] Even though many dentists retire later than most other professionals, the ageing of the profession and growing proportion of female practitioners, who are more likely than males to be in part-time positions, are likely to erode the number of full-time equivalent clinicians and therefore the clinical hours produced.

Attracting professionals west of the Great Divide in NSW is a long-standing issue. Reasons for dental graduates choosing an urban practice over rural practice include: city lifestyle; proximity to family and friends; personal lifestyle preferences; transport issues; and access to professional development.[6,7] Conversely, factors influencing the choice of rural employment by health professionals include: a welcoming rural community; 'partner felt welcome'; family located in a rural area; and outdoor lifestyle.[7]

Current initiatives aimed at addressing the shortage of dental professionals in rural and regional areas of NSW include: the development of rural dental clinical schools



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**Table 1. Number of dentists in NSW, by population ratios and hours of service per week delivered, 2006**

| Area Health Service | 2006 Population* | Dentists practicing in NSW only** | Dentists practicing partly in NSW** | Dentists per 100 000 | Hours of service per week delivered per 1000 area population |
|---|---|---|---|---|---|
| Sydney South West | 1 323 382 | 481 | 5 | 36.7 | 16.1 |
| South Eastern Sydney Illawarra | 1 167 811 | 698 | 11 | 60.7 | 25.5 |
| Sydney West | 1 090 980 | 421 | 8 | 39.3 | 16.8 |
| Northern Sydney Central Coast | 1 090 159 | 587 | 9 | 54.7 | 22.4 |
| Hunter New England | 822 781 | 208 | 3 | 25.6 | 11.0 |
| North Coast | 469 348 | 138 | 20 | 33.7 | 12.9 |
| Greater Southern | 461 675 | 87 | 16 | 22.3 | 8.8 |
| Greater Western | 299 033 | 63 | 2 | 21.7 | 8.9 |
| **NSW** | **6 725 169** | **2683** | **74** | **41.0** | **17.3** |

*Population data supplied by Intergovernment Relations and Funding Branch, NSW Department of Health, 2008.
**Workforce data is from Profile of the Dentist Workforce in NSW, 2006. Sydney: NSW Department of Health; 2008.[4]

by both the University of Sydney and Charles Sturt University; establishment of Rural Oral Health Centres at key rural and regional locations; rural allowances and scholarships offered by the NSW Department of Health; and rural placements for dentistry students from the University of Sydney. In addition, the NSW International Dental Graduate Program provides up to 12-months of supervised clinical experience for overseas-trained dentists who are enrolled with the Australian Dental Council, but are not yet fully registered in Australia. The 10 dentists who joined the program in January 2009 will be provided with clinical placements in NSW rural area health services wherever possible. The program has been successful in attracting several dentists to rural and regional NSW after their completion of the Program.

## The Charles Sturt University Dentistry Program

A longer-term solution has been offered by the Charles Sturt University Dentistry Program, which commences in 2009. The Program aims to attract larger numbers of rural students to study and practice dentistry and oral health therapy in rural and regional areas of NSW. With campuses and facilities in Bathurst, Orange, Dubbo, Wagga Wagga and Albury (Figure 1), it is anticipated that the Program will have a positive impact on the number of both private and public dental practitioners entering the profession in rural and regional NSW.

Charles Sturt University has demonstrated a substantial level of rural recruitment and retention of graduates from its Faculty of Health Studies who originated from metropolitan areas. Approximately 30% of these metropolitan-sourced but rurally trained health professionals have been shown to remain in country NSW to practice after graduation.[5]


**Figure 1. Planned location of Charles Sturt University Dentistry Program facilities by NSW area health service. AHS = Area Health Service.**

The first cohort of Charles Sturt University dentistry and oral health graduates will enter the workforce in 2014 and it is expected that up to 60% of these graduates will remain outside of metropolitan NSW (unpublished data; Western Research Institute. Destination of On-Campus Graduates of the Charles Sturt University: 2006 Update). In addition, agreements and partnerships between local area health services and Charles Sturt and other universities are also likely to improve access to public dental services in rural and regional NSW. For example, the Greater Western Area Health Service will share a clinical facility at Dubbo with both Charles Sturt University and the University of Sydney.

Outcomes of the Charles Sturt University Dentistry Program will be evaluated, along with the implementation of Rural Oral Health Centres and rural clinical placements by all universities within NSW as part of a review of the *NSW Oral Health Implementation Plan 2005–2010*.[8] In addition, the NSW Government is currently preparing a response to the recently released paper from the National Health Workforce Taskforce on the capacity for health education and training clinical placements across Australia.[9]

## Dental workforce projections

The Australian Research Centre for Population Oral Health (ARCPOH) at the University of Adelaide has described data whereby a national average of 49.4 dentists per 100 000 population is a baseline for a projected increase of 29% (to 63.2 dentists per 100 000 population) in 2020.[10]

Charles Sturt University has campuses within both the Greater Southern and Greater Western Area Health Services (see Figure 1). In 2006, dentist workforce data for these areas varied from 33 to 37 dentists per 100 000 population at area health service level and, on a community scale, varied from 14 to 37 dentists per 100 000 population, both of which are below the suggested national average of 49.4.[4]

The NSW data show that the regional distribution of dental therapists and hygienists, and the level of service provided are very different to that found in metropolitan areas.[4,5] Therapists provide just under twice the number of hours of service per head of population in rural area health services than in metropolitan areas. Hygienists also provide fewer hours of service per head of population in rural areas than their city counterparts.[3] With the advent of graduates emanating from regional universities in NSW, Queensland and Victoria, there are likely to be considerable changes to the distribution of these oral health practitioners in the communities that they serve, with little impact on metropolitan workforce projections.

The importance of the availability of dental professionals to rural communities and economies has also been demonstrated by the number of local councils in rural and regional NSW establishing council funded dental clinics. These councils include Gilgandra, Oberon, Narromine, Coonamble, Nyngan and Cobar. In some cases, these services are provided by fly-in or drive-in dentists from Sydney. Modelling by the Western Research Institute has estimated that the Charles Sturt University Dentistry Program will generate $52.6 million in gross regional product and $12.3 million per annum in the operational phase (unpublished data; Western Research Institute. *Charles Sturt University School of Dentistry and Oral Health Economic Impact Report, 2007*). Other likely flow-on effects include the economic impacts of vacant private practices being filled by new graduates from Charles Sturt and other universities.

## Conclusion

National dental workforce projections suggest a modest increase in the number of dental professionals nationally by 2020. The distribution of future new graduates is difficult to predict and further concentration in urban areas of NSW is likely to adversely affect rural and regional NSW, where numbers of dental professionals are already low and average ages and retirement rates are highest. The advent of the Charles Sturt University Dentistry Program along with other statewide initiatives from NSW Health, other universities and the Australian Government will help address these issues, while also boosting the capacity of both the private and public dental sector. This is more than likely to have positive impacts both socially and economically on rural communities, while also providing an additional career path for local students that does not involve rural–urban migration for tertiary study.

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# Tuberculosis in NSW, 2003–2007

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Tuberculosis (TB) has been a public health issue for a long time. 'Since the first appearance of TB in humans probably some 8000 years ago, its control has continued to elude the brightest minds and challenge both the human and economic resources of countries around the world'.[1] Towards the end of the nineteenth century antituberculosis campaigns began initially in Europe and North America.[1] Some 100 years later, tuberculosis control remains a major priority for communicable disease surveillance, prevention and control in New South Wales (NSW).[2]

Despite having one of the lowest incidence rates of tuberculosis in the world (consistently around 5–6 cases per 100 000 population since the 1980s), tuberculosis control continues to be a challenge in Australia.[3] Approximately 55% of the 9.1 million tuberculosis cases estimated globally in 2006 live in nearby South East-Asia and the Western Pacific Regions.[4]

Tuberculosis is caused by infection with the bacteria *Mycobacterium tuberculosis*.[5] When people who are infectious cough, sneeze or talk, they expel tuberculosis germs, known as bacilli, into the air. A susceptible person only needs to inhale a small number of the bacilli to acquire the infection. Most people with the *M. tuberculosis* infection harbour the bacterium without symptoms (latent infection), but some develop active tuberculosis. People who have newly acquired the infection have about a 10% chance of developing active disease in their lifetime; approximately half of those who develop tuberculosis do so within 2 years of infection.[6]

The usual incubation period from infection to demonstrable primary lesion or significant tuberculin reaction is 2–10 weeks.[6] Most people with active tuberculosis are no longer infectious after they have received 2 weeks of treatment with appropriate multi-drug therapy.

In this report we review the incidence of tuberculosis and the characteristics of patients notified with tuberculosis in NSW for the period 2003–2007.

## Methods

Tuberculosis is a notifiable disease in NSW under the *NSW Public Health Act 1991*; laboratories, doctors and hospitals must report all cases to their local public health unit. Public health unit or chest clinic staff enter case details into the Notifiable Diseases Database (NDD), which is maintained by the Communicable Diseases Branch of the NSW Department of Health. Cases were assigned to their corresponding year of notification using a specific tuberculosis field in NDD called year of diagnosis. This field was added to NDD in 2004 to assist the assignment of cases where dates of onset, specimen collected, notification and treatment overlap years. Cases in 2003 and earlier were assigned to their corresponding year if their date of onset, date of report or date of notification fell between 1 January and 31 December of the relevant year.

We analysed the characteristics of cases for the period 2003–2007 and examined trends in incidence since 1991. Incidence rates were calculated using the Australian Bureau of Statistics (ABS) estimated mid-year population for the relevant year. Estimates for different resident populations by country of birth were provided by the Health Outcomes Information Statistical Toolkit (HOIST) and were calculated from a number of ABS datasets.[7]

**Table 1. Tuberculosis notifications, incidence rate and deaths, per annum, NSW, 1991–2007**

| Year | Notified cases *N* | Rate/ 100 000 | Notified deaths *N* | % of cases |
|---|---|---|---|---|
| 1991 | 430 | 7.3 | 9 | 2 |
| 1992 | 394 | 6.6 | 20 | 5 |
| 1993 | 389 | 6.5 | 28 | 7 |
| 1994 | 393 | 6.5 | 24 | 6 |
| 1995 | 443 | 7.2 | 22 | 5 |
| 1996 | 410 | 6.6 | 16 | 4 |
| 1997 | 419 | 6.7 | 16 | 4 |
| 1998 | 378 | 6.0 | 27 | 7 |
| 1999 | 481 | 7.5 | 25 | 5 |
| 2000 | 443 | 6.9 | 39 | 9 |
| 2001 | 415 | 6.4 | 33 | 8 |
| 2002 | 447 | 6.8 | 39 | 9 |
| 2003 | 373 | 5.6 | 23 | 6 |
| 2004 | 432 | 6.4 | 25 | 6 |
| 2005 | 437 | 6.4 | 20 | 5 |
| 2006 | 465 | 6.8 | 29 | 6 |
| 2007 | 454 | 6.6 | 23 | 5 |

Source: Notifiable Diseases Database, Communicable Diseases Branch, NSW Department of Health.

10.1071/NB09001

**Table 2. Characteristics of people notified with tuberculosis, NSW, 2003–2007**

| Case characteristics | Cases in 2003 | | | Cases in 2004 | | | Cases in 2005 | | | Cases in 2006 | | | Cases in 2007 | | | Cases 2003–2007 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *N* | % | Rate#/ 100 000 | *N* | % | Rate#/ 100 000 | *N* | % | Rate#/ 100 000 | *N* | % | Rate#/ 100 000 | *N* | % | Rate#/ 100 000 | *N* | % |
| **Residence*** | | | | | | | | | | | | | | | | | |
| Sydney metropolitan | 316 | 85 | 8.7 | 371 | 86 | 10.1 | 373 | 85 | 10.1 | 415 | 89 | 11.2 | 397 | 87 | 10.6 | 1872 | 87 |
| Outer Sydney | 29 | 8 | 1.7 | 40 | 9 | 2.6 | 36 | 8 | 2.3 | 32 | 7 | 2.0 | 35 | 8 | 2.2 | 172 | 8 |
| Other NSW | 19 | 5 | 1.5 | 15 | 3 | 1.0 | 21 | 5 | 1.4 | 16 | 3 | 1.0 | 19 | 4 | 1.2 | 90 | 4 |
| Overseas/unknown | 9 | 2 | | 6 | 1 | | 7 | 2 | | 2 | 0 | | 3 | 1 | | 27 | 1 |
| **Sex** | | | | | | | | | | | | | | | | | |
| Male | 179 | 48 | 5.8 | 219 | 51 | 6.5 | 218 | 50 | 6.4 | 248 | 53 | 7.3 | 246 | 54 | 7.2 | 1110 | 51 |
| Female | 194 | 52 | 5.3 | 212 | 49 | 6.2 | 219 | 50 | 6.4 | 217 | 47 | 6.3 | 208 | 46 | 6.0 | 1050 | 49 |
| Transgender | 0 | 0 | | 1 | 0 | | 0 | 0 | | 0 | 0 | | 0 | 0 | | 1 | 0 |
| **Age group (years)** | | | | | | | | | | | | | | | | | |
| 0–4 | 12 | 3 | 2.8 | 6 | 1 | 1.4 | 12 | 3 | 2.8 | 7 | 2 | 1.6 | 7 | 2 | 1.6 | 44 | 2 |
| 5–9 | 1 | 0 | 0.2 | 0 | 0 | 0.0 | 3 | 1 | 0.7 | 1 | 0 | 0.2 | 6 | 1 | 1.4 | 11 | 1 |
| 10–14 | 4 | 1 | 0.9 | 1 | 0 | 0.2 | 2 | 0 | 0.4 | 9 | 2 | 2.0 | 8 | 2 | 1.8 | 24 | 1 |
| 15–19 | 15 | 4 | 3.3 | 15 | 3 | 3.3 | 10 | 2 | 2.2 | 11 | 2 | 2.4 | 20 | 4 | 4.4 | 71 | 3 |
| 20–24 | 29 | 8 | 6.2 | 50 | 12 | 10.9 | 47 | 11 | 10.3 | 51 | 11 | 10.8 | 46 | 10 | 9.7 | 223 | 10 |
| 25–34 | 97 | 26 | 9.9 | 100 | 23 | 10.3 | 113 | 26 | 11.7 | 99 | 21 | 10.3 | 126 | 28 | 13.0 | 535 | 25 |
| 35–44 | 56 | 15 | 5.7 | 81 | 19 | 8.1 | 62 | 14 | 6.1 | 71 | 15 | 7.1 | 54 | 12 | 5.4 | 324 | 15 |
| 45–54 | 55 | 15 | 6.1 | 47 | 11 | 5.2 | 62 | 14 | 6.7 | 63 | 14 | 6.7 | 68 | 15 | 7.2 | 295 | 14 |
| 55–64 | 30 | 8 | 4.4 | 30 | 7 | 4.3 | 41 | 9 | 5.6 | 54 | 12 | 7.2 | 41 | 9 | 5.4 | 196 | 9 |
| 65–74 | 32 | 9 | 6.8 | 50 | 12 | 10.6 | 34 | 8 | 7.1 | 35 | 8 | 7.3 | 34 | 7 | 7.0 | 185 | 9 |
| 75+ | 42 | 11 | 10.0 | 50 | 12 | 6.6 | 51 | 12 | 6.6 | 64 | 14 | 14.5 | 44 | 10 | 9.7 | 251 | 12 |
| **Aboriginal or Torres Strait Islander** | 4 | 1 | 2.9 | 3 | 1 | 2.1 | 2 | 0 | 1.4 | 4 | 1 | 2.0 | 3 | 1 | 2.0 | 16 | 1 |
| **Total** | **373** | | **5.6** | **432** | | **6.4** | **437** | | **6.4** | **465** | | **6.8** | **454** | | **6.6** | **2161** | |

#Rates are calculated by the corresponding year's population mid-year estimates.
*Residence by area health service.
Sydney metropolitan = Sydney South West Area Health Service, the Northern Sydney region of Northern Sydney Central Coast Area Health Service, the South Eastern Sydney region of South Eastern Sydney Illawarra Area Health Service and the Eastern region of Sydney West Area Health Service.
Outer Sydney = Western region of Sydney West Area Health Service, the Central Coast region of Northern Sydney Central Coast Area Health Service, Illawarra region of South Eastern Sydney Illawarra Area Health Service and the Hunter region of Hunter New England Area Health Service.
Other NSW = New England region of Hunter New England Area Health Service, North Coast Area Health Service, Greater Southern Area Health Service, Greater Western Area Health Service and Justice Health.
Source: Notifiable Diseases Database, Communicable Diseases Branch, NSW Department of Health.

Table 3. Region of birth for people notified with tuberculosis, NSW, 2003–2007

| Region of birth | Cases in 2003 | | | Cases in 2004 | | | Cases in 2005 | | | Cases in 2006 | | | Cases in 2007 | | | Cases 2003–2007 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *N* | % | Rate^/ 100 000 | *N* | % | Rate^/ 100 000 | *N* | % | Rate^/ 100 000 | *N* | % | Rate^/ 100 000 | *N* | % | Rate^/ 100 000 | *N* | % |
| Africa | 24 | 6 | 30.2 | 30 | 7 | 36.6 | 24 | 5 | 28.5 | 38 | 8 | 44.0 | 28 | 6 | 31.7 | 144 | 7 |
| Americas | 3 | 1 | 3.7 | 8 | 2 | 9.9 | 3 | 1 | 3.7 | 6 | 1 | 7.2 | 5 | 1 | 5.9 | 25 | 1 |
| Asia total | **247** | 66 | 47.6 | **272** | 63 | 50.9 | **305** | 70 | 55.4 | **311** | 67 | 54.8 | **320** | 70 | 54.6 | 1455 | 67 |
| Southern and Central Asia | 66 | 18 | 67.3 | 72 | 17 | 68.1 | 100 | 23 | 88.1 | 114 | 25 | 94.0 | 129 | 28 | 100.1 | 481 | 22 |
| North East Asia | 52 | 14 | 25.3 | 76 | 18 | 35.7 | 54 | 12 | 24.5 | 70 | 15 | 30.6 | 76 | 17 | 32.1 | 328 | 15 |
| South East Asia | 129 | 35 | 59.8 | 124 | 29 | 57.6 | 151 | 35 | 69.9 | 127 | 27 | 58.3 | 115 | 25 | 52.3 | 646 | 30 |
| Australia | 50 | 13 | 1.0 | 60 | 14 | 1.2 | 56 | 13 | 1.1 | 48 | 10 | 0.9 | 56 | 12 | 1.1 | 270 | 12 |
| Europe | 21 | 6 | 3.1 | 40 | 9 | 5.9 | 27 | 6 | 4.1 | 34 | 7 | 5.2 | 24 | 5 | 3.7 | 146 | 7 |
| Middle East | 2 | 1 | 1.6 | 7 | 2 | 5.6 | 11 | 3 | 8.6 | 10 | 2 | 7.8 | 8 | 2 | 6.2 | 38 | 2 |
| Other Oceania | 26 | 7 | 13.6 | 15 | 3 | 7.5 | 11 | 3 | 5.3 | 17 | 4 | 7.9 | 13 | 3 | 5.8 | 82 | 4 |
| **Total** | **373** | | | **432** | | | **437** | | | **465** | | | **454** | | | **2161** | |

^Rates are calculated by the corresponding year's population mid-year estimates.
Source: Notifiable Diseases Database, Communicable Diseases Branch, NSW Department of Health.

Pulmonary cases were defined as patients whose primary site of tuberculosis disease was the lung (either with or without involvement of other sites). Reactivated cases were defined as patients who had previously received a full or partial course of drug therapy followed by a new episode of disease.

Multi-drug resistant tuberculosis (MDR-TB) was defined as resistance to at least isoniazid and rifampicin, two antibiotics commonly used to treat the disease. Extreme drug resistant tuberculosis (XDR-TB) was defined as resistance to almost all drugs used to treat tuberculosis, including isoniazid, rifampicin, fluoroquinolones and at least one of three injectable drugs (i.e. amikacin, kanamycin or capreomycin).

Assessable outcomes of tuberculosis cases are those that are measurable within the NSW Tuberculosis Program as well as cases transferred interstate. Non-assessable outcomes are defined as those where cases have transferred overseas or their outcome could not be measured for other reasons.

High-burden countries were defined according to the World Health Organization (WHO) Global Tuberculosis Control 2008 – Surveillance, Planning, Financing report.[4]

## Results

Note that within NSW Health, the term 'Aboriginal' is generally used in preference to 'Aboriginal and Torres Strait Islander', in recognition that Aboriginal people are the original inhabitants of NSW.

### *Case notifications*

From 2003 to 2007, between 373 and 465 cases of tuberculosis were notified each year in NSW (median 437 cases). The rate of notifications ranged from 5.6 cases per 100 000 population in 2003 to 6.8 cases per 100 000 population in 2006 (average notification rate during the period was 6.3 cases per 100 000 population). The rate of tuberculosis in NSW remained relatively stable from 1991 through to 2007 (Table 1).

### *Demographic characteristics*

From 2003 to 2007, the incidence of tuberculosis was higher among people living in the Sydney metropolitan area than in other areas of NSW (Table 2). This finding is consistent with data from 1991 to 2002.[8]

The incidence of disease was similar for males and females in the period 2003–2007 but varied according to age (Table 2). There was a bimodal distribution for age at onset; rates peaked in those aged 25–34 years and in those 75 years and older. This pattern is similar to the age distribution for the period 1991–2002.[8] During 2003–2007, infants and preschool-aged children had a higher rate of disease than school-aged children.

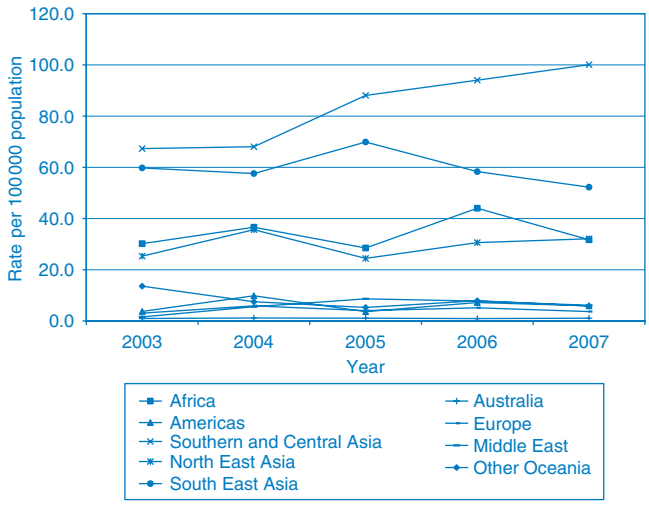


**Figure 1. Rate of tuberculosis notifications by region of birth, NSW, 2003–2007.**

Aboriginal Australians accounted for less than 1% of cases in NSW, with two to four cases reported each year during 2003–2007 (Table 2).

During 2003–2007 more than 85% of tuberculosis cases were born overseas, and over 60% were from Asia (Table 3). Over the 5-year period, there was an increase in the rate of tuberculosis among people born in Southern and Central Asia while rates in other areas of Asia remained steady (Figure 1). The rate of tuberculosis among people born in Australia continues to remain around one case per 100 000 population.

### *Site of infection*

The main site of disease from 2003 to 2007 was the lung (58–61% of cases) (Table 4). The second most reported site for all years was lymphatic tissue (17–22% of cases).

### *Case classification*

From 2003–2007, 94–97% of cases were notifications of newly diagnosed disease, and 3–6% were reactivated cases (Table 4). Of the reactivated cases, 74% had tuberculosis following treatment overseas and 26% had tuberculosis following treatment in Australia.

### *Laboratory confirmation*

Over 70% of cases during 2003–2007 were laboratory confirmed, with either *M. tuberculosis* identified by culture, nucleic acid amplification tests or both (Table 4).

During this time, sputum microscopy and culture results were reported for over 90% of cases with pulmonary disease. Of these, around 40% had acid-fast bacilli identified on direct sputum smears, and around 75% were reported to have *M. tuberculosis* cultured in the sputum.

### *Clinical outcomes*

Based on assessable outcomes from 2003 to 2007, 96–98% of cases completed treatment or were classified as cured (culture negative at completion of treatment) (Table 5). From 2003 to 2007, between 17 and 25 cases died each year; of these, tuberculosis was reported as the cause of death in one to five cases per year (Table 5).

### *HIV co-infection*

The rate of human immunodeficiency virus (HIV) testing of tuberculosis cases improved during 2003–2007, but remains low. In 2003, 68 cases (18%) were tested for HIV infection, increasing to 193 cases (43%) tested in 2007 (Figure 2).[8] Overall the proportion of cases with tuberculosis-HIV co-infection ranged from 1–3% during the period.

### *Drug resistance*

Overall, 15 (0.7%) of the 2161 tuberculosis cases reported in NSW during 2003–2007 were multi-drug resistant, compared to 25 (0.5%) of 5042 cases reported during 1999–2002.[8] One MDR-TB case (in 2005) had tuberculosis-HIV co-infection. Over the period 1999–2007, 40 cases of MDR-TB were identified, representing 1% of tuberculosis notifications.

During 2003–2007, nine (60%) cases with MDR-TB were aged 20–35 years and 11 (73%) were male. Of the 15 cases, 13 (87%) were born overseas; six in Southern and Central Asia, four in South East Asia, two in Africa and one in the Pacific Islands. Of the two Australian-born cases, one had resided in a high-burden country and one had co-existing immunosuppression.

Eleven (73%) of the MDR-TB cases presented with pulmonary disease and 10 (67%) were smear positive. Ten (67%) cases reported no previous treatment, indicating the infection was likely to be a primary infection with MDR-TB rather than a newly resistant infection. Of five cases who acquired resistance following previous treatment, four had been treated overseas and one had been treated in Australia. One case of XDR-TB was retrospectively identified in a person who was notified in 2002 using the revised case definition issued by WHO in 2007.[9] This person was born in Fiji. They presented with extrapulmonary tuberculosis and reported no past history of tuberculosis. There was a family history of tuberculosis overseas three decades before diagnosis. The case was successfully treated with second-line drugs.

### *Risk factors*

From 2003 to 2007, the most commonly reported risk factors for tuberculosis were: past residence in a high-burden country (83–88%); birth in a high-burden country (80–84%) (Table 6). During 2003–2007, the reported risk surrounding healthcare workers and transmission of tuberculosis has not changed significantly over time (Table 7). The annual proportion of cases that report having ever worked in a healthcare facility (in Australia or overseas)

**Table 4. Main site of infection, case classification and means of laboratory confirmation of patients notified with tuberculosis, NSW, 2003–2007**

| Case characteristics | Cases in 2003 | | Cases in 2004 | | Cases in 2005 | | Cases in 2006 | | Cases in 2007 | | Cases 2003–2007 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *N* | % | *N* | % | *N* | % | *N* | % | *N* | % | *N* | % |
| **Main site** | | | | | | | | | | | | |
| Lung | 223 | 60 | 262 | 61 | 252 | 58 | 278 | 60 | 266 | 59 | 1281 | 59 |
| Lymphatics | 76 | 20 | 92 | 21 | 97 | 22 | 88 | 19 | 79 | 17 | 432 | 20 |
| Pleura | 21 | 6 | 19 | 4 | 21 | 5 | 28 | 6 | 37 | 8 | 126 | 6 |
| Bone/joint | 14 | 4 | 15 | 3 | 16 | 4 | 21 | 5 | 20 | 4 | 86 | 4 |
| Kidney-genito-urinary | 8 | 2 | 14 | 3 | 13 | 3 | 10 | 2 | 13 | 3 | 58 | 3 |
| Miliary | 1 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 4 | 0 |
| Brain/central nervous system | 5 | 1 | 8 | 2 | 11 | 3 | 10 | 2 | 6 | 1 | 40 | 2 |
| Gastro-intestinal | 8 | 2 | 7 | 2 | 6 | 1 | 11 | 2 | 14 | 3 | 46 | 2 |
| Other | 16 | 4 | 13 | 3 | 19 | 4 | 18 | 4 | 19 | 4 | 85 | 4 |
| Unknown/not reported | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| **Case Classification** | | | | | | | | | | | | |
| New active | 361 | 97 | 413 | 96 | 423 | 97 | 438 | 94 | 436 | 96 | 2071 | 96 |
| Reactivated | 12 | 3 | 19 | 4 | 12 | 3 | 27 | 6 | 17 | 4 | 87 | 4 |
| Following treatment in Australia | 3 | 1 | 7 | 2 | 7 | 2 | 2 | 0 | 4 | 1 | 23 | 1 |
| Following treatment overseas | 9 | 2 | 12 | 3 | 5 | 1 | 25 | 5 | 13 | 3 | 64 | 3 |
| Unknown/not reported | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 3 | 0 |
| **Laboratory confirmed (total)[#]** | 282 | 76 | 312 | 72 | 333 | 76 | 347 | 75 | 334 | 74 | 1608 | 74 |
| Culture | 267 | 72 | 296 | 69 | 310 | 71 | 320 | 69 | 317 | 70 | 1510 | 70 |
| Polymerase chain reaction | 15 | 4 | 16 | 4 | 23 | 5 | 27 | 6 | 17 | 4 | 98 | 5 |
| Clinical | 75 | 20 | 120 | 28 | 104 | 24 | 118 | 25 | 120 | 26 | 537 | 25 |
| Other | 16 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 1 |
| Unknown/not reported | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Pulmonary cases only*** | 223 | 60 | 262 | 61 | 252 | 58 | 278 | 60 | 266 | 59 | 1281 | 59 |
| **Direct smear results** | | ^ | | ^ | | ^ | | ^ | | ^ | | ^ |
| Direct smear positive | 116 | 52 | 110 | 42 | 116 | 46 | 111 | 40 | 112 | 42 | 565 | 44 |
| Direct smear negative | 95 | 43 | 142 | 54 | 116 | 46 | 153 | 55 | 135 | 51 | 641 | 50 |
| Not reported | 12 | 5 | 10 | 4 | 20 | 8 | 14 | 5 | 19 | 7 | 75 | 6 |
| **Culture results** | | | | | | | | | | | | |
| Culture positive | 181 | 81 | 204 | 78 | 190 | 75 | 221 | 79 | 201 | 76 | 997 | 78 |
| Culture negative | 30 | 13 | 49 | 19 | 42 | 17 | 43 | 15 | 43 | 16 | 207 | 16 |
| Not reported | 12 | 5 | 9 | 3 | 20 | 8 | 14 | 5 | 22 | 8 | 77 | 6 |
| **Total number of cases** | **373** | | **432** | | **437** | | **465** | | **454** | | **2161** | |

[#]Some infections confirmed by more than one method.
*Pulmonary cases refer to the number of cases where the primary site of disease is the lung.
^% for direct smear and culture results are as a proportion of pulmonary cases only.
Source: Notifiable Diseases Database, Communicable Diseases Branch, NSW Department of Health.

**Table 5. Clinical outcome of tuberculosis cases, NSW, 2003–2007**

| Case outcomes | Cases in 2003 | | Cases in 2004 | | Cases in 2005 | | Cases in 2006 | | Cases in 2007[#] | | Cases 2003–2007 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *N* | % | *N* | % | *N* | % | *N* | % | *N* | % | *N* | % |
| **Assessable outcomes** | | | | | | | | | | | | |
| Completed | 297 | 90 | 356 | 91 | 380 | 95 | 389 | 93 | 361 | 94 | 1783 | 93 |
| Cured | 26 | 8 | 22 | 6 | 10 | 3 | 13 | 3 | 13 | 3 | 84 | 4 |
| Defaulted | 7 | 2 | 9 | 2 | 7 | 2 | 12 | 3 | 11 | 3 | 46 | 2 |
| Died from tuberculosis | 1 | 0 | 3 | 1 | 3 | 1 | 5 | 1 | 1 | 0 | 13 | 1 |
| Failure | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Treatment interrupted | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unknown | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total assessable cases | 331 | 100 | 390 | 100 | 400 | 100 | 419 | 100 | 386 | 100 | 1926 | |
| Percentage of total cases | 89 | | 90 | | 92 | | 90 | | 85 | | | |
| **Non-assessable outcomes** | | | | | | | | | | | | |
| Died with tuberculosis | 4 | 1 | 25 | 6 | 17 | 4 | 24 | 5 | 20 | 4 | 90 | 38 |
| Died | 16 | 4 | N/A | | N/A | | N/A | | N/A | | 16 | 7 |
| Transferred overseas | 3 | 1 | 16 | 4 | 20 | 5 | 21 | 5 | 21 | 5 | 81 | 34 |
| Transferred* | 19 | 5 | N/A | | N/A | | N/A | | N/A | | 19 | 8 |
| Incomplete | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 27 | 6 | 29 | 12 |
| Total non-assessable cases | 42 | | 42 | | 37 | | 46 | | 68 | | 235 | |
| **Total number of cases** | **373** | | **432** | | **437** | | **465** | | **454** | | **2161** | |

*For 2003 transferred may include transferred interstate and died may include died with tuberculosis and died from tuberculosis.
[#]Outcome of 2007 cases is preliminary data – to be confirmed mid 2009.
Source: Notifiable Diseases Database, Communicable Diseases Branch, NSW Department of Health.

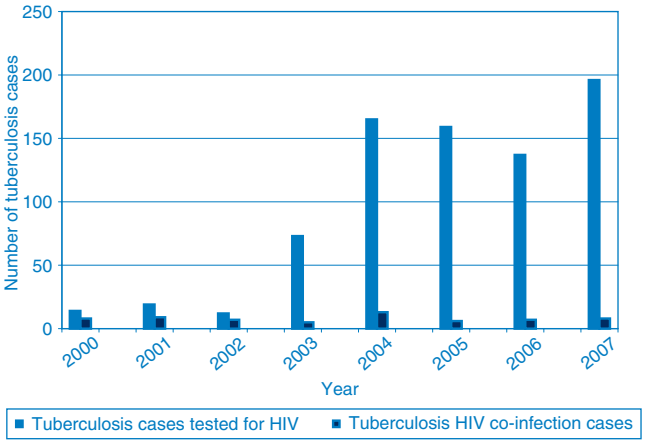


**Figure 2. Number of tuberculosis cases tested for HIV and number of co-infection cases, NSW, 2000–2007. HIV = Human Immunodeficiency Virus.**

was 5–9%, with most of these cases (4–7%) being born overseas. Cases reported as currently or recently employed as healthcare workers (at time of diagnosis) constitute 3–6% of tuberculosis cases during 2003–2007.

### *Performance indicators*

In 2002, the National Tuberculosis Advisory Committee developed national performance indicators for tuberculosis.[10] Table 8 presents the performance criteria and the NSW and Australian data for each indicator for 2003–2007.

Between 2004 and 2006, the indicator of less than 0.1 cases per 100 000 population in children aged less than 15 years was reached in NSW for Aboriginal children. The incidence of tuberculosis in Aboriginal Australians and non-Aboriginal Australian-born children are higher than the expected performance criteria Australia-wide and in NSW. Overall the NSW rate of infection in Aboriginal Australians represents three to four cases per year. No Aboriginal children in NSW have been notified with tuberculosis since 2003 when two children were reported. Four to nine cases were notified per year in non-Aboriginal Australian-born children. The majority of these children report having parents born in high-burden countries as well as other risk factors such as being a household contact of a tuberculosis case.

The crude incidence in NSW in Aboriginal Australians and non-Aboriginal Australian-born people is similar to or less than the combined rate for all Australian states and territories. However, the crude incidence of tuberculosis cases born overseas was higher in NSW compared to the incidence in other jurisdictions. Compared to the Australian data, the proportion of cases with a recorded HIV status is lower in NSW.

## Discussion

Tuberculosis in NSW continues to affect people who were born in countries with a high prevalence, with rates peaking in the 25–34 year age group and a secondary peak in the 75 and older age group. The highest incidence was among people living in the Sydney metropolitan area, reflecting migration settlement patterns as most people from high-burden countries initially settle in metropolitan areas.[11]

The success of the NSW Tuberculosis Program can be seen in the incidence of tuberculosis in NSW remaining steady over the last decade despite large-scale migration from high-burden countries.[4] Other successes of the Program are reflected in the high treatment success rates, absence of treatment failures and low rates of relapse of cases initially treated in Australia. The incidence of tuberculosis among Australian-born people is also low and may reflect the low risk of exposure in this population. Contact tracing programs and preventive therapy, occupational screening of healthcare workers as well as improvements in the health of the general population are also likely to be contributing to the low rate of tuberculosis among Australian-born people.[8]

Although overall rates of tuberculosis are low in NSW, there are still a number of performance indicators that have not reached expected outcomes. NSW reports higher rates of tuberculosis in people born overseas than in people born in Australia, which may reflect migration patterns within Australian states and territories.[12]

Since 2004, only 30–40% of tuberculosis cases in NSW were tested for HIV infection each year. The low rate of testing could be due to the reluctance of treating doctors to request the test or they may be unable to identify any risk factors for HIV infection and therefore are not testing. Risk factor assessment (in a study reviewed from North America) does not reliably predict HIV infection in tuberculosis patients.[13] Recommendations have been made that all persons with tuberculosis should be routinely offered HIV testing.[13] Improved compliance with HIV testing is needed to meet the national performance indicator of 100% of cases assessed for HIV status. NSW Department of Health is currently reviewing policies to improve the proportion of tuberculosis cases who are offered HIV testing and the proportion of positive HIV cases who are offered assessment for tuberculosis co-infection.

MDR-TB is an ever present threat to tuberculosis control in Australia. Treatment of MDR-TB and XDR-TB is more complex, requires a longer treatment time and is often associated with a poorer outcome for the patient. Although numbers of MDR-TB cases in NSW are steady, NSW is seeing an increase in rates of tuberculosis from regions with a high incidence of MDR and XDR-TB. Continued prevention and control of surveillance of tuberculosis and, in particular, resistant strains is necessary in NSW.

Nationally, an increase in the number of tuberculosis notifications in healthcare workers has been reported, especially

**Table 6. Reported risk factors for patients notified as having tuberculosis, NSW, 2003–2007**

| Risk factor | Cases in 2003 | | Cases in 2004 | | Cases in 2005 | | Cases in 2006 | | Cases in 2007 | | Cases 2003–2007 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *N* | % | *N* | % | *N* | % | *N* | % | *N* | % | *N* | % |
| Past residence in a high burden country | 315 | 84 | 369 | 85 | 368 | 84 | 409 | 88 | 400 | 88 | 1861 | 86 |
| Born in a high risk country | 299 | 80 | 344 | 80 | 362 | 83 | 392 | 84 | 380 | 84 | 1777 | 82 |
| Immunosuppressive health status/therapy | 56 | 15 | 59 | 14 | 54 | 12 | 74 | 16 | 63 | 14 | 306 | 14 |
| Household member or close contact with tuberculosis | 44 | 12 | 44 | 10 | 65 | 15 | 71 | 15 | 65 | 14 | 289 | 13 |
| Previous tuberculosis diagnosis | 24 | 6 | 23 | 5 | 20 | 5 | 29 | 6 | 25 | 6 | 121 | 6 |
| Ever worked in health industry | 17 | 5 | 21 | 5 | 40 | 9 | 31 | 7 | 32 | 7 | 141 | 7 |
| Currently or recently residing in an institution | 7 | 2 | 15 | 3 | 15 | 3 | 10 | 2 | 14 | 3 | 61 | 3 |
| Child parent/s born in high risk country[#] | 3 | 1 | 3 | 1 | 12 | 3 | 7 | 2 | 10 | 2 | 35 | 2 |
| Currently or recently residing in a homeless shelter | 2 | 1 | 7 | 2 | 11 | 3 | 14 | 3 | 5 | 1 | 39 | 2 |
| Currently or previously employed in an institution | 0 | 0 | 5 | 1 | 7 | 2 | 14 | 3 | 15 | 3 | 41 | 2 |
| Other | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| **Number of cases** | **373** | | **432** | | **437** | | **465** | | **454** | | **2161** | |

[#]Refers to children under the age of fifteen who were born in Australia but whose parents were born in a high burden country.
Source: Notifiable Diseases Database, Communicable Diseases Branch, NSW Department of Health.

**Table 7. Risk factors for healthcare worker related cases of tuberculosis, NSW, 2003–2007**

| Risk factor | Cases in 2003 | | Cases in 2004 | | Cases in 2005 | | Cases in 2006 | | Cases in 2007 | | Cases 2003–2007 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *N* | % total cases | *N* | % total cases | *N* | % total cases | *N* | % total TB cases | *N* | % total cases | *N* | % |
| Ever worked in healthcare facility – total | 17 | 5 | 21 | 5 | 40 | 9 | 31 | 7 | 32 | 7 | 141 | 7 |
| Ever worked in healthcare facility – overseas born | 14 | 4 | 18 | 4 | 32 | 7 | 27 | 6 | 27 | 6 | 118 | 5 |
| Length of stay in Australia <3 years | 3 | 1 | 10 | 2 | 10 | 2 | 12 | 3 | 10 | 2 | 45 | 2 |
| Length of stay in Australia ⩾3 years | 11 | 3 | 8 | 2 | 20 | 5 | 15 | 3 | 17 | 4 | 71 | 3 |
| Currently working or worked in last 12 months in health care facility | 10 | 3 | 14 | 3 | 25 | 6 | 19 | 4 | 26 | 6 | 94 | 4 |
| By occupation: | | | | | | | | | | | | |
| Medical/nursing | 9 | 2 | 13 | 3 | 21 | 5 | 17 | 4 | 18 | 4 | 78 | 4 |
| Allied health including dental | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 3 | 1 | 6 | 0 |
| Other | 1 | 0 | 1 | 0 | 3 | 1 | 1 | 0 | 5 | 1 | 11 | 1 |
| **Total number of cases** | **373** | | **432** | | **437** | | **465** | | **454** | | **2161** | |

Source: Notifiable Diseases Database, Communicable Diseases Branch, NSW Department of Health.

**Table 8. National performance indicators for the control of tuberculosis, data for NSW and Australia, 2003–2007**

| National tuberculosis performance indicator | Performance criteria | 2003 | | 2004 | | 2005 | | 2006 | | 2007 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Australia | NSW | Australia | NSW | Australia | NSW | Australia | NSW | Australia | NSW |
| **Annual incidence (per 100 000 population)** | | | | | | | | | | | |
| *Crude incidence* | | | | | | | | | | | |
| Indigenous Australians | <1 | 8.7 | 2.9 | 8.1 | 2.1 | 5.9 | 1.4 | 6.6 | 2.7 | *** | 2.0 |
| Non-Indigenous Australian-born | <1 | 0.9 | 0.9 | 1.2 | 1.2 | 0.8 | 1 | 0.8 | 0.9 | *** | 1.1 |
| Overseas-born persons* | ** | 10.2 | 19.3 | 10.4 | 21.9 | 20.6 | 22.5 | 20.7 | 23.8 | *** | 22.1 |
| Relapse cases initially treated in Australia | <2% of total treated cases | 1.1 | 0.8 | 1 | 1.7 | 1.4 | 1.6 | 0.9 | 0.4 | *** | 0.9 |
| *Incidence in children <15 years, by risk group* | | | | | | | | | | | |
| Indigenous Australian children | <0.1 | 5.6 | 3.6 | 0 | 0 | 0.6 | 0 | 1.7 | 0.0 | *** | 0 |
| Non-indigenous Australian-born children | <0.1 | 0.4 | 0.7 | 0.4 | 0.3 | 0.7 | 0.5 | 0.5 | 0.6 | *** | 0.7 |
| Overseas-born children* | ** | 9.9 | 6.7 | 11.4 | 3.3 | 18 | 10.9 | 19.8 | 10.8 | *** | 12.9 |
| Collection of HIV status in cases (% of cases) | 100% over next 3 years | 32.2 | 19.6 | 34 | 37.7 | 37 | 35 | 35 | 29.5 | *** | 43.5 |
| **Treatment outcome measures (%)** | | | | | | | | | | | |
| Cases evaluated for outcomes# | 100 | 98 | 100 | 98 | 100 | 100 | 100 | *** | 100 | *** | *** |
| Cases that have treatment completed and are cured | >90 | 95.1 | 86.6 | 96.9 | 87.5 | 95.3 | 89.1 | *** | 86.5 | *** | *** |
| Cases recorded as treatment failures# | <2 | 0 | 0 | 0 | 0 | 0 | 0 | *** | 0 | *** | *** |

*The performance criteria for overseas born are applied to people who have been living in Australia for more than 5 years except 2005 where it is all cases born overseas. The denominator for this rate is the total overseas born population living in Australia in 2003 and 2004 and in NSW.
**Performance criteria currently under review.
***Data not available.
#The denominator used for both 2003 and 2004 was the number of cases evaluated for treatment outcome.

among people born overseas.[3] Although NSW has seen a slight increase in cases who are healthcare workers during 2003–2007, the proportion born overseas has not changed. The risk of transmission in the healthcare setting is currently low although ongoing surveillance is required.

This report indicates that the incidence of tuberculosis in NSW has remained stable over recent years. Tuberculosis remains a disease that mostly affects people born in countries of high prevalence with little evidence of local transmission. The threats to the NSW Tuberculosis Program are similar to those that challenge tuberculosis control globally and include control of MDR-TB and XDR-TB, and identification and management of tuberculosis-HIV co-infection. To continue the success of the Program, it is important to maintain effective collaboration with key stakeholders across clinical, public health and community sectors.

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# Tuberculosis

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Tuberculosis is an infectious disease caused by organisms of the *Mycobacterium tuberculosis* complex. In 2006, 9.2 million people worldwide acquired tuberculosis, 1.5 million people died from tuberculosis, and an additional 200 000 people died from human immunodeficiency virus (HIV)-associated tuberculosis.[1] Tuberculosis is important because of this global burden of disease and the emerging risk of multi-drug resistant tuberculosis, often in association with HIV infection in developing countries.[1]

## Transmission and disease

Tuberculosis is spread via the airborne route.[2] The infectious dose is very low. It is thought that an untreated person with infectious tuberculosis can transmit the infection to 10–15 people each year.[2] In most people with the infection, the organism remains latent (inactive) within the body. A person who has latent tuberculosis infection is not infectious to others and does not have symptoms of disease. Around 5% of people with latent infection progress to active disease within 1–2 years after infection. For a person with tuberculosis infection, the overall risk of progression to tuberculosis disease is around 10% over a lifetime.[2]

People with impaired immunity are more likely to progress to active disease. HIV infection, malnutrition, being at the extremes of age, drug and alcohol abuse, certain medical conditions (e.g. kidney disease, diabetes, cancer) and immunosuppressive drugs all increase the risk of progression to active disease.[2]

In Australia, approximately 60% of people with active tuberculosis have pulmonary tuberculosis (tuberculosis in the lungs), the main infectious form of the disease.[3] Pulmonary tuberculosis generally presents with a cough (sometimes blood-stained), fever, night sweats, weight loss and tiredness.[2] A person is most infectious if the tuberculosis bacteria can be seen on a sputum smear. Tuberculosis can also involve other organs of the body, such as the lymph nodes, meninges, kidneys and joints. These forms of tuberculosis are generally not infectious. Rarely, tuberculosis can produce disseminated disease.

## Treatment

Treatment for tuberculosis is administered for at least 6 months. Commonly, four oral drugs (isoniazid, rifampicin, pyrazinamide and ethambutol) are administered for at least the first 2 months, with isoniazid and rifampicin continued for at least 4 more months. This treatment, known as 'directly observed treatment, short-course', or DOTS, is one of the pillars of tuberculosis control, and involves patients taking their medications in the presence of a healthcare worker.[1] Management of tuberculosis requires patient education, the provision of appropriate antibiotic therapy and follow-up.

## Prevention

All tuberculosis infections, and subsequent disease, are caused by exposure to people with infectious tuberculosis who have not been treated. The two key elements of prevention are:

1) early detection and effective treatment of people with active tuberculosis disease; and
2) detection of people with latent tuberculosis infection who are at greatest risk of progression to active disease: those who have recently acquired the infection and those with impaired immunity. These people can be treated with isoniazid to reduce their risk of developing active disease.[2]

## Global burden of disease

Twenty-two high burden countries account for 80% of the global burden of disease, with particularly high numbers of cases in China, India, Indonesia, South Africa, the Russian Federation and Vietnam.[1] In 1991, the World Health Assembly recognised tuberculosis as a major global health problem due to the rising incidence of the disease. The incidence of tuberculosis may have peaked in 2003, but the prevalence of co-infection with tuberculosis and HIV, particularly in sub-Saharan Africa, poses a particular challenge to tuberculosis control.[1,4]

A further challenge is the problem of multi-drug resistant tuberculosis (MDR-TB), which is resistant to at least isoniazid and rifampicin, and extensively drug resistant tuberculosis (XDR-TB), which is additionally resistant to other important, second-line drugs.[1] MDR-TB requires treatment for at least 2 years with oral and injectable drugs that are more expensive, more toxic and less effective than standard drugs. XDR-TB is very difficult to treat and may be impossible to cure, and therefore has a high mortality rate.

In 2008, the World Health Organization estimated that 4.6% of all cases of tuberculosis were MDR-TB.[1] MDR-TB was

10.1071/NB08046

found in every country surveyed, particularly in China and the former Soviet Union. It is estimated that there are now 500 000 cases of MDR-TB each year. In the same survey, XDR-TB was found in 45 countries, and is thought to account for between 4 and 24% of MDR-TB.[1]

## Tuberculosis in Australia

Note that within NSW Health, the term 'Aboriginal' is generally used in preference to 'Aboriginal and Torres Strait Islander', in recognition that Aboriginal people are the original inhabitants of NSW.

In Australia, the annual incidence rate of tuberculosis has been below 6 per 100 000 population since 1985.[3] The incidence rate in Aboriginal Australians in 2006 was seven times the rate in non-Aboriginal Australians. Although rates of tuberculosis in Aboriginal Australians have been falling, the Northern Territory, with the highest proportion of Aboriginal people, has the highest rates of tuberculosis in the country.[3] Approximately 80% of Australian cases occur in people born overseas, with the top five countries of origin in 2005 being India, Vietnam, the Philippines, China and Indonesia.[3] Unlike many other countries, co-infection with tuberculosis and HIV remains uncommon in Australia.[3] In 2006, 2.4% of Australian cases were found to be MDR-TB.[5] One case of XDR-TB was identified in 2004.[5]

## Summary

Globally, tuberculosis is responsible for a large burden of disease. The incidence of tuberculosis may have peaked, but drug-resistant forms of the disease are an emerging concern. Tuberculosis has been well controlled in Australia for the last two decades, with the highest risk now occurring in people born overseas, especially recent migrants. The effectiveness of overseas control programs, and of screening programs prior to migration, will have a major impact on Australian rates of tuberculosis in the future.

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# Communicable Diseases Report, NSW, January and February 2009

***Communicable Diseases Branch***
***NSW Department of Health***

For updated information, including data and facts on specific diseases, visit www.health.nsw.gov.au and click on **Infectious Diseases** or access the site directly at: http://www.health.nsw.gov.au/publichealth/infectious/index.asp.

Figure 1 and Tables 1 and 2 show reports of communicable diseases received through to the end of February 2009 in New South Wales (NSW).

## Vaccine-preventable diseases

### *Pertussis (whooping cough)*

Pertussis notifications continue to increase with more than 3900 cases reported in NSW in January and February. While babies and young children represent the largest proportion of notifications, an increase has also been seen in older children and adults. Increased use of polymerase chain reaction (PCR), a diagnostic test for pertussis, may account for some of the increase. Many cases have good evidence of past pertussis immunisation: the vaccine provides some protection for several years; however, pertussis immunity typically wanes thereafter.

### *Measles*

Five confirmed cases of measles were notified in NSW in January and February and another case is under investigation. Four cases had recently returned from overseas (Thailand, the United States of America and Vietnam). The case who returned from Vietnam was identified through contact tracing of a case on the same flight reported from another jurisdiction. As Vietnam is currently experiencing an outbreak of measles, it is difficult to determine whether transmission occurred during the flight or prior to boarding. The most recent case appears to have acquired measles locally, although a source case can not be identified.

### *Invasive meningococcal disease*

Twelve cases of invasive meningococcal disease were reported up to the end of February 2009 in NSW, compared with five cases in the same period in 2008. Of the 12 cases, nine were serogroup B, one was of unknown serogroup and two cases were serogroup C (the strain prevented by the current vaccine). Overall, rates of meningococcal disease have continued to decline since 2000.

### *Mumps*

Three cases of mumps have been reported in NSW so far this year. The outbreak seen in young adults mainly around south-eastern and northern Sydney in 2008 appears to have passed.

### *Rubella*

One case of rubella has been reported in NSW so far this year in a man who had recently travelled overseas.

### *Tetanus*

One case of tetanus has been reported in NSW so far this year in a man who presented with tetanus after a penetrating foot injury. The diagnosis was made clinically.

### *Influenza*

Influenza outbreaks occur each winter in NSW. The influenza virus mutates frequently and new strains emerge regularly. Vaccination is the mainstay of influenza prevention and provides good protection when the strain circulating matches that in the vaccine. Vaccine manufacturers review strains that were circulating internationally several months before winter and typically include three strains of killed influenza in the vaccine. It is impossible to predict in advance the severity of the coming influenza season, as it is largely dependent on the degree of mutation, if any, of circulating influenza strains.

The anti-influenza drugs, oseltamivir and zanamivir, can reduce the severity of illness if given early in the course of infection and can prevent illness in people exposed to an infectious person. These drugs must be prescribed by a doctor and to date have not been widely used in Australia. Analysis of strains of influenza virus in 2008 has found that one strain, influenza A H1N1, is highly resistant to oseltamivir.[1] In the past, this strain has been relatively uncommon in Australia, but it is included in this year's vaccine.

10.1071/NB09012

In preparation for the 2009 influenza season, NSW Health has:

- faxed general practitioners and Aboriginal Medical Services with order forms for free influenza vaccine for some people at high risk (those aged over 65 and Aboriginal people aged over 50 or between 15 and 49 years with underlying illnesses);
- written to aged-care facilities promoting vaccine use in residents (provided free) and staff; and
- continued to provide free vaccine for use by area health services for health-care workers.

## Enteric diseases

### *Cryptosporidiosis*

In February 2009, an increase in cryptosporidiosis cases was identified across NSW. Cryptosporidiosis is a disease caused by infection with the parasite *Cryptosporidium*. Infection causes diarrhoea and abdominal cramps that can last for many weeks. There is no specific treatment. The disease is spread in several ways, most importantly by direct contact with people or animals with the infection, or by drinking contaminated water, including inadvertently while swimming. Large outbreaks have occurred in NSW in previous years and were linked to contaminated swimming pools. In the current outbreak, many cases reported swimming as a risk factor, but in a range of different pools.

There is normally a small risk of acquiring cryptosporidiosis from ingesting water while swimming in pools. This risk is likely to be higher now given the number of cases being notified in the general community, but can be reduced by not swallowing water from the pool. There is no public health recommendation to avoid swimming in public pools for well people; however, people with diarrhoea in the previous 2 weeks should not enter pools or spas, and all swimmers should follow good hygiene practices. Person-to-person transmission can be reduced by regular hand-washing with soap and running water for 10 seconds.

### *Shigellosis*

*Shigella* infections remain elevated in men in eastern Sydney, possibly related to male-to-male sexual activities. Careful attention to hygiene (hand-washing with soap and water for at least 10 seconds) after using the toilet, before handling food, and before and after sex, will help reduce spread. People with diarrhoea should not handle food for others and avoid direct contact with others until at least 48 hours after symptoms resolve. Antibiotic treatment is recommended for patients with *Shigella* infection to reduce the likelihood of transmitting the infection to others.

### *Gastroenteritis*

In January and February 2009, NSW public health units investigated 48 outbreaks of gastroenteritis, including 43 suspected to be caused by person-to-person transmission, and five suspected to be the result of foodborne transmission.

The 43 suspected person-to-person outbreaks affected a total of 475 people. Twenty-six occurred in aged-care facilities and affected 332 people; five occurred in hospitals and affected 52 people; nine occurred in child-care centres and affected 81 people; and three outbreaks in other institutions affected 10 people. Clinical specimens were submitted for testing from 16 suspected person-to-person gastroenteritis outbreaks. Norovirus was confirmed in stool samples from six outbreaks in aged-care facilities. The causative agent was not determined for the remaining outbreaks.

Of the five suspected foodborne outbreaks, four were outbreaks of salmonellosis affecting 127 people, of whom 43 had laboratory confirmation of the diagnosis. One outbreak affecting six people was likely to be caused by a bacterial toxin. Deficiencies in food handling were the likely cause of all outbreaks.

## Sexually transmissible infections

### *Syphilis*

Syphilis remains a concern in inner Sydney, mainly among men who have sex with men. Safe sex and regular screening for those with multiple partners are important preventive measures.

## Vectorborne diseases

### *Dengue*

Forty-eight cases of dengue fever were reported in NSW residents in January and February. Of these, three acquired the infection in Cairns and the remainder acquired the infection overseas. On the Australian mainland, dengue is transmitted by the *Aedes aegypti* mosquito, a species not currently found in NSW. There are ongoing outbreaks of dengue fever in Cairns, Townsville, Port Douglas, Yarrabah, Injinoo and Innisfail.

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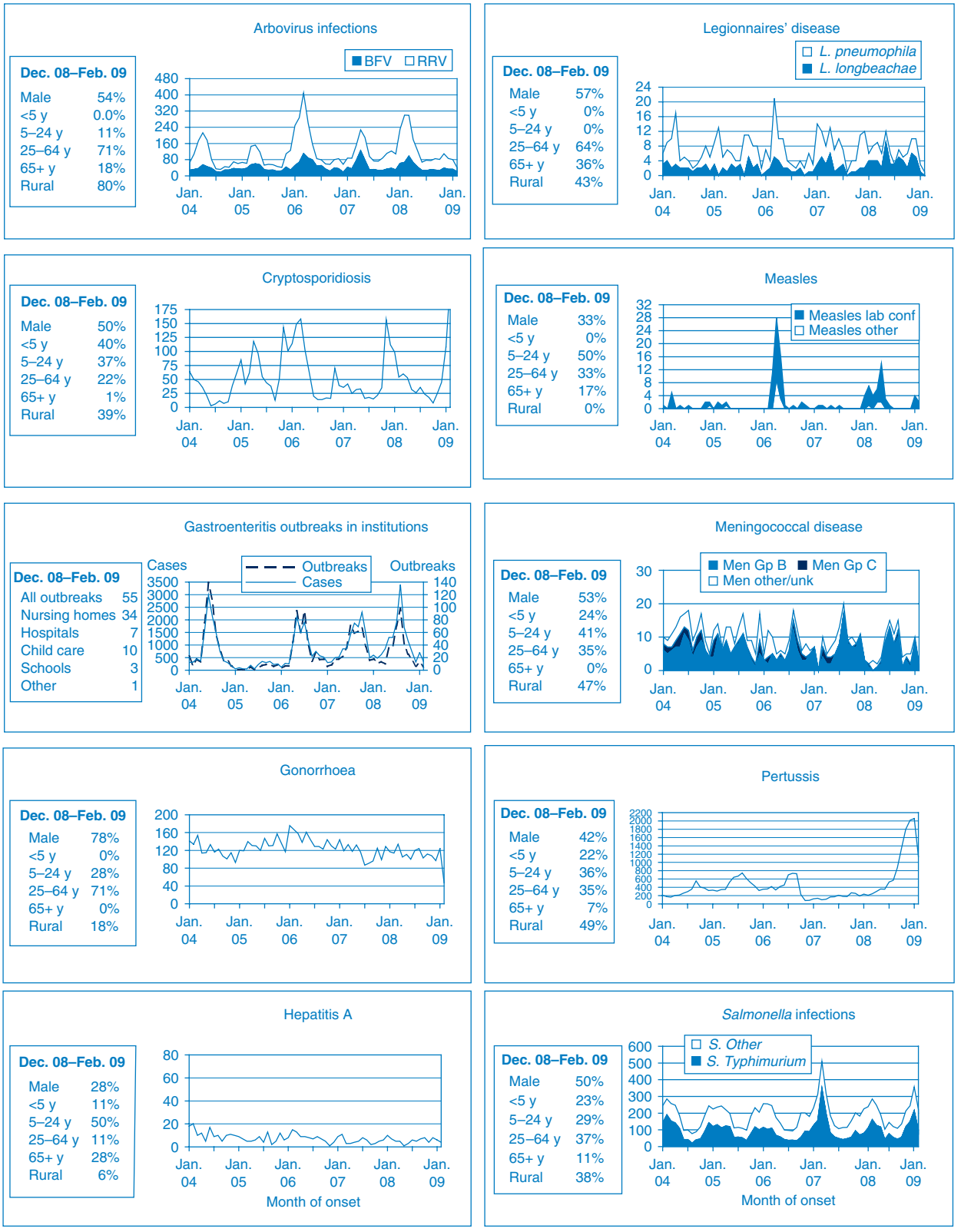
**Figure 1. Reports of selected communicable diseases, NSW, January 2004 to February 2009, by month of onset.**

Preliminary data: case counts in recent months may increase because of reporting delays.
Laboratory-confirmed cases only, except for measles, meningococcal disease and pertussis.
BFV, Barmah Forest virus infection; RRV, Ross River virus infection; lab conf, laboratory confirmed;
Men Gp C and Gp B, meningococcal disease due to serogroup C and serogroup B infection;
other/unk, other or unknown serogroups.
NB: Multiple series in graphs are stacked, except gastroenteritis outbreaks.
NB: Outbreaks are more likely to be reported by nursing homes and hospitals than by other institutions.

| NSW Population | |
|---|---|
| Male | 50% |
| <5 y | 7% |
| 5–24 y | 27% |
| 25–64 y | 53% |
| 65+ y | 13% |
| Rural | 46% |



## Table 1. Reports of notifiable conditions received in January 2009 by area health services

| Condition | Area Health Service (2009) Greater Southern GMA | SA | Greater Western FWA | MAC | MWA | Hunter New England HUN | NEA | North Coast MNC | NRA | Northern Sydney Central Coast CCA | NSA | South Eastern Sydney Illawarra ILL | SES | Sydney South West CSA | SWS | Sydney West WEN | WSA | JHS | Total For January[b] | Year to date |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bloodborne and sexually transmitted** | | | | | | | | | | | | | | | | | | | | |
| Chancroid[a] | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Chlamydia (genital)[a] | 35 | 24 | 13 | 17 | 24 | 107 | 34 | 33 | 50 | 48 | 84 | 45 | 210 | 126 | 87 | 44 | 83 | 8 | 1079 | 1079 |
| Gonorrhoea[a] | 1 | 2 | 1 | – | – | 5 | 1 | 3 | 3 | 3 | 5 | 2 | 32 | 24 | 8 | 5 | 10 | – | 106 | 106 |
| Hepatitis B – acute viral[a] | – | – | – | – | – | – | – | 1 | – | – | 1 | – | 1 | 1 | 1 | – | 1 | – | 6 | 6 |
| Hepatitis B – other[a] | 1 | 4 | 5 | – | – | 3 | 1 | – | 2 | 3 | 8 | 3 | 27 | 16 | 22 | 5 | 18 | 5 | 126 | 126 |
| Hepatitis C – acute viral[a] | – | – | 1 | – | – | – | 1 | – | – | – | – | – | – | – | – | – | – | – | 2 | 2 |
| Hepatitis C – other[a] | 14 | 14 | 1 | 6 | 3 | 18 | 6 | 19 | 23 | 16 | 11 | 15 | 32 | 34 | 29 | 5 | 19 | 35 | 302 | 302 |
| Hepatitis D – unspecified[a] | – | – | – | – | – | – | – | – | 1 | – | – | – | – | – | – | – | – | – | 1 | 1 |
| Lymphogranuloma vanereum | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Syphilis | – | – | 5 | – | – | 2 | 1 | 2 | 2 | – | 4 | 2 | 20 | 12 | 12 | 3 | 5 | 1 | 75 | 75 |
| **Vectorborne** | | | | | | | | | | | | | | | | | | | | |
| Barmah Forest virus[a] | 2 | 1 | 1 | 1 | – | 7 | 2 | 4 | 11 | 3 | – | 3 | – | – | – | – | – | – | 35 | 35 |
| Ross River virus[a] | 6 | 3 | 5 | 3 | – | 14 | 8 | 2 | 5 | 1 | 1 | 2 | 3 | 1 | – | – | – | – | 54 | 54 |
| Arboviral infection (other)[a] | – | – | – | – | – | – | 3 | 1 | 1 | – | 4 | 2 | 4 | 3 | 4 | 3 | 4 | – | 33 | 33 |
| Malaria[a] | 2 | 1 | – | – | – | 1 | – | – | – | – | – | – | – | – | 1 | – | 2 | – | 9 | 9 |
| **Zoonoses** | | | | | | | | | | | | | | | | | | | | |
| Anthrax[a] | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Brucellosis[a] | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Leptospirosis[a] | – | – | – | – | – | – | – | 1 | – | – | – | – | – | – | – | – | – | – | 1 | 1 |
| Lyssavirus[a] | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Psittacosis[a] | – | – | – | – | – | – | – | – | – | 1 | – | – | – | 1 | – | – | – | – | 1 | 1 |
| Q fever[a] | 2 | – | 1 | 1 | – | 2 | 3 | 3 | 3 | – | – | – | – | – | – | – | – | – | 15 | 15 |
| **Respiratory and other** | | | | | | | | | | | | | | | | | | | | |
| Blood lead level[a] | – | – | 3 | 1 | – | – | – | 1 | – | – | – | – | 1 | – | – | – | – | – | 6 | 6 |
| Influenza[a] | 21 | 3 | – | – | 4 | 9 | – | 1 | 2 | 2 | 9 | 2 | 18 | 3 | 9 | 12 | 15 | – | 110 | 110 |
| Invasive pneumococcal infection[a] | – | – | – | – | – | 1 | – | 1 | – | 1 | 2 | 3 | 2 | 2 | 4 | 1 | 4 | – | 21 | 21 |
| *Legionella longbeachae* infection[a] | – | – | – | – | 1 | – | 1 | – | – | – | – | – | – | – | 1 | – | 1 | – | 4 | 4 |
| *Legionella pneumophila* infection[a] | – | – | – | – | 1 | – | 1 | – | – | – | – | – | – | – | – | 1 | – | – | 3 | 3 |
| Legionnaires' disease (other)[a] | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Leprosy | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Meningococcal infection (invasive)[a] | – | 1 | – | – | – | – | 2 | – | – | – | – | 3 | 2 | – | 3 | – | – | – | 11 | 11 |
| Tuberculosis | 1 | – | – | – | – | 1 | – | – | 1 | – | 10 | 1 | 7 | 5 | – | 2 | 5 | – | 33 | 33 |
| **Vaccine–preventable** | | | | | | | | | | | | | | | | | | | | |
| Adverse event after immunisation | 1 | – | – | – | – | – | – | – | – | 1 | 1 | – | – | 1 | – | – | 2 | – | 6 | 6 |
| *H. influenzae b* infection (invasive)[a] | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Measles | – | – | – | – | – | – | – | – | – | – | – | – | 2 | 1 | – | – | – | – | 3 | 3 |
| Mumps[a] | – | – | – | – | – | – | – | – | – | – | – | – | 2 | 1 | – | – | – | – | 3 | 3 |
| Pertussis | 85 | 30 | 10 | 43 | 23 | 104 | 25 | 86 | 177 | 121 | 162 | 338 | 263 | 80 | 120 | 183 | 271 | – | 2121 | 2121 |
| Rubella[a] | – | – | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | 1 | – | 2 | 2 |
| Tetanus | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| **Enteric** | | | | | | | | | | | | | | | | | | | | |
| Botulism | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Cholera[a] | – | – | – | – | – | – | – | – | – | – | 2 | – | – | – | – | – | – | – | 2 | 2 |
| Cryptosporidiosis[a] | 1 | – | – | 1 | 1 | 17 | 1 | 3 | 9 | 2 | 3 | 1 | 9 | 2 | 3 | 3 | 5 | – | 61 | 61 |
| Giardiasis[a] | 5 | 2 | – | 1 | 1 | 11 | 4 | – | – | 4 | 16 | 3 | 26 | 13 | 8 | 13 | 8 | – | 115 | 115 |
| Haemolytic uraemic syndrome | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Hepatitis A[a] | – | – | – | – | – | – | – | – | – | 1 | 3 | – | 1 | – | 1 | – | – | – | 6 | 6 |
| Hepatitis E[a] | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |
| Listeriosis[a] | – | – | – | – | – | – | – | – | – | – | 1 | – | – | – | 1 | – | – | – | 2 | 2 |
| Salmonellosis[a] | 18 | 5 | 2 | 11 | 2 | 26 | 10 | 13 | 18 | 4 | 40 | 11 | 40 | 20 | 43 | 21 | 30 | – | 316 | 316 |
| Shigellosis[a] | – | 1 | – | – | 1 | – | – | – | – | – | – | – | 12 | 2 | – | – | 3 | – | 20 | 20 |
| Typhoid[a] | – | – | – | – | – | – | – | – | – | – | – | – | – | 2 | 3 | – | 2 | – | 7 | 7 |
| Verotoxin producing *E. coli*[a] | – | – | – | – | – | 1 | 1 | – | – | – | – | – | – | – | 1 | – | – | – | 3 | 3 |
| **Miscellaneous** | | | | | | | | | | | | | | | | | | | | |
| Creutzfeldt–Jakob disease | – | – | – | – | – | 1 | – | – | – | – | – | – | – | – | – | – | – | – | 1 | 1 |
| Meningococcal conjunctivitis | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – |

[a]Laboratory-confirmed cases only. [b]Includes cases with unknown postcode.
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NSA, Northern Sydney Area CSA, Central Sydney Area WSA, Western Sydney Area FWA, Far West Area HUN, Hunter Area NRA, Northern Rivers Area ILL, Illawarra Area SWS, South Western Sydney Area JHS, Justice Health Service.

## Table 2. Reports of notifiable conditions received in February 2009 by area health services

| Condition | Area Health Service (2009) | | | | | | | | | | | | | | | | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Greater Southern | | Greater Western | | | Hunter New England | | North Coast | | Northern Sydney Central Coast | | South Eastern Sydney Illawarra | | Sydney South West | | Sydney West | | | | For February[b] | Year to date |
| | GMA | SA | FWA | MAC | MWA | HUN | NEA | MNC | NRA | CCA | NSA | ILL | SES | CSA | SWS | WEN | WSA | JHS | | | |
| **Bloodborne and sexually transmitted** | | | | | | | | | | | | | | | | | | | | | |
| Chancroid[a] | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | | – | – |
| Chlamydia (genital)[a] | 31 | 39 | 4 | 18 | 12 | 118 | 31 | 25 | 68 | 51 | 70 | 30 | 152 | 77 | 67 | 39 | 96 | – | | 944 | 2023 |
| Gonorrhoea[a] | – | 1 | – | – | – | 5 | 1 | 1 | 2 | 4 | 7 | 1 | 29 | 19 | 12 | 4 | 6 | – | | 95 | 201 |
| Hepatitis B – acute viral[a] | – | – | – | 1 | – | – | – | – | – | – | – | – | – | – | 1 | 1 | – | – | | 3 | 9 |
| Hepatitis B – other[a] | 2 | 4 | 1 | 5 | 3 | 7 | – | – | 2 | 7 | 90 | 2 | 96 | 89 | 80 | 19 | 1 | – | | 408 | 534 |
| Hepatitis C – acute viral[a] | 2 | – | – | – | – | 1 | – | – | – | – | – | – | – | – | 1 | – | – | – | | 4 | 6 |
| Hepatitis C – other[a] | 34 | 9 | 2 | 13 | 3 | 49 | 9 | 7 | 28 | 71 | 52 | 14 | 2 | 70 | 105 | 14 | 1 | 1 | | 487 | 789 |
| Hepatitis D – unspecified[a] | – | – | – | – | – | – | – | – | 1 | – | – | – | – | – | – | – | – | – | | 1 | 2 |
| Lymphogranuloma vanereum | – | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | – | – | – | | 1 | 1 |
| Syphilis | – | – | – | – | – | 2 | 1 | 1 | 1 | 4 | 4 | 1 | 43 | 23 | 7 | 3 | 7 | – | | 101 | 176 |
| **Vectorborne** | | | | | | | | | | | | | | | | | | | | | |
| Barmah Forest virus[a] | 1 | – | – | – | – | 5 | 3 | 1 | 13 | 1 | 1 | 2 | – | 1 | – | – | – | – | | 28 | 63 |
| Ross River virus[a] | 5 | – | 1 | 1 | 1 | 4 | 5 | 3 | 6 | 2 | – | – | 1 | – | – | 1 | – | – | | 30 | 84 |
| Arboviral infection (other)[a] | – | – | – | – | – | – | 1 | – | 1 | 1 | 6 | – | 3 | 1 | 3 | 2 | 2 | – | | 20 | 53 |
| Malaria[a] | – | – | – | – | 1 | – | 1 | 1 | – | 1 | 1 | – | – | – | 1 | – | – | – | | 7 | 16 |
| **Zoonoses** | | | | | | | | | | | | | | | | | | | | | |
| Anthrax[a] | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | | – | – |
| Brucellosis[a] | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | | – | – |
| Leptospirosis[a] | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | | – | 1 |
| Lyssavirus[a] | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | | – | – |
| Psittacosis[a] | – | – | – | – | – | – | 2 | – | – | 1 | – | – | – | – | – | 1 | – | – | | 4 | 5 |
| Q fever[a] | – | 2 | 1 | 2 | 1 | 3 | 1 | 3 | 5 | – | – | – | – | – | – | – | – | – | | 18 | 33 |
| **Respiratory and other** | | | | | | | | | | | | | | | | | | | | | |
| Blood lead level[a] | 1 | 1 | 3 | 7 | – | – | – | – | – | – | – | – | 1 | – | 1 | – | – | – | | 14 | 20 |
| Influenza[a] | 14 | 1 | – | – | – | 1 | 2 | – | – | 3 | 4 | – | 1 | 3 | 4 | 3 | 14 | – | | 50 | 160 |
| Invasive pneumococcal infection[a] | 3 | – | – | – | 1 | 4 | – | – | 1 | 1 | 8 | – | 3 | 3 | – | 2 | 3 | – | | 29 | 50 |
| *Legionella longbeachae* infection[a] | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | | – | 4 |
| *Legionella pneumophila* infection[a] | – | – | – | – | 1 | – | – | – | – | – | – | 1 | – | – | – | – | – | – | | 2 | 5 |
| Legionnaires' disease (other)[a] | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | | – | – |
| Leprosy | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | | – | – |
| Meningococcal infection (invasive)[a] | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | – | 1 | – | – | | 2 | 13 |
| Tuberculosis | – | 1 | – | – | – | – | – | – | – | 1 | 4 | – | 1 | 1 | – | – | 7 | – | | 15 | 48 |
| **Vaccine–preventable** | | | | | | | | | | | | | | | | | | | | | |
| Adverse event after immunisation | 1 | – | – | – | – | – | – | – | 1 | 2 | – | 1 | 3 | – | – | 1 | 2 | – | | 11 | 17 |
| *H. influenzae b* infection (invasive)[a] | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | – | 1 | – | – | | 2 | 2 |
| Measles | – | – | – | – | – | – | – | – | – | – | 1 | – | 1 | – | 1 | – | – | – | | 3 | 6 |
| Mumps[a] | – | – | – | – | – | – | – | – | – | – | – | 1 | – | – | – | – | – | – | | 1 | 4 |
| Pertussis | 73 | 22 | – | 26 | 16 | 144 | 19 | 59 | 122 | 123 | 110 | 278 | 158 | 98 | 196 | 139 | 205 | – | | 1786 | 3907 |
| Rubella[a] | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | | – | 2 |
| Tetanus | – | – | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | – | – | | 1 | 1 |
| **Enteric** | | | | | | | | | | | | | | | | | | | | | |
| Botulism | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | | – | – |
| Cholera[a] | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | | – | 2 |
| Cryptosporidiosis[a] | 5 | 4 | – | 8 | 2 | 23 | 7 | 12 | 20 | 12 | 49 | 5 | 36 | 22 | 33 | 20 | 39 | – | | 297 | 358 |
| Giardiasis[a] | 2 | 1 | – | 1 | – | 22 | 8 | 5 | – | 3 | 13 | – | 33 | 17 | 17 | 6 | 23 | – | | 152 | 267 |
| Haemolytic uraemic syndrome | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | – | – | – | – | | 1 | 1 |
| Hepatitis A[a] | – | – | – | – | – | – | – | – | – | – | 2 | – | 2 | – | 3 | – | 3 | – | | 11 | 6 |
| Hepatitis E[a] | – | – | – | – | – | – | – | – | – | – | 1 | – | – | 1 | – | – | – | – | | 2 | 2 |
| Listeriosis[a] | – | – | – | – | – | – | – | – | – | – | – | – | 1 | – | – | – | – | – | | 1 | 3 |
| Salmonellosis[a] | 14 | 14 | – | 5 | 4 | 16 | 12 | 10 | 24 | 14 | 49 | 2 | 61 | 50 | 36 | 13 | 22 | – | | 346 | 662 |
| Shigellosis[a] | 1 | – | – | – | – | 1 | – | – | – | – | 1 | – | 6 | 3 | – | – | 2 | – | | 14 | 34 |
| Typhoid[a] | – | – | – | – | – | – | – | – | – | – | 2 | – | – | 1 | 1 | – | 1 | – | | 5 | 12 |
| Verotoxin producing *E. coli*[a] | – | – | – | – | – | 4 | – | 1 | – | – | – | – | 1 | – | – | – | – | – | | 6 | 9 |
| **Miscellaneous** | | | | | | | | | | | | | | | | | | | | | |
| Creutzfeldt–Jakob disease | – | – | – | – | – | 1 | – | – | – | – | – | – | – | – | – | – | – | – | | 2 | 3 |
| Meningococcal conjunctivitis | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | | – | – |

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NSW HEALTH

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# NSW PUBLIC HEALTH BULLETIN


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