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Health sector leadership in mitigating climate change: experience from the UK and NSW

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Abstract: The threat to human health from climate change means that all levels of government and private and public agencies will need to change their current practices to reduce carbon emissions. The health sector will also need to respond and change practice. The National Health Service in the United Kingdom is developing a systematic and strategic approach to reduce its carbon footprint, as described in the recently released NHS Carbon Reduction Strategy for England. The work is being led by the Service's new Sustainable Development Unit. While the Australian health care system has not yet embraced a shared vision for carbon reduction, there are examples emerging of how the sector is contributing to reduce greenhouse gas production. Examples from two NSW area health services to reduce energy use and promote active transport are presented. In both countries, these changes are supported by new legislation and policy.

There is a strong international scientific consensus about the consequences of the warming of the world's climate system with a recent *Lancet* editorial arguing that 'climate change is the biggest global health threat of the 21st century'.[1–3] A rise of more than 2% in the earth's average surface temperature will have significant health and social costs for Australia.[4] Urgent international action is required; within Australia action is required by all levels of government, across all sectors and by individuals, to avoid the potential consequences. Professor Tony McMichael, a member of the United Nations Intergovernmental Panel on Climate Change, stated 'We are not talking just about regrettable collateral damage. These health risks signify something profound – the potential of climate change to undermine the foundations of our wellbeing, health and survival.'[5]

This article presents arguments for why and how the health sector can respond to the threat posed by climate change. It highlights the work of the newly established Sustainable Development Unit of the United Kingdom's National Health Service (NHS) and the 2009 Carbon Reduction Strategy for England.[6] It is consistent with the 2008 World Health Organization's general recommendations for how the health sector might achieve carbon savings.[7] Local examples from area health services (AHSs) in New South Wales (NSW) of carbon reduction initiatives are highlighted.

NHS Sustainable Development Unit

The Sustainable Development Unit focuses on carbon reduction by the NHS with the intention 'to meet our needs today without compromising the ability to meet our needs and the needs of others – today and tomorrow'.[6] The Unit has been established to: inform and shape policy around promoting sustainable development and reducing carbon

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emissions in the NHS; engage in primary and secondary research to measure changes in carbon use; examine changes in carbon use that will occur up to 2050 and how the NHS can manage those changes; and to develop and promote this agenda.

Why the UK health sector needs to act

There are many reasons why the health sector should act to mitigate climate change. Some of these reasons are:

1. The 2008 *Climate Change Act* for England has set a target of an 80% reduction in carbon emissions on 1990 baseline levels by 2050.[8] To achieve this target, a transformational change is required by the health sector.
2. Within an evidence-based health system, there is an imperative to respond to the immediate threat of climate change in light of the scientific evidence of the need to reduce carbon emissions.[1]
3. Some strategies to reduce carbon emissions create opportunities for immediate health co-benefits, especially in the way we promote how we move (active transport such as walking and cycling) and how we eat (a more balanced diet including less meat/dairy).
4. There are financial savings to be made from reduced energy costs from reducing the use of energy.
5. It is important that the health sector continues to be resilient and robust, responding to changes in the political and social environment.
6. Consultation with health workers has demonstrated their commitment to addressing climate change.[9]
7. There is a special responsibility and opportunity for the health sector to lead by example.

The vision for UK health services in the next 50 years is congruent with a low carbon society. Providing improved management of chronic diseases, delivering convenient care closer to home and the better use of technology are themes associated with both saving resources and improved health care.

Health co-benefits from reducing carbon use in the health sector

There are three levels of health co-benefits from reducing carbon use. First, there are the benefits from initiatives such as active travel, including personal health benefits from being more physically active, and, because fewer cars are being driven, reduced traffic congestion and air pollution. Secondly, there are benefits from a more sustainable health care system, which is congruent with health care policy developments such as care closer to home, chronic disease management and self care. Thirdly, there are benefits for international health equity if developing countries can move from pre-carbon economies to post-carbon systems, avoiding a period of heavy carbon use. Climate change makes these developments that the health sector is already engaged with, even more compelling.

The carbon footprint of the NHS

The NHS is one of the largest employers in the world; it is also a large procurer of goods and services from local, national and international economies. Consequently it is often the biggest single employer in regional areas and forms a significant component of the regional economy.

Reflecting its size, the NHS is responsible for 20 million tonnes of carbon dioxide per annum. It is the largest public sector contributor to climate change in England, producing 25% of public sector emissions which is equivalent to the emissions of an entire medium-sized country.[10] The NHS carbon footprint is composed of energy (heating, lighting, hot water and ventilation; 22%), travel (staff, patients and visitors; 18%) and procurement (the supply chain of activities producing goods and services used by the health system; 60%).[10] Despite an increase in efficiency, the NHS has increased its carbon footprint by 40% since 1990.[10] This means that meeting the *Climate Change Act* targets of a 26% reduction by 2020 and an 80% reduction by 2050 will be a challenge. The 2009 Carbon Reduction Strategy establishes that the NHS should have a target of reducing its 2007 carbon footprint by 10% by 2015. This will require the current level of growth of emissions to not only be curbed, but also for the trend to be reversed and absolute emissions reduced. Interim NHS targets will need to meet the government targets.

This will require transformational change management beyond that required to master the technical aspects of using less carbon; organisational structures, responsibilities and accountabilities within the NHS are being reconsidered to ensure that change happens. Consequently, while the move to a more sustainable health system will need to be driven at all levels, the commitment from the top levels of management is essential.

The challenge to reduce the NHS carbon footprint

Steps the NHS has already taken to reduce carbon include measuring, monitoring and displaying what energy is currently being used in health facilities.[11] This helps to increase carbon literacy and carbon numeracy of health care workers and patients, and reduce carbon use. Another strategy is to promote low-carbon transport like car sharing by offering reduced parking costs for car-sharing arrangements. As in all change programs, there has to be an immediate benefit to those doing the changing. Prominent programs like car sharing or parking spaces for bicycles also send a visible and important message to the public that the health system takes carbon reduction seriously.

Influencing the commissioning and procuring of goods and services is essential to carbon reduction because of the emissions associated with procurement. NHS contracts now include statements such as 'criteria relating to sustainability and low carbon operations will increasingly be used in the commissioning of services and the procurement of goods'. The buying power and potential leverage of the health sector is significant and can have considerable knock-on effects throughout the community through the goods and services it buys or commissions. This is important because of the multiplier effect through the supply chain.

The carbon footprint in the NSW health sector

In NSW, health facilities account for 53% of the total NSW Government building energy usage.[12] For example, in the Sydney West Area Health Service in 2007–2008, 106 gigawatt hours of electricity and 348 terajoules of gas were used, equivalent to the use of a city the size of Lithgow.[13] It also used 665 megalitres of water, about the amount of 1.5 Olympic-sized swimming pools per day. This water and power cost $11.3 million per year to purchase and caused 125 000 tonnes of carbon dioxide to be emitted into the atmosphere, equivalent to the emissions of about 25 000 cars.[13] The cost of these utilities is also expected to rise from between 12 and 35%, adding further pressure to reduce energy use and the associated costs.

The NSW Government Sustainability Policy proposes: reducing greenhouse gas emissions from buildings to 2000 levels by 2020; a 15% reduction in water usage; that all products and appliances purchased to be 4.5-energy-star rated; and a renewable energy target of 20% by 2020.[12] However, many in the health sector workforce are unaware of these targets. A shift in thinking that prioritises a smaller carbon footprint will be required across the whole Australian population and, equally, will need to be applied within the health sector workplace.

NSW initiatives

Sydney West Area Health Service – Energy

Blacktown, Mount Druitt and Nepean Hospitals are now generating 40–50% of their electricity onsite using cogeneration fired by natural gas. This has resulted in an average 15% reduction in electricity consumption across the Sydney West Area Health Service (SWAHS). Twenty thousand energy efficient light fittings have been installed across SWAHS facilities.[14] An independent audit has demonstrated that the area has reduced its carbon emissions by over 8000 tonnes in 2007–2008, and energy efficient upgrades at Westmead Hospital (the largest teaching hospital within the area) have compensated for the additional electricity consumption associated with the opening of two new buildings. In 2005, SWAHS was the first AHS in NSW to become a carbon trader, earning 22 286 NSW Greenhouse Abatement Certificates to date, equivalent to a reduction of 22 286 tonnes of carbon emissions.[14]

While these energy saving projects require investment to implement, they are usually responsible for recurrent savings. For example, at Westmead Hospital a lighting upgrade that cost approximately $2 million is estimated to save about $300 000 each year with a net financial benefit anticipated after 7 years. Similarly, a water recycling project that cost about $2.5 million is expected to save about $215 000 each year. Generally speaking, energy consumption can be reduced by up to 25%, with a relatively easy 10% reduction achieved through lighting upgrades.

SWAHS have completed a series of large-scale energy efficiency upgrades over the past 5 years and are now planning a series of further projects. Using Energy Performance Contracting a detailed audit of a facility is first undertaken to identify the opportunities for energy and water savings.[15] A business case is then prepared, which leads to a project proposal based on guaranteed savings.

The projects completed by SWAHS represent an investment of $13 million in new energy and water efficient infrastructure with savings estimated to be over $1.8 million every year. The scope of projects covered includes all the major AHS facilities, consisting of nine hospitals and 11 Community Health Centres.

Sydney South West Area Health Service – Transport

Health services generate an enormous number of trips to and from facilities every day. As previously described, how people travel can directly influence both their carbon use and their health. A strategy to reduce car use trialled by the Sydney South West Area Health Service has been the development of transport access guides for major trip generators such as hospitals.[16] These guides illustrate how to travel to and from the hospitals using active travel by showing: where the cycle paths are; recommended walking routes from rail stations; locations of bus stops; and an indication of the frequency of buses. By not showing car parking stations and making active travel easier, this strategy is intended to influence the decision of how to travel to these destinations.

Another strategy has been to work with local cycling groups to develop cycling specific maps to highlight cyclist preferred routes to and from health facilities.[17] Other activities to encourage greater levels of cycling have included: working with local councils on developing Bicycle Plans; the development of a cycling proficiency course to increase the skills and confidence of people wanting to cycle more; and the development of a staff bicycle pool.[18–20]

Health professionals as agents for change

As respected members of the community, health professionals can have a large influence on opinion. Their numbers and geographic dispersion throughout the population, as well as their clinical and social networks, ensure contact with almost everyone in a local population.[21,22] Health professionals have an important role in supporting an environment for change within the health sector and evidence from the NHS suggests that this a role they would welcome.[6]

Conclusion

The threat to human health from climate change means that all levels of government and private and public agencies will need to change their current practices to reduce carbon emissions. All Australians will need to play a part in creating a healthy future and will need to fundamentally change the way they think and live. While the Australian health care system has not yet embraced the challenge of reducing its carbon footprint from a whole systems perspective as the NHS has done, there are many local examples of leadership in NSW.

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Newborn feeding practices at the time of discharge from hospital in NSW in 2007: a descriptive study

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Abstract: Objectives: To describe the pattern of infant feeding at discharge from care after birth and the characteristics of mothers who are at risk of low rates of breastfeeding. **Methods:** Data were obtained from the NSW Midwives Data Collection for 2007. Information on infant feeding was obtained for babies who were alive at discharge from care after birth. Of 96 030 births reported, 93 505 (97.4%) were eligible for analysis. A descriptive analysis of factors associated with variations in breastfeeding was carried out. **Results:** In 2007, 80% of babies were fully breastfed, 7% were partially breastfed, and 13% were not breastfed. Babies born to mothers with the following characteristics had relatively low rates of full breastfeeding: teenage mothers (69%); Aboriginal mothers (64%); mothers born in South-East Asia (71%), North-East Asia (72%) and Melanesia, Micronesia and Polynesia (74%); mothers who commenced antenatal care later than 20 weeks gestation (74%); mothers who smoked (67%); mothers who received general anaesthetic during delivery (67%); mothers who gave birth by caesarean section (76%); mothers living in the most socially disadvantaged areas (73%); mothers living in remote and very remote areas (73% and 76% respectively); and mothers of preterm infants (70%). **Conclusion:** There is a need to improve overall rates of breastfeeding initiation in NSW. Particular attention and support needs to be given to the groups of mothers identified in this study as having relatively low rates of full breastfeeding.

The benefits of breastfeeding for mothers and newborns are well documented. Benefits for the mother include reduction in postpartum bleeding, a contraceptive effect leading to increased spacing between pregnancies, and reduced risk of pre-menopausal breast cancer. For the infant, breastfeeding helps protect against diarrhoea, respiratory tract infections, otitis media and other infections. There is some evidence that breastfeeding is associated with reduced rates of allergies, obesity, diabetes, hypertension, cancer and Crohn's disease, and with improved intellectual and motor development.[1]

The National Health and Medical Research Council (NHMRC) recommends that infants are exclusively breastfed for the first 6 months of life and has established a target of at least 90% for initiation of breastfeeding in Australia.[2] The NSW Health policy on breastfeeding[3] identifies several strategies that are intended to improve initiation of breastfeeding. These include: implementation of the Baby Friendly Hospital Initiative across area health services; incorporating breastfeeding education and referral into routine antenatal care and other hospital and health services; and identifying and providing specific breastfeeding education and support interventions to women who are at risk of low rates of breastfeeding.

From 2007, the type of infant feeding on discharge from hospital has been reported for all infants born in New South Wales (NSW). The objectives of this study are to describe the pattern of breastfeeding practices at the time of discharge from care after birth and to describe the characteristics of mothers at risk of low rates of breastfeeding.

Methods

Data were obtained from the NSW Midwives Data Collection (MDC) for 2007. The MDC is a population-based surveillance system covering all births in NSW public and private hospitals, as well as home births. It encompasses all live births and stillbirths of at least 20 weeks gestation or at least 400 g birth weight. Births in NSW are reported to the NSW Department of Health under the NSW *Public Health Act 1991*.

From 2007, the MDC has collected information on infant feeding at the time of discharge from hospital

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(or discharge from care for home births) for all infants born in NSW. Infant feeding is reported via three tick-box categories: breastfeeding, expressed breastmilk and infant formula. More than one type of feeding may be reported by ticking multiple boxes. Infant feeding was classified into three categories: full breastfeeding, which included babies who were reported to be breastfed or to be receiving expressed breastmilk; any breastfeeding, which included babies who were reported to be receiving breastmilk and infant formula; and no breastfeeding.

Information on breastfeeding was obtained from the MDC for babies who were born in 2007 and who were alive at the time of discharge from care – records of stillborn babies, babies who died in the hospital of birth, and babies for whom information on breastfeeding was not stated were excluded. Of the 96 030 births reported to the MDC in 2007, 93 505 (97.4%) were eligible for analysis. Of the 2525 excluded birth records, 1465 did not contain information about breastfeeding.

In this article, the term Aboriginal is used to encompass both Aboriginal and Torres Strait Islander mothers. Country of birth groups were created from categories defined in the Standard Australian Classification of Countries.[4] The enhanced Accessibility/Remoteness Index of Australia (ARIA+)[5] was used to measure remoteness. The ARIA+ value is based on road distance to a 'service centre'. Births were classified into five categories of remoteness, determined by the ARIA+ score of their Statistical Local Area (SLA) of residence in NSW, ranging from major cities to very remote areas. Socioeconomic groups were constructed using the Index of Relative Socioeconomic Disadvantage (IRSD), which is one of the Socioeconomic Indices (SEIFA) produced by the Australian Bureau of Statistics (ABS).[6] IRSD scores based on the 2006 Census were assigned to SLAs in NSW. The NSW population was divided into five groups based on the IRSD scores of their SLA of residence. Births were allocated to one of five groups from the lowest quintile (most disadvantaged) to the highest quintile (least disadvantaged). Descriptive analyses were carried out using SAS version 9.1.3.[7] Analgesia administered during labour and/or delivery was classified into five mutually exclusive groups. These groups were: non-pharmacological only (including no pain relief); gas (nitrous oxide) with no other pharmacological analgesia; narcotics (usually pethidine), with or without gas; epidural (including epidural, caudal, spinal and combined methods), with or without narcotics or gas; and general anaesthetic, with or without epidural, narcotics or gas.

Results

On discharge from hospital in 2007, 80% of babies were fully breastfed, 6.5% were partially breastfed and 13.2% were not breastfed.

Table 1 shows that rates of full breastfeeding were lower among babies born to the following population groups:

- mothers aged less than 20 years – the lowest rates of full breastfeeding were among teenage mothers (69%), who also had the highest rate of no breastfeeding (28%). Rates of full breastfeeding rose with increasing maternal age to a high of 82% among mothers aged 30–34 years and then declined slightly to 79% among mothers aged 40 years and over.
- Aboriginal mothers compared to non-Aboriginal mothers – 64% of Aboriginal mothers fed their babies fully with breastmilk compared to 81% of non-Aboriginal mothers. The proportion of babies born to Aboriginal mothers who were not breastfed was more than twice that of babies born to non-Aboriginal mothers (31% versus 13%).
- mothers born in South-East Asia, North-East Asia and Melanesia, Micronesia and Polynesia – less than 75% of babies of mothers born in South-East Asia, North-East Asia and Melanesia, Micronesia and Polynesia were fully breastfed compared to 81% of mothers born in English-speaking countries and 88% of babies of mothers born in Eastern Europe, Russia and Central Asian and Baltic States.
- mothers who commenced antenatal care later (greater than 20 weeks gestation) rather than earlier – 74% of babies born to mothers who commenced antenatal care after 20 weeks gestation were fully breastfed, compared with 81% of mothers who commenced antenatal care at less than 20 weeks gestation.
- mothers who smoked during pregnancy – 82% of mothers who did not smoke during pregnancy fully breastfed their babies, compared with 67% of mothers who did smoke.
- mothers who received general anaesthetic during delivery – 67% of babies born to mothers who received a general anaesthetic during delivery were fully breastfed, lower than the 81% of babies born to mothers who received other forms of analgesia during labour or delivery, and 84% of babies born to mothers who received non-pharmacological pain relief.
- mothers who gave birth by vaginal breech delivery or by caesarean section – the lowest rates of full breastfeeding were among mothers who gave birth by vaginal breech delivery (71%) and by caesarean section (76%).
- mothers living in remote and very remote areas – of mothers living in remote and very remote areas, 74% fully breastfed their babies, compared to over 80% of mothers in more accessible areas.
- mothers living in relatively socially disadvantaged areas – there was a trend of increasing rates of full breastfeeding with increasing socioeconomic status.

Table 1. Maternal and infant factors associated with infant feeding practices at discharge from care after birth, NSW, 2007

	Full breastfeeding		Any breastfeeding		No breastfeeding		Total	
	n	%	*n*	%	*n*	%	*n*	%
Maternal age (years)								
12–19	2227	68.5	118	3.6	905	27.8	3250	100
20–24	9865	76.6	669	5.2	2350	18.2	12 884	100
25–29	20 122	80.5	1569	6.3	3296	13.2	24 987	100
30–34	25 402	82.2	2055	6.7	3428	11.1	30 885	100
35–39	14 697	81.8	1369	7.6	1899	10.6	17 965	100
40+	2765	78.6	331	9.4	422	12	3518	100
Not stated	14	87.5	2	12.5	0	0	16	100
TOTAL	75 092	80.3	6113	6.5	12 300	13.2	93 505	100
Maternal Aboriginality								
Aboriginal or TSI	1778	64.4	128	4.6	857	31	2763	100
Non-Aboriginal	73 175	80.8	5968	6.6	11 419	12.6	90 562	100
Not stated	139	77.2	17	9.4	24	13.3	180	100
TOTAL	75 092	80.3	6113	6.5	12 300	13.2	93 505	100
Maternal country of birth								
English speaking	58 603	81.1	3213	4.4	10 454	14.5	72 270	100
Central & South America	669	83.8	79	9.9	50	6.3	798	100
Melanesia, Micronesia & Polynesia	1106	73.6	179	11.9	217	14.4	1502	100
Southern Europe	653	77.6	78	9.3	110	13.1	841	100
Western & Northern Europe	677	88	43	5.6	49	6.4	769	100
Eastern Europe, Russia, Central Asian & Baltic States	611	88.3	46	6.6	35	5.1	692	100
Middle East & Africa	3489	81.5	430	10.0	363	8.5	4282	100
South-East Asia	3578	70.5	917	18.1	577	11.4	5072	100
North-East Asia	2856	72.4	768	19.5	323	8.2	3947	100
Southern Asia	2696	85.8	347	11	101	3.2	3144	100
Other – not stated	154	81.9	13	6.9	21	11.2	188	100
TOTAL	75 092	80.3	6113	6.5	12 300	13.2	93 505	100
Duration of pregnancy at first antenatal visit (weeks)								
0–19	68 940	81.1	5419	6.4	10 605	12.5	84 964	100
20+	4911	73.5	522	7.8	1248	18.7	6681	100
Not stated	1241	66.7	172	9.2	447	24	1860	100
TOTAL	75 092	80.3	6113	6.5	12 300	13.2	93 505	100
Smoking in pregnancy								
No	67 026	82.3	5527	6.8	8853	10.9	81 406	100
Yes	7805	66.7	559	4.8	3344	28.6	11 708	100
Not stated	261	66.8	27	6.9	103	26.3	391	100
TOTAL	75 092	80.3	6113	6.5	12 300	13.2	93 505	100
Analgesia								
Non-pharmacological	14 609	83.8	796	4.6	2019	11.6	17 424	100
Gas	17 104	83	1037	5	2462	11.9	20 603	100
Narcotic	8264	78.8	608	5.8	1611	15.4	10 483	100
Epidural	32 697	78.9	3296	8	5422	13.1	41 415	100
General anaesthetic	2398	67.4	376	10.6	785	22.1	3559	100
Not stated	20	95.2	0	0	1	4.8	21	100
TOTAL	75 092	80.3	6113	6.5	12 300	13.2	93 505	100
Type of birth								
Normal vaginal	45 696	82.3	2794	5	7022	12.6	55 512	100
Forceps	2641	81.3	296	9.1	312	9.6	3249	100
Vacuum extraction	5541	82.1	523	7.8	682	10.1	6746	100
Vaginal breech	225	71	39	12.3	53	16.7	317	100
Caesarean section	20 923	75.8	2460	8.9	4228	15.3	27 611	100
Not stated	66	94.3	1	1.4	3	4.3	70	100
TOTAL	75 092	80.3	6113	6.5	12 300	13.2	93 505	100
Plurality								
Singleton	73 591	80.9	5619	6.2	11 703	12.9	90 913	100
Twin	1468	57.8	482	19	591	23.3	2541	100
Triplet	33	64.7	12	23.5	6	11.8	51	100
TOTAL	75 092	80.3	6113	6.5	12 300	13.2	93 505	100
Gestational age (weeks)								
<28	103	64.8	15	9.4	41	25.8	159	100
28–31	314	68.6	61	13.3	83	18.1	458	100
32–36	3652	70.1	569	10.9	987	19	5208	100
37–41	70 249	81	5420	6.2	11 095	12.8	86 764	100
42+	758	85	44	4.9	90	10.1	892	100
Not stated	16	66.7	4	16.7	4	16.7	24	100
TOTAL	75 092	80.3	6113	6.5	12 300	13.2	93 505	100
ARIA* category								
Major Cities	48 716	79.4	4985	8.1	7670	12.5	61 371	100
Inner Regional	18 345	82.1	777	3.5	3220	14.4	22 342	100
Outer Regional	6051	81.8	241	3.3	1102	14.9	7394	100
Remote	480	73.3	32	4.9	143	21.8	655	100
Very Remote	153	75.7	5	2.5	44	21.8	202	100
TOTAL	73 745	80.2	6040	6.6	12 179	13.2	91 964	100
Index of Relative Socioeconomic Disadvantage								
1st quintile (most disadvantaged)	14 973	72.7	1921	9.3	3699	18	20 593	100
2nd quintile	13 867	80.2	734	4.2	2693	15.6	17 294	100
3rd quintile	13 702	80.7	919	5.4	2360	13.9	16 981	100
4th quintile	14 909	80.7	1362	7.4	2194	11.9	18 465	100
5th quintile (least disadvantaged)	16 294	87.5	1104	5.9	1233	6.6	18 631	100
TOTAL	73745	80.2	6040	6.6	12179	13.2	91964	100

*Accessibility/Remoteness Index of Australia.
Source: NSW Midwives Data Collection (HOIST. Centre for Epidemiology and Research, NSW Department of Health).
Note: For the ARIA+ and SEIFA breakdowns, the total of 91 964 excludes records with interstate or missing SLAs, and records with SLAs coding 'Off-shore Areas & Migratory' which cannot be converted to an ARIA1 or SEIFA code.

Rates of full breastfeeding were also lower in babies born of multiple pregnancies (twins and triplets) compared to singleton babies, and babies born prematurely compared to babies born at term.

Discussion

Information on breastfeeding at discharge from care after birth was available for the first time on a population basis in NSW in 2007. While some babies may be fully breastfed immediately after birth, and not fully breastfed by the time they are discharged from care, it is likely that the NHMRC target of at least 90% for initiation of breastfeeding is currently not being met in NSW.

The study identified groups of mothers who have relatively low rates of full feeding with breastmilk: teenage mothers; Aboriginal mothers; mothers who smoke; mothers born in South-east Asia, North-east Asia and Melanesia, Micronesia and Polynesia; mothers who gave birth by vaginal breech delivery or by caesarean section; mothers who received a general anaesthetic during delivery; mothers living in rural and remote areas; mothers living in socially disadvantaged areas; mothers of twins and triplets; and mothers of preterm infants. However, there is little population-based information in Australia to allow comparison.

This pattern was also found in a sample of children born between 2003 and 2004 and followed up as part of the Longitudinal Study of Australian Children (LSAC).[8] The LSAC measured breastfeeding initiation rather than breastfeeding at hospital discharge and therefore found higher rates of breastfeeding initiation than our study: initiation was lower for infants of 35–36 weeks' gestation (88.2%) than 37–39 weeks' gestation (92.0%) and ⩾40 weeks' gestation (93.9%). Twins and triplets, and babies born by vaginal breech delivery, are more likely to be premature – the relatively lower rate of full breastfeeding among premature infants is likely to explain at least some of the lower rate of breastfeeding in these groups of infants.

We found that rates of full breastfeeding were lower among mothers who received general anaesthesia during delivery compared to other forms of analgesia or no analgesia. A similar pattern was found by Torvaldsen et al in a cohort study of mothers from the Australian Capital Territory who gave birth in 1997, although they found 93% of mothers either fully or partially breastfed their babies in the first week postpartum, a substantially higher percentage than in this study.[9]

In an examination of data from the Australian National Health Surveys carried out by the ABS in 1995, 2001 and 2004–05, Amir et al found that social disadvantage was consistently associated with lower rates of initiation of breastfeeding.[10] They also found an increasing difference between the highest and lowest socioeconomic groups over time, with infants in higher socioeconomic groups more likely to be breastfed in 2004–05 than previously. While we do not have data from past years for comparison, we found a substantial difference (15%) in rates of full breastfeeding between the lowest and highest socio-economic groups.

A limitation of this study is that the validity of reporting infant feeding practices on the MDC is not known, although previous validation studies of the MDC have found the validity of information collected on events occurring during birth and the immediate postpartum period are generally well reported.[11,12] This study was restricted to an examination of maternal and infant factors for which information was available on the MDC. Elsewhere, other factors have been found to be associated with initiation of breastfeeding. In the LSAC, lower rates of initiation of breastfeeding were found among overweight and obese mothers compared to mothers of normal weight.[13] In a cohort study of mothers giving birth in four hospitals in Western Australia and Queensland, breastfeeding at hospital discharge was found to be most strongly associated with perceived paternal support of breastfeeding, followed by the infant feeding decision being made before pregnancy and the baby having a normal (as opposed to low) birth weight.[14] Information on socioeconomic status was limited to ecological measures of SEIFA and ARIA in our study, and information on health service activities promoted as part of the joint WHO–UNICEF Baby Friendly Hospital Initiative, such as rooming-in practice and encouraging breastfeeding on demand, are not collected as part of the MDC. Furthermore, intention to breastfeed is not reported on the MDC and it may be that some mothers have already made a decision not to breastfeed prior to the birth. This study is descriptive and further work is needed to explore how factors associated with breastfeeding interact and which factors are more strongly associated with breastfeeding once the other factors are taken into account.

Despite these limitations, this study provides information on factors that can be used in the clinical setting to help identify mothers who are at risk of not breastfeeding.

Conclusion

There is a need to improve rates of initiation of breastfeeding in NSW. While initiation rates need to be improved in general, particular attention should be given to the population groups identified by this study.

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Evaluation of three population health capacity building projects delivered by videoconferencing in NSW

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Abstract: Three population health projects in falls prevention, smoking cessation and refugee health secured funding through the NSW Telehealth Initiative. All were capacity building projects delivered through live videoconferencing sessions between April and August 2007. Videoconferencing as a mode of delivery was evaluated from the perspective of those who delivered the projects. **Method:** Qualitative semi-structured interviews with 12 key informants explored for each project: the organisation and delivery of the education sessions; the utility of videoconferencing for delivering training programs; and the perceived potential to apply videoconferencing to other functions. **Results:** The projects were all delivered successfully through live videoconferencing. The main benefits observed were: the ability to deliver training to large numbers of people across multiple locations within a relatively short time and for reasonable costs; and the ability to improve access to high quality professional development for rural and remote workers. Technical difficulties were minor. The support required for these kinds of e-learning projects to succeed were identified. **Conclusion:** The evaluation confirmed the value of videoconferencing as a vehicle through which equity of access to learning opportunities for population health workers across NSW can be achieved.

In 2005, the NSW Telehealth Initiative called for submissions for innovation projects through the Telehealth Innovation Fund, and for the first time sought applications for population health interventions. Three population health projects were subsequently successful in securing funding. These projects sought to build the capacity of the health workforce to provide population health interventions and were delivered through live videoconferencing sessions between April and August 2007. Videoconferencing is a technology that involves the transmission of images, voice and data between two or more sites using telecommunication channels; through the extensive Telehealth network hundreds of videoconference sites have been established across the eight area health services (AHSs) in New South Wales (NSW) for the delivery of clinical services and administrative and professional development activities.[1,2] A condition of funding was that videoconferencing as a mode of delivery was evaluated from the perspective of those who delivered the projects. This article describes the findings of the evaluation.

The three projects

Preventing falls and harm from falls in older people

Fall injury is a major cause of preventable injury-related hospitalisation and loss of independence among people aged 65 years and over in NSW. The NSW Clinical Excellence Commission implemented the Falls Prevention Telehealth Project to assist hospitals in rural AHSs to implement the National Guidelines (*Preventing falls and harm from falls in older people. Best practice guidelines for Australian hospitals and residential aged care facilities*) developed by the Australian Council for Safety and Quality in Health Care. The project was an education program that sought to prepare health professionals to implement best practice to prevent falls in NSW hospitals and aged-care facilities. Three videoconference sessions each of 2 hours duration were conducted across eight Telehealth sites – two from each of the four rural AHSs. Between 12 and 20 people attended at each site, with approximately 105 participants per session. The sessions were interactive and were recorded; a copy of the DVD/CD was distributed to the participants.

NSW smoking cessation training program

The Centre for Chronic Disease Prevention and Health Advancement within the NSW Department of Health piloted the delivery of an accredited, competency-based

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training program in the treatment of nicotine dependence using live videoconferencing as the delivery method. The training addressed two units of competency in tobacco use and evidence-based treatment of nicotine dependence within the national Vocational Education and Training accredited Population Health Training Package. Accredited trainers delivered 10 modules, each of 2 hours duration, to 27 sites and a total of 309 participants.[3]

Refugee Health Training and Support Initiative to enhance service delivery to rural and remote refugee populations

The NSW Refugee Health Service, located at the Sydney South West Area Health Service, used videoconferencing to deliver a series of lectures/information sessions on refugee health issues to clinicians and population health staff. Six lectures of 1 hour duration were provided on the topics of infectious disease, child health, mental health, the physical impact of torture, oral health and nutrition, and refugee women's health. Eleven sites participated with between 30 and 70 participants for each session. In addition, a small number of networking sessions for refugee health nurses working in rural and remote areas were conducted.

To determine the utility of using live videoconferencing to deliver population health training and other potential applications, an external evaluation was commissioned by the Population Health Division, NSW Department of Health; this was undertaken in July and August 2007.

Methods

A process evaluation examined the following three areas across each project: their organisation and delivery (including what worked well, what difficulties were experienced and the workload involved); the utility of videoconferencing for the delivery of the sessions; and the potential for future application of the technology.

The evaluation sought information about using the medium of videoconferencing to provide learning sessions for professional development in the population health area. It did not assess the impact or quality of the individual projects; separate evaluations were undertaken by each project to explore this. A consultant was contracted to carry out the evaluation. Oversight of the project was provided by an Advisory Group who initially helped to refine the evaluation questions. To allow the consultant to become familiar with the three projects and the processes associated with delivering learning sessions through videoconferencing, relevant background documentation was reviewed, preliminary discussions were held with each project manager, and one session of the refugee health project was observed.

Qualitative semi-structured interviews were conducted with key informants. Key informants were determined as being workers who were directly involved in and/or responsible for the planning and delivery of the projects. Interviews were conducted with 12 people and included:

- the project coordinators and other staff from each project
- people who acted as site facilitators at the remote sites
- presenters of the sessions
- NSW Health Telehealth Initiative staff.

The views of participants in the sessions were not sought. The majority of interviews were conducted face-to-face, however those held with rural informants were undertaken by telephone. The interviews were guided by a written protocol that was provided to the informant prior to their interview. To minimise the potential for recall bias the evaluation was undertaken at the same time the projects were being delivered, and the report completed in September 2007.

The information gathered through the interviews was analysed and a summary of preliminary findings prepared. The Advisory Group reviewed the preliminary findings and reviewed a draft of the report before it was finalised.

Results

Organisation and delivery

The projects were complex. Each involved the live delivery of learning sessions to between eight and 11 remote sites located in rural locations across NSW, with each session drawing up to 105 participants (Table 1). Despite this complexity the projects were all delivered successfully through live videoconferencing.

Table 1. Description of sites and number of participants for three population health capacity building projects delivered by videoconferencing in NSW in 2007

Project	Sites (*n*)	Location of sites Metro/rural	Participants (*n*)
NSW Smoking Cessation Training Program	27	Metro/rural	309
Falls Prevention Telehealth Project	8	Rural	99
Refugee Health Training and Support Initiative	11	Rural	150

Successful organisation and delivery of a session required a designated project coordinator with project management skills at the central delivery location and local facilitators at each remote site. Both these roles were found to be necessary. Box 1 summarises the core tasks undertaken by each. In all cases, the workload required, especially in the planning and organisation stages, was underestimated.

The effectiveness of videoconferencing is reliant on the technology; overall, the majority of technical problems experienced were considered to be minor. However, when technical disruptions did occur it was both frustrating and stressful to those organising a session. There were varying levels of technical support available both at the host and remote sites and where there was little infrastructure support, the sessions were vulnerable to disruption.

The timely availability of supporting resources, such as course materials and PowerPoint presentations, was an important aspect of providing training through videoconferencing, and the information technology systems in some rural locations could not manage the transfer of these large electronic files. Further, some participants did not have computer access to allow them to receive materials electronically.

Utility of videoconferencing

All informants were satisfied that videoconferencing had met the needs of their projects and all considered it an appropriate technology through which to deliver population health learning initiatives.

The two main benefits highlighted were: the ability to deliver training to large numbers of people across multiple locations within a relatively short time and for reasonable costs; and the ability to improve access to high quality professional development for rural and remote workers. It was considered unlikely that initiatives of similar scope and reach could be delivered in a face-to-face mode due to the associated costs.

The informants identified many other benefits of videoconferencing. Both the smoking cessation and falls prevention projects were modules consisting of a number of short sessions designed for staged learning over time. These modules allowed for the assimilation and application of learning between sessions and for participants to discuss their experience in subsequent sessions with their peers.

The centralised delivery of learning sessions was associated with a number of perceived benefits. It allowed learning to be delivered in a consistent manner for all participants. The informants commented that other ways of rolling out training, such as train-the-trainer modes, can be less consistent in their delivery. It also allowed the participants direct access to experts and the opportunity to interact with them.

The development of learning communities was facilitated in a number of ways. Firstly, as it took less time to attend these sessions it encouraged clinicians to participate, allowing for multidisciplinary learning. Secondly, it

Box 1. Roles and responsibilities fulfilled by project coordinators and site facilitators for three separate capacity building projects in population health delivered through videoconferencing in NSW in 2007

Project coordinator

- Planning and organising sessions dates/times and site bookings
- Preparation of agendas
- Recruitment, briefing and supporting site facilitators
- Recruitment and briefing of presenters
- Preparation and distribution of promotion and advertising material
- Preparation and distribution of written materials and resources to support the learning
- Gaining the support of local managers to achieve the release of staff to attend sessions
- Management of host site technology
- Chairing the sessions and ensuring appropriate follow-up.

Site facilitators

- Coordination of all aspects of local administration and support for the project
- Recruitment and selection of local participants, including registration
- Local promotion
- Distribution of materials and resources to participants
- Completion and return of any documentation required by the project
- Manage the local site equipment during the sessions, including troubleshooting local difficulties
- Facilitate question time.

expanded the networks of the participants and led to collaboration. These connections occurred between: participants attending at a site, participants at different sites, and participants and the central or statewide service that delivered the training. Some groups continued to meet after the sessions were completed.

Future applications

Videoconferencing was seen as a valuable tool for building workforce capacity in population health and many ideas were offered about its future use. These included: providing access services (i.e. interpreter services) in remote areas; forming part of communication strategies for guidelines; and enabling collaboration between isolated practitioners, such as rural refugee health nurses.

Informants expressed caution about the infrastructure required to ensure the reliability of videoconference delivery. In addition, many projects use non-Telehealth sites and a better understanding of the potential interaction and connectivity across the various systems is required. Many Telehealth sites were installed for clinical use and cannot be readily adapted for other functions. Clinical services also remain the first priority for the use of these facilities. Informants noted that increasing demand for these resources from an expanding range of functions will require management.

Discussion

These three Telehealth-funded projects successfully applied videoconferencing to support professional learning in population health in NSW. They were well received and together reached over 500 people in metropolitan and rural locations. Together they confirmed how increased access to training and professional development opportunities for a substantial number of rural and remote workers can be achieved with few resources. They demonstrated the potential of videoconferencing to deliver e-learning initiatives and how this technology can be used to build and sustain learning communities that provide support to remote practitioners.

The projects demonstrated the range of complexity in the delivery of learning that is possible; from information sessions to competency-based modules that included the assessment of participants.[3] The participation of experts in the sessions generated interest in these projects; previous evaluations of the delivery of Bug Breakfast in NSW has shown that remote participants especially value the opportunity to interact with experts.[4,5] Videoconferencing should however be viewed as only one vehicle for providing capacity building and the mode of delivery chosen to deliver a learning session should fit both the purpose of a session and the resources available.[6]

The geographical distance spanned by these projects was large. For example, the largest rural AHS, the Greater Western, covers 55% of the landmass of NSW.[7] While the majority of the NSW population live in urban settings, 20% live in inner regional areas and 7% in outer regional and remote areas.[8] The delivery of population health capacity building activities to health staff across this large geographical area was made possible by using videoconferencing as the delivery method.

Videoconferencing a learning session is different to the delivery of face-to-face sessions and requires preparation and support.[9,10] Combining videoconferencing with other, related learning supports ensured a good quality episode of training and the evaluation confirmed some of the other elements that need to be in place for this to occur. These are: central project coordination and local site facilitators; reliable information technology systems in rural and remote areas, including ready access to computers and printers; a supportive environment encouraged by senior staff; and an appropriate level of infrastructure support at the state and local level.

A strategic review of Telehealth in NSW Health undertaken in 2008 suggested that Telehealth could provide a vehicle for developing an e-learning environment for the NSW Health system. Indeed, a recent survey conducted by the NSW Department of Health in 2009 identified 148 e-learning programs currently delivered through Telehealth.

The NSW Health Telehealth Network is a large network and consequently offers a means of providing equity of access to information and learning and development activities. In addition, Telehealth is not the only telecommunications network in NSW. A mapping exercise describing all the major networks that can be accessed by NSW Health staff for videoconferencing, and the potential connectivity between these systems, could expand the resources available for e-learning activities.

The evaluation has demonstrated that the invitation for submissions through the Telehealth Innovation Fund 2005–2006 provided an important stimulus for population health services to consider how they might incorporate Telehealth in their practice. Until 2005, there had been few funding submissions from the public health field. The inclusion of population health interventions in the 2005–2006 invitation has generated enthusiasm for applying the technologies available through Telehealth by the public health workforce in NSW.

Conclusion

The evaluation confirmed the value of videoconferencing as one vehicle through which equity of access to learning opportunities for population health workers across NSW can be achieved. It also demonstrated how it can be used to build and sustain learning communities to support remote practitioners.

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Estimate of the number of *Campylobacter* infections in the Hunter region, NSW, 2004–2007

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Abstract: Objectives: Campylobacteriosis is not notifiable in NSW and the number of cases of *Campylobacter* disease is thus not well described. **Methods:** De-identified campylobacteriosis records for 2004–2007 were requested from laboratories in the Hunter region of NSW. Based on notifying laboratory, a *Salmonella* notification weighting was applied to laboratory-confirmed campylobacteriosis cases to provide an overall estimate of *Campylobacter* disease in the area. **Results:** The estimated median of the annual number of laboratory-confirmed campylobacteriosis cases was 788 (range 700–1022). The ratio of estimated *Campylobacter* cases to *Salmonella* notifications was 5.5 : 1. **Conclusion:** *Campylobacter* infection causes considerable disease in the Hunter, and likely in NSW. Regular review of *Campylobacter* laboratory results may be valuable.

Campylobacteriosis is a bacterial infection that predominantly causes gastrointestinal illness within 2–5 days (range 1–10 days) of exposure to *Campylobacter*. Symptoms, which include diarrhoea (frequently with bloody stools), abdominal pain, fever, nausea and vomiting, generally persist for up to 7 days. Symptoms can be prolonged or recurrent and the sequelae of infection may include rheumatological disorders, peripheral neuropathies and Guillain-Barre Syndrome.[1,2] Without antibiotic treatment, infected individuals can excrete bacteria for up to 7 weeks.[1]

The reservoir for *Campylobacter* is domesticated and wild animals and the environment. *Campylobacter jejuni* causes the majority of human infections and most commonly occurs after ingestion of, or contact with, infected foods of animal origin, particularly poultry.[1,3–5] Ingestion of as few as 500–600 *Campylobacter* bacteria may cause illness.[3] In Australia, an estimated 75% of campylobacteriosis is thought to be foodborne.[6] Cases of foodborne *Campylobacter* infection are usually sporadic in nature and point-source foodborne outbreaks are not commonly identified.[7,8] Phenotypic methods currently used for distinguishing *Campylobacter* pathogens are of limited use so public health investigation or control activities occur rarely. In New South Wales (NSW), the inability to detect and control or prevent outbreaks of *Campylobacter* because of limitations in strain typing is the reason it is not a notifiable disease.[8] DNA methods for typing strains, including multi-locus sequence typing and polymerase chain reaction, are under development.[9]

In all Australian jurisdictions except NSW, confirmed *Campylobacter* infections are required to be notified to health departments under public health legislation. Campylobacteriosis is the most commonly notified enteric condition in Australia with 17 020 notifications in 2007. Between 2004 and 2007, the overall notification rate reached 120.5 per 100 000 population.[10] After campylobacteriosis, salmonellosis is the next most notified enteric disease in Australia. In 2007, there were 9546 notifications of *Salmonella* infections from all states and territories, with an overall notification rate of 45.4 per 100 000 population. All states and territories that notify both infections had more *Campylobacter* than *Salmonella* notifications annually between 2004 and 2007, except for the Northern Territory.[11] After accounting for underreporting, it has been estimated that approximately 227 000 *Campylobacter* infections occur annually in Australia.[12]

The number and epidemiology of cases of campylobacteriosis in NSW is currently poorly described, in part because it is not notifiable. This study describes the epidemiology of laboratory-confirmed *Campylobacter* infection in the Hunter region of the Hunter New England Area Health Service (HNEAHS) between 2004 and 2007.

NSW is divided into eight area health services. The Hunter region refers to the south-eastern part of the HNEAHS and includes the city of Newcastle. In the Hunter region three laboratories receive the majority of stool specimens; two private laboratories that service the private health sector and one public laboratory that services the public hospital

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system and some private medical practices. In 2005, the estimated resident population of the Hunter region was 8.4% of NSW's population (i.e. 573 525 people).[13]

Methods

The three laboratories in the Hunter region were approached to participate in the study: the public laboratory and one large private laboratory agreed to participate by providing de-identified records of people whose *Campylobacter* infection was detected between 1 January 2004 and 31 December 2007. For each positive sample, a laboratory identifier, the person's date of birth, age, sex, residential postcode and specimen collection date were provided.

The data from both laboratories were merged into a single dataset, which was cleaned and checked for duplicates. A specimen was identified as a duplicate if it was collected from an individual up to 8 weeks after a previous specimen. Only infections in residents of the Hunter region were included in the analyses.

One private laboratory did not participate in the study so the total number of laboratory-confirmed *Campylobacter* infections diagnosed in the Hunter region for 2004–2007 was estimated. As salmonellosis is notifiable to the NSW Department of Health by all laboratories, internal quality assurance data were used to identify the notifying laboratory for each case of salmonellosis notified in the Hunter between 2004 and 2007. The proportion of salmonellosis notifications received from all laboratories in the region, and the annual median proportion of salmonellosis notifications (2004–2007 data) from the two participating laboratories were determined. The annual median proportion of salmonellosis notifications was applied to the *Campylobacter* diagnoses to permit an estimate of the total number of cases diagnosed from all laboratories in the area.

We assumed that the proportional distribution of *Campylobacter* infections and salmonellosis notifications across the three Hunter area laboratories was similar because:

- both bacteria are detected using stool culture by local laboratories
- salmonellosis and campylobacteriosis generally have similar transmission modes.[1]

We further assumed that the proportional distribution was stable throughout the study period.

Hunter region campylobacteriosis cases were described and compared to national descriptive notification data.

Results

There were 2010 isolates of *Campylobacter* detected by the two participating laboratories between 2004 and 2007. Of these, 357 (18%) were excluded as duplicate records and 91 (4.5%) were excluded as isolates from people who were not resident in the study area. Sixty percent of the remaining 1562 isolates were detected by the public laboratory (n = 944).

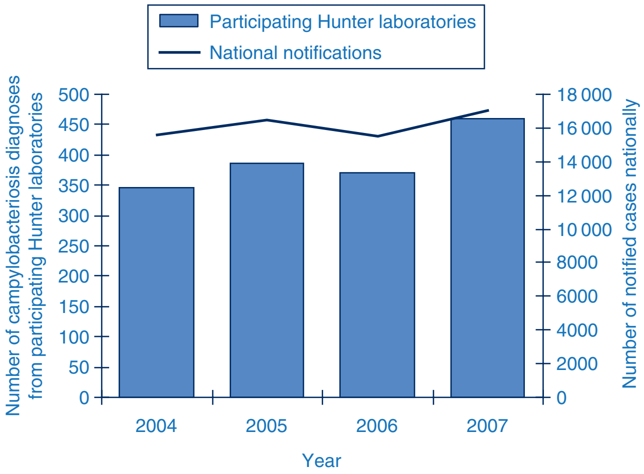

Figure 1. Number of laboratory-confirmed campylobacteriosis cases diagnosed by participating laboratories in the Hunter region of NSW, and the number of campylobacteriosis notifications in Australia*, for the period 2004–2007. *Excludes NSW where campylobacteriosis infection is not notifiable.
Source: Campylobacteriosis diagnosis data of laboratories participating in the study and the National Notifiable Diseases Surveillance System.

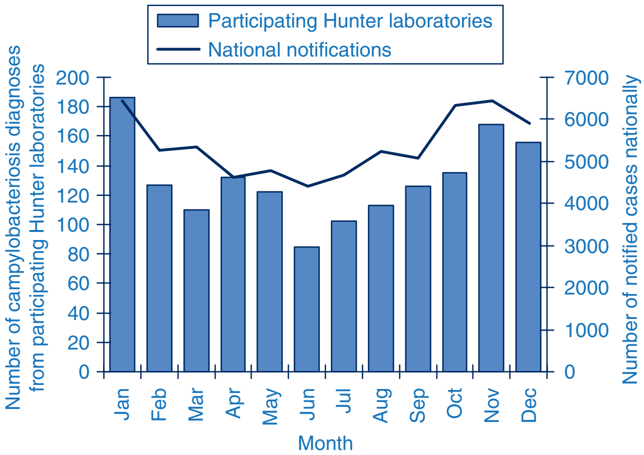

Figure 2. Number of laboratory-confirmed campylobacteriosis cases from participating laboratories in the Hunter region of NSW, and the number of campylobacteriosis notifications in Australia*, by month, for the period 2004–2007. *Excludes NSW where campylobacteriosis is not notifiable.
Source: Campylobacteriosis diagnosis data of laboratories participating in the study and the National Notifiable Diseases Surveillance System.

The least number of laboratory-confirmed cases of campylobacteriosis occurred in 2004 (n = 346) and the greatest in 2007 (n = 460). The pattern of a yearly increase in the number of cases in the Hunter (except 2006) was also observed in the national data (Figure 1). In the Hunter and nationally, the number of laboratory-confirmed cases peaked between November and January (Figure 2).

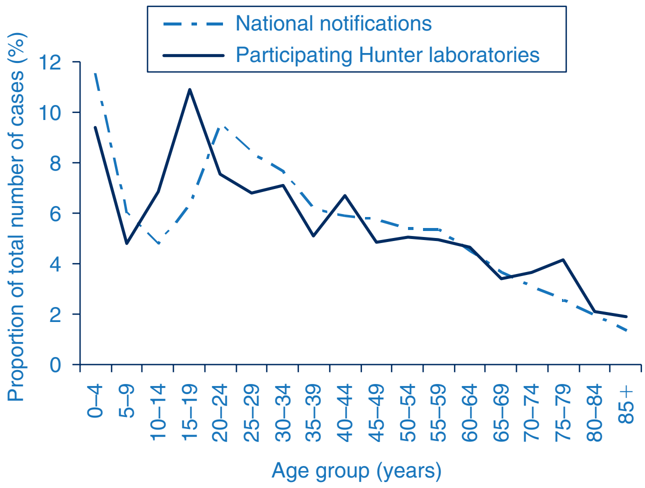

Figure 3. Proportional age distribution of laboratory-confirmed cases of campylobacteriosis from participating laboratories in the Hunter region of NSW, and notified nationally in Australia*, by 5-year age group, for the period 2004–2007. *Excludes NSW where campylobacteriosis is not notifiable.
Source: Campylobacteriosis diagnosis data of laboratories participating in the study and the National Notifiable Diseases Surveillance System.

Between 2004 and 2007, 54% (844/1562) of laboratory-confirmed *Campylobacter* infections in the Hunter region were diagnosed in males. For the same period nationally, males comprised 55% of notifications. In the Hunter region, there was a predominance of males in all age groups up to 50 years, after which age case counts in males and females were similar. The median age of diagnosis for males was 31 years (inter-quartile range 16–50 years) compared with 35 years (inter-quartile range 21–58 years) in females. In children aged under 5 years in the Hunter, 99 *Campylobacter* infections were diagnosed in boys compared with 48 in girls. This gives a boy to girl ratio of 2.1 : 1, compared with a national notification ratio in this age group of 1.5 : 1.

The age distribution of laboratory-confirmed cases of campylobacterosis in the Hunter was similar to that of nationally notified cases (Figure 3), with a high proportion of cases in children aged under 5 years. Secondary peaks in the number of cases occurred in the 15–19-year age group in the Hunter region (10.8%) and 20–24-year age group nationally (9.6%).

The local quality assurance data contained 584 salmonellosis notifications for residents of the Hunter between 2004 and 2007. The median annual proportion of Salmonella notifications processed by the participating laboratories was 48% (range 37–54%). Applying this proportion and range to the number of laboratory-confirmed *Campylobacter* infections identified by participating laboratories, the estimated median of the annual number of laboratory-confirmed cases of campylobacteriosis in the Hunter region was 788 (range 700–1022) between 2004 and 2007 (Table 1). The ratio of the estimated annual number of *Campylobacter* infections to salmonellosis notifications in the Hunter ranged between 5.3 and 6.0:1, with a median of 5.5:1 (Table 2). The lower and upper estimates of the median annual number of *Campylobacter* diagnoses produced ratios ranging from 4.9 to 7.1:1.

Discussion

This study estimated that in the Hunter region of NSW, campylobacteriosis is approximately five times more common than salmonellosis. The epidemiology of *Campylobacter* infection in the Hunter appears to be similar to other temperate areas of Australia in terms of trends in gender distribution, the number of cases occurring each year and seasonality. These similarities in demographics support the validity of this estimation process.

The ratios of annual counts of *Campylobacter* infection to *Salmonella* notifications in other Australian jurisdictions range from 5.7 : 1 in Victoria to 0.6 : 1 in the Northern Territory. If the assumptions in the Hunter are valid, the lower estimate of the *Campylobacter* to *Salmonella* infection ratio in Hunter residents is similar to that of Victorian residents.

Using *Salmonella* notification data to help estimate the total number of laboratory-confirmed cases of campylobacterosis is logical given the similarities in laboratory diagnostic methods and the nature of the bacteria. The use of this methodology and the assumptions made are supported by the ratio of *Campylobacter* to *Salmonella* cases in other jurisdictions, which has a limited range. We are not aware of any reasons why this should differ in the Hunter region.

Limitations to the validity of this method include the use of quality assurance data, which may have contained some duplicate *Salmonella* reports. There may also have been some misclassification by laboratories for the *Salmonella* data. As each case could have been notified by multiple laboratories, we assumed that the laboratory with the earliest notification date initially diagnosed the case. It is possible that specimens from laboratories with slower notification processes are underrepresented, although we detected no evidence of this bias in practice. Furthermore, it is unknown whether the annual variability in the proportion of *Salmonella* notifications received from participating laboratories was due to inaccuracies in the data, changes in notification processes or other factors.

Age-specific rates, age-standardised rates and the rate of laboratory-confirmed infection with campylobacterosis by smaller geographical area were not calculated because

Table 1. Number of *Salmonella* isolates from all laboratories in the Hunter region of NSW, proportion from participating laboratories, number of *Campylobacter* isolates from participating laboratories and estimated total number of campylobacteriosis cases from all laboratories, 2004–2007

Year	Notified *Salmonella* cases, all laboratories (*N*)	Notified *Salmonella* cases, participating laboratories (*N*)	Proportion of *Salmonella* notifications from participating laboratories (%)	Laboratory-confirmed *Campylobacter*, participating laboratories (*N*)	Estimated median *Campylobacter*, all laboratories* (*N*) (range)
2004	136	66	49	346	721 (641–935)
2005	147	80	54	386	804 (715–1043)
2006	140	52	37	370	771 (685–1000)
2007	161	76	47	460	958 (852–1243)
Median	144	71	48	378	788 (700–1022)

*An estimate of the median and range of total laboratory-confirmed *Campylobacter* infections in the Hunter region was calculated by applying the overall proportion of salmonellosis notifications from participating laboratories (median 48%, range 37–54%) to the number of *Campylobacter* infections identified by these laboratories.
Source: Campylobacteriosis diagnosis data of laboratories participating in the study and the National Notifiable Diseases Surveillance System.

Table 2. Ratio of *Campylobacter* to *Salmonella* infection notifications for Australian states and territories* and the Hunter region of NSW, 2004–2007**

Year	ACT	NT	Qld	SA	Tas	Vic	WA	Hunter
2004	3.8	0.6	1.5	3.7	5.1	5.7	3.0	5.3
2005	4.3	0.6	1.7	3.6	2.5	4.2	3.1	5.5
2006	3.3	0.7	1.5	4.5	3.1	4.1	2.4	5.5
2007	3.8	0.6	1.9	3.0	3.2	3.4	2.1	6.0
Median	3.8	0.7	1.6	4.0	3.2	4.3	2.5	5.5

*The ratio for Australia has been calculated using the number of notifications for all states and territories, excluding NSW, where campylobacteriosis is not notifiable.
**Using an estimated total number of *campylobacteriosis* diagnoses from all participating laboratories.
ACT, Australian Capital Territory NT, Northern Territory Qld, Queensland SA, South Australia.
Tas, Tasmania Vic, Victoria WA, Western Australia Hunter, part of the Hunter New England Area Health Service.

the population of Hunter residents serviced by the two participating laboratories is unknown.

Campylobacterosis causes a considerable morbidity and has potentially serious sequelae, so there is value in monitoring the longer-term trends in infection, particularly to determine the impact of measures implemented to reduce infection rates in humans. Measures have included initiatives in domestic and food production settings, especially in the poultry industry.[5,14] Regular review of the demographic details of people in NSW with laboratory-diagnosed *Campylobacter* infection would provide baseline data against which the effectiveness of control measures could be determined.

Conclusions

This study provides evidence that the number of cases of laboratory-confirmed campylobacteriosis in the Hunter region is considerably greater than the number of notifications of salmonellosis. The trends in the Hunter are likely to be similar to other regions of NSW. Regular review of *Campylobacter* laboratory results may be valuable over time.

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Feral pig hunting: a risk factor for human brucellosis in north-west NSW?

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Abstract: A multi-agency investigation followed the notification of four locally acquired human brucellosis cases in north-west NSW. Feral pig hunting within a geographically discrete region was identified as the likely exposure with *Brucella suis* the suspected cause. To test whether feral pigs in the region were infected with *Brucella*, serological testing was performed on trapped feral pigs and testicular abscesses from condemned carcasses bound for export were cultured. Although no *Brucella* species were identified in the feral pigs tested in NSW, *Leptospira* species were. Strengthening of human surveillance and ongoing collaboration between animal and human health agencies is required to confirm that *Brucella suis* causes brucellosis in humans and feral pigs in north-west NSW.

Feral pigs are known reservoirs for brucellosis in Queensland and overseas.[1–3] In 1990, Hone estimated that there could be 13.5 million feral pigs (with 95% confidence intervals of 3.5–23.5 million) inhabiting about 38% of Australia.[4] There is increasing human contact with feral pigs in Australia, as meat from hunted feral pigs is exported to Europe for human consumption.[5]

Of the species of *Brucella* bacteria that commonly cause human disease only *B. suis* is locally acquired in Australia, with feral pigs being the confirmed reservoir in Queensland but not NSW. *B. melitensis* does not occur in Australia and the country was declared free from *B. abortus* in 1989 following the National Brucellosis and Tuberculosis Eradication Campaign.[6]

Although rare in Australia, brucellosis is the most common zoonosis worldwide and is an illness that can be acquired through travel.[7,8] Unfortunately, serological tests by which most human diagnoses are made cannot distinguish between *Brucella* species and therefore it is difficult to determine the relative contribution of locally acquired *B. suis* and overseas acquired species.

This article reports the findings of the human and animal health investigation that followed the notification of four human brucellosis cases and which aimed to identify *B. suis* in feral pigs in rural north-west NSW.

Public health investigation and findings

Between December 2006 and September 2009, four men who met the clinical and laboratory case definition for brucellosis were notified to Hunter New England Population Health. All described regular recreational or occupational feral pig hunting prior to the onset of their symptoms. They reported hunting close to Moree, which is located approximately 120 km from the Queensland border, with one also hunting around the Queensland border. All described butchering carcasses without using personal protective equipment. None of their hunting companions reported similar illness and none reported overseas travel or consumption of unpasteurised dairy products from countries in which *Brucella* is endemic in the 3 months prior to the onset of their illness.

All cases were diagnosed by serology which was conducted using the standard agglutination test (SAT). Only one case had blood cultured, more than 5 months after the onset of his illness, and *Brucella* was not detected. Therefore, the *Brucella* species causing the case's illness was not confirmed. All cases were symptomatic at presentation and their symptoms included fever, sweats, abdominal pain, vomiting and loin and back pain. They were treated with doxycycline and rifampicin for the recommended period and recovered. Table 1 summarises the demographic, clinical, laboratory and hunting location details of the four cases.

Animal health investigation and findings

Blood sampling of trapped feral pigs in the region where human cases had occurred was arranged through the

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Table 1. Characteristics of four men from NSW diagnosed with brucellosis between 2006 and 2009

Case no.	Age (years)	Year of diagnosis	SAT titre on diagnosis[A]	Blood culture	Time from symptom onset to diagnosis (weeks)	Hunting area
1	64	2009	1280	Not performed	7	Moree area
2	29	2008	320	Not performed	3	Moree to Queensland border
3	41	2008	320	*Brucella* not detected	26	Moree area
4	31	2006	1280	Not performed	5	Moree area

[A]A four-fold rise in titre in paired sera indicates brucellosis, whereas a single titre equal to or greater than 160 suggests active infection or repeated exposure to *Brucella* species.

NSW Department of Industry and Investment (I & I NSW) with the cooperation of the North West Livestock Health and Pest Authority. Samples from over 200 pigs on 31 separate trapping occasions from different locations were submitted for serology. None of these samples were positive for *Brucella* serology, whereas 20 were positive for *Leptospira*, 17 for *Leptospira interrogans* serovar pomona and three for *Leptospira borgpetersenii* serovar tarassovi; both these serovars are pathogenic to humans.

In a separate investigation, Australian Quarantine Inspection Service (AQIS) officers arranged for the culture of testicular abscesses that had resulted in feral pig carcasses bound for export being condemned. Testicular abscesses in the absence of injury are a good indicator of brucellosis in feral pigs. While several testicular samples sourced from feral pigs from southern Queensland identified *B. suis*, those sourced from northern NSW did not. However, it is not unusual for old abscesses caused by brucellosis to have no viable bacteria.

Discussion

Human brucellosis and leptospirosis are notifiable by pathology laboratories under the NSW *Public Health Act 1991*. Human brucellosis surveillance needs to differentiate local from overseas acquired cases, as local acquisition has implications for Australia's animal health.[9] If locally acquired *B. abortus* or *B. melitensis* were detected, this would affect Australia's brucellosis-free status. If locally acquired *B. suis* is identified, I & I NSW should be notified so that the source, presumably feral pigs, can be investigated and targeted for eradication, reducing the risk to humans.

Animal surveillance for *B. abortus* is ongoing and is reported in Animal Health Australia's National Animal Health Information System. Despite extensive testing, *B. abortus* has not been detected in recent years.[10]

While *B. suis* was not identified in the four men or the feral pigs tested in NSW, pigs are able to cross the border from Queensland where the disease is known to occur and could have been the source of infection. The presence of potentially zoonotic *Leptospira* infection in feral pigs from north-west NSW was confirmed by this investigation. Therefore, this collaboration between human and animal health agencies allowed for an improved understanding of the epizoology of local feral pigs and the potential risk to humans, and identified a novel surveillance mechanism (sampling condemned export carcasses) for monitoring the health of feral pigs in a defined catchment area.

Conclusion

Although human brucellosis and leptospirosis are rare, feral pig hunting is likely to be a risk factor for locally acquired disease in north-west NSW. We propose that the surveillance of human brucellosis be strengthened by: investigating and reporting for cases, the likely place of disease acquisition (Australian state/s or overseas) and participation in feral pig hunting activities (for locally acquired cases); and by encouraging speciation of *Brucella* through blood culture. In addition, an ongoing collaboration with animal health colleagues is required to confirm *B. suis* infection in NSW feral pigs and subsequent transmission to feral pig hunters.

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Murray Valley encephalitis virus

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Murray Valley encephalitis virus (MVEV) is a mosquito-borne flavivirus closely related to the Japanese encephalitis and West Nile viruses.[1] The vast majority of infections are asymptomatic or mild; however, the most severe form of disease – encephalitis – has a mortality rate of up to 30%, with 30–40% of survivors having permanent neurological disabilities.[2] There is no specific treatment or vaccine for the disease. MVEV is endemic in northern Australia[3] but has rarely been seen in south-eastern Australia since a national epidemic in 1974 of 58 cases with 20% mortality.[4]

The primary vector of MVEV during epidemics is thought to be the common banded mosquito, *Culex annulirostris*, which prefers breeding in shallow, warm, fresh water.[5] The primary vertebrate hosts of MVEV are thought to be water birds, which act as reservoirs for the virus. The Nankeen (Rufous) Night Heron, cormorants and the Australian Darter are considered important reservoirs, but many bird species can be infected with MVEV.[6]

Much remains unknown about MVEV ecology. There are two main theories explaining the appearance of the virus in south-eastern Australia:

1) MVEV is constantly present in small, unknown locations from which it amplifies during periods of drought through the highly localised accumulation of vectors or following heavy rainfall (widespread multiplication of mosquitoes and birds);[7,8] and/or
2) MVEV is introduced via infected birds from endemic areas in northern Australia after heavy rainfall in the central and eastern parts of the continent.[9]

A new third theory suggests that atmospheric conditions, in particular low pressure cells, may support the spread of the virus.[10]

MVEV surveillance systems

MVEV activity is monitored in susceptible regions of New South Wales (NSW) by detecting MVEV in trapped mosquito samples and/or detecting seroconversion to MVEV in sentinel chicken flocks. These surveillance systems are intended to provide an early warning of MVEV activity. Monitoring of meteorological events can also give a broad indication of likely vector and host activity, while climatic indices can be used in epidemic predictive modelling.[4,11–13]

Most recently, in 2001 a small serosurvey in the Macquarie Marshes in north-western NSW found evidence of MVEV activity in humans post-1974 and pre-2000–2001. MVEV seroconversion was detected in sentinel chickens in northern inland NSW in 2000–2001, and again at Menindee in 2003, with no human cases. In 2008, both mosquito and chicken samples indicated MVEV activity in central NSW and the Riverina, with one mild non-encephalitic human case detected in the Macquarie Marshes.[13]

The question remains: why is MVEV disease not seen more often in south-eastern Australia despite the recent evidence for virus activity? MVEV has a high sub-clinical infection rate: it has been estimated that only one in 800–1000 infections result in clinical disease.[14] This combined with a low index of suspicion amongst general practitioners means that mild cases are likely to be missed (the human case in 2008 had insisted on being tested for MVEV).

Since 1974, rainfall, land use, water and wetland management in susceptible regions have changed and are likely to have had an impact on the ecology of the virus. Sentinel chicken flocks and mosquito trapping sites have also been reduced, leading to less opportunity for detection of the virus.

Public health response

The detection of MVEV via the surveillance program has prompted a rapid release of public health warnings with personal protection against mosquito bites being encouraged. The timely release of these health messages has hopefully encouraged behavioural changes so that exposure to potentially viraemic mosquitoes has been reduced. These warnings, which can be targeted to the lifestyles and literacy levels of at-risk communities, also aim to increase awareness of possible symptoms for both the general public and relevant health professionals. Raising the index of suspicion for MVEV amongst local health professionals is vital for early notification of suspected cases to public health units and for the collection of pathology samples for testing at the Institute of Clinical Pathology and Medical Research at Westmead Hospital.

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Conclusion

MVEV should be considered as a possible – albeit rare – cause of disease in rural NSW. The high mortality and morbidity associated with MVEV can invoke community fear, media alarm and public health concern. This justifies monitoring and preparation for the unpredictable return of MVEV disease to south-eastern Australia.

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Salmonella: pits and pets

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What is salmonellosis?

Salmonellosis is primarily a foodborne disease in humans. It is responsible for the greatest number of enteric disease notifications in New South Wales (NSW). In 2007, a total of 4000 cases of salmonellosis were notified in NSW. This may, however, represent only one-eighth of salmonellosis cases in the community because few people present for treatment and testing.[1]

Salmonella is a bacterial pathogen found in the intestinal tract of some animals. After ingestion of contaminated food or water, *Salmonella* colonises and invades the mucosal layer of the small and large intestine. This invasion causes the release of adenyl cyclase, creating an inflammatory response and production of the fluid that leads to diarrhoea. Sometimes the bacteria enters the bloodstream, leading to systemic illness.[2]

Clinical features

The incubation period for salmonellosis in humans ranges from 6 to 72 hours (although it is usually 12–36 hours). Symptoms include diarrhoea, abdominal pain, fever, headache and sometimes vomiting and bloody diarrhoea. The duration of illness is most often 4–7 days, although symptoms may persist for much longer. Treatment is usually supportive only; most people will recover with rest and fluids. Antibiotics are not usually recommended because they may increase the duration of illness.[3]

Diagnosis

Salmonella infections can only be confirmed by laboratory testing of a submitted specimen (usually a stool). The laboratory isolate *Salmonella enterica* is then separated into one of over 2000 serotypes (such as *S*. Typhimurium or *S*. Infantis).[4] Further subtyping of some common *Salmonella* serotypes such as *S*. Typhimurium is performed to improve discrimination. Methods used for subtyping in NSW are phage typing and multi-locus tandem-repeat variant analysis.

Risk factors

The main risk factor for developing salmonellosis is eating raw or undercooked food such as poultry, beef, lamb, pork and eggs. It can also be spread from person-to-person or through contact with a contaminated animal or environment. Anyone is at risk of being infected with *Salmonella*; however, elderly people, children and immunocompromised individuals are at greater risk of developing more serious illness.[5]

Prevention

Salmonella contamination of food can be prevented by the following measures:

- minimising the potential for contamination during food production and transportation (e.g. ensuring animal feeds, irrigation water and storage areas do not become contaminated)
- keeping hot foods hot (⩾60°C) and cold foods cold (⩽5°C)
- handling and storing raw foods and ready-to-eat foods separately to prevent cross-contamination
- thoroughly cooking meals
- washing hands regularly with soap and water during food preparation and after activities like playing outdoors, touching animals and going to the toilet.

Public health response

Laboratories are required to notify local public health units whenever *Salmonella* has been isolated from a human clinical specimen. Public health units investigate clusters of people diagnosed with the same strain to identify common links. Where links are identified, the NSW Food Authority conducts an environmental investigation (including inspection of the food preparation area and source of ingredients) and applies control measures. Investigations help prevent further disease and inform public heath policy to prevent further outbreaks.

Environmental *Salmonella* infection

While food is the most common source of *Salmonella* infection, contact with *Salmonella* bacteria in the environment is thought to be responsible for a small proportion of cases.[6] Transmission may occur when people come into contact with a contaminated environment or an infected animal. Some *Salmonella* serotypes are more commonly found in the environment and in distinct geographical areas.

While rare in other Australian states, *Salmonella* Mississippi is thought to be endemic in Tasmanian

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wildlife. Human infections are associated with drinking tank water and contact with birds and animals.[7] Infections are also thought to be associated with child hand behaviours, such as lack of hand washing before eating and finger sucking.[7]

The Northern Territory (NT) has the highest rate of *Salmonella* infection in Australia. A recent case control study found various *Salmonella* strains in around 20% of all household environment samples in the state, with little difference between cases and controls. All turtle tanks and a large proportion of frog faeces, vacuum dust and backyard soil tested positive for *Salmonella* (S. Williams, OzFoodNet, 24 March 2009, pers. comm.). This high prevalence of *Salmonella* in households and animals in the NT may indicate that it is ubiquitous in tropical environments.

Data collected by OzFoodNet – the national foodborne disease surveillance network – reports that there were three *Salmonella* outbreaks linked to an environmental source between 2001 and 2007. Two of these outbreaks were associated with children at child-care centres following chick hatching programs. The other, a rare strain of antibiotic-resistant *Salmonella* Paratyphi B biovar Java associated with tropical fish tanks, occurred across Australia.[8]

In 2008, an outbreak of salmonellosis occurred in the northern Sydney area of NSW, mostly affecting children under the age of 5. Epidemiological investigation linked the outbreak to two public playgrounds in the area. Environmental investigation found the sand in the playgrounds positive for *Salmonella* Paratyphi B biovar Java. In collaboration with the local council, the playgrounds were closed and the sand was replaced. The source of the contamination is still under investigation.

While the source of *Salmonella* infection is usually contaminated food, it is important to consider contaminated environments or infected animals as potential sources when investigating outbreaks, particularly if the cases are mainly among young children.

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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 Public Health then Infectious Diseases, or access the site directly at: http://www.health.nsw.gov.au/publichealth/infectious/index.asp.

Figure 3 and Tables 1 and 2 show reports of communicable diseases received through to the end of October 2009 in New South Wales (NSW).

Potential exposures to rabies and Australian bat lyssavirus infection

Lyssaviruses are a group of viruses that include rabies and Australian bat lyssavirus (ABLV). Rabies is an infection of mammals that is transmitted through biting or scratching. It occurs in many parts of the world, but not in Australia. Infection with rabies can sicken and kill the affected mammal, and infection in humans is usually fatal.

ABLV is a virus that is related to, but slightly different from, rabies. Humans are rarely infected: only two cases of human infection with ABLV have been recorded, both in Queensland in the mid-1990s and both were fatal.

Overseas, mammals that carry rabies include: bats, dogs, cats, raccoons, skunks, monkeys, and other mammals that bite and scratch. Australian mammals do not carry rabies. In Australia, only bats – both the larger flying foxes (or fruit bats) and the smaller insectivorous (or micro) bats – have been found to carry ABLV.

People may be at risk of rabies while travelling overseas if they come into contact with wild mammals or with domestic mammals that bite and scratch that have not been vaccinated against rabies. In Australia, people who handle bats are at risk of ABLV infection. No-one should attempt to handle bats unless they have been vaccinated against rabies and are trained in – and use – the proper personal protective equipment. If a sick or injured bat is found, the local wildlife rescue service should be contacted. Bites or scratches from Australian bats (or mammals overseas) require urgent treatment. For more information, see: http://www.health.nsw.gov.au/factsheets/infectious/rabiesbatinfection.html.

Anthrax

Anthrax was recently reported on a farm in southern NSW following the sudden death of several sheep. The public health investigation revealed four human contacts, all of whom remain well. Of these, one person had repeated direct contact with affected carcasses and received a 10-day course of ciprofloxacin for chemoprophylaxis.

Anthrax is an acute infectious bacterial disease caused by a toxin released by the anthrax bacterium (*Bacillus anthracis*). The disease can affect many species of domestic and wild animals and humans. The NSW *Stock Diseases Act 1923* requires that animals with suspected anthrax infection be notified immediately to the NSW Department of Industry and Investment (I & I NSW) via the local Livestock Health and Pest Authority.

Anthrax occasionally appears in livestock (mainly sheep and cattle) from properties located in the 'anthrax belt', a wide region, which extends across central NSW and into Victoria. Because anthrax spores survive in soil for decades, unimmunised livestock in these areas can develop the infection when they graze. I & I NSW can provide advice about anthrax vaccination of livestock in affected areas.

Once anthrax infection is confirmed on a property, the regional Veterinary Officer notifies local public health unit staff who then identify and manage health risks to any human contacts.

Anthrax infection in humans is extremely rare in NSW. Humans are at risk when they come into close contact with the body fluids or tissues of an animal that has died from anthrax. Cutaneous anthrax is the most common form of

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anthrax infection seen in NSW. This appears as an itchy blister or lump that enlarges and becomes ulcerated, leaving an area of black, dead tissue in the middle of the lesion. The infection is treated with antibiotics. For more information, see: http://www.health.nsw.gov.au/factsheets/infectious/anthrax.html, and http://www.dpi.nsw.gov.au/agriculture/livestock/health/humans/anthrax.

Measles

Two unrelated cases of measles were reported during September and October.

The first case, a woman aged in her 30s who had recently returned from travelling in South Africa, was reported from the Northern Sydney Central Coast Area Health Service. The case was symptomatic during the flight to Australia but was not notified until more than a week after her arrival in Sydney. An outbreak of measles has been reported in South Africa in recent months (http://www.promedmail.org/pls/otn/f?p=2400:1202:50943::NO::F2400_P1202_CHECK_DISPLAY,F2400_P1202_PUB_MAIL_ID:X,79609).

Measles can be prevented if measles-containing vaccine is given to a susceptible person within 3 days of their exposure to an infectious case, or if normal human immunoglobulin is given within 7 days of their exposure. In this case, as more than 7 days had passed since the flight, post-exposure prophylaxis would not have been helpful for potentially susceptible contacts. However, passengers thought to be at risk of infection (i.e. those born in Australia since 1966, many of whom have not been exposed to measles infection or who would have received only one dose of Measles-Mumps-Rubella vaccine) sitting in the two rows surrounding the case were contacted by public health units. These passengers were provided with information on the symptoms of measles and how to prevent further spread. No secondary cases were identified.

The second case was reported in a student aged in his 30s from the Hunter New England Area Health Service. The case reported no recent travel, and the source of infection remains unknown. Contacts were identified at a university and at two hospitals in the area. Due to delays in confirmation, people who were in contact with the case were provided with information about measles and how to prevent further spread. No secondary cases were identified.

There have been 12 cases of measles reported in NSW in 2009 to date compared with 39 for the same period in 2008. In Australia, most cases are reported in either travellers who have acquired the infection in countries where measles is endemic, or in their contacts. Measles vaccine is routinely given to infants at 12 months and 4 years and this confers long-lasting immunity.

Meningococcal disease

Fourteen cases of meningococcal disease were reported during September and October. There have been 79 cases of meningococcal disease in NSW in 2009, including four deaths. For the corresponding period in 2008, there were 69 cases reported and three deaths.

There are several serogroups responsible for meningococcal disease infection. A free vaccine for meningococcal C disease was added to the National Immunisation Program Schedule in 2003 and is routinely given to infants at 12 months of age. Consequently, serogroup C meningococcal disease is now mainly seen in adults and in unimmunised children. In NSW, the most common is serogroup B for which there is no vaccine.

Hepatitis A

Fourteen cases of hepatitis A were reported in NSW in September and October. Of these, 10 were likely acquired overseas, and the remaining four in Australia. Of these four, two reported consuming semi-dried tomatoes 2–6 weeks before the onset of illness, one reported travel to Victoria, and one acquired the infection from a partner who had travelled overseas. Public health experts continue to investigate the cause of the outbreak of hepatitis A linked to semi-dried tomatoes in Victoria (http://hnb.dhs.vic.gov.au/web/pubaff/medrel.nsf/LinkView/D8172AF758EDF26ECA25764A002574DE?OpenDocument).

Hepatitis A virus infection is one of the causes of inflammation of the liver (or 'hepatitis'). Symptoms include feeling unwell, aches and pains, fever, nausea, lack of appetite, abdominal discomfort, followed by dark urine, pale stools and jaundice (yellowing of the eyeballs and skin). Illness usually lasts 1–3 weeks (although some symptoms can last longer) and is almost always followed by complete recovery. Hepatitis A is usually transmitted when virus from an infected person is swallowed by another person through: eating contaminated food; drinking contaminated water; handling nappies, linen and towels soiled with the faeces of an infectious person; or after direct contact (including sexual contact) with a person in the infectious stage of the illness.

Pandemic (H1N1) 2009 influenza

In September and October 2009, influenza activity in NSW – as measured by the number of people who presented to emergency departments (EDs) with influenza-like illness (ILI) and the number of patients who tested positive for H1N1 at diagnostic laboratories – continued to decline after peaking in July. In summary, there were:

- declines in presentations to EDs for ILI, although presentations were higher than for the same period last year
- 52 cases of laboratory-confirmed influenza (including 42 of pandemic (H1N1) 2009 influenza) reported in

Figure 1. Comparison of weekly counts of emergency department (ED) visits for influenza-like illness, November 2008–November 2009 (solid line), with each of the 5 previous years (dotted and dashed lines).
Source: NSW Public Health Real-time Emergency Department Surveillance System (PHREDSS), NSW Health.

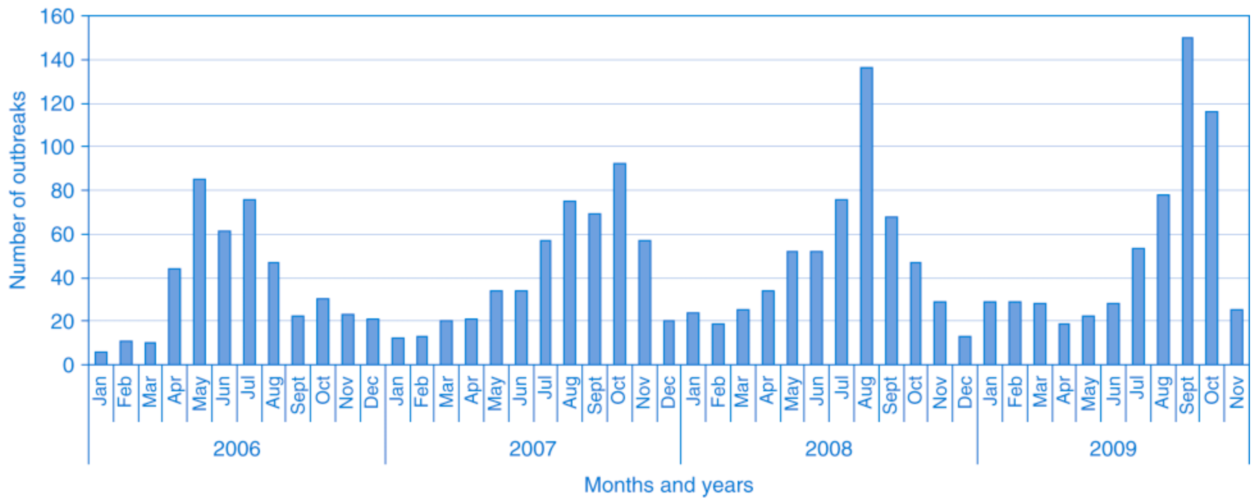

Figure 2. Reported outbreaks of gastroenteritis in institutions, NSW, January 2006–November 2009, by month.
Source: EntEpi: NSW Health Enterics Outbreak database (2009 data), Institutional Gastroenteritis Access database (2006–2008 data), Communicable Diseases Branch, NSW Department of Health.

September and 12 (including 11 of pandemic (H1N1) 2009 influenza) in October

- three deaths notified in association with confirmed pandemic (H1N1) 2009 influenza
- 28 admissions to hospital following presentation to EDs with ILI in September and 15 in October.

For a more detailed report on respiratory activity in NSW see: http://www.health.nsw.gov.au/publichealth/Infectious/reports/influenza_02112009.asp

Gastroenteritis outbreaks

During September and October, there were 265 outbreaks of gastroenteritis in institutions in NSW reported, including 155 outbreaks in aged-care facilities, 62 in hospital wards, 40 in child-care centres and eight in other facilities. All outbreaks appear to have been caused by viruses and spread from one person to another. *Clostridium difficile* infection may also have played a role in one outbreak. In winter months, there is an increase in the number of outbreaks of viral gastroenteritis reported in institutions in NSW (Figure 2).

Figure 3. Reports of selected communicable diseases, NSW, January 2004 to October 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%

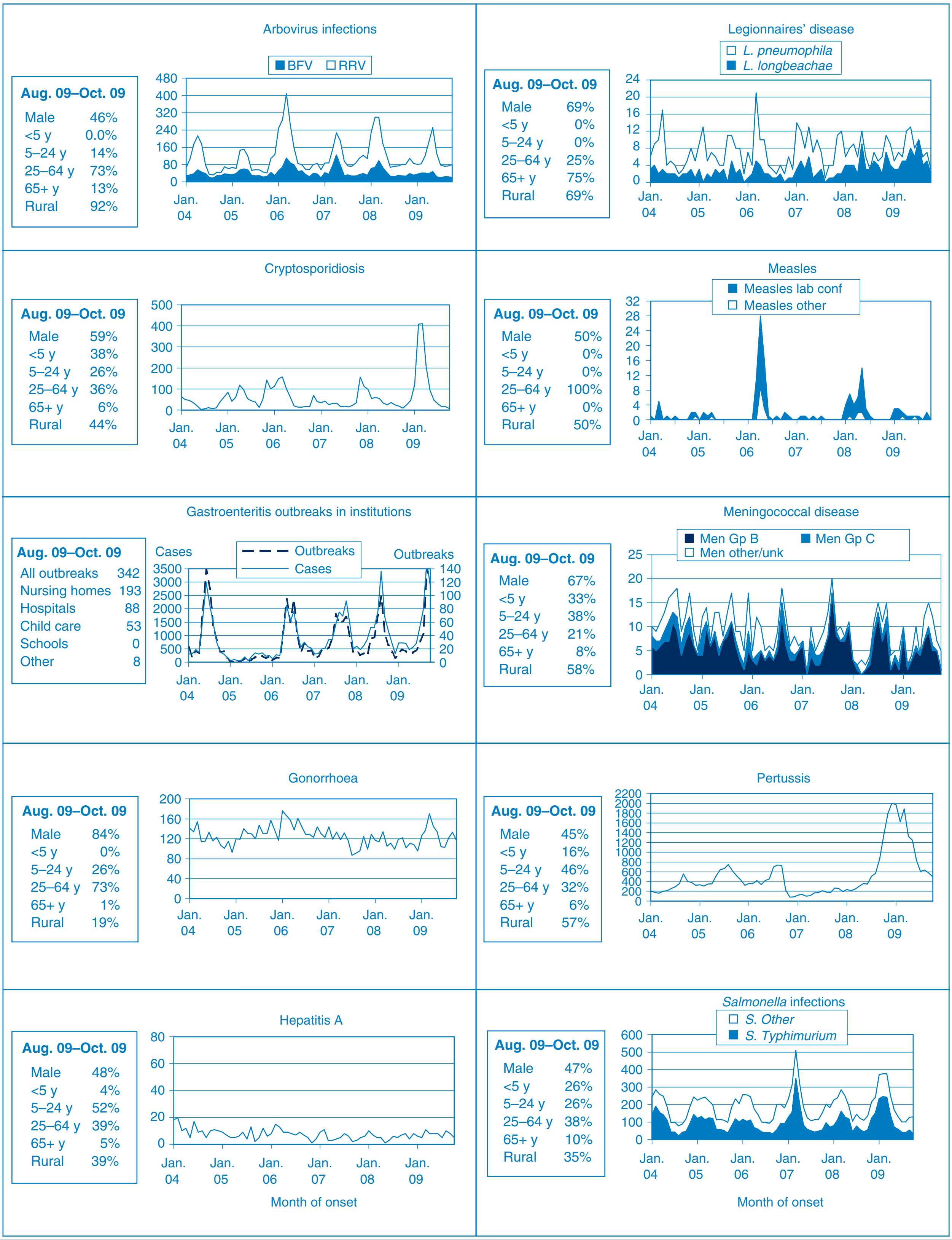

Table 1. Reports of notifiable conditions received in September 2009 by area health services

Condition	Area Health Service (2009): Greater Southern GMA	Greater Southern SA	Greater Western FWA	Greater Western MAC	Greater Western MWA	Hunter New England HUN	Hunter New England NEA	North Coast MNC	North Coast NRA	Northern Sydney Central Coast CCA	Northern Sydney Central Coast NSA	South Eastern Sydney Illawarra ILL	South Eastern Sydney Illawarra SES	Sydney South West CSA	Sydney South West SWS	Sydney West WEN	Sydney West WSA	JHS	Total: For September[b]	Total: Year to date[b]
Bloodborne and sexually transmitted																				
Chancroid[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chlamydia (genital)[a]	41	37	14	22	26	196	36	35	70	65	89	54	206	116	123	55	108	16	1317	11288
Gonorrhoea[a]	2	2	3	–	–	6	1	3	3	6	11	4	43	24	12	3	7	–	131	1165
Hepatitis B – acute viral[a]	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	2	25
Hepatitis B – other[a]	2	2	4	2	2	8	2	4	1	3	41	3	37	64	119	9	73	5	385	2792
Hepatitis C – acute viral[a]	–	–	–	–	–	1	–	–	–	–	1	–	–	–	–	–	1	–	3	22
Hepatitis C – other[a]	11	13	9	8	5	36	13	21	28	25	21	21	57	64	63	34	56	54	548	4788
Hepatitis D – unspecified[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6
Lymphogranuloma vanereum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Syphilis	1	1	6	–	–	5	1	1	1	3	8	3	23	23	16	2	11	–	106	923
Vectorborne																				
Barmah Forest virus[a]	–	–	–	–	1	5	1	4	5	1	–	2	–	–	–	–	–	–	19	295
Ross River virus[a]	8	1	–	3	2	14	5	12	7	–	2	3	–	–	1	1	–	–	59	807
Arboviral infection (other)[a]	–	–	–	–	–	1	–	1	1	–	1	–	1	–	–	–	4	–	9	139
Malaria[a]	–	–	–	–	–	–	–	2	–	–	–	–	1	–	3	–	2	–	8	79
Zoonoses																				
Anthrax[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Brucellosis[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Leptospirosis[a]	–	1	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–	3	17
Lyssavirus[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Psittacosis[a]	–	–	–	–	–	–	–	1	–	–	–	–	1	–	–	–	–	–	2	22
Q fever[a]	1	1	–	1	1	1	–	–	1	–	1	3	–	–	–	–	–	–	10	120
Respiratory and other																				
Blood lead level[a]	–	–	5	2	1	1	–	–	2	–	1	–	2	–	2	1	1	–	18	179
Invasive pneumococcal infection[a]	–	1	–	1	1	5	1	2	2	6	3	4	4	4	9	5	4	–	52	376
Legionella longbeachae infection[a]	–	–	–	–	–	3	–	–	–	–	2	2	–	–	–	–	1	–	8	50
Legionella pneumophila infection[a]	–	–	–	–	–	1	–	–	–	–	1	–	–	–	–	–	–	–	2	26
Legionnaires' disease (other)[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Leprosy	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Meningococcal infection (invasive)[a]	1	–	–	–	–	2	–	–	1	–	1	–	1	2	–	–	–	–	8	75
Tuberculosis	1	–	–	–	–	1	1	–	–	–	6	1	5	–	–	3	13	–	31	303
Vaccine-preventable																				
Adverse event after immunisation	1	1	–	1	–	–	1	–	–	3	–	–	–	1	1	–	–	–	9	107
H. influenzae b infection (invasive)[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6
Measles	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10
Mumps[a]	–	–	–	–	–	–	–	–	1	–	1	–	1	–	–	–	–	–	3	30
Pertussis	39	19	7	10	44	96	15	26	44	24	61	48	48	24	40	44	58	–	647	11303
Rubella[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8
Tetanus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Enteric																				
Botulism	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cholera[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3
Cryptosporidiosis[a]	–	–	–	–	–	3	1	1	1	–	1	1	3	1	1	1	–	–	14	1377
Giardiasis[a]	4	6	–	2	2	23	3	3	–	7	27	10	25	9	15	4	7	–	147	1610
Haemolytic uraemic syndrome	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3
Hepatitis A[a]	–	–	–	–	–	–	1	–	–	–	–	–	1	–	2	1	–	–	5	71
Hepatitis E[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	14
Listeriosis[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	20
Salmonellosis[a]	1	4	4	1	1	11	5	3	10	4	10	6	21	3	14	3	13	–	115	2046
Shigellosis[a]	–	–	–	–	–	1	–	–	1	–	1	–	–	3	2	–	–	–	8	134
Typhoid[a]	–	–	–	–	1	–	–	–	–	–	1	–	–	–	–	–	–	–	2	36
Verotoxin producing *E. coli*[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	19
Miscellaneous																				
Creutzfeldt–Jakob disease	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	12
Meningococcal conjunctivitis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2

[a]Laboratory-confirmed cases only. [b]Includes cases with unknown postcode.
NB: Data are current and accurate as at the preparation date. The number of cases reported is, however, subject to change, as cases may be entered at a later date or retracted upon further investigation. Historical Area Health Service configurations are included for continuity/comparison purposes and to highlight regional differences.
NB: Influenza data has not been provided here since May 2009. See www.health.nsw.gov.au/PublicHealth/Infectious/a-z.asp#I for up-to-date information.
NB: From 1 January 2005, Hunter New England AHS also comprises Great Lakes, Gloucester and Greater Taree LGAs (LGA, Local Government Area), Sydney West also comprises Greater Lithgow LGA.
NB: HIV and AIDS data are reported separately in the Public Health Bulletin quarterly.
GMA, Greater Murray Area; MAC, Macquarie Area; NEA, New England Area; CCA, Central Coast Area; SES, South Eastern Sydney Area; WEN, Wentworth Area; SA, Southern Area; MWA, Mid Western Area; MNC, North Coast Area.
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 October 2009 by area health services

	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				
Condition	GMA	SA	FWA	MAC	MWA	HUN	NEA	MNC	NRA	CCA	NSA	ILL	SES	CSA	SWS	WEN	WSA	JHS	For October[b]	Year to date[b]
Bloodborne and sexually transmitted																				
Chancroid[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chlamydia (genital)[a]	51	26	10	9	22	150	34	31	47	44	85	62	223	129	119	48	101	10	1210	12498
Gonorrhoea[a]	1	–	1	–	–	5	2	4	1	6	13	6	66	29	12	2	6	–	154	1319
Hepatitis B – acute viral[a]	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1	26
Hepatitis B – other[a]	3	–	1	2	1	4	1	1	1	2	33	2	55	62	61	8	50	5	299	3091
Hepatitis C – acute viral[a]	–	–	–	1	–	1	–	–	–	–	–	–	–	1	1	–	–	–	4	26
Hepatitis C – other[a]	15	10	1	12	5	31	7	19	18	22	19	35	46	54	43	19	24	34	426	5214
Hepatitis D – unspecified[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6
Lymphogranuloma vanereum	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1	3
Syphilis	–	1	–	–	–	3	1	1	2	4	6	2	17	22	15	–	9	–	86	1009
Vectorborne																				
Barmah Forest virus[a]	–	1	1	–	1	6	1	3	6	2	–	2	–	–	–	–	1	–	24	319
Ross River virus[a]	7	–	1	9	1	13	3	9	9	3	–	2	1	1	1	–	–	–	60	867
Arboviral infection (other)[a]	1	–	–	–	–	–	–	–	–	–	–	1	–	1	2	–	–	–	5	144
Malaria[a]	–	–	–	–	–	1	–	–	–	–	2	–	–	–	–	–	1	–	4	83
Zoonoses																				
Anthrax[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Brucellosis[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Leptospirosis[a]	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	18
Lyssavirus[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Psittacosis[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	22
Q fever[a]	–	–	2	–	–	5	–	–	–	–	–	–	–	–	1	–	–	–	8	128
Respiratory and other																				
Blood lead level[a]	–	–	–	–	–	6	–	–	1	–	1	–	–	–	1	2	1	–	12	191
Invasive pneumococcal infection[a]	1	1	–	–	1	7	2	2	–	2	3	4	4	5	9	2	2	–	45	421
Legionella longbeachae infection[a]	–	–	–	–	–	–	–	–	–	–	–	1	2	–	–	–	–	–	3	53
Legionella pneumophila infection[a]	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	27
Legionnaires' disease (other)[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Leprosy	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Meningococcal infection (invasive)[a]	–	–	–	1	–	1	–	–	1	–	–	2	2	–	–	–	–	–	7	82
Tuberculosis	1	–	–	–	–	1	–	–	–	–	5	3	10	–	–	–	14	–	34	337
Vaccine-preventable																				
Adverse event after immunisation	1	–	–	1	–	–	–	–	–	1	–	3	1	–	–	–	1	–	8	115
H. influenzae b infection (invasive)[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6
Measles	–	–	–	–	–	1	–	–	–	–	1	–	–	–	–	–	–	–	2	12
Mumps[a]	–	–	–	1	–	–	–	–	–	1	1	–	1	1	–	–	–	–	5	35
Pertussis	22	36	3	10	27	73	17	32	44	26	67	39	46	20	41	28	41	–	572	11875
Rubella[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8
Tetanus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Enteric																				
Botulism	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cholera[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3
Cryptosporidiosis[a]	–	1	–	–	–	–	1	–	1	–	–	2	2	2	1	–	–	–	10	1387
Giardiasis[a]	1	2	–	1	3	9	2	2	1	6	23	6	31	13	14	5	14	–	134	1744
Haemolytic uraemic syndrome	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3
Hepatitis A[a]	1	–	–	–	–	1	–	–	–	–	1	2	1	1	2	–	–	–	9	80
Hepatitis E[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	15
Listeriosis[a]	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	1	–	3	23
Salmonellosis[a]	2	3	–	2	2	6	2	5	10	6	23	6	21	20	18	7	21	–	154	2200
Shigellosis[a]	–	–	–	–	–	–	–	–	2	–	2	1	2	1	–	1	–	–	9	143
Typhoid[a]	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1	37
Verotoxin producing *E. coli*[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	19
Miscellaneous																				
Creutzfeldt–Jakob disease	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	12
Meningococcal conjunctivitis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2

[a]Laboratory-confirmed cases only. [b]Includes cases with unknown postcode. [c]Data is incomplete.
NB: Data are current and accurate as at the preparation date. The number of cases reported is, however, subject to change, as cases may be entered at a later date or retracted upon further investigation. Historical Area Health Service configurations are included for continuity/comparison purposes and to highlight regional differences
NB: Influenza data has not been provided here since May 2009. See www.health.nsw.gov.au/PublicHealth/Infectious/a-z.asp#I for up-to-date information.
NB: From 1 January 2005, Hunter New England AHS also comprises Great Lakes, Gloucester and Greater Taree LGAs (LGA, Local Government Area), Sydney West also comprises Greater Lithgow LGA
NB: HIV and AIDS data are reported separately in the Public Health Bulletin quarterly.
GMA, Greater Murray Area; MAC, Macquarie Area; NEA, New England Area; CCA, Central Coast Area; SES, South Eastern Sydney Area; WEN, Wentworth Area; SA, Southern Area; MWA, Mid Western Area; MNC, North Coast Area.
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.

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