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Navigating public health chemicals policy in Australia: a policy maker's and practitioner's guide

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Abstract: Chemicals are ubiquitous in everyday life. Environmental health practitioners rely on a complex web of regulators and policy bodies to ensure the protection of public health, yet few understand the full extent of this web. A lack of understanding can hamper public health response and impede policy development. In this paper we map the public health chemicals policy landscape in Australia and conclude that an understanding of this system is essential for effective environmental health responses and policy development.

There are over 39 000 chemicals on the world market today,[1] with the potential for this number to increase significantly through new manufacturing techniques such as nanotechnologies. These chemicals are widespread, occurring in everything from the food we eat, to the clothes we wear, to the cars we drive. The regulation of an item that permeates through every facet of our lives is by its nature complex. This complexity is difficult to navigate, particularly when public health practitioners are faced with an adverse health effect from a chemical product.[2] Knowledge of the range of chemical regulators and policy bodies allows for proper engagement with the system.

In an attempt to prevent adverse health effects occurring governments produce policies designed to minimise the exposure of the population to chemicals. Environmental health practitioners are often called upon to design or review these policies for the protection of the public's health, but without having a fundamental understanding of the regulators who can enact this protection it is difficult to ensure the policy developed will be effective and functional.

The following describes the complex web of regulators and policy makers in Australia that underpins the development of comprehensive, well-informed chemicals policy and appropriate practitioner response.

Making the chemical policy web

The current fragmented system of chemical regulation in Australia grew out of Australian federalism. In 1901 the Australian Constitution assigned a limited list of powers to the Commonwealth Government. The regulation of chemicals was not among them, leading to each state developing a unique approach to chemical issues and fragmenting chemical issues across different portfolios.[3]

The rise of the environmental movement in the 1960s and 1970s saw the establishment of the first state-based environmental protection agencies and national ministerial councils. Strong nationalisation of chemical policy issues in the form of targeted ministerial councils and national regulators only emerged in the 1990s out of the Hawke Government's 'New Federalism' and attempts to develop national regulatory strategies through the Council of Australian Governments (COAG). This period saw the establishment of national regulators in agricultural and

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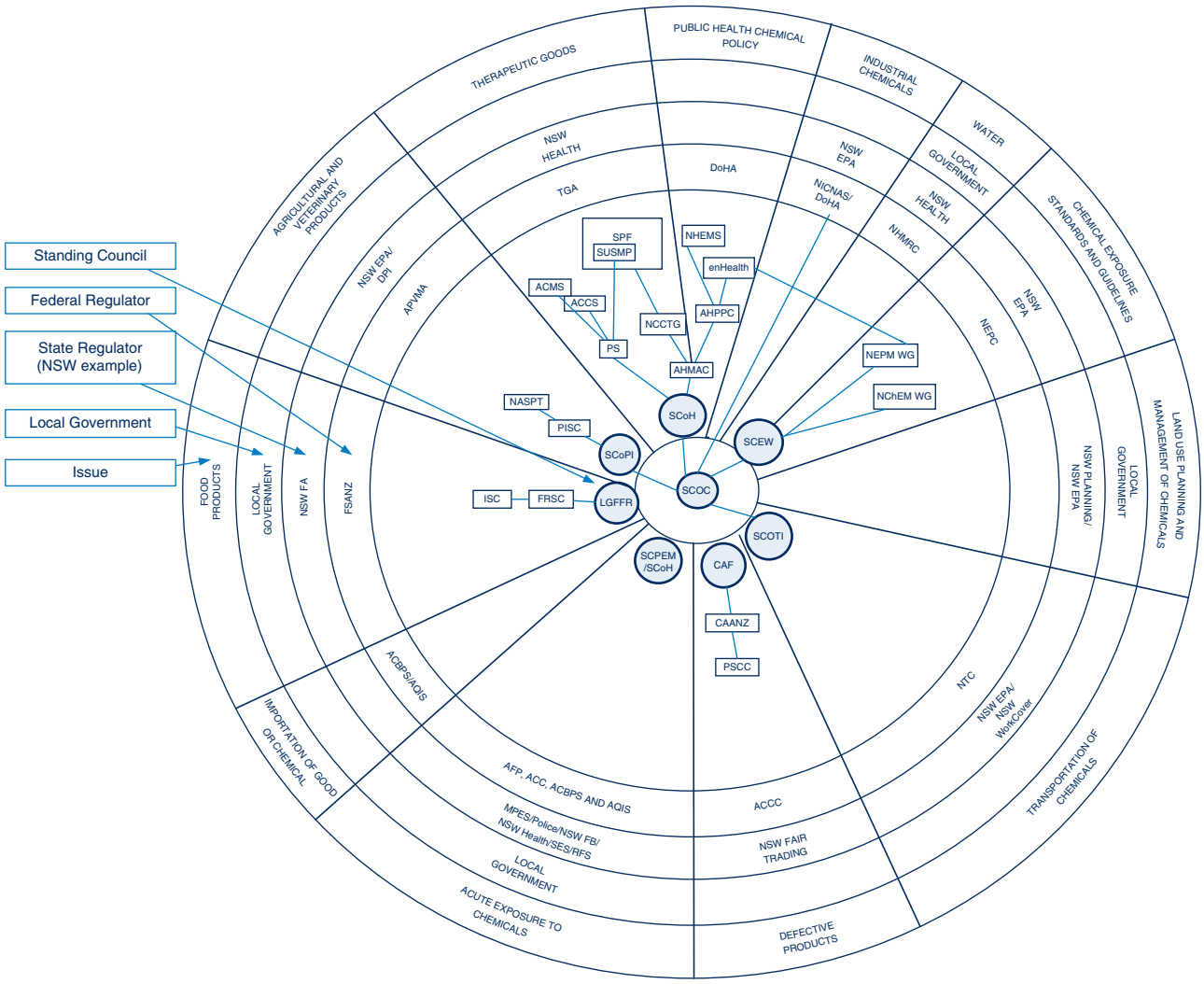

Figure 1. The web of government bodies responsible for public health chemicals regulation and policy in Australia.
See Table 2 for a list of acronyms used in this figure.

veterinary medicines, therapeutic goods, food, industrial chemicals, as well as various other agencies and ministerial councils. However, since much of the legislative power to implement and monitor controls rests with the states and territories, these agencies were limited in their ability to impose national uniformity of policy.

A third wave of reform began in 2005 with the then Prime Minister's direction to reduce unnecessary regulatory burden on business.[4] COAG set about establishing a high-level taskforce to develop an integrated, national chemicals policy. The main aim of these reforms was to develop uniform regulation between states on chemical issues. These reforms are ongoing and while they are designed to develop uniformity within areas of chemical regulation (such as therapeutics), there is limited development of uniformity between areas of chemical regulation.

Current structure of chemicals policy

The current structure of public health chemicals policy in Australia remains highly fragmented with 12 distinct segments (Figure 1). Some correspond to industrial sectors: therapeutic goods, agricultural and veterinary products, food products and a general category of industrial chemicals. Others developed out of responses to distinct regulatory problems: defective products, exposure standards, acute exposure, transportation of chemicals, land use planning, water, importation and public health policy.

Tables 1a and 1b stratify 10 of these areas with their agencies and functions at federal and state level. Table 2 provides a list of acronyms used in this paper.

Chemicals policy in Australia has the Standing Committee on Chemicals (SCOC) at its centre (Figure 1). The SCOC consists of representatives from the various standing councils and federal government agencies. It heads a regulatory hierarchy in each segment led by a standing council of federal and state ministers, which works towards more uniform national policy responses.[5] These standing councils are generally supported by committees of senior state and federal bureaucrats and any federal government

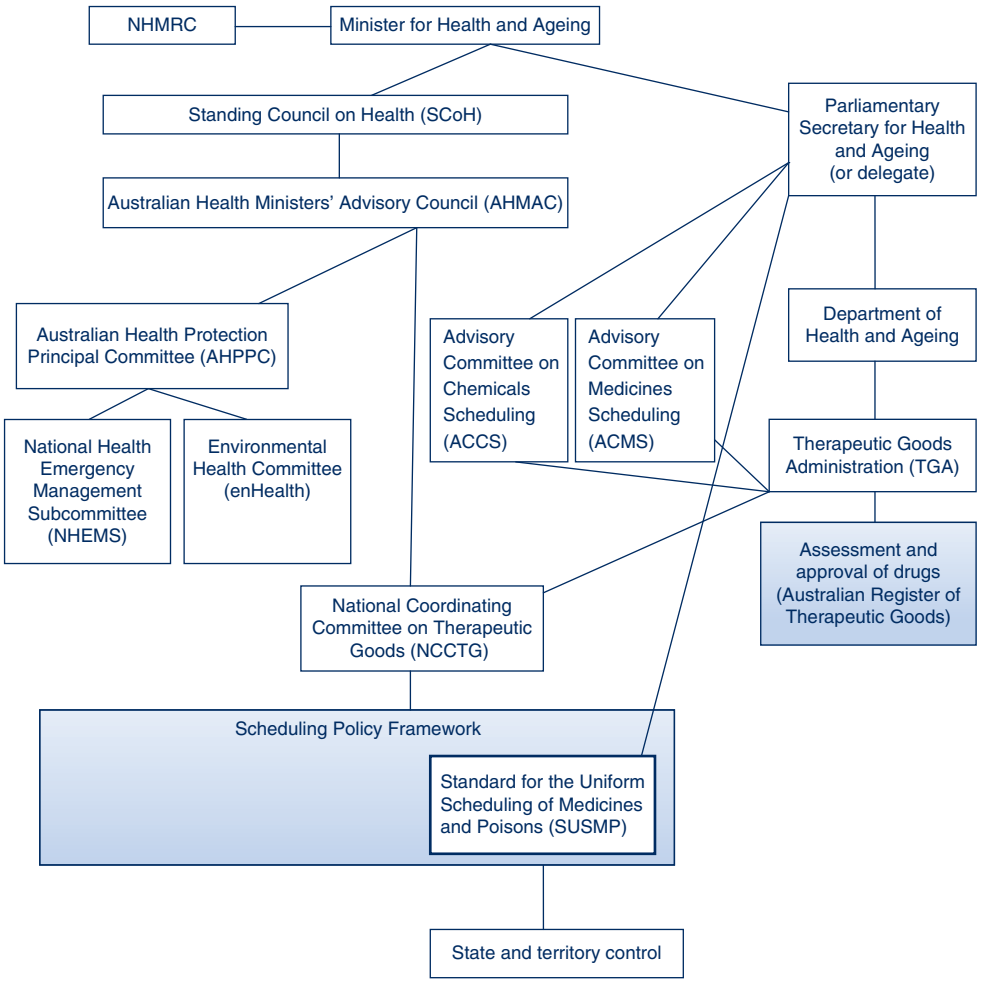

Figure 2. Government bodies responsible for therapeutic goods and public health chemicals in Australia.
NHMRC: National Health and Medical Research Council.

agencies with regulatory responsibility for the area of chemicals policy in question.

Segmented areas of chemicals regulation and policy

Therapeutic products, emergency management and public health chemical policy: the Standing Council on Health and the Therapeutic Goods Administration

The ministerial Standing Council on Health (SCoH) provides overall leadership in the regulation of therapeutic goods and public health issues arising from chemicals (Figure 2), drawing advice from the Australian Health Ministers' Advisory Council (AHMAC). For public health policy the AHMAC take advice from six key subcommittees, of which the Australian Health Protection Principal Committee (AHPPC) is the most important in terms of chemicals policy. The AHPPC includes federal and state Chief Medical/Health Officers, with representatives from other technical agencies, and provides advice and makes recommendations regarding environmental health policy and environmental threats and emergencies. It draws this advice from the Environmental Health Committee (enHealth) and the National Health Emergency Management Subcommittee (NHEMS).

The National Coordinating Committee on Therapeutic Goods (NCCTG), a sub-committee of AHMAC, has overall responsibility for the Scheduling Policy Framework (SPF), a framework that sets out the national system for applying access restrictions on all poisons (including therapeutics) that pose a potential risk to public health and safety.[6] Chemicals are 'scheduled' according to the degree of risk and the level of control required to protect consumers. A chemical may be referred to one of two committees to determine at what level it is to be scheduled – the Advisory Committee on Medicines Scheduling (ACMS) and the Advisory Committee on Chemicals Scheduling (ACCS). These committees provide advice to the Commonwealth Parliamentary Secretary for Health and Ageing (PS) (or their delegate), who has the final decision regarding the scheduling of the chemical in question;[7] this decision will be made after extensive public consultation. A record of this decision is included in the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP). Each state then

develops its own regulations around purchasing, packaging, labelling and enforcement of the SUSMP.

Products for which therapeutic claims are made are regulated by the Therapeutic Goods Administration (TGA) and associated state government agencies. The TGA assesses therapeutic goods for listing or registration on the Australian Register of Therapeutic Goods (ARTG), undertakes monitoring activities, and provides technical and administrative support to those committees involved in the scheduling of chemicals.

Agricultural and veterinary products: the Standing Council on Primary Industries and the Australian Pesticides and Veterinary Medicines Authority

The regulation of agricultural and veterinary chemicals follows a similar model (Figure 3) with the ministerial Standing Council on Primary Industries (SCoPI) developing policy and direction for the national regulator, the Australian Pesticides and Veterinary Medicines Authority (APVMA).

The SCoPI is supported by the Primary Industries Standing Committee (PISC). Sitting under the PISC is the National Agvet System Policy Taskforce (NASPT) which is tasked with developing a new national framework for the regulation of agricultural and veterinary chemicals.

The APVMA is the regulator responsible for the assessment and registration of agricultural and veterinary chemical products in Australia. Through the National Registration Scheme the APVMA registers and regulates the manufacture and supply of all pesticides and veterinary medicines used in Australia, up to the point of retail sale. The APVMA also assesses agricultural and veterinary chemicals or products for potential impacts on human health, the environment, trade and efficacy.

The APVMA contracts the Office of Chemical Safety (OCS) in the Department of Health and Ageing to undertake public health assessments. As part of this assessment, the product may also be classified as a poison, at which point the product is referred to either the ACMS or ACCS for scheduling. The APVMA will set Maximum Residual Levels. These are the highest concentrations of agricultural and veterinary chemical residues permitted in food or animal feed and are set ensuring consumption of foods with these residues does not constitute an undue hazard to human health. The APVMA approves the labelling of a product. They also have the power to refuse an application if they are not satisfied that the product will not be harmful to human beings, and may also put conditions on its manufacture and supply.[8] The APVMA also run a Chemical Review Program and an Adverse Experience Reporting Program.

The control of use of pesticides and veterinary medicines beyond the point of retail sale is the responsibility of state and territory governments (Table 1a).

Food products: the Legislative and Governance Forum on Food Regulation and Food Standards Australia New Zealand

The Legislative and Governance Forum on Food Regulation (LGFFR) is responsible for the development of domestic regulatory policies for food and the development of domestic policy guidelines for setting food standards (Figure 4).

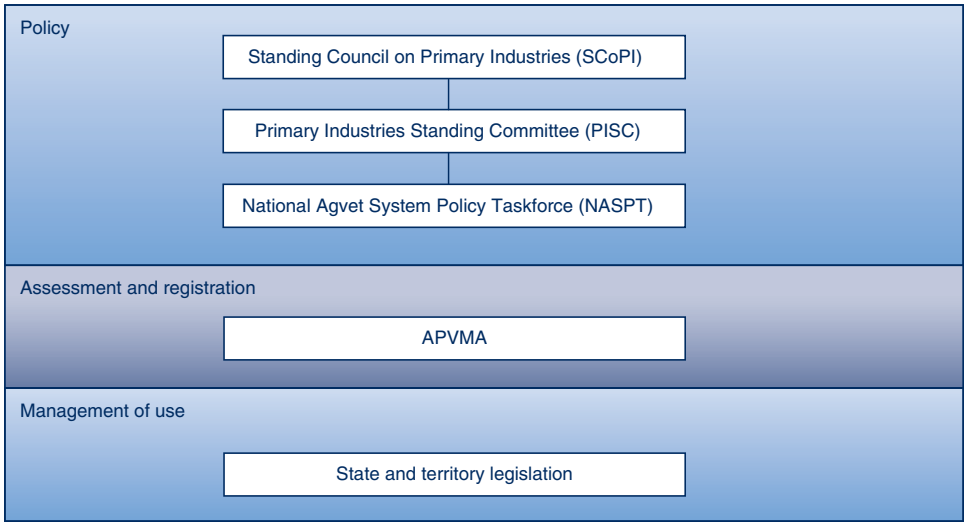

Figure 3. Government bodies responsible for agricultural and veterinary products in Australia.
Agvet: agricultural and veterinary.
APVMA: Australian Pesticides and Veterinary Medicines Authority.

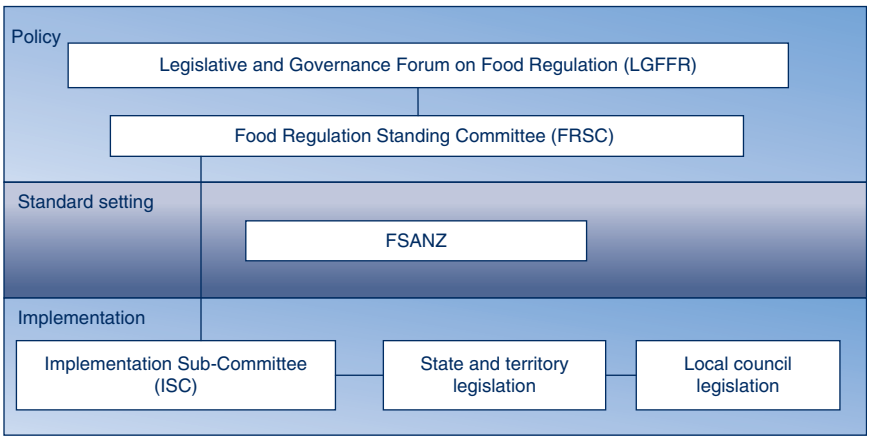

Figure 4. Government bodies responsible for food products in Australia.
FSANZ: Food Standards Australia New Zealand.

Under the LGFFR is the Food Regulation Standing Committee (FRSC) which is responsible for coordinating policy advice to the LGFFR.

Sitting below the FRSC is the Implementation Sub-Committee (ISC) which develops and supervises the implementation and enforcement of food regulations and standards across the jurisdictions.

Food Standards Australia New Zealand (FSANZ) is the national food regulator responsible for developing and maintaining the Food Standards Code and ensuring the protection of public health and safety around food issues. The Food Standards Code regulates the use of ingredients, the composition of some foods, and the presence of contaminants from food contact materials and environmental sources. FSANZ is also responsible for the labelling of both packaged and unpackaged food. It sets maximum levels for chemicals in food, which includes incorporating pesticide Maximum Residual Levels set by APVMA into food law.

In developing or reviewing any food regulatory measures, FSANZ must have regard to any policy guidelines set by the LGFFR. The implementation and enforcement of the Foods Standards Code is the responsibility of the ISC, and state and local governments.

Defective products: Legislative and Governance Forum on Consumer Affairs and the Australian Competition and Consumer Commission

Policy direction around consumer protection stems from the Legislative and Governance Forum on Consumer Affairs (CAF), the ministerial council of federal and state ministers for consumer affairs (Figure 5). Under the CAF sits Consumer Affairs Australia New Zealand (CAANZ), consisting of heads of state and federal consumer affairs departments. In turn, the CAANZ receives policy advice from three advisory committees and the Product Safety Consultative Committee (PSCC). The PSCC provides

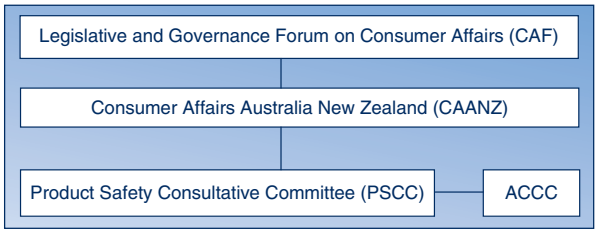

Figure 5. Government bodies responsible for defective products in Australia.
ACCC: Australian Competition and Consumer Commission.

advice and recommendations on product safety specific policy, education and compliance matters. It also provides advice to the Australian Competition and Consumer Commission (ACCC) on proposed product safety regulations, bans, standards and responses to emerging issues.[9]

The ACCC is the national regulator of consumer products and administers the Commonwealth *Competition and Consumer Act 2010*. This Act sets out the Australian Consumer Law.

The powers that the ACCC has over product safety are of most relevance here. Under the Act the Assistant Treasurer has powers to recall or ban products that do not meet certain standards, are defective, or create an imminent risk of death, serious illness or serious injury. The ACCC can undertake assessments of the chemical hazards in products, which may be in conjunction with the National Industrial Chemicals Notification and Assessment Scheme (NICNAS).

The Australian Consumer Law is designed to create a consistent approach to the banning or recalling of products in Australia. As such, state and territory governments are limited in their approaches to recall or ban a product, which will occur at the national level. State and territories have the ability to impose interim bans and consult with the national regulator about product safety issues.

Industrial chemicals: National Industrial Chemicals Notification and Assessment Scheme

Industrial chemicals has developed as a residual category. If a chemical does not fit into any other Australian regulatory scheme, it will fall under the Industrial Chemicals portfolio. As such, the Department of Health and Ageing, of which NICNAS is a part, has representation on the SCOC.

NICNAS is the Australian regulator of industrial chemicals. It undertakes assessment of all new industrial chemicals on the Australian market and is also considering the assessment of over 38 000 existing chemicals on the Australian Inventory of Chemical Substances, which may not have undergone assessment under modern guidelines, through the Inventory Multi-tiered Assessment and Prioritisation Program.[10] NICNAS also provides advice to other agencies regarding individual chemical contamination of products, and maintains strong links with the ACCC in this regard.

Although NICNAS has no authority to ban or phase out a chemical, it does have the power to prescribe conditions of use of a chemical which can be adopted and implemented through relevant state and territory legislation; it may also make recommendations to the PS for referral to the ACCS for inclusion of the chemical on the SUSMP.

Environmental health chemicals policy and chemical exposure standards: the Standing Council on Environment and Water and the National Environment Protection Council

The Standing Council on Environment and Water (SCEW) addresses broad national policy issues relating to environmental management and protection. Incorporated within the SCEW is the National Environment Protection Council (NEPC), a statutory ministerial council that has the power to create National Environment Protection Measures (NEPMs). NEPMs are broad framework-setting statutory instruments that may consist of goals, standards, protocols and guidelines. They provide guidance on issues such as air and water quality, land contamination and hazardous waste. State and federal health agencies also have an active role in the development of NEPMs through enHealth which has membership on the various NEPM Working Groups (NEPM WG).[11] State and territory governments have agreed to implement the NEPMs within their jurisdictions.

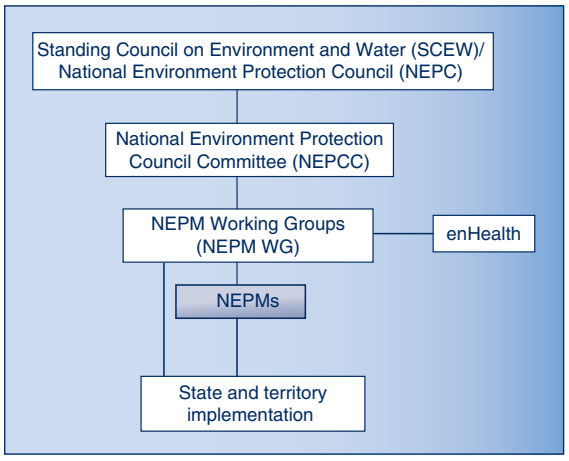

Figure 6. Government bodies responsible for the development of National Environment Protection Measures (NEPMs) in Australia.
enHealth: Environmental Health Committee.

Importation regulation: Australian Quarantine and Inspection Service and Australian Customs and Border Protection Service

The Australian Quarantine and Inspection Service (AQIS) administer the Imported Food Inspection Scheme. Under this scheme, food is inspected according to the level of risk it may pose to the population as determined by FSANZ. Testing may include targeted hazardous contaminants, pesticides and antibiotics, microbiological contaminants, natural toxicants, metal contaminants and food additives.[12] In addition to the routine testing of imported food, AQIS conducts survey testing of imported food. It receives this direction from the ISC.

The powers of the Australian Customs and Border Protection Service (ACBPS) stem from the Commonwealth *Customs Act 1901*, the Commonwealth *Customs Tariff Act 1995* and related legislation. However, ACBPS also administers legislation on behalf of other government agencies. In terms of products inappropriately contaminated with chemicals the ACBPS has the power to hold, seize, test and in certain circumstances recall products. This will often be undertaken in consultation with NICNAS, OCS, TGA, AQIS, APVMA, ACCC and the Australian Federal Police depending on the type of chemical or product (personal communication, D Hunt, 15 September 2010).

Additional Standing Councils relevant to chemicals regulation and policy

There are a number of other Standing Councils, regulators and policy bodies that deal with a range of issues relating to chemicals including water, transport, land use planning and acute exposure to chemicals and the emergency management of chemical-related incidents pertaining to them (Tables 1a and 1b) (Figure 1).

Conclusion

This paper describes the system of chemical regulators and government policy bodies responsible for protecting public health in Australia. Understanding this system should be paramount to any policy maker or public health

worker in the area of chemical exposure as it is essential for effective environmental health responses and policy development, and will lead to greater efficacy in environmental health outcomes.

Acknowledgments

The authors gratefully acknowledge Dr Sarah Potter for her input.

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Table 1a. Areas of chemical regulation stratified by level of government in Australia

Area / Tier of government	Industrial Chemicals	Agricultural and Veterinary Products	Therapeutic Goods	Food Products	Chemical Exposure Standards
Federal (Ministerial council)		SCoPI	SCoH	LGFFR	SCEW
Federal (Ministerial council support body)		PISC	AHMAC	FRSC	NEPC NEPCC
Federal (Minister responsible)	Health & Ageing	Agriculture, Fisheries & Forestry	Health & Ageing	Health & Ageing	
Federal (Secretariat)	DoHA	DAFF	DoHA	DoHA	NEPCSC
Federal (Main regulatory body and responsibility)	NICNAS (DoHA) Assess industrial chemicals and cosmetics	APVMA (Statutory Authority) Assess and register agricultural and veterinary chemicals and products. Adverse Experience Reporting Program and product recall function	TGA (DoHA) Assess and register medicines, ensuring quality, safety, efficacy and availability	FSANZ (Statutory Authority) Develop and maintain Food Standards Code. Assess chemicals in foods	NEPC (Statutory Council) Develop NEPMs. Assess and report on the effectiveness of NEPM implementation
State (regulatory responsibility)	Operationalise recommendations around industrial chemicals through poisons scheduling, environmental protection processes and in safety of consumer goods	Control use of pesticides and veterinary medicines beyond the point of retail sale through legislative initiatives, codes of practice manuals, or standard operating procedures	Determine place of purchase, packaging and labelling of drug or poison. State and territory governments classify the vast majority of drugs and poisons in accordance with the SUSMP	Investigate contaminated foods, enforce and interpret the Food Standards Code	Implement NEPMs
State Regulators					
NSW	NSW FT, NSW EPA, NSW Health	NSW EPA/DPI	NSW Health	NSW FA	NSW EPA
ACT	DJCS, ACT Health, ESD	ESD	ACT Health	ACT Health	ESD
NT	DJ CA, DH, NRETAS	DPIF	DH	DH	NRETAS
Qld	DJAG, Qld Health, DEHP	DAFF, Qld Health	Qld Health	Qld Health, SF Qld	DEHP
SA	CBS, SA Health, EPA SA	SA Health, PIR SA	SA Health	SA Health, PIR SA, DA SA	EPA SA
Tas	DoJ, DHHS, DPIPWE	DPIPWE	DHHS	DHHS, DPIPWE	DPIPWE
Vic	DoJ, DoH, EPA Victoria	DPI	DoH	DoH, PS Vic, DFS Vic	EPA Victoria
WA	DoC, DoH, DEC	DAF, DoH	DoH	DoH	DEC

See Table 2 for a list of acronyms used in this table.

Table 1b. Areas of chemical regulation stratified by level of government in Australia (continued)

Area / Tier of government	Defective Products	Acute Exposure	Transportation of Chemicals	Land Use Planning	Water
Federal (Ministerial council)	CAF	SCPEM, IGC-ACC, SCoH	SCOTI		SCEW
Federal (Ministerial council support body)	CAANZ	National Policing Senior Officers Group, National Emergency Management Committee, Intergovern-mental Committee on Drugs	Transport and Infrastructure Senior Officials' Committee		Senior Officers Committee
Federal (Minister responsible)	Assistant Treasurer	Attorney General, Home Affairs and Justice, Health & Ageing	Health & Ageing		Health & Ageing
Federal (Secretariat)	Treasury	Attorney Generals and DoHA	DTI		DSEWPC
Federal (Main regulatory body/ responsibility)	ACCC (Statutory Authority) Administer the *Competition & Consumer Act*. Ability to enforce or ban and develop standards	AFP, ACC, ACBPS Border protection and national coordination of crime prevention (illicit drugs and terrorism)	National Transport Commission Develop nationally consistent policies and regulation around transportation safety		NHMRC Foster the development of consistent health standards between the states and territories
State (regulatory responsibility)	Investigate, recall, interim ban and enforcement of defective or unsafe goods	Operational aspects of emergency management, drug enforcement and counter terrorism	Enforce legislation around the safe transportation of chemicals	Develop and enforce policies and regulations around land use in coordination with local government	Implement and enforce chemical requirements for drinking water
State Regulators					
NSW	NSW FT	MPES, NSW Police, NSW FB, NSW EPA, NSW Health, SES, RFS	NSW EPA & NSW WorkCover	NSW Planning and Infrastructure, NSW EPA	NSW Health
ACT	DJCS	ACT ESA, AFP, ACT Health	WorkSafe ACT	ESD	ACT Health
NT	DJ CA	NT PFES, DH, NT Worksafe	NT Worksafe	DLPE, NRETAS	DH
Qld	DJAG	DCS, Qld Police, Qld Health	DTMR	DSDIP, DEHP	DEHP
SA	CBS	SA MFS, SA CFS, SA Police, SA Health, EPA SA	SafeWork SA	DoPLG, EPA SA	SA Health
Tas	DoJ	DPEM, DHHS	WorkCover Tasmania	TPC, DPIPWE	DHHS
Vic	DoJ	OESC, Vic Police, DoH	WorkSafe Victoria	DPCD, EPA Victoria	DHS
WA	DoC	FESA WA, WA Police, DoH	DMP	Planning WA, DEC, DoH	DoH, ERA, DoW

See Table 2 for a list of acronyms used in this table.

Table 2. List of acronyms used in this paper

Federal Acronym	Name
ACCS	Advisory Committee on Chemicals Scheduling
ACMS	Advisory Committee on Medicines Scheduling
ACC	Australian Crime Commission
ACCC	Australian Competition and Consumer Commission
ACBPS	Australian Customs and Border Protection Service
AFP	Australian Federal Police
AHMAC	Australian Health Ministers' Advisory Council
AHPPC	Australian Health Protection Principal Committee
APVMA	Australian Pesticides and Veterinary Medicines Authority
AQIS	Australian Quarantine and Inspection Service
ARTG	Australian Register of Therapeutic Goods
CAANZ	Consumer Affairs Australia New Zealand
CAF	Legislative and Governance Forum on Consumer Affairs
DAFF	Department of Agriculture, Fisheries and Forestry
DoHA	Department of Health and Ageing
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
DTI	Department of Transport and Infrastructure
enHealth	Environmental Health Committee
FRSC	Food Regulation Standing Committee
FSANZ	Food Standards Australia New Zealand
IGC-ACC	Inter-Governmental Committee of the Australian Crime Commission
ISC	Implementation Sub-Committee
LGFFR	Legislative and Governance Forum on Food Regulation
NASPT	National Agvet System Policy Taskforce
NCCTG	National Coordinating Committee on Therapeutic Goods
NChEM WG	National Chemicals Environmental Management Working Group
NEPC	National Environment Protection Council
NEPCC	National Environment Protection Council Committee
NEPCSC	National Environment Protection Council Service Corporation
NEPMs	National Environment Protection Measures
NEPM WG	National Environment Protection Measures Working Group
NHEMS	National Health Emergency Management Subcommittee
NHMRC	National Health and Medical Research Council
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NTC	National Transport Commission
OCS	Office of Chemical Safety
PISC	Primary Industries Standing Committee
PS	Parliamentary Secretary for Health and Ageing
PSCC	Product Safety Consultative Committee
SCOC	Standing Committee on Chemicals
SCEW	Standing Council on Environment and Water
SCoH	Standing Council on Health
SCPEM	Standing Council on Police and Emergency Management
SCoPI	Standing Council on Primary Industries
SCOTI	Standing Council on Transport and Infrastructure
SPF	Scheduling Policy Framework
SUSMP	Standard for the Uniform Scheduling of Medicines and Poisons
TGA	Therapeutic Goods Administration
State Acronym	**Name**
New South Wales (NSW)	
DPI	Department of Primary Industries
MPES	Ministry for Police and Emergency Services
NSW EPA	NSW Environment Protection Authority
NSW FA	NSW Food Authority

(*Continued*)

Table 2. (Continued)

State Acronym	Name
NSW FB	NSW Fire Brigade
NSW FT	NSW Fair Trading
RFS	Rural Fire Service
SES	State Emergency Service
Australian Capital Territory (ACT)	
ACT ESA	ACT Emergency Services Agency
DJCS	Department of Justice and Community Safety – Office of Regulatory Services
ESD	Environment and Sustainable Development
Northern Territory (NT)	
DH	Department of Health
DJ CA	Department of Justice – Consumer Affairs
DLPE	Department of Lands, Planning and the Environment
DPIF	Department of Primary Industry and Fisheries
NRETAS	Department of Natural Resources, Environment, the Arts and Sport
NT PFES	Northern Territory Police, Fire and Emergency Services
Queensland (Qld)	
DAFF	Department of Agriculture, Fisheries and Forestry
DCS	Department of Community Safety
DEHP	Department of Environment and Heritage Protection
DJAG	Department of Justice and Attorney General – Office of Fair Trading
DSDIP	Department of State Development, Infrastructure and Planning
DTMR	Department of Transport and Main Roads
SF Qld	Safe Food Queensland
South Australia (SA)	
CBS	Consumer and Business Services
DA SA	Dairy Authority South Australia
DoPLG	Department of Planning and Local Government
EPA SA	Environmental Protection Authority South Australia
PIR SA	Department of Primary Industry and Regions South Australia
SA CFS	South Australian Country Fire Service
SA Health	South Australian Health
SA MFS	South Australian Metropolitan Fire Service
Tasmania (Tas)	
DHHS	Department of Health and Human Services
DoJ	Department of Justice – Consumer Affairs and Fair Trading
DPEM	Department of Police and Emergency Management
DPIPWE	Department of Primary Industries, Parks, Water and Environment
TPC	Tasmanian Planning Commission
Victoria (Vic)	
DFS Vic	Dairy Food Safety Victoria
DoH	Department of Health
DoJ	Department of Justice – Consumer Affairs Victoria
DPCD	Department of Planning and Community Development
DPI	Department of Primary Industries
DHS	Department of Human Services
EPA Victoria	Environment Protection Authority Victoria
OESC	Office of Emergency Services Commissioner
PS Vic	PrimeSafe Victoria
Western Australia (WA)	
DAF	Department of Agriculture and Food
DEC	Department of Environment and Conservation
DoC	Department of Commerce – Consumer Protection
DoH	Department of Health
DoW	Department of Water
DMP	Department of Mines and Petroleum
ERA	Economic Regulation Authority
FESA WA	Fire and Emergency Services Authority of Western Australia

Trends in notifiable blood lead levels in NSW, 1998–2008

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Abstract: Aim: In the absence of published statewide notification data, the aim of this study was to analyse trends in notifiable blood lead levels (hereafter referred to as lead poisoning) in NSW from 1998 to 2008, to help inform lead poisoning notification policy. **Methods:** NSW blood lead poisoning notification data for 1998–2008 were extracted from the Notifiable Diseases Database and analysed by age, gender and Area Health Service of residence. **Results:** There were 6000 lead poisoning notifications from 1998 to 2008, with an average annual notification rate of 11.8 per 100 000 population for 1998–2003. This rate declined to an average of 4.0 per 100 000 population in the period 2004–2008. Males accounted for 92% of notifications, and males aged 20–59 years had average notification rates between 20 and 27 per 100 000 population. Children aged 0–4 years had notification rates of 9.3 per 100 000 population in girls and 13.6 per 100 000 population in boys. **Conclusion:** Notification rates have fallen dramatically, however children aged 0–4 years and men are disproportionately represented in lead poisoning notifications.

Lead is a naturally occurring mineral found within the Earth's crust in many parts of the world.[1] Lead poisoning occuring after exposure to lead has been of public health importance worldwide for centuries.[2] In 2009 the Australian National Health and Medical Research Council made a public statement that there is no safe level of lead exposure, and recommended that all Australians have blood lead levels less than 10 µg/dL.[3]

The routes of lead exposure include ingestion, inhalation and skin contact. Once lead is absorbed into the bloodstream it spreads throughout the body, where it can affect the nervous, haematopoietic, endocrine, renal, skeletal and reproductive systems.[1,4] The potential health outcomes from lead poisoning vary between individuals and are due to the route of exposure, the dose absorbed, the duration of exposure and the person's age.[1,3,4] Children and pregnant women are considered the most sensitive to lead exposure; children absorb 40–70% of ingested lead compared to 10–20% in adults,[5] while women exposed before or during pregnancy transfer lead to the foetus via the placenta, and after pregnancy to the infant in breastmilk.[3]

Acute lead poisoning occurs at blood lead levels of 70 µg/dL or higher, and is considered a clinical emergency.[3] At these levels, signs and symptoms range from stomach pain and vomiting to encephalopathy and death. The long-term consequences of exposures in children include reduction in intellectual development even when blood lead levels are less than 10 µg/dL.[6] Treatment for lead poisoning is limited to the use of chelating agents that bind to lead in the blood and assist excretion in urine. Chelating agents can be used in adults with levels above 50 µg/dL,[7] whereas chelation in children with levels less than 45 µg/dL does not improve long-term behavioural or cognitive outcomes.[8] There is also concern that chelation therapy will redistribute lead to susceptible organs, including the brain, where it may be reabsorbed.[9]

Lead mining and smelter activities that cause lead-rich emissions to be blown into residential areas and deposited as dust in and around houses and gardens are the most common sources of contamination of human environments.[1] In the past lead was used in applications including face powders, and for preserving wine,[2] while more recently lead and lead alloys have been used in everyday products such as paint, car batteries and plastic coatings.[3] In Australia, lead was added to petrol to improve engine combustion performance from the 1930s until 2002, despite public health concerns about lead exposure.[10] The use of leaded petrol resulted in widespread contamination of dust and soil in urban and industrial areas, causing increased blood lead levels in people exposed, particularly children.[11] Improved awareness about the

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effects of lead and the introduction of legislation in Australia has resulted in the reduction and removal of lead from car fuels and paints.[12,13]

In New South Wales (NSW) active screening for lead poisoning has been conducted for children and for workers exposed to lead since the early 1990s. In December 2011, the mandatory notification of blood lead concentrations 15 µg/dL or above was changed, under the *NSW Public Health Act 1991**, to the lower level of 10 µg/dL or above.[14]

The aim of this study was to describe trends in notifications of lead poisoning in NSW from 1998 to 2008 to help inform public health policy.

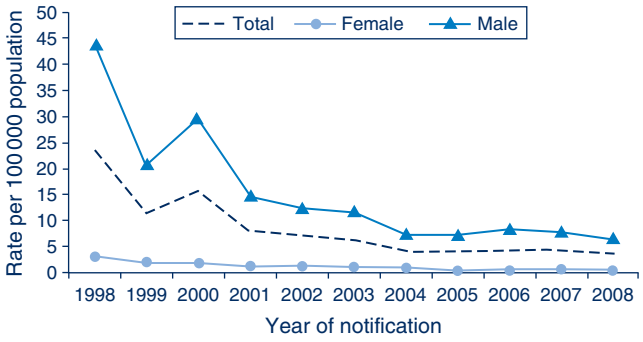

Figure 1. Annual lead poisoning notification rates per 100 000 population, for males and females, NSW, 1998–2008.
Source: Notifiable Diseases Database (since 2010, the Notifiable Conditions Information Management System), NSW Ministry of Health.

Methods

In NSW the notification of lead poisoning is mandatory for hospitals, clinicians and laboratories. Notifications are based on the results of a confirmatory venous blood sample to determine the lead concentration, which is measured in micrograms per decilitre (µg/dL). Between 1998 and 2008, a blood lead concentration of 15 µg/dL or more was classified as lead poisoning and was notifiable to the then NSW Department of Health.[15] Notified cases were then investigated by local public health units.[16] The investigating public health unit staff entered demographic information and blood lead levels of the cases into the Notifiable Diseases Database (NDD), which was used for the collection of notifiable disease case information in NSW until the implementation of the Notifiable Conditions Information Management System in 2010. Data from active surveillance programs conducted in occupational settings and child blood lead screening programs were included in routine NDD data. Active surveillance programs included blood lead screening in children in the north Lake Macquarie area from 1993 to 2006, and continuous surveillance in children in Broken Hill since 1991.

All notifications of lead poisoning in NSW for the period 1998–2008 were extracted from the NDD using the Health Outcomes Information Statistical Toolkit (HOIST). The data were analysed using SAS® (version 9.1.3, SAS Institute, Cary, NC, USA) and Microsoft Excel. Population estimates were obtained from the Australian Bureau of Statistics. Due to changes in Area Health Service boundaries, area of residence was defined by the NSW Health pre-2005 (former) Area Health Services ($n = 17$).

As a major source of lead notifications ceased operation in 2003, analysis by time period was divided into time period 1 (1998–2003) and time period 2 (2004–2008). Data were analysed by gender, age group, (former) Area Health Service, blood lead concentration and occupation. Occupational variables were identified from a predetermined list in the NDD; some of these served as a proxy for sources of lead exposure (e.g. lead smelter worker or miner).

Results

There were 6000 lead poisoning notifications in NSW for the period 1998–2008, with an average annual notification rate of 8.2 per 100 000 population. The highest annual notification rate was in 1998 (23.0 per 100 000 population, $n = 1400$). Notification rates declined each year, with the exception of 2000 (Figure 1).

Gender and age

Males accounted for 92% ($n = 5538$) of all notifications with a notification rate of 15.2 per 100 000 population for the period 1998–2008. The highest notification rate for males was 43.0 per 100 000 population in 1998; by 2004, annual notification rates in males had decreased to below 10.0 per 100 000 population (Figure 1). For females, the notification rate began at below 5.0 per 100 000 population in 1998 and steadily declined to below 1.0 per 100 000 population in 2008 (Figure 1).

People notified with lead poisoning between 1998 and 2008 ranged in age from 0 to 87 years. Men aged 25–34 had the highest notification rate of 27.1 per 100 000 population, while the lowest notification rates were in 10–14-year old boys and girls. The gender differences become more noticeable at 15 years of age (Figure 2). Seventy-eight percent of notifications ($n = 4701$) were observed in men aged 20–59 years, who had an annual notification rate of almost 70.0 per 100 000 population in 1998, which declined to 10.0 per 100 000 population in 2004.

The 0–4-year age group accounted for 9.3% of notifications ($n = 559$), of which 60% were in boys. The notification rate in girls aged 0–4 years was 9.3 per 100 000 population, and for the same age group of boys, 13.6 per 100 000 population (Figure 2). The highest annual

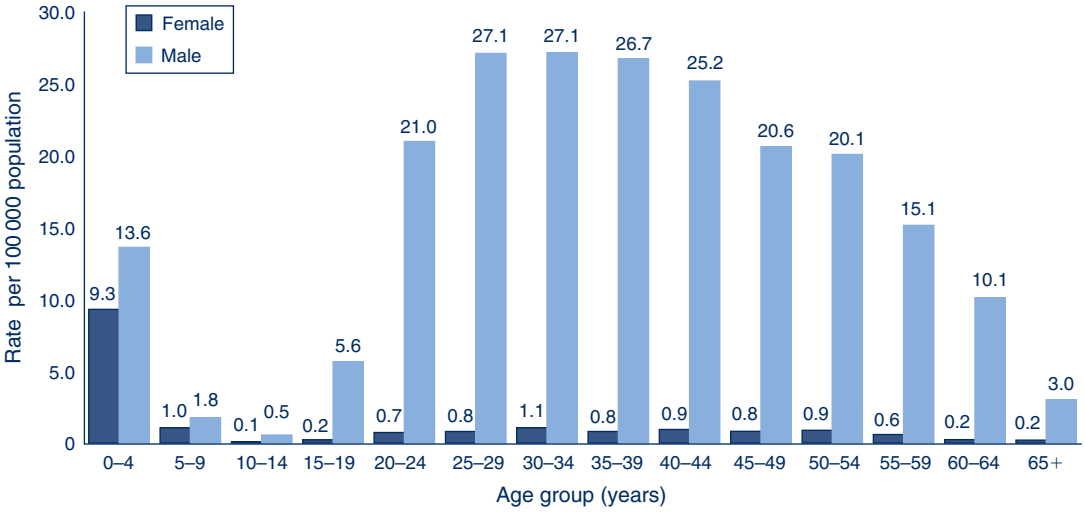

Figure 2. Average annual lead poisoning notification rates per 100 000 population, for males and females and by age group, NSW, 1998–2008.
Source: Notifiable Diseases Database (since 2010, the Notifiable Conditions Information Management System), NSW Ministry of Health.

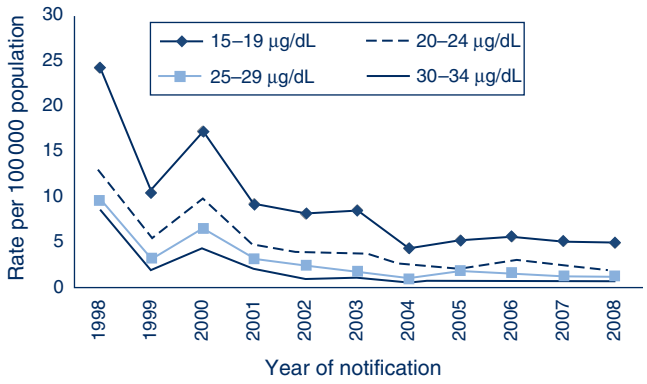

Figure 3. Annual lead poisoning notification rates per 100 000 population for four blood lead concentrations, in men aged 20–59 years, NSW, 1998–2008.
Source: Notifiable Diseases Database (since 2010, the Notifiable Conditions Information Management System), NSW Ministry of Health.

notification rate for boys aged 0–4 years was 30.0 per 100 000 population in 1999.

Blood lead concentrations

Blood lead concentrations were recorded for 96.6% ($n = 5795$) of notifications. Forty-three percent ($n = 2503$) of blood lead concentrations were in the lowest notifiable range (15–19 µg/dL), while 54% ($n = 3011$) were in the 20–49 µg/dL range, 2% ($n = 125$) were in the 50–69 µg/dL range, and 1% ($n = 56$) were 70 µg/dL or above. Figure 3 shows a further breakdown of notification rates by year, stratified by blood lead concentrations, in men aged 20–59 years, and demonstrates the downward trend in notification rates of blood lead concentrations in all years except 2000.

Geographic distribution of notifications

Sixty-two percent ($n = 3732$) of lead poisoning notifications were in locations outside of Sydney. The highest notification rates in 1998–2003 were 227.4 per 100 000 population in the former Far West Area Health Service, and 52.1 per 100 000 population in the former Hunter Area Health Service (Table 1). Over the period of analysis, lead poisoning notifications declined by 50% or greater in most Area Health Services: the former Macquarie Area Health Service increased by 230%, and the former Mid West Area Health Service increased by 39% (Table 1). From 1998 to 2008, 68.9% of lead poisoning notifications in children aged 0–4 years were in the former Far West Area Health Service which had a notification rate of 104.5 per 10 000 population. The former Hunter Area Health Service accounted for 14% (1.9 per 10 000 population), while 12.3% of notifications in the 0–4-year age group were from Sydney (0.24 per 10 000 population).

Occupation

Occupational information was recorded for 37% of all adult notifications. Women had occupation recorded in 10% ($n = 29$) of cases, while 40% of men had occupation recorded. Occupations with the highest proportions of notifications were lead smelter employees (37%; $n = 735$) and miners (23%; $n = 453$). For the period 1998–2002 (with the exception of 1999), smelter workers had the highest frequency of notifications, after which (with the exception of 2005) miners had the highest number of notifications (Figure 4). Other occupational categories identified with high notification rates included contractors (13%) and factory workers (10%).

Table 1. Average annual lead poisoning notifications and rates per 100 000 population, in NSW, by former Area Health Service (AHS), categorised by two time periods (TP1: 1998–2003 and TP2: 2004–2008) and the percentage reduction in notifications between time periods

Area Health Service of residence	1998–2003			2004–2008			Total	% change TP 1–TP 2
	n	Rate	% Male	*n*	Rate	% Male		
Central Coast	70	4.0	87	26	1.7	100	96	-63
Central Sydney	240	8.2	84	70	2.7	90	310	-71
Far West	664	227.4	76	80	35.4	63	744	-89
Greater Murray	42	2.7	95	27	2.0	89	69	-36
Hunter	1713	52.1	96	224	7.7	94	1937	-87
Illawarra	197	9.3	98	58	3.1	97	255	-71
Macquarie	72	11.5	99	240	46.4	96	312	+230
Mid North Coast	35	2.2	91	9	0.6	78	44	-74
Mid West	33	3.2	94	46	5.3	87	79	+39
New England	45	4.2	96	13	1.5	100	58	-71
Northern Rivers	57	3.6	86	30	2.1	77	87	-47
Northern Sydney	129	2.8	92	48	1.2	98	177	-63
South Eastern Sydney	153	3.3	90	79	2.0	97	232	-48
South Western Sydney	578	12.3	97	172	4.2	99	750	-70
Southern	27	2.4	93	22	2.1	95	49	-19
Wentworth	126	6.7	94	62	3.9	94	188	-51
Western Sydney	432	10.3	96	144	3.8	94	576	-67
Overseas	1	–	100	1	–	100	2	–
Not stated	12	–	83	23	–	96	35	–
Total	4626	11.8	92	1374	4	93	6000	-70

Analysis was divided into TP1: 1998–2003 and TP2: 2004–2008 because in 2003 a major source of lead notifications ceased operation.
Source: Notifiable Diseases Database (since 2010, the Notifiable Conditions Information Management System), NSW Ministry of Health.

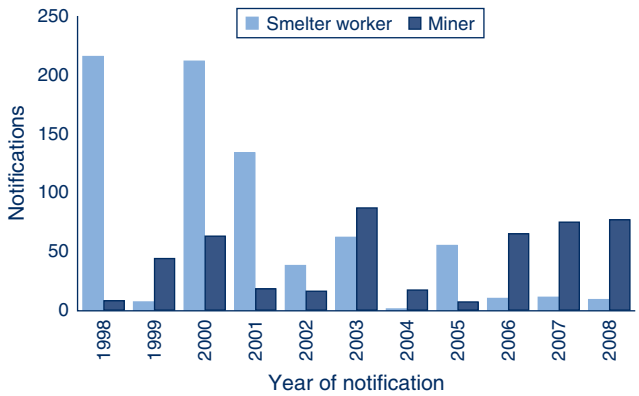

Figure 4. Annual notifications of lead poisoning in lead smelter workers and miners, NSW, 1998–2008.
Source: Notifiable Diseases Database (since 2010, the Notifiable Conditions Information Management System), NSW Ministry of Health.

Discussion

There was a 70% reduction in lead poisoning notifications in NSW from 1998 to 2008, with fewer than 250 notifications each year since 2004. Men of working age and children aged 0–4 years are disproportionately represented in lead poisoning notifications, with rates among men more than three times higher than among women. Populations in the former Far West, Hunter and Macquarie Area Health Services of NSW had the highest notification rates for lead poisoning.

The interpretation of this study is limited by data quality, with more than half of adult cases missing occupational data. Because the source of lead exposure was not available, occupation was used as a proxy for the source of exposure. In future, a review of case files from lead poisoning investigations and the recent inclusion of a variable for exposure site in the new notification data management system will help describe sources, without the need to use proxies. There is also likely to be a selection bias due to active surveillance programs, and greater awareness of public health practitioners in geographical areas, age groups and occupations at high risk. Screening has been important for understanding the epidemiology of lead exposure, because the acute symptoms of lead poisoning are not present at lower blood lead concentrations.[1,3] However, the likely selection bias for children and men means that women will tend to be under-represented in notification data. The reporting of more robust

information about testing, including the reason for testing (i.e. occupational vs. childhood screening or clinical suspicion) would help clarify the extent of this selection bias.

Notification rates of lead poisoning in NSW have been linked to occupational activities. For more than 100 years, mining and, formerly, smelting, have occurred in Broken Hill (former Far West Area Health Service),[17] and smelting has occurred in the north Lake Macquarie area (former Hunter Area Health Service).[18] There are marked differences in the ages of notified cases in these two locations. In the former Hunter Area Health Service, 90% of cases were in adults aged 20–59 years, whilst in the former Far West Area Health Service, children aged 0–4 years accounted for 52% ($n = 385$) of notified cases. In comparison, the former Hunter Area Health Service had 4% ($n = 78$) of notifications in the 0–4-year age group. An explanation for this difference is the location of Broken Hill city, which is in the immediate vicinity of the active mine site with above ground historical waste disposal, and regional soils that have natural lead deposits. These sources produce ongoing exposure from lead-laden dust in and around houses where children play.[19]

Occupational exposures are also likely to account for the differences in notification rates between men and women which became more evident from the age of 15 years. In the former Hunter Area Health Service, lead poisoning notifications reduced following the closure of the Lake Macquarie smelter in 2003.[20] Increased lead mining activity in the former Macquarie Area Health Service (Cobar) since 2003[21] has resulted in miners being the most frequently notified occupation. Other occupations and hobbies that have been associated with lead exposures include battery making and recycling, soldering, stained glass manufacture and lead-based paint abatement.[3,22]

Since 1991 the blood lead screening of children in Broken Hill has underpinned education and risk reduction interventions provided to individuals and their families.[23,24] These interventions resulted in almost 75% of children aged 1–4 years recording blood lead levels below 10 µg/dL by 2007.[25] In the north Lake Macquarie area, the positive influence of public health action allowed active surveillance to stop after mean blood lead levels in children decreased to less than 5 µg/dL in 2006,[18] 3 years after the closure of the smelter.

From December 2011, the notifiable blood lead level in NSW has been reduced to 10 µg/dL in line with the current National Health and Medical Research Council recommendation.[3] A review conducted by the Centers for Disease Control and Prevention in the United States concluded that there is sufficient evidence for adverse health effects in children and adults at blood lead concentrations below 5 µg/dL.[26] Both of these recommendations have implications for public health policy and practice in NSW.

Conclusion

Active surveillance practices for lead poisoning in NSW have enhanced our knowledge of this condition, particularly in the former Hunter and Far West Area Health Services. Encouragingly, a large reduction in notifications and the concentrations of blood lead samples was observed from 1998 to 2008. Despite these reductions, there remains an over-representation of children and miners in more recent years of analysis. Importantly, these findings support ongoing primary prevention, improved surveillance measures and the mandatory notification of lead poisoning, which remain essential to addressing lead poisoning in NSW.

Acknowledgment

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*The *Public Health Act 2010* (NSW) (http://www.health.nsw.gov.au/phact/)
The *Public Health Act 2010* (NSW) was passed by the NSW Parliament in December 2010 and commenced on 1 September 2012. The Public Health Regulation 2012 was approved in July 2012 and commenced, along with the *Public Health Act 2010* (NSW), on 1 September 2012. The objectives of the Regulation are to support the smooth operation of the Act. The Act carries over many of the provisions of the *Public Health Act 1991* (NSW) while also including a range of new provisions.

Improving participation by Aboriginal children in blood lead screening services in Broken Hill, NSW

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Abstract: Lead poses a health risk to young children with detrimental effects on their intellectual development. Attendance rates for Aboriginal children at routine blood lead screening and at follow-up appointments in Broken Hill, NSW, have declined in recent years. This study sought to identify strategies to improve the participation of Aboriginal children aged 1–4 years in blood lead screening services in Broken Hill. **Methods:** Attendance rates during the period 2000–2010 were determined using the Broken Hill Lead Management database. From June to August 2011, Aboriginal community members, service providers and public health staff were invited to interviews and focus groups to explore barriers, enablers and suggestions for improving participation. **Results:** In 2009, 27% of Aboriginal children aged 1–4 years attended blood lead screening and 29% of these children with blood lead levels over 15 µg/dL attended follow-up appointments. Barriers to participation in lead screening services included community perceptions, reduced service capacity, socio-economic and interorganisational factors. Enablers included using a culturally acceptable model, linking lead screening with routine health checks and using the finger-prick method of testing. **Conclusions:** The final report for the study included recommendations to improve participation rates of Aboriginal children including using social marketing, formalising collaboration between health services, supporting disadvantaged families and employing an Aboriginal Health Worker.

Exposure to lead poses a health risk particularly to young children with detrimental effects on their intellectual development.[1] The mining town of Broken Hill, New South Wales (NSW), was built around one of the world's largest silver-lead-zinc ore deposits and has been mined continuously since 1884. In 1991 a survey of pre-school aged children in Broken Hill found lead was a significant public health issue; a state government-funded Lead Management Program was established in 1994 to reduce blood lead levels in children aged 1–4 years.[2] The program which included blood lead screening began as an adequately resourced, stand-alone service until 2001, when it was integrated into existing child health services and its dedicated funding finished at the end of 2006. Services are currently offered by the Broken Hill Child and Family Health Services and Maari Ma Health Aboriginal Corporation (Maari Ma). In 2004, 80% of Aboriginal children attended screening services. After 2004 attendance rates for Aboriginal children began declining and reached a low of 27% in 2009, below that of the general population (37%).[3]

There is no known threshold defining 'safe' levels of exposure to lead, but the National Health and Medical Research Council currently recommends interventions at a community level when appreciable numbers of children have blood lead levels exceeding 10 µg/dL.[1] Forty percent of Aboriginal children aged 1–4 years screened in 2010 were above 10 µg/dL.[3] Blood lead levels 15 µg/dL and above are notifiable to NSW Health.* In 2010, 21% of Aboriginal children screened had blood lead levels requiring notification.[3] Aboriginal people continue to experience socio-economic disadvantage which places them at greater risk of exposure to behavioural and environmental health risk factors,[4] and this should be taken into consideration in the planning and provision of relevant services.

In 2011, we undertook a study to gain a better understanding of the decline in screening rates in Aboriginal children aged 1–4 years and to identify strategies to improve their participation in blood lead screening services in Broken Hill. The study was undertaken on behalf of the Far West Local Health District.

*In December 2011, the mandatory notification level changed to 10 µg/dL or above.

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Table 1. Number and type of participants in interviews and focus groups undertaken in Broken Hill, NSW, 2011

	Interviews *n*	Focus groups *n*	Focus group participants *n*
Community members	15	0	0
Broken Hill Child and Family Health Services	1	1	4
Maari Ma Health Aboriginal Corporation	2	1	4
Broken Hill University Department of Rural Health	0	1	3
Total	18	3	11

Methods

The study took place in two phases. The first involved reviewing data from the Broken Hill Lead Management Program, set up as part of the original lead program to record children's test results. The second phase used qualitative methods to explore emerging themes.[5] Semi-structured interviews and focus groups with Aboriginal parents and carers of young children, service providers and public health staff were used to gain a better understanding of:

- the perceptions of the health risks of lead for children
- the reason for the downward trend in Aboriginal children's attendance at screening programs
- how these declining attendance rates might be improved.

Broken Hill Lead Management database

De-identified data from the Broken Hill Lead Management database from 2000 to 2010 were reviewed. Records for Aboriginal children aged 1–4 years of age were extracted. Duplicates and those with missing blood lead values were excluded, leaving a data set of 864. Attendance rates for annual screening were calculated for children recorded as having attended blood lead screening at least once in a calendar year. Australian Bureau of Statistics Census data for 2001 and 2006 were used to calculate screening rates.[6] Attendance rates for follow-up visits by children whose blood lead levels were 15 µg/dL and above from 2004 to 2010 were also calculated.

Lead Health Program Testing Schedule

Attendance at follow-up appointments was measured against the protocol outlined in the Lead Health Program Testing Schedule and Interventions (available on request from Broken Hill Child and Family Health Services). Children were grouped according to whether or not their follow-up visits were in accordance with recommendations in the protocol. Children with a blood lead level between 11 and 20 µg/dL are requested to return at 6-month intervals for follow-up testing. Children with levels between 21 and 39 µg/dL are requested to return at 3-month intervals and those with levels 40–49 µg/dL at 1-month intervals. Case management including education and home assessment to identify the pathway of lead ingestion is offered to all families of children with blood lead levels over 10 µg/dL.

Interviews and focus groups

Participants with a range of relevant experience, skills and knowledge were invited to interviews and focus groups (Table 1). Aboriginal parents or carers of young children were invited to informal interviews at an Aboriginal preschool and an Aboriginal playgroup. Interviews were conducted while participants were involved in the routine functions of the centre (e.g. playing with children, helping with morning tea). Service managers were invited to individual interviews in order to explore planning and management strategies. Two interviews were conducted at their place of work and one was by telephone. Three focus groups were conducted with health professionals to facilitate discussion and the exchange of ideas and to reflect on blood lead screening services for Aboriginal families. Participants included lead screening staff, a health promotion officer, an early childhood health nurse, a practice nurse, research staff and an epidemiologist.

Interviews with community members lasted approximately 10 minutes while other interviews and focus groups were 40–60 minutes. Informed consent was obtained from all participants. Confidentiality and privacy were ensured as contributions used in the report were de-identified. Interviews were sound recorded (with the exception of interviews with community members where written records were taken), transcribed, and analysed manually to identify barriers, enablers and strategies. The study investigators verified the resultant material.

Ethics approval was obtained from the former Greater Western Area Health Service Human Research Ethics Committee (HREC /11/GWAHS/4) and from the Aboriginal Health and Medical Research Council of NSW (AHMRC, 771/11).

Results

Attendance rates at blood lead screening services for Aboriginal children aged 1–4 years increased steadily from 55% in 2000 to 80% in 2004. From 2005 attendance rates gradually declined and reached a low of 27% in 2009. The screening rate began to improve in 2010, increasing to 39% (Table 2).

Table 2. Number and estimated percentage of Aboriginal children aged 1–4 years, screened at least once for blood lead levels in Broken Hill, NSW, 2000–2010

Year	Aboriginal children screened *n*	Estimated Aboriginal population *n*	%
2000	75	137	55
2001	85	137	62
2002	96	137	70
2003	98	137	72
2004	110	137	80
2005	97	137	71
2006	71	144	49
2007	81	144	56
2008	56	144	39
2009	39	144	27
2010	56	144	39

Sources: Broken Hill Lead Management database; 2001 and 2006 Australian Bureau of Statistics Census data.

Table 3. Number and percentage of Aboriginal children aged 1–4 years with blood lead levels 15 µg/dL or more who attended follow-up appointments in Broken Hill, NSW, 2004–2010

Year	Blood lead level ≥15 µg/dL *n*	Follow-up attendance *n*	Percentage followed-up %
2004	33	26	79
2005	22	11	50
2006	20	8	40
2007	19	9	47
2008	12	5	42
2009	7	2	29
2010*	12	4	33

*2010 contains some missing data for follow-up due in 2011
Source: Broken Hill Lead Management database.

Follow-up rates for Aboriginal children aged 1–4 years whose blood lead levels were 15 µg/dL and above have declined from 2004 when 79% attended follow-up appointments. In 2009, 29% returned for follow-up and in 2010, 33% returned (Table 3).

The findings from the interviews and focus groups were grouped into common themes to identify why Aboriginal children's attendance at screening programs was declining and how attendance might be improved: barriers, enablers and strategies.

Barriers

Community members generally agreed that health risks and the importance of screening were not well promoted. Many participants recalled risks related to learning and intellectual development but had forgotten health messages about ways to reduce the risk of lead ingestion. Many referred to the fact that there was no practical or financial help for affected families to act on recommendations by health staff (e.g. fixing cracks in ceilings, planting grass over dirt yards) and that this lack of support was a significant barrier to attending screening services. Some community members commented that there were other more important priorities for many families.

Service providers described barriers related to service capacity and funding for key positions. Most agreed that community perceptions were a significant factor in preventing uptake of health services for Aboriginal children:

> *People don't see lead as a health issue anymore because we're not telling them it's a health issue.* (Focus group)

> *There was an Aboriginal Health Worker that worked with our program. That was a fantastic way to identify and communicate the lead problem with the Aboriginal community. Unfortunately that position no longer exists.* (Focus group)

There was wide agreement among service providers that socio-economic barriers needed to be acknowledged and were factors contributing to the decline in attendance at screening services. Service providers commented that families felt there was nothing that could be done to help them if their child had elevated blood lead levels:

> *…..[families with limited resources are] living in rental houses, landlords are not going to plant lawn, they're not going to clean the ceilings out, they're not going to help them so there is a …this is the best I can do…I can keep my kids' hands clean, I can keep my house clean, but when you're living in a house and the dust is coming through the roof, the dust storms are coming through the house, how do you do it?* (Focus group)

Service providers also discussed gaps in communication between health services, including no formal meetings to share information or discuss issues related to declining attendance rates and strategies. Some service providers and managers were not aware of information available from the Lead Management database. That services did not share case management of Aboriginal children with high lead levels or do joint home visits were raised as issues for Aboriginal families.

Enablers

Many community members recalled the special lead screening days held at Maari Ma and felt that these encouraged families to come for their children's screening. They also felt that using the finger-prick testing method and assisting with transport to the centre encouraged the community to bring their children for screening.

Service providers described enabling factors related to service capacity: providing the lead screening service within a model of care that was culturally acceptable to the Aboriginal community and providing verbal information, as opposed to telephone reminders or letters, with face-to-face communication, home visiting, flexible screening times and culturally appropriate resource materials.

> *One of the best things we did was organise the intake of 11 trainee health workers for the Certificate IV [in Aboriginal and/or Torres Strait Islander Primary Health Care]. So the engagement of people around the community has been far, far greater. And the workforce is very mobile; they're very community based as well.* (Focus group)

> *The first people they see are Aboriginal people, the next line of people they see are Aboriginal people and so, Aboriginal Health in Aboriginal Hands, there's nothing works better.* (Service manager)

There was wide agreement among service providers and public health staff that linking lead screening with other services such as immunisation and child development checks was proving to be successful in increasing attendance.

Suggestions for action

Many community members wanted to see health messages relating to lead promoted in the community. Most spoke fondly of the old lead mascot 'Lead Ted' and would like to see a return of the specific lead screening days held at Maari Ma.

Service providers agreed that more funding, even if not to health directly, would be helpful in re-engaging with the community in a variety of ways including assisting those in financial need. Further expansion of services at Maari Ma was also seen as important, including ongoing or additional training so that staff could provide case management as well as screening services. Some felt that better use of the Lead Management database would help service providers identify and respond to declining attendance rates for screening of lead in Aboriginal children.

Public health staff were in agreement with the other service providers in terms of barriers and enablers to lead screening. They felt it was important to re-engage with the community, perhaps through the Aboriginal Community Working Party in Broken Hill, to increase confidence that help was available for children with high lead levels.

Discussion

This study shows a steady increase in screening rates for Aboriginal children from 2000 to 2004 despite declining investment in lead awareness and the Lead Management Program's integration into existing health services. The screening rate for Aboriginal children was high in 2004 (80%) after which it declined. Two factors that may explain the high attendance rates at this time were the special days for lead screening that were taking place at Maari Ma and the role of an Aboriginal Health Worker employed by Child and Family Health Services to identify Aboriginal children who were due for a blood lead test and to encourage and assist families to bring those children to the centre. After 2004 dedicated resources ceased and as a consequence both the position of Aboriginal Health Worker and the special lead screening days at Maari Ma ended. Attendance rates began to decline in annual screening and follow-up. The rates of testing and follow-up were lowest in 2009 when Maari Ma experienced a decline in workforce capacity. The low rates of follow-up are of concern as they indicate that even children with elevated blood lead levels are not engaging with the available services offered through case management, including education, home visiting, soil sampling and further monitoring of blood lead levels. Attendance and follow-up rates for Aboriginal children increased slightly in 2010, since Maari Ma has begun offering finger-prick testing.

Maari Ma, which now screens the majority of Aboriginal children in Broken Hill, identified logistical barriers to the participation by Aboriginal children in lead screening services related to workforce capacity, the physical space currently available and the difficulty of ensuring the correct environment to conduct the test (e.g. room temperature, dust-free). A new facility is being built and Maari Ma has recently supported a cohort of Certificate IV Aboriginal and Torres Strait Islander Primary Health students, which will help to address these barriers. Some Aboriginal families were not comfortable engaging with government services, an important barrier to health screening as it is the government services which currently provide comprehensive case management of children with elevated blood lead levels. Staff at Maari Ma were concerned that some Aboriginal families have felt judged by government health services and feared having their children removed, particularly when a home visit was recommended.

In terms of improving current participation rates, Maari Ma staff described issues related to service capacity such as having the right people in the right positions with the right training, and issues related to their service model such as face-to-face communication, home visiting to follow-up those who did not attend appointments and providing transport to assist families. This approach suggests that using a culturally appropriate model, combined with other strategies aimed at community engagement are likely to be successful in improving blood lead screening rates for Aboriginal children aged 1–4 years.

Community members expressed concern over the difficulty or inconvenience for some people to prove their Aboriginal status to access Maari Ma health services. There was also some concern that as the Aboriginal community in Broken Hill is small some patients may have a personal relationship with service providers, which may discourage them from using the service. While access to an Aboriginal Community Controlled Heath Service (ACCHS) is important and provides a culturally appropriate and safe environment for families, it is also important for people to have a choice of services.

Recommendations were developed from the findings and from discussions with stakeholders involved in lead management services in Broken Hill and are included in a report prepared for the Far West Local Health District. These recommendations focus on re-engaging with the Aboriginal community to develop and implement programs to promote lead screening, formalising relationships between government and ACCHSs at both the local and regional level, seeking funding to assist disadvantaged families, linking lead screening with routine health visits and re-instating the dedicated position of an Aboriginal Health Worker.

Conclusion

The findings of this study are encouraging. While attendance and follow-up rates have declined in recent years, there have been periods of very high attendance rates by Aboriginal children despite reductions in lead program funding. Aboriginal community members have expressed a desire to see lead health promoted again in the community. Interviews and focus groups have confirmed a commitment to lead as an important health issue by staff and managers of child health services in Broken Hill. Using a culturally appropriate model, supporting disadvantaged families and developing collaborative partnerships are needed to increase participation in lead screening services. These findings can be used to inform policy and planning.

Acknowledgments

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Update on actions to improve lead screening rates in Aboriginal children in Broken Hill

Participation in lead screening by Aboriginal children in Broken Hill has improved since the study was completed. In 2011, 70% of Aboriginal children were tested (up from 40% in 2010).[1] This improved participation may be attributed to concerted efforts at both local and regional levels. As a first step the findings of the study were widely disseminated to stakeholders (service managers, providers and the Aboriginal Community Working Party). A lead health workshop was held in Broken Hill, and was attended by environmental health and toxicological experts and population health staff from the Far West Local Health District. Strategic planning meetings led by the Local Health District and attended by a range of service managers and providers focused on lead. Lead screening was aligned with the childhood immunisation schedule and reminders were sent to parents. While initial testing of most Aboriginal children is conducted at Maari Ma Health Aboriginal Corporation, there is greater collaboration now with the Broken Hill Child and Family Health Services for case management of children with high lead levels than was reported in the study. These efforts have seen lead screening rates in Aboriginal children return to previously high levels.

1. Far West Local Health District. Blood lead trends in children aged less than 5 years in Broken Hill 2011. Available at: http://www.fwlhn.health.nsw.gov.au/UserFiles/files/FAR%20WEST%20Lead%20Health%20Data%20Report%202011.pdf (Cited 21 November 2012).

Communicable Diseases Report, NSW, September and October 2012

Communicable Diseases Branch
Health Protection NSW

For updated information, including data and facts on specific diseases, visit www.health.nsw.gov.au and click on **Public Health** and then **Infectious Diseases**. The communicable diseases site is available at: http://www.health.nsw.gov.au/publichealth/infectious/index.asp.

Figure 1 and Tables 1 and 2 show notifications of communicable diseases with onset in September and October 2012 in New South Wales (NSW).

Enteric infections

Outbreaks of suspected foodborne disease

Eight outbreaks of gastrointestinal disease, thought to be due to consumption of contaminated food and which affected at least 80 people, were reported in September and October 2012. These outbreaks were linked to restaurants or cafes (4), food supplied by caterers (2) and private residences (2). *Salmonella* Typhimurium (STm) was found to be the cause for three outbreaks; the implicated food vehicles in two of these outbreaks were raw egg mayonnaise and chicken. In one outbreak multiple foods were consumed and the vehicle was unable to be determined. In another outbreak affecting six groups, norovirus was identified as the cause and oysters were identified as the food vehicle. In other outbreaks the causative organism could not be identified due to either lack of sampling of ill people or of suspected food vehicles.

The *Salmonella* outbreaks were identified by monitoring of clusters of STm through molecular typing (multiple-locus variable tandem repeat analysis – MLVA). A cluster of 45 cases of a STm MLVA subtype was investigated in September and October. Thirty-five cases of STm were interviewed; 88% had consumed pre-cut chicken pieces in the 3 days prior to onset of illness. Cases continue to be notified and the investigation in collaboration with the NSW Food Authority is ongoing.

Viral gastrointestinal disease

There were 180 outbreaks of gastroenteritis in institutions reported in September and October 2012, affecting at least 2944 people. The previous 5-year average for this period was 148 outbreaks. A total of 87 outbreaks occurred in aged-care facilities, 75 in child-care centres, 15 in hospitals and three in other facilities. In the 83 (46%) outbreaks in which a stool specimen was collected, norovirus was confirmed in cases from 29 (16%) outbreaks and rotavirus was confirmed in 20 (11%).

Respiratory infections

Influenza

Influenza activity, as measured by the number of people who presented with influenza-like illness to 59 of the state's largest emergency departments, returned to pre-seasonal levels in September and October after a peak in mid-July. In addition, the number of people who tested positive for influenza A by diagnostic laboratories decreased to pre-seasonal levels throughout September and October, after a peak in late June. The number of people who tested positive for influenza B also decreased over the reporting period. While this number has yet to return to pre-seasonal levels, it is well below the peak reached in June.

In September, there were:

- 196 presentations to emergency departments (rate 1.3 per 1000 presentations)
- 774 cases of laboratory-confirmed influenza including:
  - 269 (35%) influenza A
  - 506 (65%) influenza B.

In October, there were:

- 139 presentations to emergency departments (rate 0.7 per 1000 presentations)
- 260 cases of laboratory-confirmed influenza including:
  - 42 (16%) influenza A
  - 218 (84%) influenza B.

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

Vaccine-preventable diseases

Meningococcal disease

Eleven cases of meningococcal disease were notified in NSW in September and October 2012 (seven in September and four in October), a decrease from 15 notified in the

same period in 2011. The age of the cases ranged from 5 months to 87 years and included six cases aged less than 5 years. There were no deaths due to meningococcal disease notified in this period. Seven (64%) cases were due to serogroup B (for which there is no vaccine), three (27%) were due to serogroup W135, and one (9%) was unable to be typed. Of the 15 cases notified during the same period in 2011, nine (60%) were due to serogroup B, one (7%) was due to serogroup Y, one (7%) was due to serogroup C and the remaining four (27%) were of an undetermined serogroup.

It is recommended that a single dose of vaccine against meningococcal C disease be given to all children at the age of 12 months as well as persons at high risk of disease.[1]

Measles

Seventy-seven cases of measles were notified in NSW in September and October 2012; all were part of an ongoing outbreak that began in April. This was an increase compared to the six cases reported for the same period in 2011. The age groups most affected were children aged 0–4 years ($n = 24$), of which 13 were aged less than 1 year, and young adults aged 30–34 years ($n = 10$). The average age of cases was 17.5 years (range: 6 months–61 years), and 49% were female. Six (8%) cases were Aboriginal people.

Most cases were notified in South Western Sydney Local Health District (71%), followed by Western Sydney (Parramatta) (17%), however outbreak-associated cases were also reported in the Illawarra Shoalhaven ($n = 4$), North Coast (Port Macquarie) ($n = 3$) and South Eastern Sydney ($n = 1$) LHDs as well as Justice Health ($n = 1$). Of the 77 notifications, 64 (83%) were laboratory confirmed.

The majority (81%) of the cases were not vaccinated for measles. Of the 15 cases that were reported to have been vaccinated, five were documented as partially or fully vaccinated for age. Of these, one 10–14-year old had received, according to the Australian Childhood Immunisation Register, two doses; two 10–14-year olds had received one dose; and a 9-month old and a 10-month old who were vaccinated as contacts of confirmed cases had received one dose each.

Pertussis

During September and October, 776 cases of pertussis were notified with onset in the period in NSW, less than one-third of the 2410 cases notified for the same period in 2011. Most cases were in the 5–9-year age group ($n = 237$), followed by the 0–4-year ($n = 140$) and the 10–14-year age groups ($n = 129$).

Direct protection for young infants remains available through free vaccination for pertussis that is administered at 2, 4 and 6 months of age. The first dose can be provided as early as 6 weeks of age. There is also a booster dose at 3½ to 4 years. New parents and grandparents should also discuss the benefits of pertussis vaccination for themselves with their general practitioner.[1]

Sexually transmissible infections and bloodborne viruses

Gonorrhoea

The number of gonorrhoea notifications has continued to rise, with a total of 732 laboratory-confirmed cases notified in NSW in September and October 2012; this is an increase of 41% compared with the same period in 2011 ($n = 519$). Since January 2012, there has been an average of 312 notifications of gonorrhoea per month, with a peak of 361 notifications in May.

Syphilis

A total of 95 cases of syphilis were notified to NSW Health with onset in September and October 2012, fewer than the 148 cases notified in the same period in 2011. A reporting delay may account for some of this decrease.

Lymphogranuloma venereum

NSW Health was notified of 12 cases of lymphogranuloma venereum with onset in September and October 2012, an increase from the six cases reported in the same period in 2011.

Reference

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Figure 1. Reports of selected communicable diseases, NSW, Jan 2004 to Oct 2012, 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 infections, RRV = Ross River virus infections, 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%

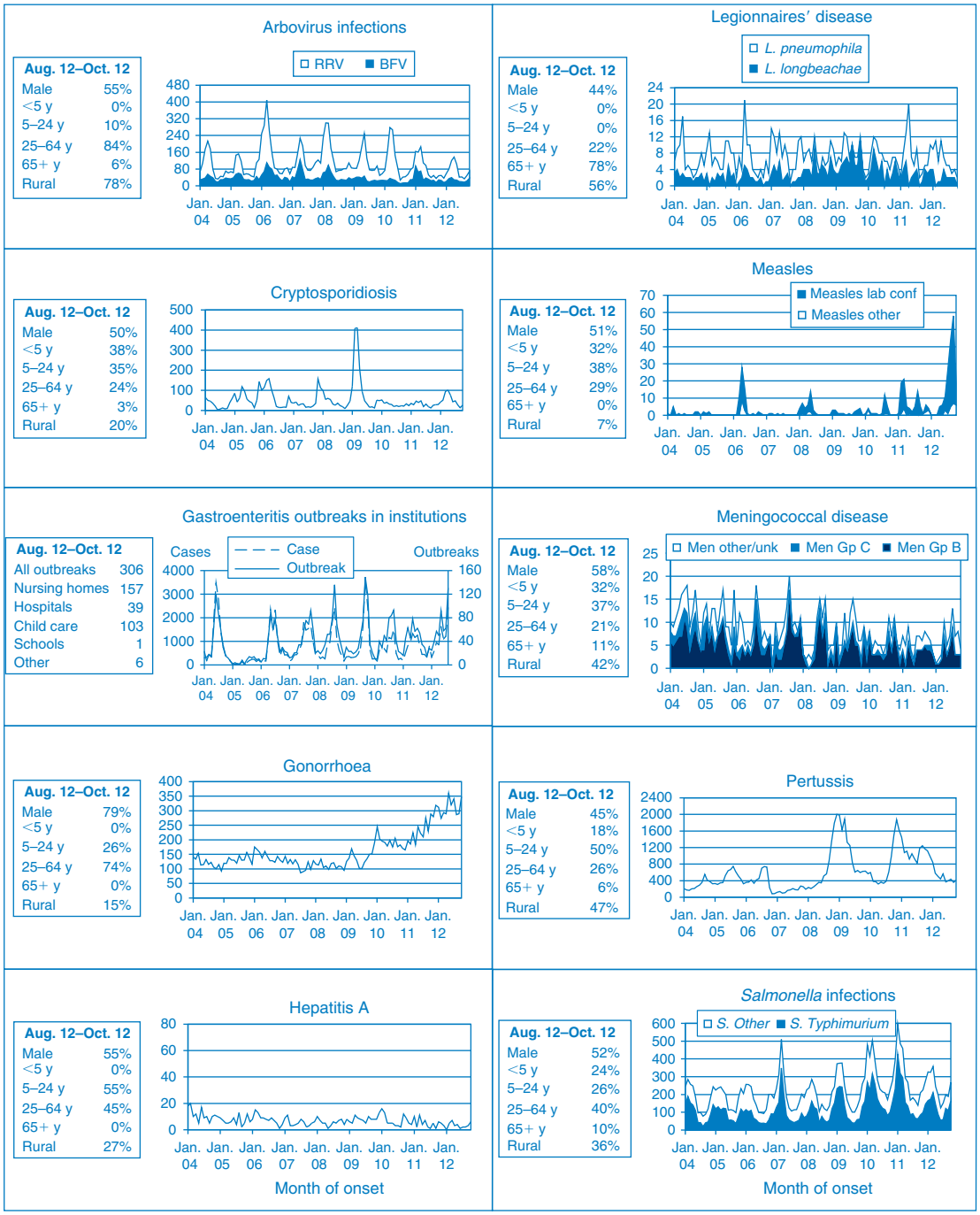

Table 1. Notifications of scheduled medical conditions with an onset date in September 2012 by Local Health District, NSW

Condition	Local Health District																Total	
	Murrumbidgee (including Albury)	Southern NSW	Western NSW	Far West	Hunter New England	Northern NSW	Mid North Coast	Central Coast	Northern Sydney	South Eastern Sydney	Illawarra Shoalhaven	Sydney	South Western Sydney	Western Sydney	Nepean Blue Mountains	Justice Health	For Sep[b]	Year to date[b]
Bloodborne and sexually transmissible																		
Chancroid[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chlamydia (genital)[a]	54	19	56	5	224	74	48	76	116	264	73	157	137	146	77	15	1542	16 091
Gonorrhoea[a]	7	3	2	3	11	2	1	7	33	106	8	61	24	28	6	19	321	3030
Hepatitis B – acute viral[a]	–	–	–	–	1	–	–	–	–	–	–	–	1	–	–	–	2	18
Hepatitis B – other[a]	1	1	6	1	6	–	3	4	25	25	5	33	37	42	5	1	195	1803
Hepatitis C – acute viral[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	29
Hepatitis C – other[a]	12	9	14	1	24	17	12	24	12	22	11	23	35	26	16	23	281	2568
Hepatitis D – unspecified[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3
Lymphogranuloma venereum	–	–	–	–	–	–	–	–	–	1	–	3	1	1	–	–	6	17
Syphilis	3	–	2	–	2	–	–	3	3	17	2	17	6	9	–	–	65	598
Vectorborne																		
Barmah Forest virus[a]	–	1	–	–	4	11	6	–	–	–	–	–	–	–	1	–	23	241
Ross River virus[a]	7	–	1	–	6	5	1	3	1	–	–	–	–	1	1	–	26	490
Arboviral infection (other)[a]	–	–	–	–	1	2	–	1	4	2	2	–	1	3	–	–	16	206
Malaria[a]	–	–	–	–	1	–	1	–	–	1	–	1	–	2	–	–	6	53
Zoonoses																		
Anthrax[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Brucellosis[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3
Leptospirosis[a]	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	17
Lyssavirus[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Psittacosis[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10
Q fever[a]	–	–	1	–	3	–	1	–	–	–	–	–	1	–	–	1	7	77
Respiratory and other																		
Blood lead level[a]	2	–	4	13	4	1	–	1	–	2	–	3	2	4	1	–	37	389
Influenza[a]	40	16	43	–	132	55	10	11	77	125	33	46	78	70	37	–	774	7478
Invasive pneumococcal infection[a]	3	5	3	1	4	2	2	–	4	7	2	6	10	6	5	–	60	444
Legionella longbeachae infection[a]	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–	–	2	20
Legionella pneumophila infection[a]	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	2	47
Legionnaires' disease (other)[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8
Leprosy	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Meningococcal infection (invasive)[a]	–	–	–	–	3	–	–	–	–	–	1	–	1	1	1	–	7	55
Tuberculosis	–	–	–	–	1	–	–	–	4	3	–	1	7	1	–	2	19	197
Vaccine-preventable																		
Adverse event after immunisation	3	4	–	–	2	–	–	2	–	4	–	–	1	1	1	1	19	145
H. influenzae b infection (invasive)[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Measles	–	–	–	–	–	–	–	–	–	1	3	–	45	10	–	–	59	152
Mumps[a]	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	1	87
Pertussis	20	13	34	–	44	10	12	22	41	28	22	27	13	56	18	–	360	4631
Rubella[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10
Tetanus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Enteric																		
Botulism	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cholera[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Cryptosporidiosis[a]	–	–	–	–	1	–	1	–	2	3	1	4	1	–	1	–	14	536
Giardiasis[a]	3	4	14	–	24	1	7	4	16	17	7	10	11	14	9	–	141	1580
Haemolytic uraemic syndrome	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1	8
Hepatitis A[a]	–	–	–	–	–	–	1	–	–	–	–	–	–	2	–	–	3	28
Hepatitis E[a]	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1	6
Listeriosis[a]	1	–	–	–	–	–	–	–	–	1	–	–	–	1	–	–	3	26
Rotavirus[a]	3	1	38	1	85	14	5	16	67	56	55	32	61	69	26	–	530	1257
Salmonellosis[a]	8	2	3	–	16	6	6	9	29	21	12	21	15	31	9	1	189	2115
Shigellosis[a]	–	–	1	–	–	–	–	–	1	3	–	–	–	–	–	–	5	88
Typhoid[a]	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	31
Verotoxin-producing *E. coli*[a]	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	10
Miscellaneous																		
Creutzfeldt–Jakob disease	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	6
Meningococcal conjunctivitis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

[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.
Data are reported by Local Health District of residence (geocoded to 2011 boundaries).
Source: Notifiable Conditions Information Management System, NSW Ministry of Health.

Table 2. Notifications of scheduled medical conditions with an onset date in October 2012 by Local Health District, NSW

Condition	Local Health District																Total	
	Murrumbidgee (including Albury)	Southern NSW	Western NSW	Far West	Hunter New England	Northern NSW	Mid North Coast	Central Coast	Northern Sydney	South Eastern Sydney	Illawarra Shoalhaven	Sydney	South Western Sydney	Western Sydney	Nepean Blue Mountains	Justice Health	For Oct[b]	Year to date[b]
Bloodborne and sexually transmissible																		
Chancroid[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chlamydia (genital)[a]	63	40	69	8	236	92	37	82	170	283	97	160	151	165	82	102	1837	17928
Gonorrhoea[a]	3	2	1	3	19	7	–	2	50	137	5	76	40	43	13	9	411	3441
Hepatitis B – acute viral[a]	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	19
Hepatitis B – other[a]	6	–	3	1	5	–	6	3	27	23	–	32	36	52	4	–	198	2001
Hepatitis C – acute viral[a]	–	–	2	–	2	–	–	–	–	1	–	–	–	–	–	1	6	35
Hepatitis C – other[a]	14	9	14	5	26	15	8	11	12	17	15	10	31	31	12	30	260	2828
Hepatitis D – unspecified[a]	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	2	5
Lymphogranuloma venereum	–	–	–	–	–	–	–	–	–	2	–	4	–	–	–	–	6	23
Syphilis	–	–	–	–	4	–	–	1	3	12	1	7	1	–	–	1	30	628
Vectorborne																		
Barmah Forest virus[a]	2	–	–	–	6	13	7	1	1	–	4	–	1	1	1	–	37	278
Ross River virus[a]	6	–	3	1	10	5	2	5	1	–	–	–	1	–	1	–	35	525
Arboviral infection (other)[a]	–	–	–	–	4	2	–	–	11	2	–	3	2	2	–	–	26	232
Malaria[a]	–	–	–	–	2	–	–	–	–	–	1	1	–	2	1	–	7	60
Zoonoses																		
Anthrax[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Brucellosis[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3
Leptospirosis[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	17
Lyssavirus[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Psittacosis[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10
Q fever[a]	–	–	–	–	7	–	–	–	–	–	–	–	1	–	–	2	10	87
Respiratory and other																		
Blood lead level[a]	3	1	29	10	3	–	–	–	–	3	–	1	2	3	4	–	59	448
Influenza[a]	14	7	8	–	21	13	4	3	24	57	4	16	37	35	16	1	260	7738
Invasive pneumococcal infection[a]	3	2	2	1	3	–	–	3	8	5	5	2	4	3	2	–	43	487
Legionella longbeachae infection[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	20
Legionella pneumophila infection[a]	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	2	49
Legionnaires' disease (other)[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8
Leprosy	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Meningococcal infection (invasive)[a]	–	–	–	–	2	–	–	1	–	–	–	–	–	1	–	–	4	59
Tuberculosis	2	–	1	–	–	–	–	–	1	5	–	6	2	–	–	–	17	214
Vaccine-preventable																		
Adverse event after immunisation	4	2	1	–	2	–	–	–	–	–	1	1	1	1	–	–	13	158
H. influenzae b infection (invasive)[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Measles	–	–	–	–	–	–	3	–	–	–	1	–	10	3	–	1	18	170
Mumps[a]	–	–	–	–	–	–	–	–	1	1	–	1	–	1	–	–	4	91
Pertussis	25	11	24	–	49	18	10	28	70	36	23	22	27	55	17	1	416	5047
Rubella[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	10
Tetanus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Enteric																		
Botulism	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cholera[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Cryptosporidiosis[a]	–	–	–	–	–	2	–	–	6	12	2	4	1	1	–	–	28	564
Giardiasis[a]	5	3	9	–	12	2	–	5	24	32	8	15	9	10	4	–	138	1718
Haemolytic uraemic syndrome	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8
Hepatitis A[a]	–	1	1	–	–	–	–	–	2	–	–	–	2	–	–	–	6	34
Hepatitis E[a]	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	1	7
Listeriosis[a]	–	–	–	–	–	–	–	1	1	–	–	1	–	–	–	–	3	29
Rotavirus[a]	15	1	35	–	65	11	–	16	31	24	11	17	41	37	15	–	319	1576
Salmonellosis[a]	12	3	10	–	25	16	4	11	45	42	8	21	29	29	14	–	269	2384
Shigellosis[a]	–	–	–	–	1	–	–	–	3	2	–	2	1	1	1	–	11	99
Typhoid[a]	–	–	–	–	–	–	1	–	–	1	–	–	1	2	–	–	5	36
Verotoxin-producing *E. coli*[a]	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	11
Miscellaneous																		
Creutzfeldt–Jakob disease	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	7
Meningococcal conjunctivitis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

[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.
Data are reported by Local Health District of residence (geocoded to 2011 boundaries).
Source: Notifiable Conditions Information Management System, NSW Ministry of Health.

Contents

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