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Influencing population health performance: feedback from managers, population health staff and clinicians on the *NSW Population Health Standards for Area Health Services*

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Abstract: The *NSW Population Health Standards for Area Health Services* have recently been introduced in NSW to assist area health services assess and improve performance in population health. Greater Western Area Health Service was the pilot site for trialling the *Standards* as a self-assessment tool. Following self-assessment, managers, population health staff and clinicians were asked for feedback. Staff were either interviewed or participated in a group discussion. Consulting with staff who would be required to use the *Standards* in the long term was seen as important for facilitating implementation across the area health service. The *Standards* were seen as credible and potentially beneficial, especially in raising the profile of population health work and encouraging population-based and integrated approaches.

In the health sector, standards have been developed for individual practice, programs and organisations, and are used to assess performance and encourage its improvement.[1] Standards Australia defines a standard as ‘a published document which sets out specifications and procedures designed to ensure that a material, product, method or service is fit for its purpose and consistently performs in the way it was intended’.[2] A standard ‘encodes within it knowledge about how to’ and is used to transfer that knowledge into practice.[3]

The NSW Department of Health commissioned a series of projects to evaluate the *NSW Population Health Standards for Area Health Services* introduced in late 2005. One of these projects determined the extent to which the *Standards* were reflected in area health service performance agreements.[4] This paper presents another of these projects and examines the *Standards’* potential value from the perspective of the area health service staff who would be required to apply them.

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Methods

Staff participated in the process either through interview or group discussion.

Interviews

In order to gather a wide range of views, staff were purposively selected from Greater Western Area Health Service (GWAHS) executive and non-executive tiers with different work roles (managerial, population health), work settings (hospital, community health, population health) and directorates (Population Health, Planning and Performance, Clinical Operations) represented. Staff were contacted directly and provided with information about the *Standards*. They were informed that their participation in the process was voluntary and that responses would be de-identified to maintain confidentiality. There was the opportunity to discuss any concerns before verbally consenting to participate. Sixteen of 18 people contacted (nine women and seven men) agreed to be interviewed. All interviews were conducted by one of the authors and audiotaped. Interviews ran for 30–45 minutes.

After a pilot of two interviews, a list of open-ended questions was developed and refined. The questions sought feedback on: the self-assessment process; the *Standards'* potential benefits and risks; factors that would help or hinder implementation; and how the *Standards* could be improved. The questions were an initial prompt for further responses and discussion. Pilot interviews were not included in the final analysis.

Group discussion

As the views of clinicians had not been sought in the interviews, a group discussion was held with eight clinicians working in hospital and community health settings. Participants were given information about the *Standards* before the session and were asked to consider the strengths and weaknesses, and factors that would help or hinder implementation. One of the authors facilitated the session and another took notes. The session ran for approximately 60 minutes.

Data analysis

Data analysis occurred concurrently with data collection. Audiotapes of interviews were transcribed for meaning, rather than verbatim. An initial reading of the transcripts identified the main points, which, along with pertinent quotes, were documented on an interview summary sheet. Transcripts were then coded by a single person. As further interviews were transcribed and coded, similar codes were collapsed into categories. Categories that recurred across interviews were noted as potential themes.

For comparison, two transcripts were coded by another author. Differences in coding and interpretations were discussed to reach agreement about categories. These categories, with associated quotes, were further discussed with all authors to reach agreement on themes.

Notes taken during the group session were read to identify the main points. Points in addition to or contrary to those gained from interviews were noted.

Results

Feedback on the Standards *as a self-assessment process*

The self-assessment took place in 2006 during a time of significant organisational change. Participants noted the difficulty in using the *Standards* as a self-assessment tool in this context.

There was uncertainty among participants about how narrowly or broadly the *Standards* were to be applied: too narrow and the *Standards* have little relevance outside population health circles; too broad and the practicalities of data collection become a problem in completing the self-assessment task.

For self-assessment to impact on performance, there needs to be a way of taking action. For some participants, the results of the self-assessment would 'drive some of the change' and provide 'a focus to enable us to work on specific strategies'. Others were more sceptical about the benefits of an audit. Future benchmarking with other area health services was seen as helpful.

Potential benefits and risks of implementing the Standards

Everyone interviewed reported that the *Standards* had potential benefits (Box 1).

All interviewees discussed possible risks or adverse consequences; in particular, that assessment using the *Standards* could become a bureaucratic process removed from everyday practice.

Factors that would help or hinder implementation

Staff involvement in developing and implementing the *Standards* was seen as crucial, and requires a good

Box 1. Reported potential benefits of the *NSW Population Health Standards for Area Health Services*

- Promote population health
- Educative for staff, especially staff outside population health
- Provide opportunity to examine existing systems and processes, and where appropriate, incorporate the Standards to make improvements in practice
- Increase accountability to communities, managers and for workers themselves
- Increase accountability funds spending
- Encourage better practice in the organisation

understanding of the tool and its purpose. One participant stated that the interview process itself had been educative. Participating in the process had helped their understanding of why the *Standards* had been developed and given them the opportunity to think about the potential value to their own practice. Others saw implementation as part of a bigger change, with one participant commenting that:

> some of the changes that are required are about revolution, about a complete change in the way we do business and that requires a broader debate, a more inclusive debate, and this tool would assist that debate but you need general practitioners, specialist doctors and patients and community members using the tool, to get that sort of focus.

Successful implementation hinges on an organisation being orientated and committed to population health approaches. Most participants strongly expressed the idea that leadership and clear direction with tangible outcomes and rewards were needed along with links to other initiatives.

A recurring idea in the interviews was how to use the *Standards* in a way that demonstrates their practical purpose:

> Being real, not being bureaucratic and ticking boxes so you can demonstrate that it [the *Standards*] is being treated seriously and that it is part of our core business.

Issues were raised about the capacity of the area health service to implement the *Standards*, including the need for resources and appropriate data collection systems (Box 2).

How the Standards *can be improved*

The language and jargon used alienated staff who were not specialists in population health and were not 'applicable to people on the ground'.

To rate performance, the current form of the *Standards* uses four levels of achievement, from A (highest level) to D (lowest level). This system was not well supported. Level A was perceived to be:

> unachievable and unhelpful as being a gold bar set up so high…it wouldn't actually help to raise the standard of the work that you were doing.

Box 2. Factors hindering implementation of the *NSW Population Health Standards for Area Health Services* self-assessment tool

- Lack of understanding among staff about the content and purpose of the Standards and the tool
- Logistics of implementation over large geographical areas
- Resources required for set up across the area health service
- Resources required for maintenance and continued use of the tool

Level D was thought to be equally unhelpful:

> I think…it does not acknowledge any good work that is done…it basically says whatever it is you're doing isn't worth counting. I don't think that's a reasonable way of encouraging staff involved to take on board the *Standards*.

Several participants thought greater emphasis should be placed on equity issues and tackling upstream determinants of health. The health of Aboriginal and Torres Strait Islander peoples was seen by some as missing altogether, and hence detrimental to presenting the health of Aboriginal and Torres Strait Islander peoples as a high priority.

Issues from group discussion

Feedback from the group discussion with clinicians was consistent with the interviews. The *Standards* in their current form were not seen as appropriate or accessible for clinicians. There was concern about the impact the *Standards* would have on workloads and how to manage any extra work. Clinicians understood the importance of engaging with communities about population health and thought that the *Standards* would help change expectations about health services and encourage communities to value evidence-based approaches.

Clinicians also wondered how these *Standards* related to other standards, including professional standards, and advised that the various reporting requirements would not be compatible. More detail about group discussion results is available in the evaluation report.[5]

Discussion

The *Standards* were seen as a step forward in helping area health services assess and improve their own performance in population health. As an assessment tool, further modification is needed, especially to encourage 'buy-in' from managers and clinicians who are not working in specialised population health roles.

Feedback on the *Standards* was obtained from only a small number of staff in one rural area health service. Nearly half of interviewees worked in the Population Health, Planning and Performance directorate and had been directly involved in the self-assessment process. These staff members were therefore familiar with the *Standards*. Greater involvement of staff from outside this directorate may have elicited different findings. Nevertheless, there was consistency in responses between staff of the directorate and other staff.

This study took place during a time of significant change when all area health services in New South Wales (NSW) were undergoing restructure. GWAHS, an area health service with unique issues for implementation in terms of its geographical spread, was formed by merging three previously separate area organisational cultures. In these circumstances, staff interviewed may have been particularly aware of organisational barriers that needed to be overcome to allow successful area-wide implementation.

The *Standards* need to have credibility with area health service staff if they are to be successfully implemented and in turn influence population health performance. While there was general support for the idea of standards in population health, there was a strong feeling that population health should be central to the organisation's business for the *Standards* to have credibility. The *Standards* were seen as potentially helpful in raising the profile of population health and setting goals for population health action.

Standards, as 'encoded knowledge' need to be 'decoded' easily. The current version of the *Standards* is written from a specialist population health viewpoint and does not translate well into what other area health service staff do on a daily basis. Area health service staff require time to engage with and extract meaning from standards expressed in plain language, and to decide how to use that knowledge to improve performance in their own setting.

The *Standards* as a self-assessment tool can identify current strengths and weaknesses, and identify where improvements could be directed. Those interviewed sought greater clarity about how area health services could take those next steps. Researchers note the lack of evidence-based tools to help improve performance in the population health context and the need for a science base that can 'support accurate and reliable assessments of the practice of public health at local, state and national levels'.[6]

To effect these changes will be a major undertaking and that requires widespread support across the organisation and from outside, including support from the broader NSW community. The NSW Department of Health could assist area health services in a variety of ways, for example, through: revision of relevant policies to strengthen their population health orientation; engaging with other jurisdictions to develop a nationally coherent approach; and providing statewide co-ordination and resources where required.

Conclusion

The *Standards* show promise as a tool for area health services to assess their ability to deliver services in line with a population health approach. While it would be easier and less resource intensive to confine the use of population health standards to population health staff, if applied across an area health service, they offer greater potential to break down 'silos' between clinical and population health disciplines and harness more local expertise to tackle issues affecting the health of populations.

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A comparison of two nutrition signposting systems for use in Australia

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Abstract: Consumers are interested in making healthier food choices but the mandatory nutrition information panel currently in use in Australia is not easily understood or interpreted by most consumers. A simple nutrition signpost would be valuable. This paper reviews two nutrition signposting systems currently being considered for adoption in Australia. The authors conclude that a system similar to the colour-coded Traffic Light System is likely to be most useful.

Why use signposting?

Consumers today are interested in the nutritional quality of the food products they purchase. As such, mandatory nutritional labelling requirements are now present in several countries including the United States of America (USA), Australia and New Zealand. In Australia, legislation requires that nutrition information be listed on packaged food in the form of a nutrition information panel (NIP), with the aim of assisting consumers to make healthier food choices.[1–3] When used by health professionals and technically minded consumers, the NIP is highly informative, but general consumers find it difficult to comprehend.[4–7] A simple labelling or signposting system that is easily seen and easily and quickly interpreted would assist consumers in making healthier food choices.[1,8–10] It has been suggested that the combination of a nutrition signpost together with the traditional NIP is likely to be more effective in assisting consumers to make healthier choices.[3,8,11]

Front-of-pack signposts, or logos, such as the Heart Foundation tick and the Glycaemic Index (GI) symbol have already been voluntarily used widely in Australia. These signposts have been shown to assist consumers in selecting healthier choices within the same food group.[12,13] However, there can be a lack of transparency around the inclusion criteria of privately owned systems and often limited evaluation of the impact. Research has shown that when a signpost is endorsed officially by government legislation or standards, its credibility is strongly increased.[8] In the United Kingdom (UK), a voluntary signposting system is not providing a high level of assistance to consumers as some food manufacturers oppose the recommended system and use their own signposts, resulting in a plethora of different signposts creating confusion among consumers. Thus, if an effective, simple-to-use signpost can be identified for use in Australia, a mandatory system supported by Food Standards Australia New Zealand (FSANZ) to govern the use of such a signpost would be preferred, with inclusion criteria clearly presented to the public and its impact evaluated on a regular basis.

Potential signposting systems for use in Australia

There are two nutrition signposting systems that have been developed recently and are considered primary contenders for use in Australia by various population health groups and industry:

- The colour-coded Traffic Light System (CTLS)
- The Percentage Daily Intake (%DI)

There are several other signposting systems previously or currently trialled in various countries – for example, the Choices front-of-pack stamp, Smart Spots and Shop Smart with Heart – but these other systems have not been sufficiently evaluated within the Australian context and are not considered within this paper.[14–16]

Colour-coded Traffic Light System

The CTLS has been developed by the Food Standards Agency (FSA) in the UK, where it is currently used. This system categorises the four key nutrients most associated with public health issues (fat, saturated fat, sugars and salt) as high, medium or low compared to a set of agreed criteria and these nutrients are then each given a red, amber or green rating, which are portrayed as red, amber or green traffic lights on the package (Figure 1).[17,18] Another light is sometimes included in the signpost for energy content but it is not a core criterion.[19] The criteria, which are universal across food types, compare the total fat, saturated fat, sugar and salt content of the food item against the Guideline Daily Amount (GDA) for each 100 g. The cut-offs for each category are summarised in Table 1.[19] The FSA recommends a particular list of foods that the CTLS should be used on (mainly composite, processed foods), but does not discourage its use on other products, including drinks.[19]

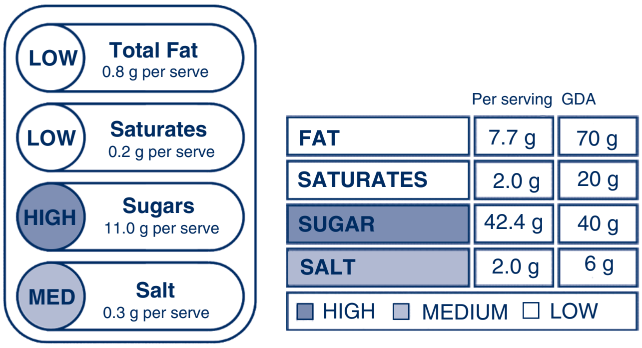

Figure 1. Samples of the colour-coded Traffic Light System. GDA: Guideline Daily Amount.
■ red: high; ■ amber: medium; □ green: low.
Source: Food Standards Agency (UK).[38]
Reproduced with permission.

The CTLS is designed to promote the moderation message, by encouraging consumers to select food items with more green or amber lights and limit those with red lights.[20] Sales data from the UK suggest that this labelling system may be effective, although sales may also be influenced by other factors such as price and promotion. For example, sales of breakfast cereals with mainly green lights or amber lights are growing twice as fast as breakfast cereals in total, and frozen meals with red lights on the label decreased in sales by 35%.[21] Similar effects on sales have been reported for other products.[22,23]

Jones and Richardson demonstrated that a traffic light signpost helps guide the attention of the consumer to the important nutrients (i.e. those associated with chronic disease) as well as improving the accuracy of the healthiness rating of nutrition labels.[24] When a traffic light signpost was present, consumers were more likely to assess the healthiness rating using a combination of nutrients, rather than a single one such as fat or energy content. The authors suggest caution when interpreting their results though, as in their study the colour-coded traffic light was placed next to the NIP, whereas it was designed for use on the front of pack.

The traffic light signposts of some of the commonly consumed food items generated using the criteria specified in Table 1 are shown in Figure 2.

Feunekes et al. indicated that the CTLS gives inconsistent differentiation between healthier and less healthy products within certain categories.[8] For example, initially the CTLS did not provide any distinction between breakfast cereals such as cocoa puffed rice and wheat bran flakes with sultanas, even though the latter has a better nutrient profile and is generally regarded as a healthier choice due to the presence of fruit sugars rather than added sugars. The FSA has updated the sugar criteria so that only non-milk extrinsic sugars (NMES) – i.e., added sugars – are considered to determine the red colour code (high) (see Table 1 and Figure 2).[19]

The CTLS has also been criticised for labelling some core foods such as cheese with three or even four red lights (Figure 2), potentially contributing to a reduction in intake of these foods. This could be avoided if different cut-offs were specific to foods or food groups.[20] Such mislabelling could also be avoided by the additional use of a single traffic light to represent the overall nutrient profile or healthiness of the food product, taking into account other nutrients such as fibre and protein. The single traffic light could be generated by criteria similar to the Nutrient Profile Modelling System (NPMS) used by FSANZ in the eligibility assessment of Nutrition, Health and Related Claims.[25]

Table 1. Criteria used in the colour-coded Traffic Light System for classifying nutrients as green, amber or red

Nutrient	Type	Green (Low)	Amber (Medium)	Red (High)	
Total fat	Solids	≤3.0 g/100 g	>3.0 to ≤20.0 g/100 g	>20.0 g/100 g	>21.0 g/portion*
	Liquids	≤1.5 g/100 mL	>1.5 to ≤10.0 g/100 mL	>10.0 g/100 mL	
Saturated fat	Solids	≤1.5 g/100 g	>1.5 to ≤5.0 g/100 g	>5.0 g/100 g	>6.0 g/portion*
	Liquids	≤0.75 g/100 mL	>0.75 to ≤2.5 g/100 mL	>2.5 g/100 mL	
Sugars#	Solids	≤5.0 g/100 g	>5.0 to ≤12.5 g/100 g	>12.5 g/100 g	>15.0 g/portion*
	Liquids	≤2.5 g/100 mL	>2.5 to ≤7.5 g/100 mL	>7.5 g/100 mL	
Salt (NaCl)	Solids	≤0.3 g/100 g	>0.3 to ≤1.5 g/100 g	>1.5 g/100 g	>2.4 g/portion*
	Liquids	≤0.3 g/100 mL	>0.3 to ≤1.5 g/100 mL	>1.5 g/100 mL	

The sugars colour code is determined as follows: the lower limit of amber is determined using **total** sugars; the upper limit of amber is determined using non-milk extrinsic sugars, i.e. **added** sugars; if the food item falls in the amber category and is high in fruit or milk sugars, a statement on the packaging to highlight the presence of natural sugars (e.g. contains naturally occurring sugars) is required.
* per portion criteria were used to ensure foods contributing more than 30% of the recommended upper intake for total fat, saturated fat, sugar and 40% of salt be labelled red.
Source: Food Standards Agency (UK).[19]

Another limitation of the CTLS alone is the potential for confusion around product choice by a consumer when faced, for example, with a product that carries two green lights and two red lights. Consumers may also find it confusing as to whether a 5 g serve of food carrying red lights is less healthy than a 300 g serve of a food carrying amber lights. The CTLS, however, is designed for comparison within a particular food group, and it is unlikely the serving size would vary much within a food group. Also, the overarching concept of discouraging consumption of foods with red lights still applies.

Critics have suggested that CTLS may act as a disincentive for food manufacturers to improve the nutritional composition of food products, if it is not technically possible to move from red to amber or from amber to green.[26,27] Certainly many manufacturers were unable to make the required changes to meet the criteria of the National Heart Foundation tick, which is similar conceptually to the single traffic light. However, many manufacturers did respond by removing around 33 tonnes of salt from their products in a year.[28]

Percentage Daily Intake

In 2006, the Australian Food and Grocery Council (AFGC) recommended the inclusion of information on the percentage daily intake (%DI) for key nutrients on the packages of their members' products.[29] The %DI labelling concept originated in the USA, where percentage daily value (%DV) is included in the nutrition fact panel. A very similar concept has been developed in the UK, called percentage guideline daily amounts (%GDA).[30] In Australia, some food manufacturers have already placed a stand-alone signpost or %DI counter, for a wide range of nutrients beyond those recommended by the AFGC, on the front of their food packages (Figure 3).[29]

Percentage daily intakes are generally calculated as the percentages of the nutrients provided by one serving of the food compared to the reference value of an average male adult who consumes a daily diet of 8700 kJ. Only the inclusion of the %DI of energy is required under this scheme, but the seven core nutrients (energy, protein, fat, saturated fat, carbohydrates, total sugars and sodium), which are the same as those included in the traditional NIP,

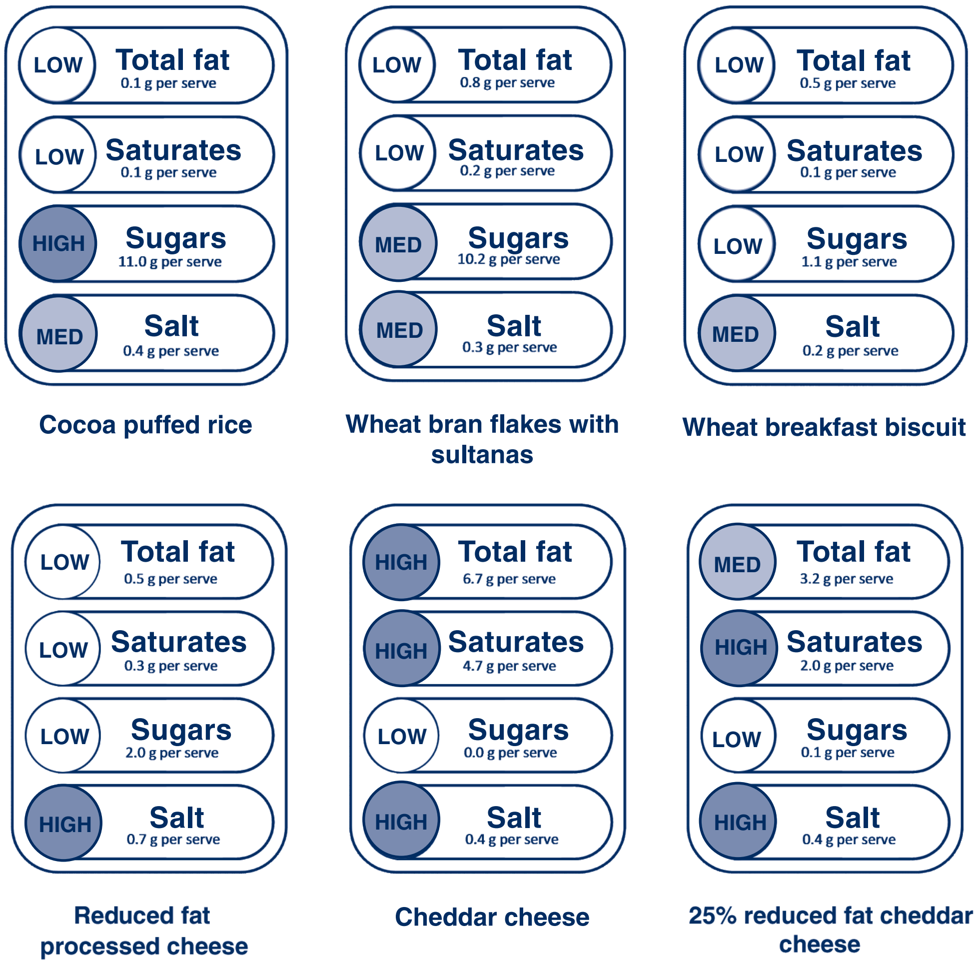

Figure 2. Traffic light signposts of commonly consumed food items
A statement on the packaging to highlight the presence of natural sugars would be required for this product, e.g.'contain sugars naturally occurring from the fruit'.
Modified with permission from Food Standards Agency (UK).

Per 30 g serve

Energy 480 kJ	Protein 1.6 g	Fat 0.1 g	Sat fat 0.1 g	Carbs 26.3 g	Sugars 11.0 g	Fibre 0.4 g	Sodium 196 mg
5.5%	3.2%	0.1%	0.4%	8.5%	12.2%	1.3%	7.3%

Figure 3. Percentage daily intake counter. Sat fat: saturated fat; Carbs: carbohydrates.

are usually listed. Additional %DI values for nutrients such as fibre, vitamins and minerals can also be included in this system, but are not compulsory.

While the %DI counter provides factual information about specific nutrients, it is likely that it is too complex for most consumers. Interpretation requires the consumer to consider:

(i) different serving sizes of similar products, as illustrated for breakfast cereals in Figure 4

(ii) information about other foods to be consumed throughout the day

(iii) how the guide fits in with their average daily requirement, which is not necessarily the same as an average adult male.

In addition, the approach includes 'negative' nutrients such as saturated fat and 'positive' nutrients such as fibre, which add to the complexity of this system.[31] In the case of negative nutrients, the consumer is expected to moderate intake to a recommended upper limit; on the other hand, for positive nutrients, the consumer is expected to pursue the recommended minimum intake. Several studies have reported on the limitations of the %DI to consumers. Levy et al. reported that 71% of adults in a study did not understand the meaning of %DV (the US version of %DI), and most incorrectly rated the fat content of food items using this system.[32] In another study, Barone et al. found that the provision of %DV was misperceived by undergraduate participants and the system did not alter judgments about the overall healthiness of a product.[33] Notably, recent research by FSANZ shows that non-NIP users are unlikely to benefit from the %DI concept, and that consumers need several attempts to evaluate products in a forced situation before the %DI can be used correctly, severely limiting its application and effectiveness.[34]

The %DI counter has strong support from some stakeholders who believe the system allows easy comparison between products, and who highlight the existing use of the system, but this appears to be contradicted by consumer research.[35] The implementation of this system in Australia and New Zealand would be relatively simple as there is existing approval by FSANZ for the inclusion of %DI information on food packages. The food industry also believes that the use of a %DI counter in Australia and New Zealand could assist international harmonisation of labelling, as many countries use a similar system already. However, Beard has suggested that the industry may favour the %DI counter because it is concerned about the impact of red lights on the sales of certain products.[13] Even if manufacturers can reformulate their products such that they carry fewer red or more green lights, the process takes time, costs and is risky to business.[4]

Support for the %DI system may be more prevalent in the UK where inclusion of an NIP is not mandatory (unless a nutrition claim is made).[26,27,36,37] In Australia, the %DI system may be less valuable as NIPs are mandatory and thus the use of the simpler CTLS is a potentially useful

Per 30 g serve

Energy 480 kJ	Protein 1.6 g	Fat 0.1 g	Sat fat 0.1 g	Carbs 26.3 g	Sugars 11.0 g	Fibre 0.4 g	Sodium 196 mg
5.5%	3.2%	0.1%	0.4%	8.5%	12.2%	1.3%	7.3%

Cocoa puffed rice

Per 45 g serve

Energy 639 kJ	Protein 4.3 g	Fat 0.8 g	Sat fat 0.2 g	Carbs 28.6 g	Sugars 10.2 g	Fibre 6.4 g	Sodium 122 mg
7.3%	8.6%	1.1%	0.8%	9.2%	6.4%	21.3%	5.3%

Wheat bran flakes with sultanas

Per 30 g serve

Energy 492 kJ	Protein 4.1 g	Fat 0.5 g	Sat fat 0.1 g	Carbs 22.1 g	Sugars 1.1 g	Fibre 3.6 g	Sodium 96 mg
5.7%	8.2%	0.7%	0.4%	7.1%	1.2%	12.0%	4.2%

Wheat breakfast biscuit

Per 20.5 g serve

Energy 133 kJ	Protein 4.8 g	Fat 0.5 g	Sat fat 3.0 g	Carbs 2.0 g	Sugars 2.0 g	Fibre 0.0 g	Sodium 267 mg
1.5%	9.6%	0.7%	1.3%	0.6%	2.2%	0.0%	11.6%

Reduced fat processed cheese

Per 30 g serve

Energy 503 kJ	Protein 7.8 g	Fat 9.9 g	Sat fat 6.6 g	Carbs 0.0 g	Sugars 0.0 g	Fibre 0.0 g	Sodium 198 mg
5.8%	15.6%	14.1%	27.5%	0.0%	0.0%	0.0%	8.6%

Cheddar cheese

Per 21 g serve

Energy 230 kJ	Protein 6.5 g	Fat 3.2 g	Sat fat 2.0 g	Carbs 0.1 g	Sugars 0.1 g	Fibre 0.0 g	Sodium 162 mg
2.6%	13.0%	4.6%	8.3%	0.0%	0.1%	0.0%	7.0%

25% reduced fat cheddar cheese

Figure 4. Percentage daily intake counters of commonly consumed food items. Sat fat: saturated fat; Carbs: carbohydrates.

Table 2. Advantages and disadvantages associated with two different nutrition labelling systems proposed for use in Australia

	Colour-coded Traffic Light System (CTLS)	% Daily Intake (%DI) counter
Advantages	• Requires no calculation by the consumer to interpret information therefore more equitable • Easy to understand • Indication of nutrient profile at a glance • Eye-catching and immediately noticeable • Quick to interpret	• Provides more detailed, 'factual' information • Widely supported by the food industry
Disadvantages	• Some potential to confuse: e.g. if two green and two red lights appear on the same product • Does not take into account other positive nutrients (e.g. fibre, protein)	• No guidance on relative amounts (i.e. what is 'a lot'/'a little') • May confuse consumers as it is based on 'per serve' • Not relevant for children and adolescents • Requires consumer education to be useful • Very difficult to interpret by less educated consumers

addition, in combination with the more detailed NIP. %DI information can be effectively included in the CTLS, which has already been demonstrated by UK food manufacturers.

Opponents of the %DI approach are also concerned that the %DI is based on an average male adult diet therefore has little application for children. In contrast, the CTLS is based on per 100 g, which is essentially a percentage, so a red light relating to fat for adults (> 20 g per 100 g) would have the same application to children, though the cut-off may be different.

Conclusion

The advantages and disadvantages of the two systems are summarised in Table 2. Based on this assessment, we believe that a system similar to the colour-coded Traffic Light System currently used in the UK is likely to be more effective for use in Australia than a percentage daily intake (%DI) counter. In particular, it would complement the more detailed mandatory NIP already in operation. A combination of a single traffic light, based on the overall nutrient profile of the food, together with the CTLS for individual nutrients, including total fat, saturated fat, sugar and salt, would offer additional benefits. Whichever system is chosen, there should be clear and specific mandatory guidelines on how the information should be presented on food packages to minimise confusion to consumers. Further research on the effect of a CTLS on consumer behaviour would be valuable, including investigation of the effect of labelling on sales. Consideration should also be given to producing a set of criteria appropriate for each food group.

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Is there a risk of malaria transmission in NSW?

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Abstract: NSW has a putative malaria vector in *Anopheles annulipes*, and increased numbers of immigrants from malaria endemic countries who may be infective to mosquitoes but asymptomatic. We examine the factors known to influence malaria transmission and conclude that local transmission is possible but unlikely. The public health implications are that there should be systematic screening of immigrants from malaria endemic countries on arrival, and that the public health capacity to identify and respond to a malaria outbreak should be maintained.

Australia has been considered malaria free since 1981; however, there are approximately 700 imported cases of malaria reported each year.[1,2] The most recently documented outbreak of locally acquired malaria occurred in 2002 near Cairns in Queensland with 10 confirmed cases resulting from an infected traveller, who may have become infected in Indonesia or Madagascar.[3]

Australia has been receiving increasing numbers of immigrants from malaria endemic areas, with 9846 people from Africa arriving in 2004–2005 under humanitarian programs.[4] Of 215 consecutive African refugees screened for malaria at a clinic in Newcastle, 22 (10%) had malarial parasites of at least one species; 21 *Plasmodium falciparum*, three *P. malariae*, two *P. ovale*, and one *P. vivax* (Davis J, Webber M, personal communication, 2006). Refugee settlement has increased in regional areas where structured screening programs have not previously existed. Unlike returned travellers who have no immunity and thus are symptomatic if infected with malaria parasites, migrants from endemic regions may show no symptoms and go undiagnosed unless specifically tested.

It is therefore important to address the questions: does the presence of the putative vector mosquito *An. annulipes* in New South Wales (NSW) pose a threat for malaria transmission given the occurrence of imported infections and what are the public health implications?

Background on malaria

There are four species of human malaria parasites: *P. falciparum*, *P. vivax*, *P. ovale* and *P. malariae*. The most dangerous is the potentially fatal *P. falciparum*, which together with *P. vivax* accounts for approximately 90% of cases in Australia.[1] The incubation period for malaria is generally one to two weeks, but can be longer for certain strains and following chemoprophylaxis. A person with the infection becomes infective to mosquitoes late in the course of the initial illness (from as little as a week to over a month), but can remain periodically infective to mosquitoes for up to a year (*P. falciparum*) or longer for other malaria species. Not all treatments eradicate the gametocytes, the stage that infects mosquitoes. This means that, with international travel and immigration, there is always a small chance that an infective person will arrive who could infect local *Anopheles* mosquitoes.

Mosquitoes that feed on gametocyte carriers are not immediately infective, as the malaria parasite undergoes part of its life cycle in the gut wall of the insect and then actively migrates to the salivary glands from where it is injected along with anticoagulant saliva during a bite. The time taken for the mosquito stages to be completed and the mosquito to become infective is referred to as the extrinsic incubation period (sporogony, or the extrinsic cycle) and is highly temperature dependent, ranging from 4 days at 30°C to 16 days at 20°C (Figure 1). This is of great importance, as at lower temperatures the incubation period may be longer than the average lifespan of the mosquito resulting in few or no infective mosquitoes.

Malaria in NSW

In Australia, the mosquito known as *Anopheles farauti* sensu lato is considered the most important vector of malaria. It is principally found in areas north of 19° latitude in Queensland and north of 15° latitude in the Northern Territory, although it has been reported in Mackay (21°9′) and Townsville (19°15′), and north of 17° in the Northern Territory. The area considered at greatest risk of malaria in Australia has been primarily determined by the range of *An. farauti* s.l., climate supportive of parasite

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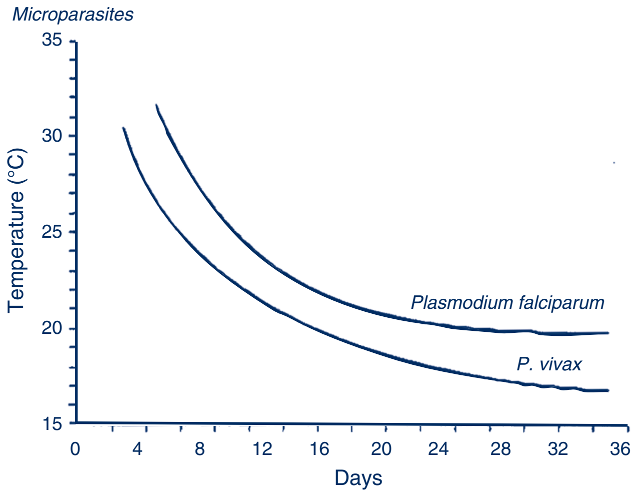

Figure 1. The duration of sporogonic development (latent period) of malaria parasites in the mosquito host (*Anopheles* spp.) in relation to environmental temperature (°C).[15] Used with permission.

transmission and historical records of outbreaks. However, transmission of malaria in Australia has historically occurred as far south as Melbourne in the east and Perth in the west, and a range of *Anopheles* species occurs throughout the country, although little is known of their respective capacities to transmit *Plasmodium* parasites under field conditions.[5]

Historically, there has been a small number of locally acquired malaria cases in NSW, thought to be eight in the 20th century, all of them *P. vivax* and most associated with military personnel returning from overseas service with transmission attributed circumstantially to *An. annulipes* s.l.[5] This mosquito is generally the most abundant of the six *Anopheles* species known to occur in NSW, the others being *An. amictus*, *An. atratipes*, *An. bancroftii*, *An. pseudostigmaticus* and *An. stigmaticus*. Laboratory studies have shown *An. annulipes* s.l. to be capable of transmitting malaria parasites but they have not been found infected in nature.[5,6] While little is known of the malaria capacity of the remaining species, they are considered relatively rare and unlikely to pose a risk for malaria transmission, although *An. amictus* can be locally abundant and has been suspected to be involved in malaria transmission in the Northern Territory.

Anopheles annulipes s.l. is a spindly looking grey mosquito of which the wings and legs are mottled with white scales. The larval stages are associated with a range of freshwater habitats and lie flat under the water surface, often in the thin layer of water above algal blooms. This mosquito is typically found in flooded ground pools and, although it is not usually associated with estuarine wetlands, larvae occasionally colonise these brackish water habitats when rainfall has reduced the salinity of the ground pools. The adult mosquitoes may live for up to three weeks and the female mosquitoes take blood meals from humans (as well as other mammals) predominantly from dusk to dawn. Mark–release–recapture experiments on this mosquito species at Griffith, NSW, revealed mean dispersal distances of approximately 1.2 km, although some mosquitoes were found to travel up to 5 km.[7]

In the Australasian region, the mosquitoes called *An. annulipes* s.l. and *An. farauti* s.l. are each a group of species, called sibling species, that are morphologically similar but vary in their distribution and biology, and probably in their capacity to transmit *Plasmodium* species. It is not known which siblings were included in the laboratory studies that demonstrated transmission capacity or were involved in historical field transmission.

Assessing the risk of an outbreak in NSW

Malaria transmission is dependent on many probabilistic events, such as a mosquito finding someone who is infective (gametocytes present in peripheral blood), the mosquito being capable of being infected and then living long enough to develop sporozoites and thus become infective, and the opportunity of biting a susceptible person and transmitting the parasite. The threats to this process are many: successful treatment of infected people to prevent them becoming infectious to a mosquito; use of personal protection measures against mosquito bites including insect screens, clothing, insecticides and repellents; dry weather that can reduce mosquito longevity; cold weather that prolongs the extrinsic cycle; and the presence of other blood sources and the relatively low density of people in many inland parts of rural and regional NSW where *An. annulipes* s.l. is more abundant.

Mathematical models offer an understanding of the transmission dynamics of malaria, and while variable values are not available for NSW they can provide a useful framework for considering the risk of local malaria transmission.[8] The basic reproductive ratio (R_0), the number of new cases of malaria generated by one case introduced into a population of fully susceptible hosts during the duration of the case, may be quantified by multiplying the transmission rate factor from vector to human during the life-span of the vector (T_H) with the transmission rate factor from human to vector during the duration of infection in the human (T_V).

In this model, $T_H = V/H\ a\ b_H\ L_V$

while $T_V = a\ b_V\ D_H$

where:
- V is the density of vectors
- H is the density of human hosts
- a is the biting rate on the human host per vector, which includes the biting frequency (estimated as the reciprocal of the length of the gonotrophic cycle) and the proportion of blood meals taken on humans

Box 1. Glossary

Imported malaria: people arriving with malaria acquired overseas.

Introduced malaria: local transmission from imported cases.

Indigenous malaria: local transmission from other than an imported case.

Established (endemic) malaria: continuing transmission of indigenous malaria.

Receptive areas: places where the climate and suitable vectors could result in established malaria if it was introduced.

Gametocyte: the stage of parasite transferred from humans to mosquitoes.

Sporozoite: the stage of parasite transferred from mosquitoes to humans.

Sensu lato (s.l.): 'in the broad sense' (Latin); when a species name is used to refer to a group of morphologically similar sibling species.

- b_H is the proportion of infectious bites on humans that produce a patent infection in humans
- b_V is the proportion of bites by susceptible mosquitoes on infected people that produce a patent infection in the vector
- L_V is the life expectancy of the vectors
- D_H is the duration of infectiousness in the host.

Important assumptions underpinning this model include a lack of immunity in the susceptible human population, which is a robust assumption in NSW and an absence of a parasite-induced effect on vector survival or behaviour.[9,10]

$$\text{Thus } R_0 = T_H \times T_V = V/H\, a^2\, b_H\, b_V\, D_H\, L_V$$

Variables included in a mathematical model for explaining the transmission of malaria

V: the spatial and temporal abundance of *An. annulipes* s.l. fluctuates across NSW. The availability of suitable habitat in Griffith in the inland results in high adult populations in late summer (Figure 2), while in Port Stephens on the coast *An. annulipes* s.l. is present at relatively low densities (Figure 3) with only a few individual mosquitoes collected in traps that may contain many thousands of mosquitoes dominated by *Aedes vigilax* and *Culex annulirostris*.

H: the density of human hosts may be affected by planning decisions if residential developments occur in areas close to productive mosquito habitats or areas of intense mosquito activity. In the inland areas with greatest abundance of *An. annulipes*, there are generally low to very low human population densities; however, urban sprawl may increase the number of human populations close to mosquito habitats.

a: the number of bites per vector depends on the accessibility of humans to host-seeking female mosquitoes. Biting rates will be influenced by factors such as the use of insect screens, bed nets, insect repellents, presence of alternative blood sources and frequency and nature of nocturnal outdoor activities. The contact between mosquitoes and humans may also be increased when refuge sites for adult mosquitoes, such as heavily vegetated areas, are close to dwellings.

b_H: the probability that human infection occurs when bitten by an infected mosquito is generally assumed to be 0.8 to 1.0.

b_V: this variable includes not only the proportion of mosquitoes that become infected while taking a blood meal, but also the delay due to sporogonic development that must occur before they become infective. The duration of sporogony is highly temperature dependent as shown in Figure 1, and is a crucial factor limiting malaria outside the tropics.

L_V: to transmit malaria parasites, the female mosquito has a blood meal, lays eggs, and goes looking for another

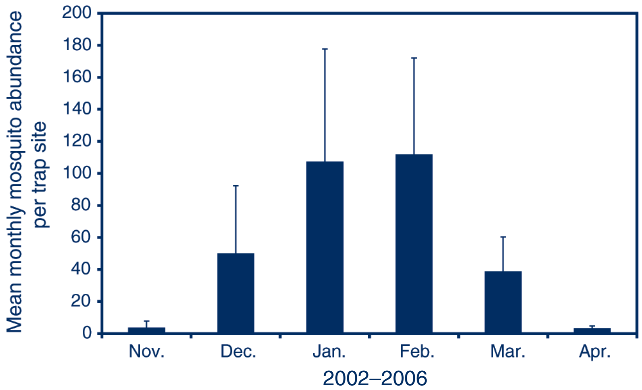

Figure 2. Mean monthly abundance and standard error (SE) of *Anopheles annulipes* sensu lato at Griffith, NSW; aggregate years 2002–2006 (NSW Health 2006).

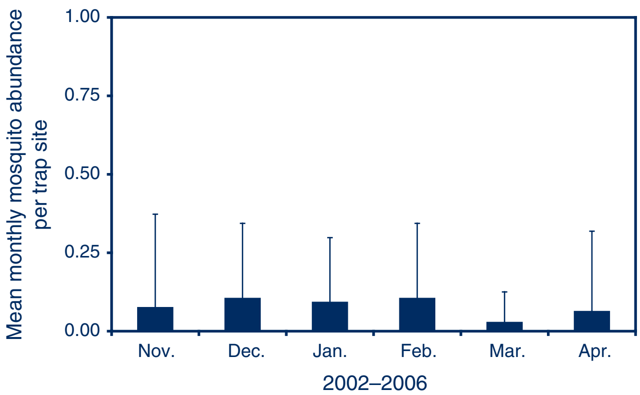

Figure 3. Mean monthly abundance and standard error (SE) of *Anopheles annulipes* sensu lato at Port Stephens, NSW; aggregate years 2002–2006 (NSW Health 2006).

meal. The survival of adult mosquitoes is influenced by humidity, temperature and availability of suitable refuge sites (e.g. vegetation). Studies of *An. annulipes* s.l. at Echuca, Victoria, on the Murray, and Appin, NSW, demonstrated that the oldest mosquitoes were present in summer and late autumn. Based on the ambient temperature at each site, up to 6.6% of females at Appin and 10.3% at Echuca lived long enough to potentially become infective.[11]

D_H: the duration of infectiveness of a human with malarial gametocytes in their blood depends on the infecting malaria species, whether treatment was provided and what treatment was provided. Untreated *P. vivax* can be infective for 1–2 years, but *P. falciparum* is generally infective for less than one year. In a malaria-naïve person, the infection will cause symptoms that should prompt early diagnosis by an alert clinician and, hopefully, effective treatment, which interrupts transmission. Such treatment may explain the absence of malaria transmission in NSW in recent decades. People from endemic areas who are tolerant of malaria infection will not have a febrile illness so may not be diagnosed. Unless they are adequately screened, they could remain infective for a prolonged period (Figures 2 and 3).

Scenario

It is probable that over many years, if Australians keep travelling overseas and immigrants keep arriving, during a period of unusually high mosquito abundance, triggered by major rainfall and during above average temperatures in late summer or early autumn, malaria transmission will occur in NSW. The risk would be further increased in those areas where high levels of human activity occur between dusk and dawn in close proximity to mosquito-breeding habitats and particularly in areas that provide harbourage for adult mosquitoes, including heavily forested parklands within residential or recreational areas.

How long would it take to detect and respond to a malaria outbreak?

Immigrants tolerant to *P. falciparum*, however, arriving in NSW and carrying gametocytes may be infective to mosquitoes for months or possibly up to or longer than a year. If they were fed on by anopheline mosquitoes capable of transmitting malaria, then the shortest delay before outbreak detection would include the extrinsic cycle of 10–12 days, an incubation period of 7–14 days before infected humans become symptomatic, a diagnostic delay of 7 days before malaria infection is confirmed and a period of 2–4 days for identifying the area requiring appropriate mosquito control and organising appropriate larvicidal and adulticidal treatments: a total of at least 30 days before mosquito control is initiated. During this time, the original infective person would continue to be fed on by mosquitoes. This estimate is similar to the most recent Australian outbreak at Mission Beach, Queensland in 2002, in which the period from infection of the mosquitoes to public health notification was 30–33 days.[3] If several people were bitten by infective mosquitoes and were all presenting with similar symptoms at the same time, then the diagnostic delay may be reduced. As gametocytes occur relatively late in the course of illness, infection of mosquitoes from secondary cases is unlikely, as supported by experience from North Queensland where despite abundant *An. farauti* s.l. and higher humidity and temperatures than in NSW, no secondary cases resulted from a local transmission incident.[12] This outcome may demonstrate the effectiveness of local public health services: conducting careful follow up of cases, particularly regarding exposure to areas where mosquitoes are abundant; excluding the likelihood of local infection during follow-up of confirmed cases; increasing public awareness of measures to reduce exposure to mosquito vectors; and retaining entomological expertise to identify local risks and apply effective larval and adult mosquito control measures.

Climate change

The possible impact of climate change on malaria in Australia has been discussed elsewhere.[13,14] The issue is complex, as various mosquito species will be differentially affected by rainfall, temperature and tidal changes. The consensus is that a temperature rise of 1.5°C may extend the malaria-receptive zone southward by a couple of hundred kilometres in the Northern Territory and Queensland. This temperature rise would thus extend the area in which malaria vigilance is required but would not pose a public health problem in NSW. The risk of outbreaks after disasters such as cyclones, which are predicted to become more frequent, should be considered in northern Australia, as housing and health-care facilities could be damaged, and potentially require emergency insect control.

Conclusions

Malaria is not a major health risk in NSW although the possibility of transmission cannot be ruled out completely. Receptivity to malaria will not increase significantly with global warming of 1.5°C. The high prevalence of malaria found during screening of immigrants in Newcastle suggests that immigrants from malaria-endemic countries should be tested for malaria on arrival in a systematic screening program. In NSW, medical practitioners should maintain a clinical index of suspicion in cases of febrile illness, particularly with multisystem involvement. The public health capacity to respond rapidly and effectively to a malaria outbreak must be ensured.

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Admission to hospital for effects of heat and light: NSW, 1993–94 to 2003–04

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Abstract: The study examined the hospital admission rates and characteristics of patients experiencing severe heat-related morbidity in NSW using data from the NSW Health Inpatient Statistics Collection. The study covered the 11-year period from July 1993 to June 2004. ICD-10-AM. codes examined included T67 (effects of heat and light). There was an average of 91 admissions for each year due to a principal diagnosis of the effects of heat and light, with consistently more males than females admitted (1.7 : 1). Many of the admissions (39%) were of people 65 years of age or older. Most admissions (49%) occurred in the summer months of December and January.

The 2003 heat wave in Europe and climate change caused by humans have heightened interest in the relationships between climate and public health generally, and heat-related morbidity and mortality in particular.[1–3] While many studies have examined heat-related mortality, in some cases associated with specific heat waves, fewer studies have examined heat-related morbidity; for example, by analysis of hospital records.[4–10] The study examines the hospital admission rates and patient characteristics for severe heat-related morbidity in New South Wales (NSW) by analysing routinely-collected hospital inpatient data.

Methods

Data used in the study were from the NSW Health Inpatient Statistics Collection (ISC). The ISC is a census of all admitted patient services provided by NSW public hospitals, public psychiatric hospitals, public multi-purpose services, private hospitals and private day procedures centres.[11] Eleven years of de-identified unit record data were obtained for the period 1 July 1993 to 30 June 2004. Clinical information in the ISC, such as principal diagnosis, additional diagnoses and external causes of injury or poisoning, is coded according to the International Statistical Classification of Diseases and Related Health Problems – Tenth Revision – Australian Modification (ICD-10-AM). Codes examined included T67 (effects of heat and light), incorporating T67.0 (heatstroke and sunstroke), T67.1 (heat syncope), T67.2 (heat cramp), T67.3 (heat exhaustion, anhydrotic), T67.4 (heat exhaustion due to salt depletion), T67.5 (heat exhaustion, unspecified), T67.6 (heat fatigue, transient), T67.7 (heat oedema), T67.8 (other effects of heat and light) and T67.9 (effect of heat and light, unspecified). External causes Y40–Y59 (drugs, medicaments and biological substances causing adverse effects in therapeutic use) used in addition to a T67 diagnosis were also examined.

Temporal characteristics were examined by analysis of the data by year, month and day of the week. Spatial characteristics were examined through analysis of the data by statistical division. Statistical division is an Australian Standard Geographical Classification defined area, which represents a large, general purpose, regional-type geographic area. Statistical divisions represent relatively homogeneous regions characterised by identifiable social and economic links between the inhabitants and between the economic units within the region.[12] There are a total of 12 statistical divisions in NSW. Spatial characteristics were also examined through analysis of the data by latitudinal (north or south) and coastal/non-coastal groupings of statistical divisions. The six statistical divisions north of approximately 33.3°S were categorised as ‘north’, and the six statistical divisions south of this latitude were categorised as ‘south’. The six statistical divisions with a coastal border were categorised as ‘coastal’, while those without a coastal border were categorised as ‘non-coastal’. Rates were age-standardised using the 1996 Australian population.

Results

Over the study period, there were a total of 1289 admissions for effects of heat and light as either the principal or an additional diagnosis. Most of these (78%) were as the principal diagnosis. Where the effects of heat and light were used as an additional diagnosis, the most common principal diagnoses included volume depletion (E86) (14%), syncope and collapse (R55) (8%) and other medical care (Z51) (5%). All effects of heat and light results presented are for the principal diagnosis admissions only. There were an average of 91 admissions each year due to a principal diagnosis of effects of heat and light, although the number varied considerably from year

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Table 1. Summary of the number of admissions for effects of heat and light (T67: ICD-10-AM) in NSW from 1993–94 to 2003–04

Year	Principal diagnosis *n*	Additional diagnosis† *n*	Total *n*	Sex (M : F)*	Age (years)* Range	Median
1993–94	80	31	111	1.3 : 1	1–91	50
1994–95	80	34	114	1.4 : 1	9–99	62
1995–96	55	27	82	1.2 : 1	1–97	48
1996–97	78	19	97	1.7 : 1	7–97	43
1997–98	101	42	143	1.9 : 1	<1–95	48
1998–99	78	20	98	1.5 : 1	1–89	58.5
1999–00	50	23	73	1.9 : 1	13–98	61.5
2000–01	116	36	152	1.6 : 1	2–91	54
2001–02	78	17	95	3.1 : 1	<1–99	40.5
2002–03	146	27	173	1.9 : 1	<1–103	52.5
2003–04	139	20	159	1.7 : 1	<1–96	49
Total	1001	296	1297	1.7 : 1	<1–103	52

*These relate only to principal diagnosis.
†This includes six records for which T67 was also used as the principal diagnosis (1 in 1993–94, 1997–98, 1999–00, 2000–01, 2001–02 and 2002–03), and two records for which T67 was used as more than one additional diagnosis; additional diagnoses 2 and 3 in 1995–96, and additional diagnoses 1 and 2 in 2002–03.
ICD-10-AM: International Statistical Classification of Diseases and Related Health Problems – Tenth Revision – Australian Modification.
Source: NSW Health Inpatient Statistics Collection.

to year, with a minimum of 50 in 1999–00 and a maximum of 146 in 2002–03 (Table 1). The crude average annual statewide hospital admission rate for the effects of heat and light was 1.5 for every 100 000 population. There were consistently more males than females admitted due to a principal diagnosis of effects of heat and light, with the ratio ranging from 1.2 : 1 to 3.1 : 1, and the overall ratio of 1.7 : 1. Admissions due to a principal diagnosis of effects of heat and light spanned all age groups, with a minimum age of less than 1 year and a maximum of 103 years.

Table 2. Number of admissions for principal diagnosis for each ICD-10-AM sub-category of effects of heat and light (T67) in NSW for each year from 1993–94 to 2003–04

Year	ICD-10-AM sub-category T67.0 *n*	T67.1 *n*	T67.2 *n*	T67.3 *n*	T67.4 *n*	T67.5 *n*	T67.6 *n*	T67.7 *n*	T67.8 *n*	T67.9 *n*
1993–94	21	2	0	6	2	46	1	0	1	1
1994–95	23	7	1	8	0	40	0	0	0	1
1995–96	21	11	1	3	0	18	0	0	0	1
1996–97	20	13	2	6	2	35	0	0	0	0
1997–98	26	16	1	7	2	44	0	0	5	0
1998–99	27	14	1	1	1	32	0	0	1	1
1999–00	24	9	0	3	0	13	1	0	0	0
2000–01	38	19	1	3	1	52	0	0	1	1
2001–02	31	10	2	5	0	26	2	0	0	2
2002–03	48	45	2	4	3	43	0	0	1	0
2003–04	50	36	2	5	3	39	1	0	0	3
Total N	329	182	13	51	14	388	5	0	9	10
%	33	18	1	5	1	39	1	0	1	1

ICD-10-AM: International Statistical Classification of Diseases and Related Health Problems – Tenth Revision – Australian Modification.
T67.0: heatstroke and sunstroke; T67.1: heat syncope; T67.2: heat cramp; T67.3: heat exhaustion, anhydrotic; T67.4: heat exhaustion due to salt depletion; T67.5: heat exhaustion, unspecified; T67.6: heat fatigue, transient; T67.7: heat oedema; T67.8: other effects of heat and light; T67.9: effect of heat and light, unspecified.
Source: NSW Health Inpatient Statistics Collection.

However, many admissions (39%) were aged 65 years and over. There was no clear trend in any of these annual characteristics over the study period.

Of the ten sub-categories, two were associated with the majority of admissions. These were 'heatstroke and sunstroke' (T67.0) and 'heat exhaustion, unspecified' (T67.5), which accounted for 33% and 39% of admissions, respectively (Table 2). Another 23% of admissions are accounted for by 'heat syncope' (T67.1) and 'heat exhaustion, anhydrotic' (T67.3). The remaining sub-categories are associated with very few admissions, each including years during the study period in which there were no associated admissions. The sub-category, heat oedema (T67.7), was not used during the study period.

Analysis of the additional diagnoses and external causes of injury or poisoning associated with T67 principal diagnosis admissions was restricted to the years 1993–94 to 2001–02 because the last two years of the data (2002–03 and 2003–04) had mixed these two fields. Sixty-three percent of T67 principal diagnosis admissions over the years 1993–94 to 2001–02 had one or more additional diagnoses, with a total of 959 additional diagnoses recorded. The most common additional diagnoses were volume depletion (E86) (15%) followed by essential (primary) hypertension

Table 3. External causes of injury or poisoning, place of occurrence of external cause of injury and activity when injured for admissions for effects of heat and light (T67) as principal diagnosis in NSW from 1993–94 to 2001–02

ICD-10-AM Code	Definition	Frequency *n*	%†
*External cause of injury or poisoning**			
X30	Exposure to excessive natural heat	469	66
W19	Unspecified fall	17	2
Y83	Surgical operation and other surgical procedures as the cause of abnormal reaction of the patient, or of later complication, without mention of misadventure at the time of the procedure	15	2
X59	Exposure to unspecified factor	14	2
W01	Fall on same level from slipping, tripping or stumbling	12	2
W18	Other fall on same level	8	1
Y04	Assault by bodily force	8	1
W92	Exposure to excessive heat of man-made origin	7	1
Y84	Other medical procedures as the cause of abnormal reaction of the patient, or of later complication, without mention of misadventure at the time of the procedure	7	1
X39	Exposure to other and unspecified forces of nature	6	1
V48	Car occupant injured in noncollision transport accident	6	1
Y52	Agents primarily affecting the cardiovascular system	6	1
Place of occurrence of external cause of injury#			
Y920	Home	54	28
Y929	Unspecified place of occurrence	51	26
Y922	School, other institution and public administrative area	25	13
Y924	Street or highway	18	9
Y928	Other specified place of occurrence	8	4
Y925	Trade and service area	6	3
Y923	Sports and athletics area	5	3
Y921	Residential institution	4	2
Y926	Industrial and construction area	3	2
Y927	Farm	3	2
Activity when injured#			
U73	Other activity	144	74
U72	Leisure activity, not elsewhere classified	5	3
U71	Unspecified sport and exercise activity	1	1
U51	Team bat or stick sports	1	1

ICD-10-AM: International Statistical Classification of Diseases and Related Health Problems – Tenth Revision – Australian Modification.
†Percentage of all principal diagnoses.
*Only the 12 leading external causes are listed.
#Only two years: 2000–01 to 2001–02.
Source: NSW Health Inpatient Statistics Collection.

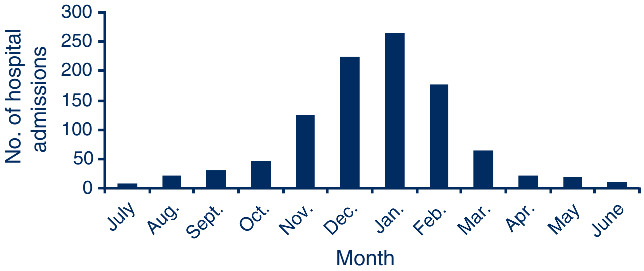

Figure 1. Month of admission for effects of heat and light (ICD-10-AM: T67) in NSW from 1 July 1993 to 30 June 2004. Only principal diagnosis effects of heat and light admissions are shown. ICD-10-AM: International Statistical Classification of Diseases and Related Health Problems – Tenth Revision – Australian Modification. Source: NSW Health Inpatient Statistics Collection.

(I10) (7%). All remaining additional diagnoses categories made up less than 4% each, with most being used only once. Nearly all the T67 principal diagnosis admissions over the years 1993–94 to 2001–02 (98%) had an external cause of injury or poisoning (Table 3). The majority of external causes (66%) were exposure to excessive natural heat (X30). A more in-depth inspection of this field revealed that approximately 2.4% of all external causes were a drug, medicament or biological substance causing adverse effects in therapeutic use (Y40–Y59), but only the six admissions with Y52 as the external cause of injury or poisoning are shown in Table 3. Place of occurrence of external cause of injury, and activity when injured, had only been used for two years of the data (2000–01 to 2001–02). For these years, 175 of the 194 records (90%) had a place of occurrence, and for the majority of these the place of occurrence was either the home, unspecified or school or other institution and public administrative area. Fewer of the records in these years had an activity when injured (150; 77%). There were only four 'activity when injured' categories used, and most were 'other activity'.

Admission did not vary considerably by day of the week, with the minimum of 126 (13%) occurring on Mondays and the maximum of 166 (17%) occurring on Tuesdays. In contrast, there was considerable monthly variation (Figure 1). Most admissions (49%) occurred in the first months of summer (December and January), with a further 30% of admissions occurring in the months either side of this period (November and February). Each of the remaining months included at most 6% of admissions, and the two winter months of June and July each included 1% or less of admissions.

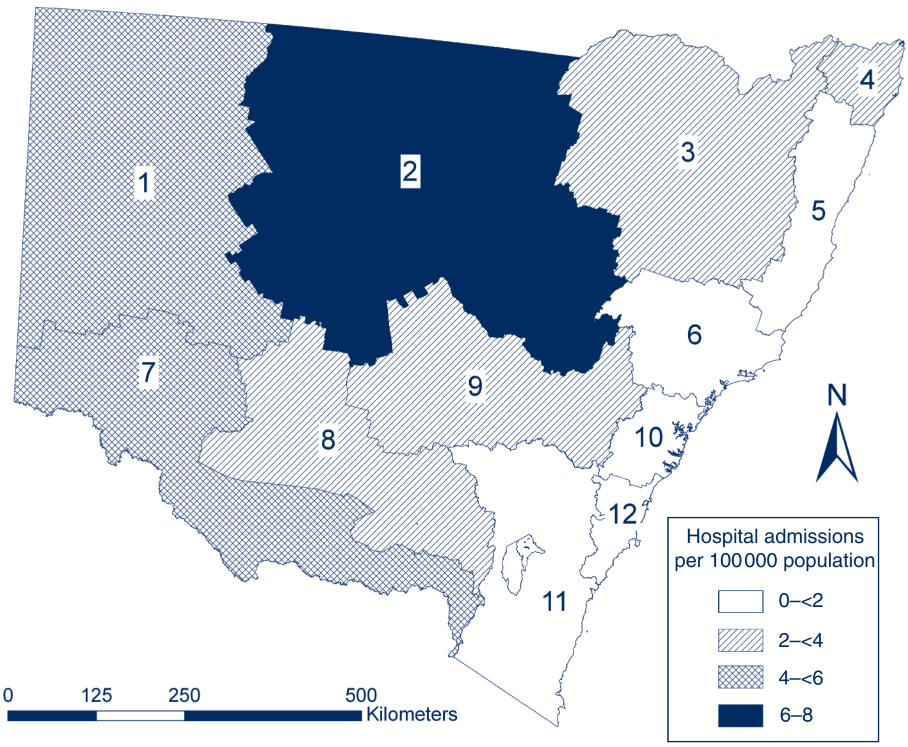

Figure 2. Hospital admission rates for principal diagnosis of effects of heat and light (ICD-10-AM: T67) in Statistical Divisions in NSW from 1 July 1993 to 30 June 2004. Statistical Divisions in NSW: 1: Far West; 2: North Western; 3: Northern; 4: Richmond-Tweed; 5: Mid-North Coast; 6: Hunter; 7: Murray; 8: Murrumbidgee; 9: Central West; 10: Sydney; 11: South Eastern; 12: Illawarra. ICD-10-AM: International Statistical Classification of Diseases and Related Health Problems – Tenth Revision – Australian Modification. Source: NSW Health Inpatient Statistics Collection.

There was strong spatial variability in admissions due to a principal diagnosis of effects of heat and light. The annual average hospital admission rate was more than twice as high in the north of the state than in the south (2.5 *v.* 1.2 per 100 000), and almost four times higher in the west (non-coastal) than in the east (coastal) (4.3 *v.* 1.1 per 100 000). Consistent with this broad pattern, the Illawarra statistical division in the south-east of the state had the lowest annual average hospital admission rate of 0.7 per 100 000, and the North Western statistical division had the state's highest annual average hospital admission rate of 7.8 per 100 000 (Figure 2).

Discussion

The study examined the hospital admission rates and characteristics of heat-related morbidity in NSW by analysis of routinely collected hospital inpatient data. As indicated in previous studies of hospital admissions, the severe types of heat-related disease (heat exhaustion and heatstroke), were the most common.[8] Because the ISC does not capture patients who present only to emergency departments, general practices or other non-hospital health services, or those who do not consult any health service, the total magnitude of heat-related illness in NSW is likely to be greater than is indicated in this study.

The seasonal variability of heat-related admissions was expected and is consistent with previous studies, including slight asymmetry around the middle of summer with skewing in admissions towards the beginning of the summer due to acclimatisation as the season progresses.[13,14] Similarly, the tendency for heat-related illness to occur in older people (median age of 52 years in the study) has been found in previous studies.[8] Although the over-representation of males does not seem to be common in previous studies, some of which have found more females than males affected by heat-related illness, two recent studies of sports and leisure-related heat illness and injury have found an excess of hospitalisations for males, suggesting participation in sports and leisure activities may have contributed to the gender difference found in the study.[8,15,16]

Previous research suggests that there may be some under-reporting of medications as an external cause. For example, in comparison to 2.4% in the present study, another study found a large proportion of heat-related admissions involved one or more medications, such as diuretics (46%) and major tranquillisers (13%), which are risk factors for heat-related illness.[8]

Acknowledgments

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Research evidence can successfully inform policy and practice: insights from the development of the NSW Health Breastfeeding Policy

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Abstract: Strengthening the bridge between research and policy has been identified as a priority if evidence-based policy is to become the norm. However, current understanding of the research–policy interface is limited. A recent policy in NSW was the first evidence-based directive with specific actions to promote and support breastfeeding within a state health system in Australia. This paper explores the development of this policy, highlighting the factors that facilitated the incorporation of research evidence into the policy.

The funding of a research centre to support NSW Health policy and workforce development was significant to the process. The existing organisational linkage ensured that the research evidence was identified, synthesised and effectively communicated, with the needs of the research users in mind and within a clear framework to guide action. The research evidence was not only strong, but also relevant with regard to prevailing political interests. The process was strengthened by the commitment of key researchers and policy makers to breastfeeding. Other types of evidence were considered, including the expert opinions of senior service providers regarding the capacity to act on the research evidence.

Current understanding of the process of 'getting research into policy and practice' is limited, yet an understanding of the process has been highlighted as critical in promoting effective and sustained public health action.[1] Strengthening the bridge between research and policy is a priority if evidence-based policy is to become the norm, rather than the exception.[2]

A recently released policy, *Breastfeeding in NSW: Promotion, Protection and Support*, was the first evidence-based directive in Australia with specific actions to promote and support breastfeeding within a state health system.[3] An exploration of the development of this policy provides insights into the research-policy interface.[4] Figure 1 illustrates key events in the policy development process.

Policy development process

Historical context and political will

The stage was set for action to be taken to support breastfeeding at the population level in New South Wales (NSW) during the 1990s. Around this time there was:

- an accumulating evidence base highlighting the multiple health benefits of breastfeeding[5]
- monitoring evidence showing that the majority of mothers in NSW do not feed their infants according to national health recommendations[6–9]
- several policies and strategies at the national and international level strongly recommending breastfeeding as the most appropriate method for feeding infants[9,10]
- an identification of the promotion of breastfeeding as one of five nutrition priorities for NSW[11]
- a comprehensive review of interventions research identifying evidence-based policy and practice recommendations on breastfeeding.[12]

Nevertheless, progress at this time was limited.

A pivotal event occurred in 2002. The NSW Childhood Obesity Summit opened with a compelling prerecorded video presentation by an expert from the US Centers for Disease Control and Prevention. Professor Bill Dietz identified breastfeeding promotion among a small number of 'best buy' strategies to combat the obesity pandemic.[13] Resolution 3.2 in the Communiqué arising from the Summit was: NSW Health will reinforce breastfeeding policies and services and encourage health professionals to support breastfeeding.[14] In the subsequent NSW Health Summit Action Plan, one of the priority actions for

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supporting parents was 'to give children a healthy start through breastfeeding'.[15] One month after the release of the Action Plan, NSW Health committed substantial funding to a 3-year NSW Health Breastfeeding Project.

The research evidence

Evidence from a synthesis of reviews of interventions to promote and support breastfeeding was available at the start of the Breastfeeding Project.[16] This evidence was critical in supporting the decision to pursue a policy-based approach. The synthesis appraised the findings of nine systematic reviews and meta-analyses from established international organisations. Importantly, the evidence was synthesised with the end-user in mind: the information was presented in a highly readable, jargon-free report within a framework for action and several action areas and corresponding intervention points were clearly identified. Decisively, the evidence synthesis concluded that:

> there is a substantial body of evidence that provides a sound basis to proceed with evidence-based programs and practices in a number of areas, particularly those areas addressed by mainstream health services. These action areas comprise the organisation of hospital services, and prenatal and postnatal community-based education and support services for women.

The Steering Committee of the NSW Health Breastfeeding Project therefore determined that an evidence-based policy was the optimal approach, with the available funds, for achieving changes to practice.

Linkage and exchange

The synthesis report was produced by the NSW Centre for Public Health Nutrition (CPHN). This centre, located at the University of Sydney, received funding from NSW Health to provide information about the state of food and nutrition in NSW and the evidence base for interventions to improve nutritional health status. The centre was also involved in the production of several other reports and papers relating to the promotion and support of breastfeeding at this time.[17,18] The information in these documents was not restricted to the systematic evidence base but considered evidence from other sources, including observational epidemiology (determinants research), as well as summarising the framework for action that had been developed over the previous several years. The researchers participated alongside the policy makers in the Steering Committee and Working Group of the Breastfeeding Project throughout policy development, enabling the evidence to be absorbed into the policy in an iterative manner.

The exchange of information was facilitated by a strong contingent of breastfeeding champions among the key researchers, experts and policy makers involved.

Feasibility to apply the evidence

The feasibility of the proposed evidenced-based approaches was assessed by a range of practitioners. Many representatives of the Steering Committee and Working Group were service providers and user representatives, who had extensive practical and clinical experience in breastfeeding and/or research backgrounds. Considerable expert knowledge, experience and opinion were therefore considered in conjunction with the research evidence.

The feasibility of implementing proposed evidence-based practices was further determined through direct consultation between the Breastfeeding Project Co-ordinator and a sample of 30 senior clinicians and area health service managers. Focus groups were also held with health professionals. This qualitative research identified several attitudinal, organisational, financial and work practice barriers to evidence-based changes to practice. Conversely, the

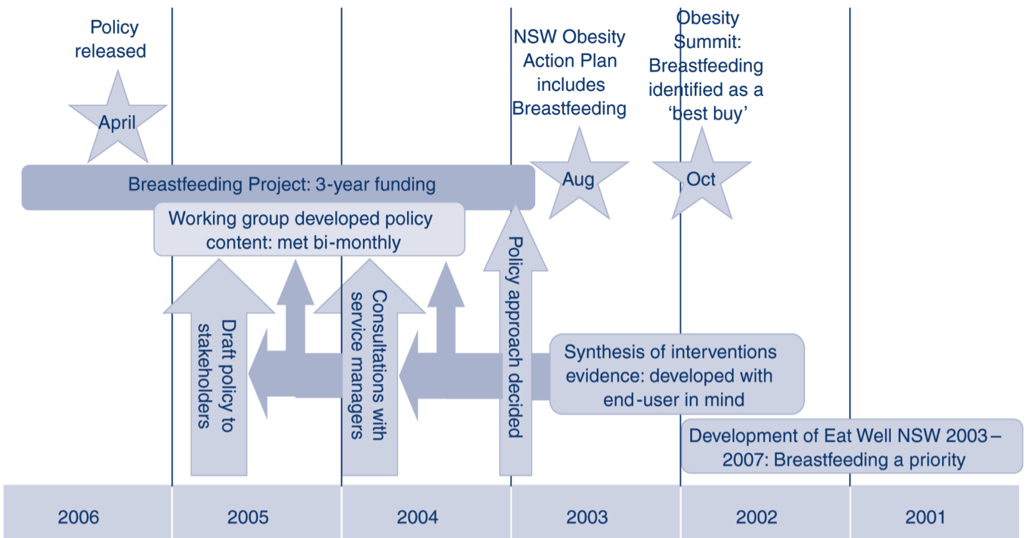

Figure 1. Timing of major events in the development of the NSW Health Breastfeeding Policy.

qualitative research identified those evidence-based initiatives and practices that were seen to be feasible and desirable, such as the Baby Friendly Hospital Initiative, for which the evidence of effectiveness is particularly strong.[19]

Discussion

Research evidence was instrumentally used, as opposed to symbolically used, in the development of public health policy and practice guidelines, the NSW Health Breastfeeding Policy.[20] Several factors were identified in facilitating the translation of the research evidence into policy.

Timeliness and relevance were key factors affecting the process. The Obesity Summit resulted in breastfeeding becoming relevant and associated with a high priority for the state agency.[21] The systematic research evidence also became immediately relevant. Timeliness or relevance is rarely reflected in practice but research findings have greater impact when they are in tune with wider developments of the time.[22,23] The strength of the research findings was important at this stage. Syntheses or systematic reviews offer a method that promotes greater levels of confidence in emergent messages and allows the development of confidence in the face of criticisms of a policy.[24]

Another major facilitator to the process was the linkage and exchange that occurred between the researchers and policy makers. Increased familiarity and contact between the world of research and the world of decision making have been identified as important in reducing the gap between research production and research usage.[2,25] The existing structural and professional linkages ensured that the evidence was identified, synthesised and communicated effectively, which often happens on a more *ad hoc* or indirect basis.[26,27] Ongoing collaboration resulted in the development of jointly owned knowledge, which has been identified as important to successful knowledge translation and exchange.[20,24]

Organisational and structural links also resulted in ongoing, frequent personal contact, a factor that is persistently identified as paramount in research utilisation.[21,28–30] The process was further enhanced through the commitment to breastfeeding of the individuals involved. These product champions ensured purposive dissemination of the research evidence.[31,32] Evidence itself is a passive resource thus an active approach to the evidence is required to make it accessible, contextualised, usable and implemented.[33] In this case, the researchers and policy makers considered the evidence to be strong and were eager to make sure the policy was underpinned by this evidence.

The research evidence was not considered in isolation. Many other types of evidence inform policy and practice and within the Breastfeeding Policy development process, stakeholders provided their own forms of evidence – knowledge, experience, ideas and opinion – to interact with the research evidence in an iterative process.[2,34] Broad stakeholder representation can often act against the underpinning of policy with research evidence as each stakeholder brings his or her own experience and ideas to the table. However, the linkages between the researchers, policy makers and other stakeholders, enabled a three-way dialogue to be maintained throughout policy development rather than a linear and unidirectional transfer of information. This dialogue also helped prevent misinterpretation of the evidence, as research findings are easy to abuse, either through selective use, de-contextualisation or misquotation.

The likelihood of policy adoption and implementation success was enhanced through the integration of qualitative evidence from consultation with service managers. Evidence derived from scientific studies is important, but best understood as providing a scientifically plausible framework for intervention, rather than a guide to detailed action at the local level.[35] The consultations provided evidence of the feasibility and desirability of policy directions, or of the capacity to act that is often lacking in getting evidence into action.[1] The importance of incorporating the views of practitioners, service users and user representatives in the development of evidence-based recommendations in public health has recently been highlighted, also within the domain of breastfeeding promotion and support, in the United Kingdom (UK).[36] Ultimately the transparent consultation and iterative exchange of information enabled the integration of the research evidence with the other types of evidence, resulting in an evidence-based product that is likely to be implemented and produce effective results.

This paper has focused on the use of research evidence in the development of the NSW Health Breastfeeding Policy to illustrate the importance of increased investment in policy-relevant public health research, including primary studies as well as research syntheses and reflections. Health providers are being encouraged to turn to research to inform and justify their service delivery decisions, and researchers are increasingly expected to engage policy makers and research consumers in both the construction and dissemination of research.[37] However, there is often not enough push from researchers or pull from decision makers to incorporate the research evidence base into policy. Decisions are commonly guided by common sense and experience rather than the formal evidence base.[1] Enhanced use of evidence, however, contributes to achieving superior outcomes for the final beneficiaries of knowledge translation, who in return, generate value for money invested in knowledge.[27]

The funding opportunity for policy-relevant research was an important factor in this case study. NSW Health provided funds to the research centre so had a vested interest in using the research findings. The funding and development of long-term research centres focussing on particular topics, or epistemic communities, are considered to be potentially the strongest ways a health system can take action to increase the possibilities of research being used to inform policy.[23,25] Partnering researchers and decision makers has been identified as a priority to facilitate linkage and exchange in Australia.[26]

Case studies such as this can be limited due to a lack of generalisation of findings. However, the primary factors affecting whether and how research evidence is translated into policy that have been highlighted in the present study are congruent with other findings. Another shortcoming is that the process has been described from the perspective of two main stakeholders; the researcher and the policy maker. Perspectives of others, particularly from those more external to the process, may provide additional insights.

Summary

Effective linkage and exchange between the researchers and the policy makers were crucial to the instrumental use of the research evidence in the development of the NSW Health Breastfeeding Policy. This was underpinned by existing structural and professional links between the researchers and the research users, enabling the research evidence to be identified, synthesised and communicated effectively. The process was strengthened by the individual beliefs of the key players. A range of other factors beyond the research evidence – such as the historical context, the political will and the involvement of stakeholders – contributed to shaping the Breastfeeding Policy.[20] Accordingly, translating research knowledge into policy and practice is a more complex and context-sensitive process than simply producing the evidence.[38]

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The re-emergence of pertussis: implications for diagnosis and surveillance

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Abstract: Pertussis, or whooping cough, a highly contagious disease caused by *Bordetella pertussis*, is making a comeback globally and nationally in spite of reasonable vaccination coverage. This paper provides an update on laboratory testing methods that assist the confirmation of clinical disease and investigation of outbreaks. Laboratory confirmation of the diagnosis by polymerase chain reaction or serology should be attempted, especially when atypical pertussis is suspected clinically. Genetic and antigenic variations in virulence factors of strains circulating in the population should also be monitored.

Pertussis, or whooping cough, is a highly contagious disease caused by *Bordetella pertussis.* This update summarises developments in laboratory testing of pertussis that assist clinicians with the confirmation of the clinical disease and the investigation of outbreaks.

Current laboratory methods

Tests currently used to confirm pertussis infection are shown in the Table 1.

Specimen collection

Proper technique and timeliness of specimen collection are important (Figure 1). Nasopharyngeal aspirates are the preferred specimens for polymerase chain reaction (PCR), but are often difficult to collect except from very young children. Aspirates produce a higher recovery of organisms than swabs, and specimens can be split for multiple tests. A swab of the nasopharynx is better than a swab of the anterior nostril for PCR. The polyester swab should be gently inserted into the base of a nostril, advanced as far as possible and rotated in the posterior pharynx for ten seconds before withdrawing. Throat swabs are also acceptable specimens for PCR. Nasopharyngeal aspirates or swabs are the only suitable specimens for culture.

Bordetella pertussis is fastidious and quite difficult to grow in the laboratory. It can be recovered from patients only in the first 3 to 4 weeks of illness, and is particularly difficult to isolate from previously immunised persons (Figure 1).[1]

Polymerase chain reaction

Laboratory confirmation of the diagnosis by PCR or serology should be attempted, especially when atypical pertussis is suspected clinically. The use of PCR has made the rapid diagnosis of pertussis possible and is more sensitive than culture.[1,2] The PCR assay is also less affected by antimicrobial therapy. However, as with culture, the sensitivity of PCR decreases with the duration of symptoms. There are occasional false-positive PCR results caused by contamination, which may occur at any stage between sample collection and the laboratory.[2]

Serology

Natural infection with *B. pertussis* is followed by an increase in the serum concentration of IgA, IgG and IgM antibodies. In contrast to natural infection, primary immunisation induces mainly IgG and IgM antibodies.[1] The greatest specificity for the serological diagnosis of *B. pertussis* infection is achieved by the measurement of IgG and IgA antibodies against pertussis toxin. Either a significant increase in serum antibody level (preferably) or single high level, in sera obtained at least 2–3 weeks into the illness may be used for diagnosis. It is rarely possible to demonstrate seroconversion because initial symptoms are non-specific and the first (acute) serum is often not collected until 2–3 weeks after the onset of cough. Anti-pertussis toxin IgG levels of >100–125 European or International Units (using standardised methodology) have been shown to be specific for recent exposure to *B. pertussis*, but this criterion was established in the context of vaccine trials and may be less sensitive and reliable for routine diagnosis.

Many different commercial and in-house serological tests – usually enzyme immunoassays (EIA) – are currently in use; they employ various antigens including pertussis toxin alone or in combination with other, less specific, *B. pertussis* antigens or a crude preparation of whole bacterial cells. The sensitivity and specificity of EIA-based assays vary considerably, but may be as low as 50–60%. The absence of established cut-off points or diagnostic criteria limit the usefulness of serological confirmation.[1,3] Despite these limitations, serological testing (most

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Table 1. Tests currently used to confirm pertussis infection

Test	Sensitivity %	Specificity %	Positive predictive value %	Negative predictive value %	Comments
Culture*	15*	100	100	88	Time consuming and rarely offered
Polymerase chain reaction (PCR)	94	97	84	99	Rapid confirmation of diagnosis; expensive; not affected by antibiotic therapy
Serology (IgA/IgM antibody)	Variable**	Variable			No single test is universally accepted or standardised nationally.*** May remain negative in infants

*Discussion with a pathology service provider is advisable before a specimen collection.
**Higher in children.
***Performance characteristics vary significantly between different serological assays, but attempts to standardise interpretation are underway.

commonly conducted by a commercial assay, which detects IgA against a whole cell pertussis antigen) has been the basis for notification of the majority of pertussis cases in older children and adults, in Australia.

New methods to confirm pertussis infection

Efforts to control outbreaks of pertussis in a community are costly and require: intensive surveillance; detailed alerts to health-care professionals; enhanced vaccination coverage and public education; and aggressive measures involving treatment, prophylaxis and the isolation of suspected cases.[4,5]

During the past decade, the demonstration of polymorphism in *B. pertussis* genes encoding the expression of pertussis toxin and pertactin (another immunogenic *B. pertussis* virulence factor) led to the suggestion that vaccine-driven evolution has resulted in decreased vaccine efficacy.[6,7] Several research groups have also accumulated data suggesting that isolates circulating in a community may be antigenically distinct from vaccine strains and from strains circulating before the introduction of the pertussis vaccination.[7,8] Recent evidence from Europe and Australia indicates that we may face the emergence of successful clones of *Bordetella* harbouring new variants of pertussis toxin.[7,9,10]

Genetic and antigenic variations in virulence factors of strains circulating in the population can be monitored to detect potential escape from immune protection. However, identification of these variants currently requires time-consuming and expensive sequence analyses. Moreover, as PCR increasingly replaces culture for diagnosis of pertussis, fewer clinical isolates are available for testing. To address this problem, researchers at the Centre for Infectious Diseases and Microbiology – Public Health, in partnership with colleagues from the Universities of Sydney and New South Wales, have been developing new

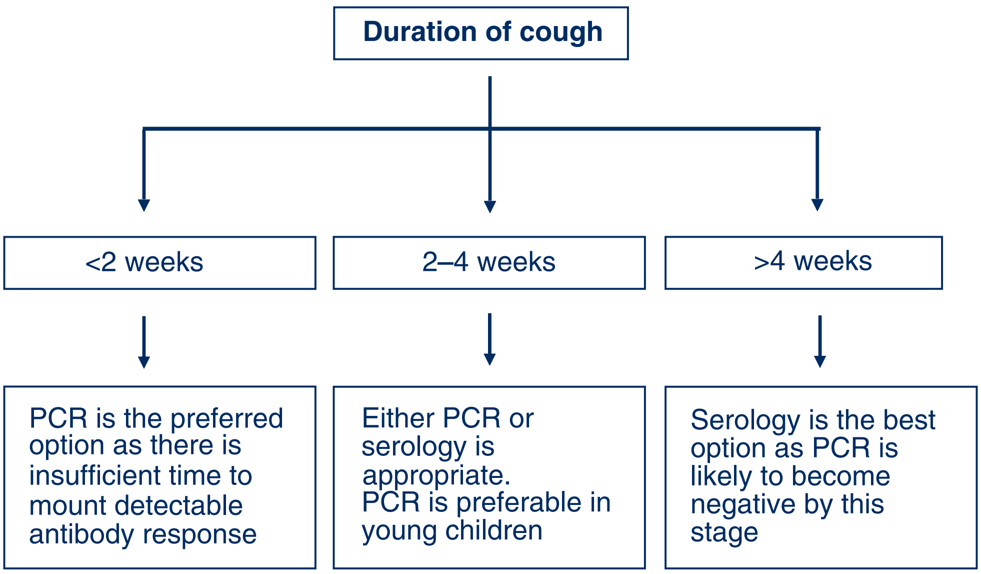

Figure 1. Decision aid for the choice of laboratory investigations in the diagnosis of pertussis. PCR: polymerase chain reaction.

culture-independent methods for molecular subtyping of *B. pertussis* directly from clinical specimens. This method will allow monitoring future epidemiological changes that predict significant antigenic variation and the potential escape from immune protection.

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Legionnaires' disease

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Epidemiology of Legionnaires' disease

Legionnaires' disease was only recently identified in 1976 after an outbreak of pneumonia in people attending a convention of the American Legion in Philadelphia, United States of America. The causative agent was identified as a previously unknown bacterium, named *Legionella*. Legionnaires' disease is a form of bacterial pneumonia and is clinically difficult to diagnose. It usually starts with general malaise, lack of appetite, muscle aches and headache, followed by high fever, chills, a dry cough and pneumonia, with occasional abdominal pain and diarrhoea. The infection is treated with antibiotics.

Overall mortality from Legionnaires' disease is approximately 5%, but is higher in hospitalised patients (up to 40%). Mortality was previously thought to be around 10%; however, newer diagnostic tests have revealed a wider spectrum of disease, with milder cases than were previously detected.

Despite the interest that surrounds outbreaks, most cases of Legionnaires' disease occur sporadically. The mode of transmission depends on the *Legionella* species, but disease is usually transmitted through inhalation of infectious particles from contaminated water (*Legionella pneumophila*) or soil (*L. longbeachae*). There has been no reported person-to-person transmission. The incubation period is 2–10 days, usually 5–6 days. Cases are more common in the summer and autumn months. Risk factors for Legionnaires' disease include increasing age, smoking and being immunocompromised.

There are between 40 and 90 cases of Legionnaires' disease reported in New South Wales (NSW) every year, with an upward trend in national notifications observed over the last 15 years. It is unclear if this is due to a real increase in infections, or to increased publicity and case finding. In NSW, cases of *L. pneumophila* occur at a higher rate in urban areas, probably due to the higher density of cooling towers.

Management of legionellosis

There have been at least eight outbreaks or clusters of Legionnaires' disease in NSW in the last 15 years. Identifying the source of sporadic or outbreak-related cases of Legionnaires' disease is always difficult because the causal organisms are common in the environment and test results usually follow some time after the exposure period, by which time the contamination has been resolved.

The most recent outbreak involved 10 cases who were exposed at Sydney's Circular Quay in January 2007.[1] Public health staff and environmental health officers from the local public health unit worked in collaboration with NSW Department of Health and the City of Sydney Council to investigate the outbreak.

The City of Sydney Council maintains a register of almost 1400 water cooling systems within its area. The register is updated annually and contains such information as the type of system and the contact details of the owner of the premises and the maintenance company. Every cooling tower in the area is inspected at least once every three years, and more often if there is a history of high *Legionella* levels or if the cooling towers are situated in highly populated areas.

If a sampled cooling tower has *Legionella* levels of 10–1000 CFU/mL, warning letters are served on building owners recommending that they review their maintenance procedures in order to comply with the regulations, and a further sample of water is taken to follow up on recommended disinfection procedures. For *Legionella* levels of 1000 CFU/mL and over, a notice is served on the building owner to immediately shut down the system and carry out disinfection of the cooling tower, and a follow-up sample of water is taken for analysis. Shut-down notices are also served when a cooling tower has repeated levels of *Legionella* between 100 and 1000 CFU/mL.

Future directions for the City of Sydney Council include: the adoption of the NSW Health endorsed *Legionella* Management Plan; implementation of a risk-based audit regime for cooling towers; notification of any failures or potential risks encountered to the local public health unit; and the implementation of education programs for building managers and maintenance companies.

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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 Infectious Diseases.
The communicable diseases site is available at: http://www.health.nsw.gov.au/publichealth/infectious/index.asp.

Tables 1 and 2, and Figure 1 show reports of communicable diseases received through to the end of June 2008 in New South Wales (NSW).

Measles

From January to June 2008, 38 cases of measles were reported in NSW compared with four cases reported in 2007. The majority of cases were reported from public health units in the Sydney area.

Fourteen cases were notified in May and a further three confirmed in June. Of those 17 cases, two were associated with overseas travel, 10 were associated with a single cluster in south-west Sydney and one had contact with a known case; for the remaining cases, the source of infection was not identified. The cases ranged in age from 7 months to 36 years; 10 were male and seven female. Over half the cases had not been immunised against measles.

In the cluster of 10 cases identified in south-west Sydney in May and early June, the initial case had attended an emergency department but was not diagnosed with measles at the time. Two siblings of this case (thought to be fully vaccinated against measles) also presented to the same emergency department five days later with fever, cough and rash (consistent with measles). The cluster had three generations of transmission:

- Generation 1: the initial case and the initial case's siblings (who were likely infected at the same time from an unknown source)
- Generation 2: four of their emergency department contacts and one of their school contacts
- Generation 3: one of the emergency department contact's work colleagues (resident in west Sydney) and one in a family member of the school contact.

Public health units across Sydney collaborated to investigate this outbreak and conducted clinics for contacts of the cases to offer vaccination and provide information.

Tuberculosis

There are close to 450 cases of tuberculosis notified every year in NSW. Treatment of the affected person and follow-up of any contacts occur primarily through the network of chest clinics across the state.

In May and June, two large school-based screenings were undertaken by Sydney South West Area Health Service.

Case 1

NSW Health was notified of a case of tuberculosis in a young man who had attended a school in the inner west of Sydney. He was symptomatic in October 2007, but not diagnosed with tuberculosis and did not commence treatment until December while overseas. The diagnosis was not reported to NSW Health until he returned to Australia some months later.

Tuberculin skin test results from the case's closest contacts (i.e. those in his household) suggested that he was unlikely to have been very infectious while at school or in flight. However, the area health service contacted the school administration and with its assistance identified 45 students and five teachers who may have been in close contact with the case. Tuberculin skin tests to screen for possible latent tuberculosis infection were offered. Follow-up continues.

Case 2

In early June, a young man attending a special school in south-west Sydney was diagnosed with active tuberculosis. Almost 50 students and staff are undergoing assessment for possible transmission. Follow-up continues.

Meningococcal disease

There were 11 cases of meningococcal disease in NSW residents in June. Seven of these were caused by *Neisseria meningitidis* serogroup B, for which there is no effective vaccine at present. Of the 11 cases:

- four were pre-schoolers, three were school-aged children, and four were adults
- seven were female

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- five lived in metropolitan, three in regional and three in rural locations.

Children in NSW are routinely offered vaccination against meningococcal disease from the age of 12 months. In recent years, a high school catch-up immunisation program has been conducted throughout the state. This conjugated vaccine only protects against serogroup C disease.

The causative agent is spread in the fine droplets shed through coughing, sneezing and spluttering. The risk from saliva from the front of the mouth is not as important as once thought.

In all cases, close contacts are assessed for the need for clearance antibiotics in case they may be carriers. Advice is given about disease symptoms and the need to seek urgent medical advice if unwell.

Control measures in NSW are based on current national guidelines, available at http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-pubs-other-mening-2007.htm

Influenza

Enhanced surveillance for influenza continued in May and June in the expectation of increased numbers of cases. This surveillance tracks data from four sources:

- influenza-like illness presentations to 28 emergency departments across NSW
- laboratory diagnoses of respiratory infections
- deaths due to influenza or pneumonia
- outbreaks.

During May and June, influenza data indicated normal background influenza activity for the season. A total of 34 laboratory-confirmed cases were notified in the state in May and 45 in June.

While vaccination against influenza may cause some side effects (mild fever, muscle aches) the vaccine does not contain live virus, and cannot cause true influenza.

Enteric diseases

In May and June 2008, NSW public health units investigated 95 outbreaks of gastroenteritis, including 88 suspected to be caused by person-to-person spread, and seven suspected to be foodborne. Foodborne outbreaks are investigated in collaboration with the NSW Food Authority.

The 88 suspected person-to-person outbreaks affected a total of 1245 people. Fifty-two occurred in aged-care facilities and affected 779 people; 22 occurred in hospitals and affected 283 people; 12 occurred in child-care centres and affected 103 people; one was in a community centre affecting three people; and one in a school where 77 students were reported absent.

Clinical specimens were submitted for testing for 39 of the 88 suspected person-to-person gastroenteritis outbreaks. Rotavirus was confirmed in stool samples from one aged-care facility outbreak, and norovirus was identified in 13 outbreaks. The causative agent was not confirmed for the remaining outbreaks.

Of the seven suspected foodborne gastroenteritis outbreaks, one was of likely viral origin affecting 17 people, where an epidemiological investigation indicated the vehicle was roast pork served at a catered function. One outbreak in a correctional facility affected all 14 people who shared a common meal; the pathogen was not identified. Chinese banquet style meals from two different restaurants were implicated in two small outbreaks with 12 people affected. Two other larger outbreaks, affecting approximately 100 people, were most likely caused by preformed bacterial toxins in foods (*Clostridium perfringens* and *Bacillus cereus*).

In late June, a diarrhoeal outbreak affecting approximately 70 residents of a nursing home in the Blue Mountains was reported. The epidemiological and clinical picture of the outbreak indicated it was most likely foodborne, with *C. perfringens* toxin detected in several stool samples. The organism was not detected in food samples.

Figure 1. Reports of selected communicable diseases, NSW, January 2004 to June 2008, 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%

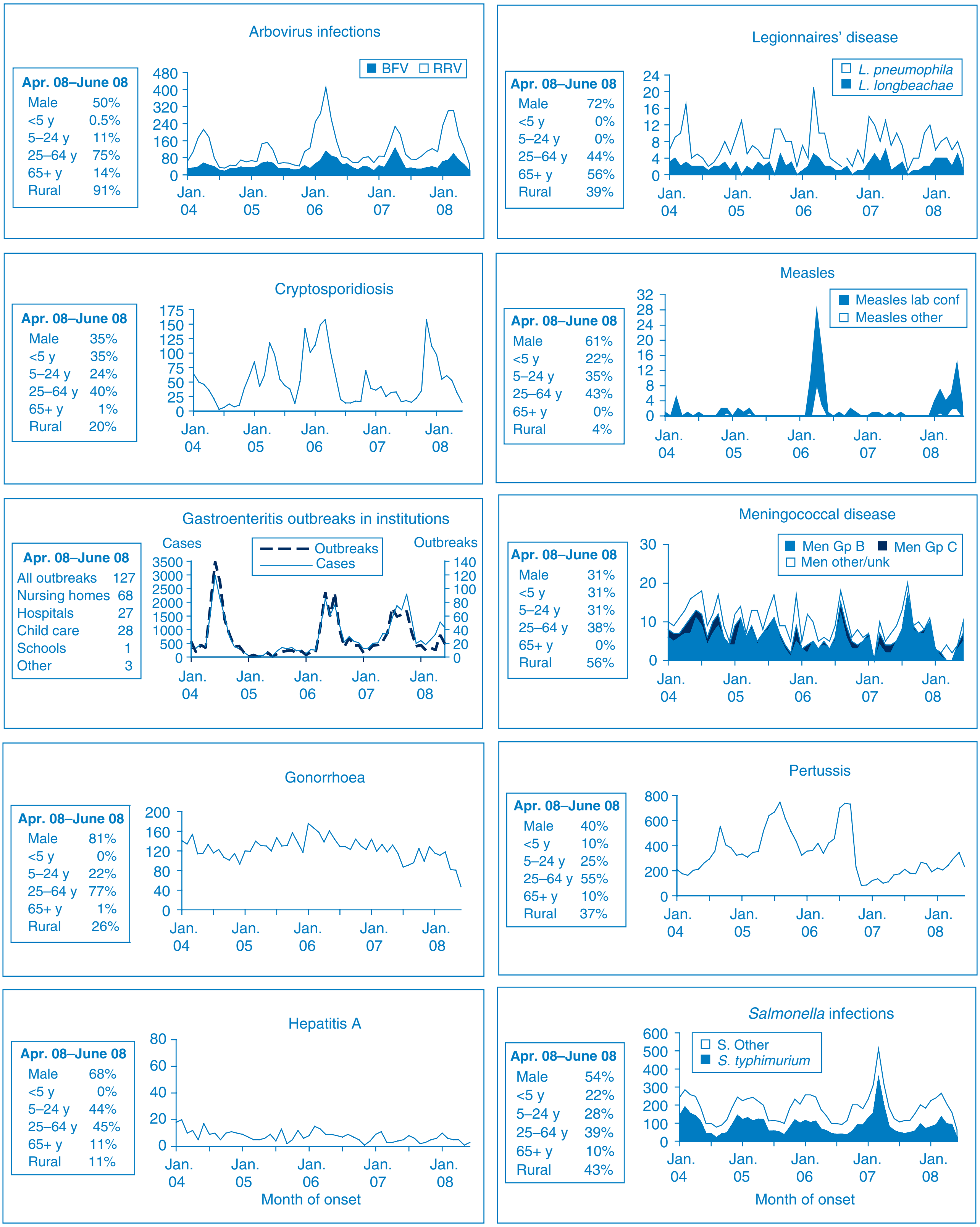

Table 1. Reports of notifiable conditions received in May 2008 by area health services

Condition	Area Health Service (2008): 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 May[c]	Total: Year to date[c]
Bloodborne and sexually transmitted[b]																				
Chancroid[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chlamydia (genital)[a]	32	24	26	28	58	141	48	28	56	39	121	55	224	1	1	33	99	6	1030	5476
Gonorrhoea[a]	1	–	1	–	–	8	1	1	2	3	14	6	32	–	–	1	5	–	77	521
Hepatitis B – acute viral[a]	–	1	–	–	–	2	–	–	1	–	1	–	–	1	1	–	–	–	7	16
Hepatitis B – other[a]	2	–	4	–	–	6	2	1	–	4	39	8	27	3	1	3	58	6	171	1064
Hepatitis C – acute viral[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
Hepatitis C – other[a]	22	11	14	3	16	39	12	22	24	36	20	17	50	–	–	10	21	38	361	2018
Hepatitis D – unspecified[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	3
Lymphogranuloma vanereum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Syphilis	–	1	9	1	2	3	1	2	1	1	5	4	36	3	1	–	13	–	85	462
Vectorborne																				
Barmah Forest virus[a]	1	1	1	1	–	13	2	14	17	1	–	–	–	–	–	–	–	–	51	347
Ross River virus[a]	16	4	6	6	1	22	7	7	10	2	2	8	2	1	–	4	1	–	99	815
Arboviral infection (other)[a]	–	–	–	1	–	1	–	–	–	–	2	–	2	–	–	–	–	–	6	57
Malaria[a]	–	–	–	–	–	–	1	2	–	1	1	2	1	–	–	–	1	–	9	46
Zoonoses																				
Anthrax[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Brucellosis[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Leptospirosis[a]	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1	8
Lyssavirus[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Psittacosis[a]	–	–	–	–	–	1	–	–	–	–	–	–	1	–	–	1	–	–	3	14
Q fever[a]	2	1	–	2	–	2	2	–	–	–	–	2	–	–	–	–	–	1	12	77
Respiratory and other																				
Blood lead level[a]	2	–	–	25	–	12	–	–	1	–	–	1	3	–	–	–	–	–	44	129
Influenza[a]	2	7	–	–	2	2	–	3	4	1	1	10	3	–	–	5	10	–	50	316
Invasive pneumococcal infection[a]	1	3	–	2	3	6	–	–	2	2	3	1	3	–	–	1	9	–	36	123
Legionella longbeachae infection[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	15
Legionella pneumophila infection[a]	–	–	–	–	–	–	–	–	–	–	–	1	1	1	1	–	–	–	4	21
Legionnaires' disease (other)[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Leprosy	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Meningococcal infection (invasive)[a]	1	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	3	14
Tuberculosis	–	–	–	–	–	4	–	–	–	3	1	2	3	1	1	1	3	–	19	159
Vaccine-preventable																				
Adverse event after immunisation	3	3	–	–	1	–	–	–	1	1	–	4	1	1	2	2	6	–	25	139
H. influenzae b infection (invasive)[a]	–	–	–	–	1	–	–	–	–	2	–	–	–	–	–	–	–	–	3	5
Measles	–	1	–	–	–	–	–	–	–	–	–	–	1	1	9	1	–	–	13	34
Mumps[a]	–	–	–	–	–	1	–	–	–	1	–	–	–	–	–	1	–	–	3	64
Pertussis	6	3	–	6	1	16	6	7	39	14	38	18	27	22	14	12	50	–	279	1238
Rubella[a]	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	1	–	3	3
Tetanus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Enteric																				
Botulism	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cholera[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cryptosporidiosis[a]	1	–	–	1	1	1	2	–	–	–	6	1	7	–	1	5	13	–	39	319
Giardiasis[a]	5	3	–	8	5	14	2	4	1	9	32	7	30	–	–	3	25	–	148	821
Haemolytic uraemic syndrome	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	6
Hepatitis A[a]	–	–	–	–	–	–	–	–	–	1	–	1	–	–	1	–	–	–	3	30
Hepatitis E[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1	5
Listeriosis[a]	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	1	1	–	3	21
Salmonellosis[a]	3	3	1	4	2	16	4	20	10	10	32	3	40	1	5	6	25	–	187	1119
Shigellosis[a]	–	–	–	–	–	–	–	–	1	–	–	1	1	–	–	–	1	–	4	34
Typhoid[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	2	2	–	2	–	6	19
Verotoxin producing *E. coli*[a]	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1	8
Miscellaneous																				
Creutzfeldt–Jakob disease	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	1
Meningococcal conjunctivitis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	

[a]Laboratory-confirmed cases only. [b]HIV and AIDS data are reported separately in the Public Health Bulletin quarterly. [c]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. NB: From 1 January 2005, Hunter/New England AHS also comprises Great Lakes, Gloucester and Greater Taree LGAs, Sydney West also comprises Greater Lithgow LGA. LGA, Local Government Area. AHS figures are split based on pre-2005 health area boundaries to assist interpretation of data and for continuity with past editions.
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Table 2. Reports of notifiable conditions received in June 2008 by area health services

	Area Health Service (2008)																		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 June[c]	Year to date[c]
Bloodborne and sexually transmitted[b]																				
Chancroid[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Chlamydia (genital)[a]	36	20	23	20	35	116	40	30	39	45	83	48	141	28	11	38	88	7	863	7007
Gonorrhoea[a]	–	–	–	2	–	8	2	–	5	3	9	1	32	1	–	–	4	1	69	617
Hepatitis B – acute viral[a]	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1	18
Hepatitis B – other[a]	–	4	3	–	–	6	2	1	4	2	24	4	37	1	3	7	41	1	143	1286
Hepatitis C – acute viral[a]	1	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	2	6
Hepatitis C – other[a]	16	20	4	11	16	26	4	26	18	29	21	22	39	–	–	19	32	34	340	2475
Hepatitis D – unspecified[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	5
Lymphogranuloma vanereum	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Syphilis	2	–	5	–	1	1	1	–	3	3	7	1	29	–	–	4	14	–	73	517
Vectorborne																				
Barmah Forest virus[a]	1	1	–	2	–	5	1	5	8	1	–	4	–	–	–	–	1	–	29	377
Ross River virus[a]	9	2	2	1	1	17	3	1	5	3	1	1	–	–	–	–	1	–	47	862
Arboviral infection (other)[a]	–	1	–	–	–	2	–	–	1	1	1	–	3	–	–	1	3	–	13	70
Malaria[a]	–	–	–	–	–	–	–	–	–	–	3	–	1	2	–	–	3	–	9	55
Zoonoses																				
Anthrax[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Brucellosis[a]	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	3
Leptospirosis[a]	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1	10
Lyssavirus[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Psittacosis[a]	–	–	–	1	–	1	–	–	–	–	–	–	–	–	1	–	–	–	3	17
Q fever[a]	2	–	–	–	1	1	1	1	–	–	–	–	–	–	–	–	–	–	6	80
Respiratory and other																				
Blood lead level[a]	–	–	–	6	–	2	–	1	–	–	1	1	1	–	–	1	–	–	13	129
Influenza[a]	4	2	–	–	4	5	–	1	2	1	2	4	7	–	–	6	15	–	53	316
Invasive pneumococcal infection[a]	1	1	–	3	2	8	1	3	3	3	6	2	9	4	4	2	9	–	61	123
Legionella longbeachae infection[a]	1	–	–	–	–	1	–	–	1	–	–	–	–	–	–	1	2	–	6	21
Legionella pneumophila infection[a]	–	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–	2	–	4	25
Legionnaires' disease (other)[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Leprosy	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
Meningococcal infection (invasive)[a]	1	1	–	2	–	1	–	–	–	2	1	–	1	–	–	–	1	–	11	25
Tuberculosis	1	–	–	1	–	1	–	3	–	2	6	1	3	1	–	–	9	–	29	204
Vaccine-preventable																				
Adverse event after immunisation	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1	1	1	–	4	145
H. influenzae b infection (invasive)[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	7
Measles	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	–	–	–	4	38
Mumps[a]	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	3	68
Pertussis	19	6	1	12	–	14	5	7	41	9	33	13	35	16	26	25	69	–	331	1602
Rubella[a]	–	–	–	–	–	–	–	–	–	1	–	–	–	1	–	–	–	–	2	5
Tetanus	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Enteric																				
Botulism	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cholera[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cryptosporidiosis[a]	1	–	–	–	–	–	–	2	–	1	4	–	10	–	1	5	4	–	28	352
Giardiasis[a]	2	3	4	2	4	15	4	2	1	9	29	8	21	–	–	5	16	–	126	978
Haemolytic uraemic syndrome	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	2	8
Hepatitis A[a]	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	1	–	3	32
Hepatitis E[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	6
Listeriosis[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	22
Salmonellosis[a]	3	1	5	2	2	15	4	4	4	9	13	6	16	1	1	6	7	–	100	1246
Shigellosis[a]	–	–	–	–	–	–	–	–	–	–	2	–	3	–	1	–	–	–	6	41
Typhoid[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	1	3	–	–	–	4	22
Verotoxin-producing *E. coli*[a]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	9
Miscellaneous																				
Creutzfeldt–Jakob disease	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Meningococcal conjunctivitis	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1

[a]Laboratory-confirmed cases only. [b]HIV and AIDS data are reported separately in the Public Health Bulletin quarterly. [c]Includes cases with unknown postcode.
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Contents

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