

Investigation of a multi-state outbreak of *Salmonella* Hvittingfoss using a web-based case reporting form

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Introduction

Geographically dispersed outbreaks of disease pose challenges for investigators due to the difficulty of collecting and collating comparable data in a timely fashion. In Australia, when cases are detected in more than one jurisdiction, epidemiologists in different health departments must send results of their investigations by fax or email to a coordinating site for analysis. This process can result in considerable time delays and the possibility of data transcription errors. Web-based case reporting systems which house questionnaires on a secure web site allow investigators from multiple sites to enter interview data directly into the outbreak database. NetEpi Case Manager¹ is an open source software tool designed to assist with epidemiological investigations, analyses, and other aspects of public health practice. This system is currently being developed at the Centre for Epidemiology and Research in the New South Wales Department of Health. In 2004, OzFoodNet² trialled NetEpi for the Australian Government Department of Health and Ageing to assess its usefulness as an interim outbreak case reporting system for the Biosecurity Surveillance System.³ The trial demonstrated the benefits of a web-based case reporting system and real-time access to collated uniform data. OzFoodNet decided to use NetEpi in future investigations of geographically dispersed outbreaks.

Between April and June 2005, Victoria reported an increase in the number of cases of *Salmonella enterica* ser Hvittingfoss (*S. Hvittingfoss*), with cases also detected in New South Wales, the Northern Territory, the Australian Capital Territory, Western Australia and southern Queensland. *S. Hvittingfoss* is a serovar often isolated from human, animal and environmental sources in northern Queensland, but is rarely identified in other parts of Australia. OzFoodNet used NetEpi to investigate this outbreak on behalf of the Communicable Diseases Network Australia.

Methods

An epidemic curve was constructed using *S. Hvittingfoss* notifications data from the National Notifiable Diseases Surveillance System. Hypothesis generating interviews were conducted with all notified cases of *S. Hvittingfoss* in the Australian Capital Territory, New South Wales, southern Queensland, Victoria and Western Australia whose symptom onset was between 24 April and 31 May 2005. Hypothesis generating interviews in each jurisdiction were conducted using a standard questionnaire with data being entered into a corresponding data form in NetEpi. Case name and address were not recorded. A unique identifier was created for each case using a name code and the residential post code of the case to allow individual cases to be linked to the

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notifiable diseases database in the respective jurisdiction. OzFoodNet Central Office epidemiologists at the Australian Government Department of Health and Ageing extracted the data and calculated the proportion of cases exposed to different food items.

A case-control study was conducted on newly notified cases with onset of symptoms after 1 June 2005 to measure any association between illness and the exposures most commonly identified in the hypothesis generating interviews. A case was defined as any person with *S. Hvitittingfoss* isolated from faeces with onset of diarrhoea after 1 June 2005 who was not a resident of north Queensland. Cases must have been the primary case in the household and interviewed within 30 days of onset of diarrhoea. Using progressive digit dialling from the case's telephone number, three controls per case were enrolled. Cases and controls were interviewed by telephone using specific questionnaires with the results of the interviews being entered into case or control data forms in NetEpi. Data were extracted from NetEpi by the coordinating site and analysed using Stata release 8.0.⁴

Results

The epidemic curve showed an increase in cases of *S. Hvitittingfoss* in multiple jurisdictions beginning in April 2005, with the peak of 42 cases in May 2005 being three and a half times the number of cases reported in May 2004 or 2003 (Figure).

Hypothesis generating interviews were conducted with 34 cases. These were in the Australian Capital Territory (3 cases), New South Wales (7 cases), southern Queensland (10 cases), Victoria (12 cases) and Western Australia (2 cases). The median age of cases was 15 years (range 1–87 years) and 46 per cent of cases were male. In addition to diarrhoea, other symptoms reported by cases included: lethargy (68%), abdominal pain (64%), fever (59%),

vomiting (46%), and nausea (44%). Duration of illness ranged from 36 hours to more than 21 days. Eleven cases (32%) visited hospital and seven (20%) were admitted. A high proportion of cases reported consuming a range of fruits and vegetables in the 14 days prior to illness, including: bananas (80%), tomatoes (50%), strawberries (44%) mandarins (30%) and grapes (20%). We hypothesised that infection occurred as a result of consumption of fruits or vegetables grown in north Queensland where *S. Hvitittingfoss* is endemic.

Eight cases were enrolled in the case-control study, four from New South Wales, two from Victoria and two from southern Queensland. The median age of cases was 42 years (range 6 months to 80 years) and 62 per cent were male. Twenty-four controls were recruited into the study. The median age of controls was 42 years (range two years to 94 years) and 37 per cent were male. No food items were significantly associated with *S. Hvitittingfoss* infection (Table).

Figure. Notifications of *Salmonella* Hvitittingfoss, January 2003 to August 2005, by jurisdiction

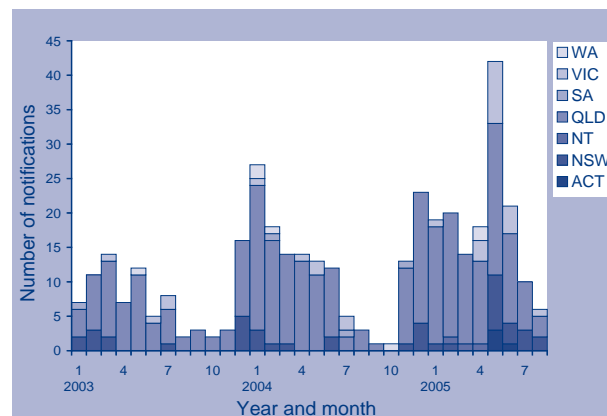


Table. Exposure to selected foods amongst *Salmonella* Hvitittingfoss cases and controls in the three days prior to illness or interview, Australia, 2005

Exposure	Cases (exposed/n)	Controls (exposed/n)	Odds ratio	95 %CI
Apples	5/8	9/24	2.8	0.4–21.7
Bananas	5/8	10/24	2.3	0.3–18.1
Chicken	5/8	15/22	0.8	0.1–6.5
Lettuce	3/8	6/24	1.7	0.2–12.2
Strawberries	2/8	3/24	2.3	0.2–25.0
Sultanas	2/8	3/24	2.3	0.2–25.0
Watermelon	1/8	1/24	3.2	0.04–268.9

Discussion

Web-based case reporting systems offer advantages both for the coordinating site and the sites interviewing cases remotely. In our investigation, it was a dramatic improvement for the coordinating site to have direct access to the data over the manual system where data was emailed or faxed irregularly. The use of a common instrument with a consistent method for recording results also improved data quality during this multi-centre outbreak investigation.

Electronic communication is increasingly being used during outbreak investigations to share information such as organism profile patterns^{5,6} or to disseminate information and questionnaires.^{7,8} Additional web-based investigation techniques include contacting study participants by email and requesting them to complete questionnaires that are loaded onto a secure website.^{9,10} Valuable time and resources can be saved using self-answered web-based tools but its usefulness will be limited by email (web) access.

No food vehicle was identified as being responsible for this outbreak. With only eight cases notified after the case-control study commenced the study lacked sufficient power to detect an association between illness and an exposure. It was decided not to include cases with onset of symptoms prior to 1 June 2005 due to the potential recall bias since cases had previously been interviewed extensively during hypothesis generating interviews. The majority of cases and controls were unable to recall specific brands of food, making measurement of exposure very non-specific.

In the future, public health investigations will increasingly use internet-based methods to collect data in outbreak settings.

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