

# UPDATE ON INFLUENZA SURVEILLANCE, DIAGNOSIS AND PREVENTION

Influenza is a highly contagious, febrile, acute respiratory disease in humans. Influenza epidemics with varying severity occur annually, whereas pandemics with high mortality rates, considerable social disruption and substantial economic losses, occur unpredictably at irregular intervals. The incidence of influenza is estimated at 500 million cases annually, or one in every three of the world's population per year<sup>1</sup>. This article updates the current knowledge on influenza surveillance, diagnosis, prevention and control.

## Virology

Influenza viruses are lipid-enveloped, negative-sense, single-stranded RNA viruses with two surface glycoproteins: haemagglutinin and neuraminidase. Influenza viruses belong to the family Orthomyxoviridae with types A, B or C. Influenza B and C infections are largely restricted to humans. Influenza C viruses, which occur sporadically and not in recognisable epidemics, cause a mild non-descript common cold. Influenza B viruses cause epidemics, but the frequency of severe infections requiring admission or causing death is generally lower for influenza B than for influenza A<sup>2</sup>.

Influenza A viruses have the ability to cause epidemics as well as pandemics and are associated with more severe disease than influenza B. Influenza A viruses are further divided into subtypes based on serological and genetic differences of haemagglutinin and neuraminidase proteins. There are 15 subtypes of haemagglutinin (H1-H15) and nine subtypes of neuraminidase (N1-N9). All these subtypes exist in wild aquatic birds with the potential to jump to other host species such as man. Influenza A viruses with haemagglutinin of the H1, H2 and H3 subtypes, and neuraminidase of N1 and N2 subtypes, have caused epidemics and pandemics in humans since 1900. Various subtypes have also been isolated from pigs, horses, seals, and whales.

Two features of influenza virus replication and evolution account for the epidemiological success of these viruses. The first feature is antigenic drift which occurs in both influenza A and B viruses. Antigenic drift is caused by point mutations in haemagglutinin and neuraminidase proteins. It occurs as part of the continuing evolution of influenza viruses after they emerge in a pandemic form and become established in humans. As antibody levels to the pandemic strain rise within the human population, the circulating influenza viruses must change antigenically to survive. The second feature is antigenic shift which occurs only among influenza A viruses. Antigenic shift is defined as the appearance in the human population of a new influenza virus containing a novel haemagglutinin (or novel haemagglutinin and neuraminidase) immunologically distinct from those of the influenza viruses circulating in recent years. Antigenic shift occurs when novel subtypes of influenza that infect only birds or pigs are transmitted directly

to humans or via genetic reassortment between human and animal influenza viruses. A pandemic takes place when human-to-human transmission of these novel viruses occurs and leads to disease in a large and immunologically susceptible human population.

Currently influenza AH1N1, AH3N2 and B are co-circulating in the community in New Zealand. The prevalence of these three groups of viruses may vary temporally and geographically during an influenza season or seasons. The circulation of influenza AH3N2 viruses has often been associated with more severe disease and with excess pneumonia and influenza mortality<sup>2</sup>. Antigenic drift variants have been responsible for annual epidemics occurring in New Zealand since the 1980s. Antigenic variation and the consequent epidemiological behaviour of influenza follow a fairly uniform pattern, in which distinct, antigenic variant strains of influenza A and B viruses emerge and become predominant over a period of approximately 2-5 years, only to be replaced by the next successful antigenic variant.

## Clinical Features

The spectrum of influenza is extremely broad, ranging from asymptomatic infections, through respiratory illness with systemic features, multi-system complications affecting the lung, heart, brain, liver, kidneys and muscle, to death, most commonly due to primary viral or secondary bacterial pneumonia. The clinical outcome may be influenced by many factors including patient's age, virus strains, chronic medical conditions, pregnancy, and smoking.

Influenza in adults typically presents with an abrupt onset of fever and chills, accompanied by headache, sore throat, myalgia, malaise, anorexia, and a dry cough. Fever (38-40°C) peaks within 24 hours of onset and lasts 1-5 days. Other less common symptoms include substantial soreness, photophobia, nausea, abdominal pain, and diarrhoea. Most symptoms typically resolve within a week, but cough and malaise may persist for one or more weeks after fever has subsided. In children, symptoms are similar to those in adults, but gastrointestinal problems such as vomiting, abdominal pain, and diarrhoea are more frequent. Maximum temperatures also tend to be higher in children than in adults, and febrile convulsions can occur.

## Surveillance

New Zealand has two forms of influenza surveillance: 1) Year-round hospital surveillance. This is conducted by sampling hospital in-patients and out-patients during routine viral diagnosis. 2) Enhanced winter season sentinel surveillance as part of the World Health Organisation Global Program. Every year from May to September, based on the population and geographic distribution, about 80 sentinel general practitioners throughout the country are recruited in the sentinel surveillance. Every week, each sentinel practice provides the weekly number of flu-like illness consulta-

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tions, as well as throat/nasal swabs, to one of five virology laboratories around the country for viral isolation and identification.

The consultation data on flu-like illness is very useful since it helps to estimate morbidity, mortality or economic impact due to influenza<sup>3</sup>. The laboratory investigation is of great importance since it allows the confirmation of clinical diagnosis, the early detection of newly emerging epidemic strains, and the determination of the annual influenza vaccine composition. It also provides important information to public health authorities for control measures and enables appropriate vaccination or prophylactic treatment of high-risk groups.

## Laboratory Diagnosis

A definitive diagnosis of influenza requires laboratory confirmation, since clinical diagnosis on the basis of clinical symptoms is not distinct enough. Diagnostic tests for influenza fall into four categories: virus isolation, detection of viral proteins, detection of viral nucleic acid, and serological diagnosis. 1) Virus isolation is the gold standard for laboratory diagnosis of influenza. The isolated virus is available for genetic and antigen analysis but it takes on average one week to get the result which is too late to initiate antiviral therapy or infection-control measures. 2) Detection of viral proteins is a fast-growing area. For example, Directigen, FluA, ZstatFlu and Biostar are appearing on the market, but there is only limited evaluation data for these. These tests are rapid and easy to perform; some are designed for use at the point-of-care. These tests are less sensitive than culture or PCR, but results are available in less than one hour. They are useful for antiviral therapy. 3) Detection of viral nucleic acid (RNA) in clinical materials or tissue culture fluids is widely used for typing and subtyping of influenza viruses by reverse transcriptase polymerase chain reaction (RT-PCR). PCR offers the advantage of sensitivity and specificity of diagnosis and does not require infectious virus for detection. Great care must be taken in the laboratory to avoid contamination of specimens. 4) Serological diagnosis is based on the detection of a four-fold or greater rise in specific antibody titre in paired serum samples. The need for paired serum samples, the first collected as soon as possible after onset of illness and the second collected 10-14 days later, limits the usefulness of serology in diagnosis and treatment of acute illness.

The importance of appropriate collection and handling of clinical samples for all types of diagnostic testing cannot be overemphasised. Influenza viruses replicate primarily in the columnar epithelial cells of the respiratory tract. Sampling of influenza viruses should attempt to maximise the harvest of virally infected epithelial cells. Nasopharyngeal washes or aspirates have a high cellular content and are superior to nasopharyngeal swabs for human influenza virus isolation. Throat swabs or washings are of limited use in the diagnosis of influenza since the majority of cells captured by this technique are squamous epithelia. However, a combined nose and throat swab is a useful specimen for influenza virus isolation due to convenience of sample collection.

Nasopharyngeal swabs should be cotton-, rayon-, or dacron-tipped, plastic coated or aluminium shafted swabs. Wooden stick swabs should be avoided because of the potential for the preservatives to leach into transport media and inhibit subsequent cell culture or PCR. The swab should be inserted deeply into the nasopharynx, rotated vigorously to collect columnar epithelial cells, removed and replaced into viral transport medium (VTM). Swabs can either be left in VTM or agitated, fluid expressed from the swab and the swab removed.

## Control and Prevention

Vaccination is the most effective measure for reducing the impact of influenza. The haemagglutinin and neuraminidase proteins are the primary targets of the protective antibody response. Antibodies against haemagglutinin neutralise virus infectivity, and antibodies against neuraminidase can modify the severity of disease. Influenza vaccines elicit a strain-specific antihaemagglutinin immune response. Influenza vaccines are highly recommended to individuals at increased risk for the development of complications of influenza infection and individuals who might transmit influenza to persons at high risk for complications. For example, in New Zealand since 1997, influenza vaccines

have been free of charge to all people over 65 years old.

In order to obtain the most effective influenza vaccines, vaccine strains need to match well with the current circulating strains. Each year, at the end of sentinel surveillance, after a complete analysis of current circulating strains, the Australian Influenza Vaccine Committee (AIVC), with New Zealand, Australia and South Africa representatives, recommends influenza vaccine composition intended for use in the following winter for these countries. Currently licensed influenza vaccines for year 2000 are trivalent inactivated formulations that contain 15 mg each of the haemagglutinin of influenza A/New Caledonia/20/99-like strain (H1N1), influenza A/Sydney/5/97-like strain (H3N2), and influenza B/beijing/184/93) strains. The inactivated vaccine is safe and immunogenic, inducing immunity in 60-90% of children and adults; however, immunogenicity is generally lower in elderly people.

Two anti-influenza A drugs, amantadine and rimantadine, interfere with the replication of influenza A (but not influenza B) viruses through blocking the function of the M2 protein - a membrane spanning protein essential for uncoating of the virus after entry into the host cell. When administered prophylactically to healthy adults or to children during the period of exposure in a normal epidemic or outbreak situation, these two drugs are 70-90% effective in preventing illness caused by naturally occurring influenza A viruses. When used therapeutically within 48 hours of the onset of symptoms, these two compounds can also reduce the severity and duration of signs and symptoms of illness. However, these two drugs have no effect on influenza B viruses and drug resistant viruses have been isolated from patients. In New Zealand, only amantadine (not rimantadine) is licensed.

The other two anti-influenza A and B drugs are neuraminidase inhibitors. Relenza (Zanamavir or GG167; administered by inhalation) and Tamiflu (Oseltamivir or GS4104; administered orally) have recently been licensed in New Zealand. These neuraminidase inhibitors are sialic acid analogues which specifically inhibit both influenza A and B neuraminidase - the viral enzyme that cleaves terminal sialic acid residues from glycoconjugates to allow the release of virus from infected cells, to prevent the aggregation of virus, and possibly to reduce viral inactivation by respiratory mucus. One published study has demonstrated that, when administered within 30-36 hours of onset of illness, Zanamavir shortened the time to alleviate major influenza symptoms by 1-2 days, but the drug provided no benefit to people without laboratory-confirmed influenza<sup>4</sup>. Zanamavir has also been shown to be safe and effective in preventing influenza in healthy adults<sup>5</sup>. Both drugs are active against influenza A and B viruses, and seem less likely to induce the drug resistant viruses than do amantadine and rimantadine. However, there is no evidence that use of either product in patients at high risk of complications of influenza, eg elderly or chronically ill, will significantly reduce either the morbidity or mortality associated with infection with influenza.

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# BACTERIOLOGY

## INVASIVE INFECTIONS

Numbers of isolates received from cases of invasive disease caused by *Haemophilus influenzae*, *Neisseria meningitidis*, *Streptococcus pneumoniae*, *Streptococcus pyogenes* (Group A) and *Streptococcus agalactiae* (Group B) during January to March 2000, are shown in Table 1.

Table 1. Sterile site isolates, January-March 2000

Organism	BC	CSF or CSF/BC	Other Sterile site	Total
<i>H. influenzae</i> *	9	0	0	9
<i>N. meningitidis</i>	24	9	0	33
<i>S. pneumoniae</i>	55	2	0	57
<i>S. pyogenes</i>	24	0	0	24
<i>S. agalactiae</i>	8	0	2	10

\* *H. influenzae*: 3 serotype b and 6 non-b

The age profile of the patients from whom the isolates were obtained is given in Table 2.

Table 2. Age distribution of cases of invasive disease, January-March 2000

Organism	<1m	1-11m	1y	2y	3y	4y	5-9y	10-24y	25-59y	≥60y
<i>H. influenzae</i> b	0	1	0	1	0	0	0	0	0	1
<i>H. influenzae</i> non b	1	1	0	0	0	0	0	1	1	2
<i>N. meningitidis</i>	0	6	8	2	2	1	4	8	1	1
<i>S. pneumoniae</i>	0	9	7	3	1	2	1	3	12	19
<i>S. pyogenes</i>	1	0	1	0	0	1	0	1	14	6
<i>S. agalactiae</i>	3	0	0	0	0	0	0	0	4	3

### *Haemophilus influenzae*

During January to March 2000, nine isolates were received from cases of *H. influenzae* invasive disease. Three of these isolates were serotype b, one was serotype f, and the others were non-serotypable using serotype-specific antisera. This compares with one serotype b from a total of seven isolates for the same period last year.

None of the non-serotypable organisms were shown by PCR to possess either the *bexA* gene necessary for capsular expression or the serotype b specific *cap* gene.

### *Neisseria meningitidis*

During January to March 2000, a total of 33 sterile site isolates were received from cases of meningococcal disease, compared with 31 for the same period last year. Of these, 30 were serogroup B, two were serogroup C, and one was serogroup Y. Serotyping and serosubtyping results of the serogroup B and C organisms are given in Table 3. The serogroup Y isolate was Y:NT:P1.5. In addition one isolate was received from a respiratory site from a notified case. This was B:4:P1.4.

The six non-subtypable isolates were shown by *porA* PCR and DNA-DNA hybridisation not to be P1.2, 4, 7 or 16.

Table 3. Serotypes and subtypes of *N. meningitidis* sterile site isolates, January-March 2000

Subtype	Serotype							Total
	1	2a	2b	4	14	15	NT	
<i>Serogroup B</i>								
P1.4				23			3	26
NST				1	1		2	4
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>1</b>	<b>0</b>	<b>5</b>	<b>30</b>
<i>Serogroup C</i>								
NST	1			1				2
<b>Total</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2</b>

NT - non typable

NST - non subtypable

All meningococci were tested against the following serotypes and subtypes:

serotype 1, 2a, 2b, 4, 14 and 15

subtypes P1.1, P1.2, P1.4, P1.5, P1.6, P1.7, P1.9, P1.10, P1.12, P1.13, P1.14, P1.15 and P1.16.

Nine blood and CSF samples from culture-negative cases of meningococcal disease were tested by PCR for the presence of meningococcal DNA. Five samples were shown to contain the meningococcal *porA* gene which encodes the subtype-specific antigens. Restriction digestion and dot blot hybridisation showed that four of these samples were subtype P1.7,4 and one was negative with the probes tested (P1.2,4,7 and 16).

PCR and culture results show that the epidemic strain (B:4:P1.4) continues to cause most cases.

## LEGIONELLOSIS AND ENVIRONMENTAL LEGIONELLA ISOLATES

During January to March 2000, 10 cases of legionellosis were identified and a further five cases were notified based on clinical grounds only. Six of the cases were regarded as confirmed and nine as probable. This compares with five confirmed and eight probable cases in the same period last year. Twelve (80%) of the cases were notified compared to a 84% notification rate last year. The majority (53%) of cases were male, and seven (47%) of the cases were aged 60 years and over.

The infecting *Legionella* species and serogroup was identified in nine cases (Table 4). The infecting *Legionella* species and serogroup could not be identified in one case. In four (40%) cases the infecting species was identified as *L. longbeachae*. This compares with 53% of cases caused by this species in the same period last year.

Table 4. Legionellosis and environmental isolates, January-March 2000

<i>Legionella</i> species/serogroup	Clinical Cases			Number of environmental isolates
	Confirmed	Probable	Total	
<i>L. pneumophila</i> serogroup 1	1	1	2	3
<i>L. pneumophila</i> serogroup 5	0	1	1	0
<i>L. pneumophila</i> serogroup 6	0	0	0	2
<i>L. feeleii</i> serogroup 1	0	0	0	1
<i>L. gormanii</i>	1	0	1	1
<i>L. hackeliae</i> serogroup 1	0	0	0	1
<i>L. longbeachae</i> serogroup 1	2	0	2	3
<i>L. longbeachae</i> serogroup 2	1	0	1	0
<i>L. longbeachae</i> serogroup unidentified	1	0	1	0
<i>L. micdadei</i>	0	1	1	0
<i>L. taurinensis</i>	0	0	0	1
<i>Legionella</i> species	0	1	1	2
<b>Total</b>	<b>6</b>	<b>4</b>	<b>10</b>	<b>14</b>

During January to March 2000, 42 presumptive environmental *legionellae* isolates from various environmental sources were received from other laboratories or were isolated by ESR. Of these, 12 could be identified to species level and two could not be identified. These two isolates were identified as belonging to the Legionellaceae family and are currently being identified using 16S rRNA gene sequencing.

Two species, *L. hackeliae* serogroup 1 and *L. taurinensis*, were identified in this quarter which had not previously been isolated in New Zealand. Both these isolates were isolated from cooling tower water. *L. hackeliae* lansing 2, the type strain, was first isolated from a bronchial biopsy in 1981<sup>1</sup>. This species would be considered to be pathogenic. However, we have not determined whether the New Zealand isolate contains the *mip* gene which is a known virulence factor of *Legionella*.

The type strain of *L. taurinensis* was described in 1999<sup>2</sup> when several organisms were isolated from a variety of hospital and community water sources in Europe<sup>2</sup>. These organisms all showed similarity with *L. spiritensis*, *L. erythra*, and *L. rubrilucens*. However, a new species was assigned and designated *L. taurinensis*. The type strain was isolated from a humidifier in the city of Turin (Italy), hence the name *taurinensis*. It is not known whether organisms in this species are pathogenic or not.

<sup>1</sup> Int J Syst Bacteriol 1985; 35: 50-59

<sup>2</sup> Int J Syst Bacteriol 1999; 49: 397-403

## LEPTOSPIROSIS

During January to March 2000, 31 cases of leptospirosis were laboratory-diagnosed and a further five cases were notified based on clinical grounds only. Thirty of the 36 cases (83%) were notified. This compares with 20 cases and a 50% notification rate in the same quarter last year.

The infecting *Leptospira* species and serovar was identified in 27 of the laboratory-diagnosed cases (Table 5). The infecting *Leptospira* species and serovar could not be identified for four cases. One case was diagnosed by both serology and isolation. This isolate was provisionally identified as *L. interrogans* serovar *australis*. This is only the second time that *L. interrogans* serovar *australis* has been isolated in New Zealand<sup>1</sup>. Interestingly, both isolations occurred in the Northland region.

The occupation was known for 22 cases: farmers (13), meat workers (6), plumber (1), storeman (1), and watchmaker (1).

The majority of cases (91%) were male and 23 (64%) were aged between 30-49.

Table 5. *Leptospira* species and serovars identified, January-March 2000

Leptospira species / serovar	Number of isolates
<i>L. interrogans</i> serovar <i>australis</i>	2
<i>L. borgpetersenii</i> serovar <i>ballum</i>	6
<i>L. interrogans</i> serovar <i>hardjo</i>	8
<i>L. interrogans</i> serovar <i>pomona</i>	7
<i>L. borgpetersenii</i> serovar <i>tarassovi</i>	4
<b>Total</b>	<b>27</b>

<sup>1</sup> NZ Med J 1980; 91: 28

## SPECIAL BACTERIOLOGY

### Interesting Isolates Received in the Special Bacteriology Laboratory

- *Corynebacterium diphtheriae* var. *mitis* non-toxicogenic strains from infected tattoos (2), leg ulcer (1), and a var. *gravis* non-toxicogenic strain from infected tattoo.
- *Erysipelothrix rhusiopathiae* from blood, mitral and aortic valves of M64y, a farmer who died following a three week febrile illness.
- *Tsukamurella* sp. identified by 16S rRNA sequencing from CAPD fluid of F36y. Aerobic actinomycetes can be difficult to identify by phenotypic methods (traditional biochemical reactions) and molecular methods such as sequencing can provide valuable answers for significant isolates.

### Listeria monocytogenes

Nine isolates of *L. monocytogenes* from human cases were referred in the period January to March 2000 (Table 6). Seven of the isolates were from non-perinatal cases who were recorded as having underlying illness or were elderly. The remaining two isolates were from a stillborn infant and a premature birth (baby survived).

During February there were 30 cases of listeria gastroenteritis associated with consumption of cooked meats from a South Island manufacturer. The cases of gastroenteritis were from Hamilton (21), Otago (7), Nelson (1), and Timaru (1) Health Districts. Isolates of *L. monocytogenes* from faeces of the gastroenteritis cases and a variety of cold meats (including unopened packets) were indistinguishable from the strain that caused the listeriosis outbreak in 1997<sup>1</sup>, referred to as serotype O1/2, DNA type 96/2.

Three of the isolates of *L. monocytogenes* from the non-perinatal cases of listeriosis which occurred in February and March were also indistinguishable by serotype and DNA type from the listeria gastroenteritis strain and the 1997 outbreak strain.

Table 6. *Listeria monocytogenes* from invasive human cases, January-March 2000

Month isolated or of onset	Health District	Sex/Age	Source	O antigen serotype
January	Hutt	M foetus	body swabs	4
January	Waikato	M 80y	CSF	4
January	Canterbury	F 65y	BC	4
January	Tauranga	F 84y	BC	4
February	Central Auckland	F 57y	BC	4
February	Southland	M 62y	CSF	1/2*
February	Canterbury	M 78y	CSF	1/2*
March	Timaru	M 59y	CSF	1/2*
March	Canterbury	M 1d	BC	1/2

\* DNA type 96/2 (ESR laboratory designation)

<sup>1</sup> Lablink 1998; 5 : 4

## *Bordetella pertussis*

During January to March 2000, 334 isolates of *Bordetella pertussis* were received for serotyping and surveillance, compared with eight for the same period last year. Three isolates were serotype 1,2, one was 1,2,3 and 330 were 1,3. The ages of the 329 cases for whom age was provided are given in Table 7. The recommended ages for vaccination against *B. pertussis* in New Zealand are at six weeks, three months, five months and 15 months.

Table 7. Age distribution of cases of *Bordetella pertussis*, January - March 2000

Age	<5m	5-<15m	15m-4y	5-9y	10-14y	15-19y	≥20y
Number	27	30	81	105	21	10	55

## *ESCHERICHIA COLI*

There were 29 isolates of *E. coli* O157 confirmed during January to March 2000 (Table 8) compared with 18 for the same period in 1999.

Table 8. *E. coli* O157 isolates, January-March 2000

Month	Sex / Age	District	Clinical Details	Isolates from known contacts
January	M 3y	Waikato	None given	
	F 6y	Canterbury	Mild diarrhoea	
	M 88y	Otago	None given	
February	F 2y	Waikato	Diarrhoea	
	M 1y	Waikato	Bloody diarrhoea	
	F 2y	Canterbury	None given	F 32y, M 38y, M 7m, F 3y
	M 8m	Waikato	Blood in faeces	
	M 4y	Waikato	Blood in faeces	
	M 1y	Canterbury	None given	
March	M 4y	Canterbury	None given	
	M 8m	Otago	None given	
	F 52y	Taranaki	Rectal bleeding	
	F 1y	Waikato	Diarrhoea	F 37y, M 38y
	F -	Taupo	None given	F 8y, F 7y, F 31y
	M 2y	Waikato	None give	
	M 17m	Dunedin	None given	
	M 2y	Canterbury	None given	
	M 3y	Canterbury	None given	
	F 35y	Waikato	None given	
	F 16	Tauranga	Bloody diarrhoea	

# ENTERIC PATHOGENS

## SALMONELLA

There were 481 human isolates of *Salmonella* during January to March 2000 compared with 870 for the same period in 1999. Of particular interest:

- *S. Typhi*

There were eight cases of *S. Typhi*, all of which either indicate overseas travel or consumption of food brought from the Pacific Islands.

- *S. Typhimurium* phage type 150

Fifteen cases of this uncommon phage type were confirmed following an outbreak at a Masterton food premise. Three cases were hospitalised, and four cases were foodhandlers.

This phage type is an unusual type in New Zealand. Previous isolates include three from patients (Otago 1998 (2) and Canterbury 2000 (1)) and one bovine isolate. The bovine isolate is of interest as it was a post mortem sample taken from Kaituna which is an area close to the Masterton water supply intake.

- *S. Typhimurium* phage type 135

Thirty three cases were confirmed following an outbreak at a Wellington café. Three cases were hospitalised, and four cases were foodhandlers.

- *S. Typhimurium* phage type 9

This phage type was isolated from family contacts in the Waikato and Nelson districts. The family had consumed mussels from the Nelson area.

## *Erratum (incorrect results 1997 and 1999)*

There was an error in Lablink Vol. 7 No. 1. Table 15. Amended table as follows:

Table 15. Predominant poultry isolates 1997-1999

Serotype	1997	1998	1999
<i>S. Typhimurium</i> 135	41%	23.9%	27.4%
<i>S. Infantis</i>	6.8%	4.5%	10.1%
<i>S. Agona</i>	0.5%	18.5%	6.5%
<i>S. Typhimurium</i> 101	5.4%	14.9%	9.6%

# ANTIBIOTIC RESISTANCE

## SURVEILLANCE OF TUBERCULOSIS RESISTANCE JANUARY TO DECEMBER 1999

Surveillance of antimicrobial resistance in *Mycobacterium tuberculosis* is accomplished by the collation of identification and susceptibility results from the three Mycobacteriology Laboratories at Green Lane, Wellington and Waikato Hospitals, and matching of laboratory data with notification data from EpiSurv at ESR. In 1999, 456 tuberculosis cases were notified, of which 302 culture positive.

A total of 301 isolates (297 *M. tuberculosis* and four *M. bovis*) were identified and tested for susceptibilities. The prevalence of isoniazid, rifampicin, ethambutol, pyrazinamide and streptomycin resistance was 5.6%, 1.0%, 0.7%, 2.7% and 5.2% respectively (Table 9). The prevalence of isoniazid resistance has decreased from around 10% in 1997-1999 to 5.6% in 1999.

Table 9. Resistances to each antimicrobial (alone or in combination), January-December 1999

Antimicrobial	Number tested	Number resistant	% resistance
Isoniazid	301	17	5.6
Rifampicin	301	3	1.0
Ethambutol	301	2	0.7
Pyrazinamide	301	8 <sup>1</sup>	2.7
Streptomycin	250	13	5.2

<sup>1</sup> Includes the four *M. bovis* isolates

Table 11. 1999 Antimicrobial resistance data from hospital and community laboratories<sup>1</sup>

	Percentage resistant (number tested <sup>2</sup> )																
	amikacin	amoxicillin/clavulanic acid	ampicillin	ceftazidime	ceftriaxone/cefotaxime	cefuroxime/cefamandole	cephalothin	co-trimoxazole	fluoroquinolone	gentamicin	imipenem/meropenem	nitrofurantoin	piperacillin	tetracycline	ticarclillin	tobramycin	trimethoprim
<i>Acinetobacter</i> spp. <sup>4</sup>	6.7 (163)			12.4 (339)				21.0 (610)	18.9 (598)	18.7 (600)	2.1 (469)		29.4 (411)			5.2 (250)	
<i>Citrobacter freundii</i> <sup>4</sup>		53.9 (614)	77.7 (542)		13.3 (158)	28.7 (129)	72.0 (168)	8.1 (221)	2.9 (314)	3.5 (226)	1.5 (137)						
<i>Enterobacter</i> spp. <sup>4</sup>	0.2 (532)	76.8 (2242)	90.9 (2199)		18.4 (895)	48.2 (664)	91.6 (888)	5.7 (1320)	3.2 (1311)	3.3 (1854)	0.6 (815)			10.1 (436)		2.9 (243)	28.3 (120)
<i>Escherichia coli</i> non urinary	0.1 (1413)	18.0 (5882)	56.6 (6251)		0.2 (2271)	3.7 (2046)	25.7 (2673)	21.6 (3349)	0.8 (2564)	1.2 (6008)	0.0 (1749)			13.1 (1631)		1.3 (1071)	
<i>E. coli</i> urinary	0.3 (3623)	10.6 (45219)	54.5 (46661)		0.3 (6069)	1.7 (5103)	26.9 (7172)	18.9 (13740)	0.9 (30502)	0.9 (15770)		1.5 (38685)		19.6 (1351)		0.8 (2490)	22.4 (23228)
<i>Klebsiella</i> spp.	0.3 (738)	9.9 (4267)	93.5 (4461)		1.9 (1428)	6.5 (1147)	17.7 (1506)	6.6 (2170)	3.1 (2135)	0.9 (2816)	0.4 (1339)			10.5 (430)		0.6 (356)	
<i>Morganella morganii</i> <sup>4</sup>	0.8 (123)	92.4 (539)	93.9 (558)		7.2 (222)	87.2 (195)	93.0 (228)	9.0 (367)	3.9 (330)	7.8 (386)	4.2 (213)						
<i>Proteus mirabilis</i>	0.8 (626)	2.9 (4005)	13.6 (4240)		0.6 (1024)	3.1 (903)	7.8 (1077)	5.4 (1623)	1.4 (3397)	0.8 (1973)	1.7 (943)			90.5 (503)		1.9 (361)	
<i>Pseudomonas aeruginosa</i>	6.9 (2565)			6.0 (4057)					8.3 (6566)	11.0 (7309)	8.4 (3456)		4.7 (4232)		10.2 (1809)	2.8 (4131)	
<i>Serratia</i> spp. <sup>4</sup>	0.0 (162)	85.4 (717)	94.3 (733)		15.8 (380)	80.1 (282)	97.9 (376)	8.7 (564)	22.0 (540)	1.0 (626)	2.0 (351)			75.0 (100)			

	Percentage resistant (number tested <sup>2</sup> )													
	amoxicillin/clavulanic acid	ampicillin	cefotaxime/ceftriaxone	clindamycin	co-trimoxazole	erythromycin	fluoroquinolone	gentamicin	methicillin/oxacillin	mupirocin	nitrofurantoin	penicillin	tetracycline	vancomycin
Coagulase-negative Staphylococci (blood isolates)				15.6 (302)	24.2 (505)	41.0 (1356)	10.8 (650)	30.3 (1166)	47.2 (1436)			81.4 (1555)	19.0 (384)	0.0 (458)
<i>Campylobacter</i> spp.						3.3 (121)								
<i>Enterococci</i> spp.		4.3 (5848)						26.3* (232)			5.3 (4391)		55.3 (816)	0.7 (1423)
<i>Haemophilus influenzae</i> (non invasive) <sup>3</sup>	0.7 (6724)	23.3 (7798)			17.1 (6608)								1.0 (6381)	
<i>Moraxella catarrhalis</i>		92.2 (1205)				2.6 (1479)							0.6 (1413)	
<i>Staphylococcus aureus</i>				3.0 (4066)	0.8 (38229)	11.9 (52424)	4.3 (16254)	2.5 (19796)	5.8 (51470)	19.3 (14906)		86.0 (53223)	2.9 (42677)	
<i>Streptococcus pneumoniae</i> (non invasive) <sup>3</sup>			8.5 (234)		61.6 (2138)	18.2 (4632)						22.6 (4844)	12.2 (1643)	
<i>Streptococcus pyogenes</i>						1.3 (11418)								

\* High level

1. Data supplied by Auckland, Canterbury, Dargaville, Gisborne, Hastings, Hutt, Middlemore, Rotorua, Southland, Taranaki, Waikato, Wairau, Wellington, and Whangarei Hospitals; and Auckland Diagnostic Medical, Medlab Bay of Plenty, Medlab Central, Medlab South, Dunedin Southern Community, Valley Diagnostic and Wanganui Diagnostic laboratories.
2. Data presented only if at least 100 isolates tested.
3. Susceptibility of isolates from invasive disease tested at ESR and reported in LabLink Vol 7/1, March 2000.
4. ESCAPPM organisms with potential for inducible cephalosporinases and stably derepressed mutants producing high-levels of cephalosporinases.

# VIROLOGY

## RESPIRATORY VIRUSES

### *Influenza*

During January to March 2000, seven isolates of influenza A were reported; Dunedin (4), Christchurch (2), and Auckland (1). Three isolates from Dunedin were subtyped. Two were influenza A H3N2 similar to A/Sydney/5/97 strain and one was influenza AH1N1 similar to A/New Caledonia/20/99 strain. Both strains were included in the influenza vaccine formulation for New Zealand in 2000.

### *Respiratory Syncytial Virus and Rhinoviruses*

During January to March 2000, 10 isolates of respiratory syncytial virus (RSV) were reported from Auckland (2), Christchurch (2), Waikato (2) and Dunedin (4). This is similar to nine isolations of RSV during the same period in 1999. Twelve isolations of rhinoviruses were reported from Auckland (11) and Waikato (1); compared with only four isolations of rhinoviruses during the same period in 1999.

## ADENOVIRUSES AND ENTEROVIRUSES

### *Adenoviruses*

A total of 22 adenoviruses were isolated and serotyped from January to March 2000 compared with 43 isolations during the same period in 1999. Adenovirus type 19, which can cause epidemic keratoconjunctivitis, was isolated from three patients in Auckland who had severe conjunctivitis. The remaining 19 adenoviruses were typed as type 1 (4), type 2 (2), type 3 (3), type 4 (2), type 5 (2), type 8 (1), type 11 (1), type 15 (1), type 17 (2), and type 29 (1).

### *Enteroviruses*

During January to March 2000, seven enteroviruses were isolated and serotyped as Coxsackie B type 2 (3), Coxsackie B type 4 (1), Echovirus type 3 (1), Echovirus type 9 (1), untypable Echovirus (1). One of the Coxsackie B type 2 was isolated from the trachea ring of a 12 month girl who died of probable accidental asphyxia.

# MYCOLOGY

A summary of the opportunistic mycoses detected during July to December 1999 is shown in Table 12. Data were collated from replies received from 11 of 11 sentinel laboratories throughout New Zealand.

The significance of some of the isolates is difficult to determine due to the absence of clinical details supplied.

Nearly 91% of the isolates were sensitive to all the agents tested (Table 10). Two isolates (0.7%) were multidrug-resistant (MDR, defined as resistance to at least isoniazid and rifampicin). These MDR isolates were from patients who were born overseas; one in Thailand and the other in India. There were three (1.2%) MDR isolates in 1998 and two (1.0%) MDR isolates in 1997. Since data collation began in 1995, all MDR isolates have been from cases that were born overseas.

Among the culture-positive cases, 274 (90.7%) were categorised as tuberculosis new cases and 28 (9.3%) as reactivations. Of the 274 new cases, 252 (92.0%) were sensitive to all agents tested, 14 (5.1%) were isoniazid-resistant, two (0.7%) were rifampicin-resistant and two (0.7%) were MDR. Among the isolates from reactivations, 23 (82.1%) were sensitive to all the agents tested, three (10.7%) were isoniazid-resistant, and one (3.6%) each was resistant to rifampicin and pyrazinamide.

Table 10. Resistance patterns among the 301 isolates, January-December 1999

	Number (%)	Resistance pattern	Number (%) with each pattern
Fully sensitive	274 (91.0)		
Resistant to 1 agent	15 (5.0)	H	6 (2.0)
		S	6 (2.0)
		Z <sup>1</sup>	3 (1.0)
Resistant to 2 agents	9 (3.0)	HR <sup>2</sup>	1 (0.3)
		HS	4 (1.3)
		HZ <sup>2</sup>	3 (1.2)
		RS	1 (0.3)
Resistant to 3 agents	2 (0.7)	HZS	1 (0.3)
		HSE	1 (0.3)
Resistant to 4 agents	1 (0.3)	HRZE <sup>3</sup>	1 (0.3)

E = ethambutol; H = isoniazid; Z = pyrazinamide; R = rifampicin; S = streptomycin

<sup>1</sup> All *M. bovis* isolates

<sup>2</sup> Includes one *M. bovis* isolate

<sup>3</sup> MDR

## SURVEILLANCE OF ANTIBIOTIC RESISTANCE IN THE WHO WESTERN PACIFIC REGION IN 1999

In 1999, a record number of laboratories (21) contributed antimicrobial resistance data for compilation into national prevalence data (Table 11). The collated results for 1999 should thus be a more accurate reflection of the actual prevalence of antimicrobial resistance in New Zealand and we would like to thank all the laboratory staff for their valuable contribution. Notably the 1999 data indicated:

- *Streptococcus pneumoniae* – an increase in penicillin resistance to 22.6%, erythromycin resistance to 18.2%, trimethoprim/sulphamethoxazole resistance to 61.6% and cefotaxime/ceftriaxone resistance to 8.5%;
- *Staphylococcus aureus* - increase in methicillin resistance from 4.7% in 1998 to 5.8% in 1999, resistance to fluoroquinolone (4.3%), erythromycin (11.9%), mupirocin (19.3%);
- *Streptococcus pyogenes* - erythromycin resistance of 1.9%;
- *Escherichia coli* - amoxicillin/clavulanic resistance of 10.6% and 18.0% among urinary and non-urinary isolates respectively; around 0.3% cefotaxime/ceftriaxone resistance and < 1% fluoroquinolone resistance among urinary and non-urinary isolates;
- *Klebsiella* spp. - 1.9% ceftriaxone/cefotaxime resistance;
- *Pseudomonas aeruginosa* - 8.3% fluoroquinolone resistance, 11.0% gentamicin resistance, 6.0% ceftazidime resistance, 8.4% imipenem resistance;
- *Campylobacter* spp. – 3.3% erythromycin resistance.

*Compiled by Maggie Brett  
Antibiotic Reference Laboratory*

Table 12. Biannual summary of opportunistic mycoses in New Zealand, July-December 1999

Organism	No. of cases	Site	Clinical data
<b>Filamentous fungi</b>			
<i>Aspergillus fumigatus</i>	7	brain abscess and ethmoid sinus (1) corneal scraping (1) CAPD (1) pleural fluid (1) lung aspirate (1) lung biopsy (1) thrombus from pseudoaneurysm (1)	Ca breast with metastases, on steroids, multiple ring enhancing intracerebral lesions corneal ulcer, treated with Amphotericin B and Itraconazole drops myeloma, CRF on CAPD respiratory failure aspergilloma hairy cell leukaemia, treated with Amphotericin B post liver transplant. Histology saw dichotomous branching hyphae suggestive of an <i>Aspergillus</i> species
<i>Exophiala jeanselmei</i>	1	Donor corneal fluid	corneal transplant, no infection
<i>Fusarium species</i>	1	R) heel	?chronic osteomyelitis, 4 year history, hyphae seen in histology sections
<i>Fusarium solani</i>	1	toes	ischaemic toes
<i>Geosmithia argillacea</i>	1	sputum	CF, also isolated with <i>Wangiella dermatitidis</i>
<i>Mucor ramosissimus</i>	1	CAPD fluid and tenchkoff catheter	ESRF, peritonitis, also isolated with <i>Candida guilliermondii</i>
<i>Phialophora richardsiae</i>	1	hand abscess	abscess, incision and drainage
<i>Scedosporium apiospermum</i>	1	olecranon bursa	bumped arm at gym, no underlying disease, drained and treated with Itraconazole (isolate was resistant)
<b>Yeasts</b>			
<i>Candida albicans</i>	36	blood culture (24)  CAPD and tenchkoff catheter (3) aortic fluid (1) pleural fluid (1)  CSF (1) aortic false aneurysm (1) stab drain aspirate (1) abdominal wound aspirate (1)  subphrenic collection (1) blood, knee aspirate and aqueous tap (1)  hip aspirate (1)	line sepsis (3); Ca (2); surgical debridement, compartment syndrome (1); CRF (3); febrile (1); perforated gall bladder, multiple antibiotics (1); hemicolectomy for Ca, pancreatic leak and fistula, patient deceased (1); burns, skin sepsis (1); bowel resection (2); gut perforation (1); premature baby, arm abscess (1); ICU patient following head injury (1); acute repair of AA (1); liver failure (1); NIDDM (1); NR (3); ESRF, peritonitis  NR Ca lung, post thoracotomy, post op sternal infection post brain tumour removal previous aortic aneurysm surgery NR ostomy bag, following oversewing of perforated DU, fistula pancreatitis premature baby, fungaemia, septic arthritis, treated with Amphotericin B RA; also isolated with <i>Candida parapsilosis</i>
<i>Candida glabrata</i>	3	blood culture (2) ascites fluid (1)	multiple myeloma (1); nephrostomy tube in situ (1) NR
<i>Candida guilliermondii</i>	4	blood culture (1) CAPD (3)	NR ESRF, peritonitis
<i>Candida parapsilosis</i>	17	blood culture (5)  abdo abscess (1) CAPD (8) CAPD and tenchkoff catheter tip (3)	AML, line sepsis (1); acute renal failure, on dialysis, treated with Fluconazole, deceased (1); lymphoma (1), autologous bone marrow transplant (1), post hemicolectomy (1) NR ESRF, peritonitis ESRF, peritonitis

Organism	No. of cases	Site	Clinical data
<i>Candida tropicalis</i>	1	blood	aplastic anaemia
<i>Cryptococcus neoformans</i>	5	bronchial wash (1) pleural fluid and blood (1) CSF (3)	old TB, CXR changes, bronchiectasis NR HIV (1), ?sarcoidosis, on steroids (1), NR (1)
<i>Malassezia furfur</i>	1	blood	line sepsis, pre-term neonate
<i>Rhodotorula mucilaginosa (rubra)</i>	2	donor corneal fluid (1) CAPD (1)	corneal transplant, no infection ESRF, peritonitis
<b><i>Pneumocystis carinii</i></b>			
	7	sputum (3) bronchial lavage (3)  bronchial lavage & lung biopsy (1)	HIV (2); AML (1) ALL (1); AML (1); respiratory infection (1) Hairy cell leukaemia
<b>Actinomycetes</b>			
<i>Actinomyces israelii</i>	3	bilateral tubo-ovarian abscess (1) liver abscess (1) tongue biopsy (1)	chronic PID, IUCC <i>in-situ</i>  NR tongue ulcer with cystic lesion ?draining sulphur granules; also isolated with <i>Propionibacterium propionicus</i>
<i>Propionibacterium propionicus</i>	2	tear duct	canalculitis
<i>Nocardia asteroides</i>	5	forearm biopsy (1) sputum (4)	NR chronic respiratory disease, also isolated with <i>Scedosporium apiospermum</i> , <i>Aspergillus fumigatus</i> & <i>Aspergillus species</i> (1), NR (3)
<i>Nocardia brasiliensis</i>	1	knee	boil on knee
<i>Nocardia farcinica</i>	1	pleural fluid	NR
<i>Nocardia nova</i>	2	sphenoid sinus bx (1) sputum (1)	ALL previous MAI
<i>Rhodococcus species</i>	1	blood culture	haematology patient, infected line

**KEY:**

AA	Aortic aneurysm	ALL	Acute lymphoblastic leukaemia
AML	Acute myeloid leukaemia	Ca	Carcinoma
CAPD	Continuous ambulatory peritoneal dialysis	CF	Cystic fibrosis
CRF	Chronic renal failure	CSF	Cerebrospinal fluid
CXR	Chest x-ray	DU	Duodenal ulcer
ESRF	End stage renal failure	ICU	Intensive care unit
IUCD	Intrauterine contraceptive device	HIV	Human immunodeficiency virus
MAI	Mycobacterium avium-intracellulare	NIDDM	Non-insulin dependent diabetes mellitus
NR	Clinical data not received	PID	Pelvic inflammatory disease
RA	Rheumatoid arthritis		

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## ESR NEWS

Updated wall charts of our tests have been sent to all submitting laboratories. Please contact us if you have not received these. The main changes are:

**Tests added:**

- PCR for vancomycin resistance genes
- Sequencing of organisms that are not able to be identified using traditional techniques
- Legionella PCR
- Leptospira PCR

**Tests removed:**

- Coxsackie B serology
- HPV PCR and typing

**Changes:**

- Antifungal susceptibility testing. Auckland Healthcare, who provide the service, will inform you of these changes.

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