ANNUAL REPORT OF THE *CDI* STERILE SITES LABORATORY REPORTING SCHEME, 1994

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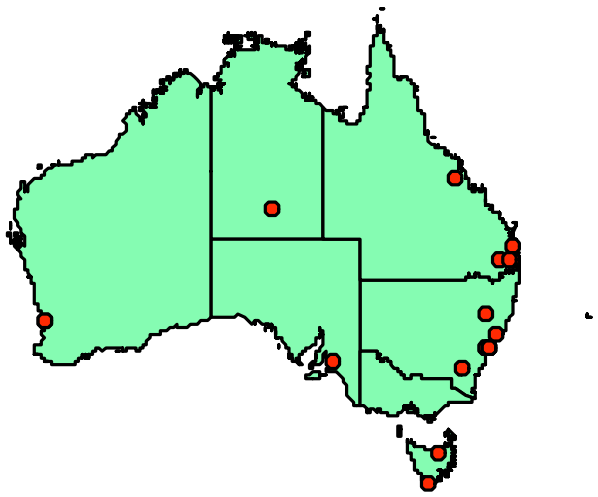
INTRODUCTION

The *Communicable Diseases Intelligence* (*CDI*) Sterile Sites Laboratory Reporting Scheme, LabDOSS, is a passive surveillance scheme based on voluntary reports contributed by a sample of laboratories throughout Australia (Figure 1). LabDOSS commenced in January 1992 after a pilot scheme was run in NSW during 1991. It was adapted from a surveillance scheme entitled the 'pathogen scheme' which attempted to report on all non-viral pathogenic organisms. LabDOSS was an attempt to better characterise the role of invasive organisms by limiting reports to isolates from normally sterile sites. The definition of a normally sterile site is one that does not under normal healthy conditions contain any microorganisms. This includes blood, cerebrospinal fluid, joint fluid, and tissue samples such as spleen, liver and muscle.

Figure 1. Distribution of contributing LabDOSS laboratories



The objectives of the LabDOSS scheme are: to improve the understanding of the epidemiology of disease caused by invasive organisms, monitor trends of invasive disease, identify emerging pathogens, guide direction for further research, and to develop and evaluate public policy based on the surveillance information.

METHODS

Reports of significant bacterial and fungal isolates from normally sterile sites are directly reported by laboratories to *CDI* monthly and entered into an EpiInfo file. Each isolate report includes a laboratory identifier, the date of specimen collection, the organism identification, data on the source of specimen and identification methods. The reports usually contain the residential postcode of the patient, data on the patient's age and sex, and information on the clinical diagnosis and risk factors.

LabDOSS is currently published in alternate issues of *CDI*. LabDOSS *CDI* monthly reports are based on the date of specimen collection. The date of specimen collection gives a better indication of the date of illness than the reporting date and allows more valid interpretation of seasonal trends.

This year's annual report on the LabDOSS scheme varies to that of the 1993 annual report. It is more selective in its content, and when data allowed, there was an attempt to demonstrate trends in invasive disease over the period 1992 to 1994. The quantitative Chi-squared method was used to analyse for trends. Denominators were the total number of isolates in the respective categories analysed.

NOTES ON INTERPRETATION

There are several possible biases in the LabDOSS scheme. Although all but one State or Territory is represented, eastern States and tertiary institutions have relatively high representation, resulting in the potential for geographical, testing and referral pattern biases. The number of isolates reported may vary each month and from year to year depending on the number and type of participating laboratories. In addition, risk factor and clinical information are not consistently provided by laboratories as data are provided by laboratory staff who do not have direct contact with the patient.

TOTAL REPORTS

There was a total of 6832 isolates of significant sepsis reported in 1994. Reports were contributed by 21 laboratories in seven States and Territories (Table 1). Fifty-one per cent (3457) of reports gave information on whether the infection was hospital acquired. Of these, 47% (1625) were classed as hospital acquired.

Source of Isolates

Blood was the most common specimen type reported, accounting for 91% of total isolates. Joint fluid comprised 2.2% of all isolates; cerebrospinal fluid 1.9%, peritoneal dialysate 1.0%; pleural fluid 0.7%; biopsies 0.2% and other tissues 2.8%.

Table 1. Total number of LabDOSS reports for 1994 , by State or Territory and contributing laboratory

State or Territory	Laboratory	Reports
Australian Capital Territory	Woden Valley Hospital, Canberra	373
New South Wales	Gosford Central Coast Hospital Service, Gosford	206
	Institute of Clinical Pathology and Medical Research, Westmead	475
	Prince of Wales Hospital, Randwick	182
	Royal North Shore Hospital, St Leonards	484
	Royal Prince Alfred Hospital, Camperdown	215
	South West Area Pathology Service, Liverpool	672
	John Hunter Hospital, Newcastle	716
Queensland	Nambour General Hospital, Nambour	97
	Ipswich General Hospital, Ipswich	117
	Central Queensland Pathology Laboratory, Mackay	34
	Greenslopes Hospital, Brisbane	113
	Royal Brisbane Hospital, Brisbane	1105
	Drs JJ Sullivan, NJ Nicolaides and Partners, Taringa	246
	Toowoomba Pathology Laboratory, Toowoomba	169
South Australia	Institute of Medical and Veterinary Science, Adelaide	654
Tasmania	Northern Tasmania Pathology Service, Launceston	146
	Royal Hobart Hospital, Hobart	256
Northern Territory	Alice Springs Hospital, Alice Springs	184
Western Australia	Princess Margaret Hospital for Children, Perth	68
	Sir Charles Gairdiner Hospital, Nedlands	327
Total		6832

Class of Isolates

Gram positive organisms comprised the majority of isolates accounting for 53.9% of reports. Gram negative organisms comprised 39.8% of isolates; anaerobes 4.4% and fungi 1.9%. Figures 2 and 3 show the class of isolates reported as a percentage of total isolates from 1992 to 1994. Significant linear trends for both an increase in gram positive organisms ($p < 0.0001$) and fungi ($p = 0.0016$), and a decrease in gram negative organisms ($p < 0.0001$) were shown for this period.

The Top 15 Organisms

The 15 most frequently isolated organisms for 1994 are shown in Table 2. 1992 and 1993 data are shown for comparison. Significant increased linear trends in the percentage of reports over the period 1992 to 1994 were seen for the following organisms: Methicillin resistant *Staphylococcus aureus* ($p < 0.0001$), *Propionibacterium ac-*

Figure 2. Total reports of Gram positive and Gram negative isolates, 1992 to 1994, as a percentage of total isolates

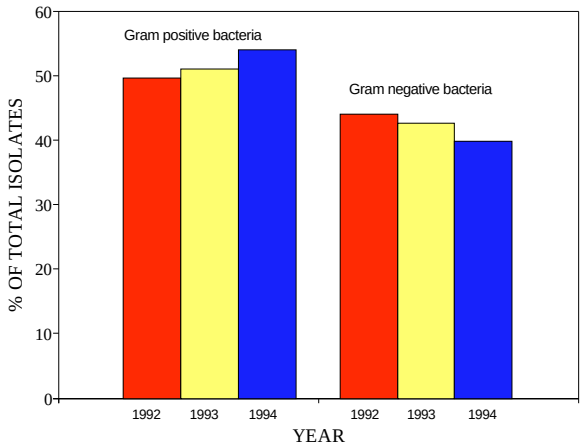


Figure 3. Total reports of fungi and anaerobes, 1992 to 1994, as a percentage of total isolates

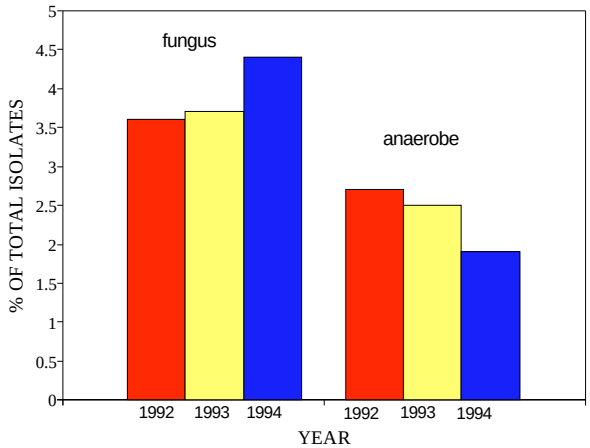


Table 2. Frequently reported isolates and percentage of total reports per year, 1992 to 1994

Organism	1992		1993		1994	
	Reports	% of Total	Reports	% of Total	Reports	% of Total
Escherichia coli	747	16.2	721	17.1	1115	16.4
Staphylococcus aureus	* 780	16.9	749	17.7	1098	16.2
Staphylococcus coagulase negative	629	13.6	694	14.1	1037	15.3
Streptococcus pneumoniae	236	5.1	180	4.3	484	7.1
Pseudomonas aeruginosa	198	4.3	174	4.1	245	3.6
MRSA	18	** 0.4	76	** 1.8	145	** 2.1
Propionibacterium acnes	6	** 0.1	13	** 0.3	141	** 2.1
Enterococcus faecalis	115	2.5	79	1.9	139	2.1
Enterobacter cloacae	87	1.9	72	1.7	116	1.7
Streptococcus Group B	58	** 1.3	54	** 1.3	116	** 1.7
Proteus mirabilis	77	1.7	62	1.5	95	1.4
Streptococcus species	42	** 0.9	50	** 1.2	92	** 1.4
Haemophilus influenzae	134	** 2.9	86	** 2.0	81	** 1.2
Streptocuccus Group A	26	0.6	54	1.3	81	1.2
Candida albicans	77	** 1.7	53	** 1.2	71	** 1.1

* Includes *Staphylococcus epidermidis* isolates
** Statistically significant for linear trend ($p < 0.05$)

nes ($p < 0.0001$), *Streptococcus* Group B ($p = 0.04$) *and Streptococcus* species ($p = 0.03$). Significant decreased trends were seen for *Haemophilus influenzae* ($p < 0.0001$) and *Candida albicans* ($p = 0.004$).

The proportion of MRSA isolates as a percentage of the total *Staphylococcus aureus* isolates also consistently increased during the period 1992 to 1994 (Figure 4). Thus, sterile site isolates of *Staphylococcus aureus* follow a similar trend to that shown in the Northern Territory[1] which demonstrated a proportional increase in all nosocomial MRSA isolates since 1989. Increased trends have also been reported in Western Australia and Tasmania[2].

BLOOD ISOLATES

A total of 6233 significant blood isolates (other than those with a diagnosis of meningitis) were reported in 1994. The age distribution for reports of bacteraemia is shown in Figure 5. Isolates were most commonly reported in the 65 to 74 years and over 75 years age groups.

The Top 15 Isolates

The 15 most frequently reported blood isolates and their percentage of total blood isolates for 1994 are shown in Table 3. Significant increased linear trends in the percentage of blood isolates over the period 1992 to 1994 were seen for Methicillin resistant *Staphylococ-*

Figure 4. MRSA isolates as a percentage of total *Staphylococcus aureus* isolates, 1992 to 1994

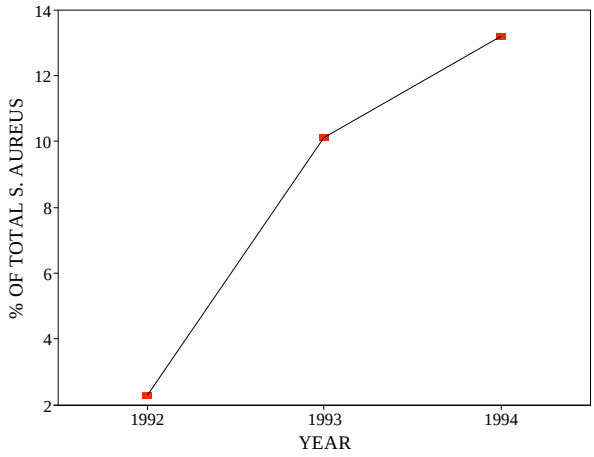


Figure 5. Age distribution of patients with bacteraemia, 1994, as a percentage of total blood

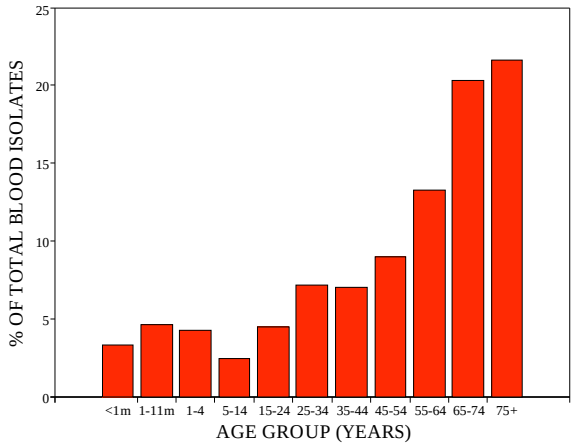


Table 3. Frequently reported blood isolates and percentage of total blood isolates per year, 1992 to 1994

Organism	1992		1993		1994	
	Reports	% of Total	Reports	% of Total	Reports	% of Total
Escherichia coli	721	18.0	676	18.7	1061	17.4
Staphylococcus coagulase negative *	556	13.9	488	13.7	963	15.8
Staphylococcus aureus	646	16.1	599	16.8	918	15.0
Streptocuccus pneumoniae	211	5.3	164	4.6	433	7.1
Klebsiella pneumoniae	135	3.4	147	4.1	244	4.0
Pseudomonas aeruginosa	180	4.5	154	4.3	233	3.8
Propionibacterium acnes	4	** 0.1	9	** 0.3	141	** 2.3
Enterococcus faecalis	105	2.6	67	1.9	129	2.1
MRSA	16	** 0.4	62	** 1.7	125	** 2.1
Enterobacter cloacae	83	2.1	63	1.8	110	1.8
Streptococcus Group B	54	1.4	48	1.4	100	1.6
Proteus mirabilis	72	1.8	56	1.6	82	1.5
Streptococcus species	38	1.0	40	1.1	82	1.3
Acinetobacter species	54	1.4	61	1.7	74	1.2
Streptococcus Group A	24	** 0.6	40	** 1.1	73	** 1.2

* Includes *Staphylococcus epidermidis* isolates

** Statistically significant for linear trend ($p < 0.05$)

cus aureus ($p < 0.0001$), *Propionibacterium acnes* ($p < 0.0001$) and *Streptococcus* Group A ($p = 0.005$) (Figure 6). Significant decreased trends were seen for *Haemophilus influenzae* ($p < 0.0001$) and *Candida albicans* ($p = 0.01$) (Figure 7).

Diagnosis

Information on the diagnosis was provided for 3867 (56.6%) of blood isolates received in 1994. A specific diagnosis was provided in 56.8% of reports, with 28.2% listing 'other' and 15.0% unknown. Gastrointestinal disease was the most commonly reported diagnosis (12.0%), followed by urinary tract infections (10.5%), lower respiratory tract infections (8.6%) and skin cellulitis wounds (7.6%).

Risk Factors

Risk factor information was provided on blood isolates in 44.4% of reports. Of these, 1546 (51.1%) reported immunosuppression, 641 (21.1%) had undergone recent surgery, 455 (15.1%) had a vascular prosthesis, and 302 (12.8%) reported other risk factors.

MENINGITIS ISOLATES

There were 220 cases of meningitis reported to LabDOSS in 1994. This represented 3.2% of total reports and contrasted with 1992 and 1993 in which meningitis reports represented 4.3% and 3.7% of total reports respectively. A significant decreased linear trend was

Figure 6. Reports of MRSA, *Propionibacterium acnes* and *Streptococcus* Group A blood isolates by year, 1992 to 1994

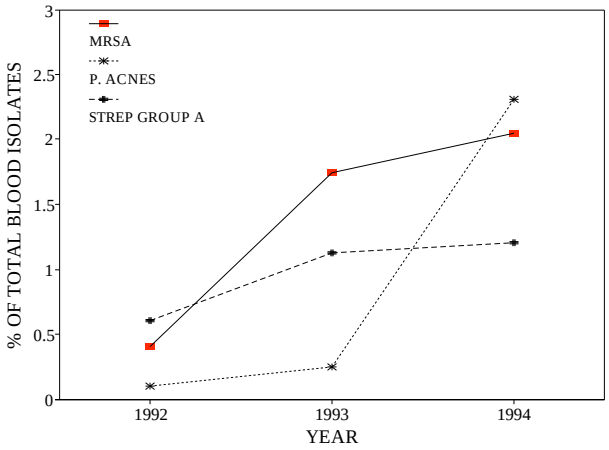


Figure 7. Reports of *Candida albicans* and *Haemophilus influenzae* blood isolates by year, 1992 to 1994

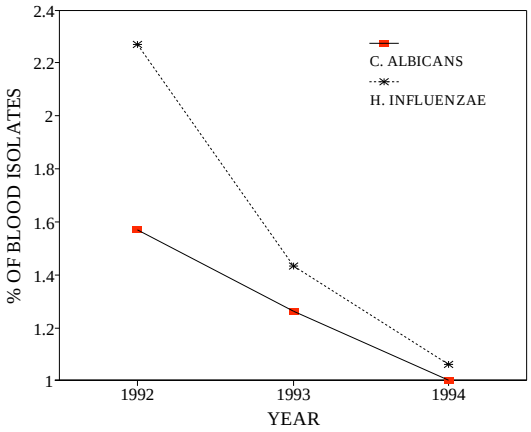


Table 4. Frequently reported meningitis isolates and percentage of total meningitis isolates per year, 1992 to 1994

Organism	1992		1993		1994	
	Reports	% of Total	Reports	% of Total	Reports	% of Total
Neisseria meningitidis	31	15.6	39	25.2	51	23.2
Streptococcus pneumoniae	25	12.6	13	8.4	41	18.6
Staphylococcus coagulase negative *	20	10.1	3	1.9	23	10.5
Cryptococcus neoformans	20	10.5	18	11.6	17	7.7
Haemophilus influenzae	43	** 21.6	31	** 20.0	16	** 7.3
Staphylococcus aureus	11	5.5	9	5.8	13	5.9
Streptococcus Group B	1	** 0.5	3	** 1.9	7	** 3.2

* Includes *Staphylococcus epidermidis* isolates

** Statistically significant for linear trend ($p < 0.05$)

demonstrated for the percentage of meningitis reports over the period 1992 to 1994 ($p = 0.003$).

Table 4 shows the most frequently reported isolates causing meningitis for 1992 to 1994 and their percentage of total meningitis reports. The proportion of *Haemophilus influenzae* isolates decreased over this period (significant for trend, $p < 0.0001$) and is likely the result of the introduction of conjugate *Haemophilus influenzae* type b (Hib) vaccines in 1992 and 1993. A steady decline in Hib cases since 1992 is documented by the National Notifiable Diseases System[3]. Cases of *Streptococcus* Group B increased ($p = 0.05$). The proportion of *Neisseria meningitidis* isolates, although not statistically significant, increased in 1993 and 1994 compared to 1992. The proportion of *Streptococcus pneumoniae* isolates increased in 1994 compared to 1993 (Figure 8).

Haemophilus influenzae

Fourteen of 16 *Haemophilis influenzae* meningitis reports were in children less than 4 years of age.

Nine of sixteen reports were classed as serotype b, with the remainder not having a serotype specified.

Neisseria meningitidis

The highest frequency of meningococcal meningitis reports (13) was in the 15-24 years age group (seven females and six males) (Figure 9). A higher incidence of meningococcal meningitis has been demonstrated in Winter and Spring[4] and the 1994 data confirm this trend with the highest incidence seen in August through to December. The same seasonal pattern for meningococcal infection was mirrored in the National Notifiable Diseases reports for 1994[3] (Figure 10).

Fifteen of 51 meningococcal meningitis reports were classed serogroup B, 12 serogroup C, one serogroup W-135 and one serotype Y.

Cryptococcus neoformans

Eight of 17 cryptococcal meningitis reports were for the 15 to 44 years age group and 15 patients were male. Immunodeficiency was reported in ten cases (all males). Eight patients had HIV infection, and two patients had other forms of immunodeficiency.

Biovariant information was provided for five reports; three were *Cryptococcus neoformans* var. *neoformans* (all

Figure 8. Reports of *Haemophilus influenzae, Neisseria meningitidis, Streptococcus* Group B and *Streptococcus pneumoniae* meningitis isolates by year, 1992 to 1994

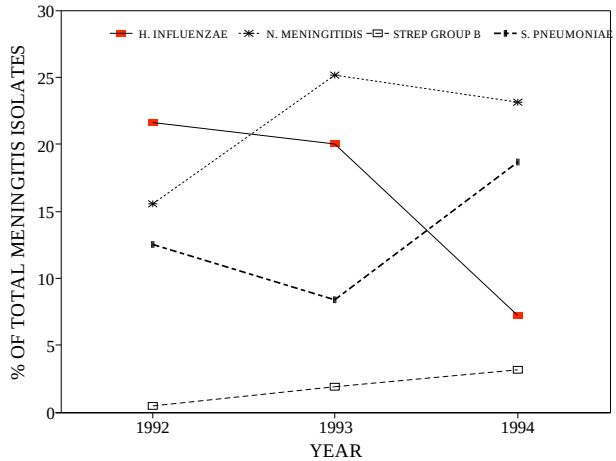


Figure 9. *Streptococcus pneumoniae* and *Neisseria meningitidis* meningitis reports by age group, 1994

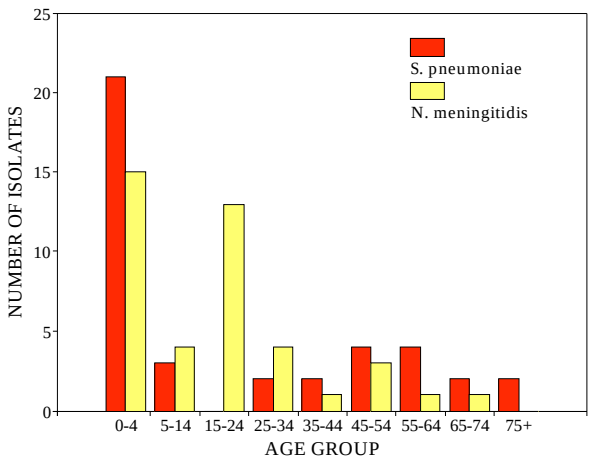
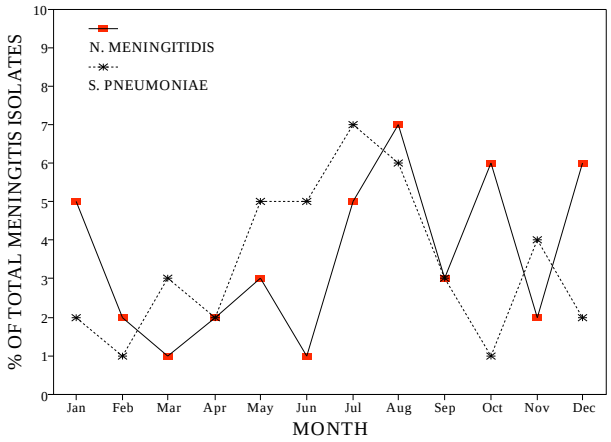


Figure 10. Reports of *Neisseria meningitidis* and *Streptococcus pneumonia* by month, 1994



cases had HIV infection) and two were *Cryptococcus neoformans* var. *gattii*.

Streptococcus pneumoniae

Twenty-one of 41 pneumococcal meningitis reports were for children less than five years of age and sixteen of these were males (Figure 9).

A higher incidence of pneumococcal meningitis has been demonstrated in Winter and Spring[5]. The 1994 data confirm this trend with the highest incidence seen in May through to August (Figure 10).

OTHER SITES

Joint Fluid

One hundred and fifty-one reports of joint fluid isolates were received. The majority of isolates were *Staphylococcus aureus*, accounting for 64.2% of reports. Other isolates included S*taphylococcus* coagulase negative (4.6%), *Streptococcus* Group B (4.0%), Methicillin resistant *Staphylococcus aureus* (3.3%) and *Streptococcus pneumoniae* (3.3%).

Peritoneal dialysate

Sixty-seven reports of peritoneal dialysate isolates were received. Organisms most frequently isolated were *Staphylococcus* coagulase negative (25.4%), *Escherichia coli* (17.9%) and *Staphylococcus aureus* (11.9%).

Pleural Fluid

Forty-six reports of pleural fluid isolates were received. Organisms most frequently isolated were *Staphylococcus aureus* (19.6%), *Staphylococcus* coagulase negative (17.4%), *Streptococcus* species (13.0%) and methicillin resistant *Staphylococcus aureus* (6.5%).

SELECTED CLINICAL CATEGORIES AND RISK FACTORS

Lower Respiratory Tract Infections

A diagnosis of pneumonia was recorded in 491 reports. The majority of isolates were *Streptococcus pneumoniae* which accounted for 52.3% of reports. The proportion of reports attributed to this organism was significantly greater than in 1992 and 1993. Other isolates included *Staphylococcus aureus* (8.1%), *Staphylococcus* coagulase negative (6.3%), *Escherichia coli* (5.3%), *Haemophilius influenzae* (3.9%) and *Klebsiella pneumoniae* (2.9%), none of which was reported in significantly different proportions from previous years.

Risk factors for pneumonia were recorded in 26.5% of reports, with the most common risk being malignancy (26.9%), followed by thoracic surgery (8.5%) and neutropaenia (8.5%).

HIV/AIDS

There were 66 reports of HIV / AIDS as a risk factor for sepsis. The majority of cases (72.7%) were reported in the 25 to 44 year age groups and 62 cases were male.

Table 5. Organism by type of surgery (expressed as a percentage of total isolates in each category), 1994

	Type of Surgery					
	Abdominal	Thoracic	Orthopaedic	Neurological	Unrinary Tract	Vascular
Organism	n=256	n=79	n=72	n=64	n=61	n=39
Enterococcus faecalis	4.7				6.6	7.7
MRSA		17.7	8.3			
Staphylococcus aureus	12.1	26.6	36.1	17.2	11.5	17.9
Staphylococcus coagulase negative *	9.3	7.6	9.7	21.9		12.8
Streptococcus Group B					4.9	
Enterobacter cloacae			5.6			
Escherichia coli	17.6	6.3	5.6	6.3	32.8	10.3
Klebsiella pneumoniae				4.3		
Proteus mirabilis					4.9	
Pseudomonas aerginosa	4.7	11.4		7.8		5.1

* Includes *Staphylococcus epidermidis* isolates

The three most commonly reported organisms were *Staphylococcus aureus* (24.2%) *Staphylococcus* coagulase negative (16.6%) and *Cryptococcus neoformans* (12.0%).

Endocarditis

There were 99 cases of endocarditis reported, 72 involving a native valve and 27 cases a prosthetic valve. Eighty-two per cent of reports were for patients over 44 years of age. The male to female sex ratio for prosthetic valve endocarditis was 1:1 whereas that for native valve endocarditis was 2.5:1.

The most frequently reported organisms in native endocarditis were *Staphylococcus aureus* (28.6%), *Streptococcus sanguis* (12.5%), *Enterococcus faecalis* (9.7%) and *Streptococcus* species (8.3%). Native valve infection was more frequently attributed to *Staphylococcus aureus* (25.9%), *Streptococcus sanguis* (14.8%), *Staphylococcus* coagulase negative (14.8%) and methicillin resistant *Staphylococcus aureus* (11.1%).

Surgery

There were 641 reports of organisms from sterile sites in patients with a risk factor of recent surgery. Abdominal surgery was most frequently reported (39.9%), followed by thoracic (12.3%), orthopaedic (11.2), neurological (10.0%), urinary tract (9.5%), and vascular surgery (6.1%). Surgery of an unspecified nature represented 10.9% of reports. Table 5 shows the five most frequently reported isolates for the different types of surgery.

CONCLUSIONS

This is the first report that has both analysed and interpreted data from the LabDOSS scheme. Roberts[6] reviewed LabDOSS data for 1992 and 1993 and concluded that the scheme appeared to be representative as it supported known trends in infectious disease, but in order to meet all its objectives stated that it would require continued expansion.

Data presented in this report may reflect current trends in invasive disease. The apparent decline in the occurrence of *Haemophilus influenzae* meningitis reports illustrated has been supported by other surveillance systems. Known seasonal patterns of pneumococcal and meningococcal meningitis were also demonstrated. The trend for increased Gram positive and decreased Gram negative isolates from sterile sites could be valid and may largely result from the greater use of antibiotics directed against Gram negative organisms. An increase in the proportion of MRSA isolates to total *Staphylococcus aureus* isolates has been reported in various hospitals[1,2] throughout Australia and sterile sites data may have reflected this trend.

Other trends described in this report are more difficult to validate due to the unknown representativeness of LabDOSS and a lack of available confirmatory data or appropriately directed research. It should be noted that a recent evalution of the LabDOSS scheme (Crerar, unpublished)* revealed the most frequently cited reason given by respondents for its limited use was uncertain representativeness. It is clear therefore, that greater representation is paramount before meaningful conclusions can be consistently derived from the present system. Consistency and completeness in reporting are also crucial for the success of such a system, and in this respect, greater focus on specific organisms and fields of information has been suggested.

The public health importance of invasive sterile sites disease is unquestionable. A representative sterile sites surveillance system is therefore necessary for accurate documentation of the epidemiology of invasive disease. Such a system can then by utilised nationally to confidently detect trends, guide policy and assess public health interventions. However, appropriate procedures to streamline the data collection process and to facilitate a broader reporting base are required. Further discussions on methods for data collection and dissemination are needed amongst relevant stakeholders.

ACKNOWLEDGEMENTS

The contribution of all LabDOSS laboratories is gratefully acknowledged, as is the assistance of Margaret Curran, Htoo Myint and Heather Mortlock.

* A report on the evalutaion of LabDOSS will be distributed to laboratories and published at a later date.

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