TSN® Database Australia, a new tool to monitor antimicrobial resistance in Australia

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Abstract

An electronic network of Australian microbiology laboratories was established to monitor the emergence and occurrence of antimicrobial resistance among clinically relevant bacteria. It is believed that the data network collected approximately 42 per cent of all antibacterial susceptibility test results generated by Australian laboratories. The network comprised 94 hospitals and 9 private commercial laboratories. Selected data elements were extracted and electronically transmitted to a central location. Upon receipt, all data were first normalised and thereafter examined for errors. Duplicate results for the same patient were identified to prevent skewing of the data toward resistance. All data passing quality assessment was staged for release of a new database release that occurred monthly. Unusual test results were first validated prior to their inclusion into the database. Using an Internet-based query tool, individual institutions could query their own data, but could only query aggregated data for other regional or national analyses. Individual patient results could be examined nor could the results of any individual institution other than their own. As of March 2002, TSN Database Australia contained 14,648,752 test results, from 2,000,394 strains (453 different taxa) and 1,213,605 patients. Since the same database concept has been established in 10 other countries (United States of America, Europe, and Canada), observations made in Australia may be compared to those observed elsewhere in the world. This article will describe TSN in greater detail, describe the query tool and some of the analyses that are possible. *Commun Dis Intell* 2003;27 Suppl:S67–S69.

Keywords: antimicrobial resistance, TSN database, monitoring

Introduction

Several years before the beginnings of TSN in Australia, the infectious disease community, concerned about growing antimicrobial resistance formed a program called the National Antibiotic Resistance Surveillance Program (NARSP). This program was directed by a NARSP committee, a group of leading experts in the field of infectious diseases including government representation from the Commonwealth Department of Health and Ageing. This national program was constructed to act as an antibiotic resistance surveillance system capturing susceptibility testing results from approximately 50 private and public infectious disease testing laboratories across the country. The program was voluntary and with government funding the program was able to compile data, mostly manually and publish the combined data yearly (usually from 1–2 years earlier). The testing sites involved with the NARSP program acted as the foundation for the automation of the surveillance system (TSN Database Australia).

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In 1998, the NARSP committee was contacted by Focus Technologies (owners of TSN) and consulted on the development of an automated resistance surveillance system. The goal was to capture a balanced dataset: a representative percentage of the susceptibility testing to effectively monitor antimicrobial resistance in Australia. NARSP suggested the sites to be approached and provided guidance on the development of TSN Database Australia in the very early stages. Subsequently, Focus formed a TSN Australian Advisory Board to assist in the process. The pool of approximately 50 NARSP testing laboratories were reviewed and 30 geographically and demographically diversified TSN testing sites (e.g., public, private, hospital and pathology services) were selected across Australia. The TSN data were divided into 4 distinct regional datasets as was advised by the TSN Australian Advisory Board. Focus incorporated a sufficient number of sites in each region to provide a representative regional sample and to maintain TSN site anonymity.

Each testing site was visited and received a formal presentation about the goals and details of the TSN program. Interested sites were required to complete a comprehensive evaluation questionnaire to establish the use of acceptable microbiology practices, quality control and their information technology capabilities in providing the necessary data for capture. Upon an acceptable evaluation review, each testing laboratory signed a written TSN Participation Agreement indicating their commitment to the program and terms for data and site confidentiality. In all, 30 sites signed on. Sites not signing on were usually unable to provide susceptibility testing data electronically through a Laboratory Information System and were subsequently considered ineligible. Replacement sites from the original list of 30 were chosen with the consultation of TSN Advisory Board members.

Installation of TSN in Australian sites began in August 1998. The national TSN Database Australia was released to participants in November 2000. At the time of writing it was estimated that TSN Database Australia captured approximately 42 per cent of all susceptibility testing done in the country annually.

Methods

The participant's susceptibility results were gathered from either a laboratory information system or directly from an automated susceptibility testing instrument through an extraction program. Patient privacy and the anonymity of each institution's data were ensured by encryption of files prior to transmission and the exclusion of patient names. Each institution's data was maintained anonymously within the TSN database. Only the submitting institution had access to its own segregated data. All files were further encrypted prior to transmission to Focus Technologies in Herndon, Virginia USA.

In Herndon, VA the data were normalised. Normalisation subjects the data to a number of processes including validating each line of data, and cross referencing the significant parts of each data line with a master data dictionary provided by the participant. The master data dictionary includes definitions for patient wards, specimen source, organism name, antimicrobial agent name, patient type (ICU, in-patient, outpatient), test method, and sub-institution. The result is two types of files, a *mrg* file and/or *rpr* file. The *mrg* file contains data ready for merging into the participant's main database. The *rpr* file contains data that requires manual resolution by a TSN Site Analyst or Microbiology Analyst. Upon resolution of the manual issues, the *rpr* file is re-entered into the normalisation process and becomes an *mrg* file.

Each month, newly created *mrg* files were loaded into the TSN database and software programs were applied. The programs eliminated duplicates, address interpretation or test method issues and review critical organism-antimicrobial agent issues. Critical organism-antimicrobial agent issues involved those instances where a particular organism-antimicrobial agent result was unusual, or hadn't been reported in the clinical literature. Examples such as vancomycin-resistant *Staphylococcus aureus* or fluoroquinolone-resistant *Streptococcus pneumoniae* would be flagged and withheld from the database pending confirmation of the result by the participating laboratory.

When these issues were resolved, the data was finally released into the TSN database and became available for use by the participant to perform queries. There were six different query types available using the Query III tool. The most common type of query was the 'SIR' query, which provided susceptible, intermediate and resistant results for a single organism-antimicrobial agent combination or to a group of organisms versus a group of antimicrobial agents over time. Trending provided the opportunity to examine the data by month, by quarter or by year. An antibiogram in which the user defined the susceptibility interpretation (S only, R only, S and I, R and I) was also available. Antibiograms could also be exported to Excel, Word, Crystal Reports, or Rich Text Format. Minimum Inhibitory Concentrations (MIC) and zone size data distribution reports were also available, as were Incidence reports.

Three datasets were defined, national, regional and institutional. All participants could look at the national data and their individual institutional data, but security programs prevented one participant from looking at another individual participant's data.

Nine different query parameters provided a wide range of criteria available to generate queries. S,I,R Sub-select offered the opportunity to look at the susceptibility patterns of alternative antimicrobial agents against organisms such as MRSA or gentamicin-resistant *Pseudomonas aeruginosa*. Specimen, patient type (ICU, in-patient, outpatient), ward, age, gender, institution type, bed size and test method were the other parameters available. Selection of organisms and antimicrobial agents were available from two different tables, a 'Top 25' list or a more comprehensive list. The query and the parameters used to generate the query could be saved for future reference. Each query could be customised in the Select Query Output Parameters window.

Results

The TSN Database Australia contained data from 103 sites, 453 taxa, and 99 antimicrobial agents. There were 14,648,752 results from 2,000,394 strains obtained from 1,213,605 patients. Each month approximately 300,000 records were entered into the database. The data could be analysed by multiple factors including any combination of the following: age and gender of the patient, specimen source, organism, susceptibility test method, drugs tested, and quantitative and qualitative test results. An example of data generated by the Query III SIR tool is shown in the Table.

Table. Trends in the susceptibility of *Staphylococcus aureus* to methicillin/oxacillin, Australia, 1996 to 2001

		S		I		R	
Year	Total	N	%	N	%	N	%
1996	16,972	15,277	90.0	0	0.0	1,695	10.0
1997	36,596	32,951	90.0	0	0.0	3,645	10.0
1998	54,542	48,667	89.2	0	0.0	5,875	10.8
1999	71,995	62,366	86.6	1	0.0	9,628	13.4
2000	93,104	80,026	86.0	2	0.0	13,076	14.0
2001	98,490	83,655	84.9	1	0.0	14,834	15.1

S Susceptible.

I Intermediate.

R Resistant.

Discussion

TSN Database Australia has demonstrated the feasibility and utility of an electronic surveillance system. The system monitors the trends of resistance in key organisms to provide timely information that can be used by physicians and pharmacists to guide patient management decisions. Data are provided to all laboratories participating in the system in the form of queries that can be performed on their own information, that of their region, and nationally. The proprietary nature of the system does not allow wider dissemination of data at this stage, although discussions are ongoing to make this data available nationally.

Acknowledgments

We would like to thank the members of the TSN Australia Advisory Board and the participating institutions.