

## **DEVELOPMENT OF AN INTERNET-BASED INFORMATION SYSTEM FOR MONITORING VETERINARY ARBOVIRUSES AND THEIR VECTORS.**

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Information on the health status of livestock, and risk factors that may impact upon it, is important for a variety of purposes. Many countries have developed extensive surveillance systems to generate this type of information. However, many of the potential uses for this information require collation and centralised analysis. An information system assists in this task.

The Australian National Arbovirus Monitoring Program (NAMP) is an ongoing cooperative program between Commonwealth and state and territory governments, based on the regular sampling of a network of sentinel herds and vector trapping sites throughout the country. The operation of the sentinel herds and vector trapping sites is the responsibility of scientists working with the seven state and territory governments. The information gathered provides a comprehensive picture of the distribution of key vectors (*Culicoides* species and mosquitoes) and of a number of important viruses (namely bluetongue virus, Akabane virus, and bovine ephemeral fever virus). The program has been operating in its current and earlier incarnations for about 30 years and has generated a wealth of historical data.

In the past, summaries of the data have been reported regularly by the separate state laboratories, and detailed analysis has been carried out at the state or local level for research or management purposes. For example, this data has been used to successfully predict outbreaks of Akabane in NSW, most recently in 1998. Ephemeral fever virus data is also used to predict outbreaks and recommend vaccination programs.

In response to the Agreement on Sanitary and Phytosanitary Measures (SPS) of the World Trade Organisation's General Agreement on Tariffs and Trade (GATT), there has been an increased requirement for reliable scientifically-based data to support international trade in animals and animal products. This has increased the need to collate surveillance data at a national level for the purpose of trade negotiations. Similarly, the establishment of zones, as introduced by the OIE, has meant that data must be collated and analysed regularly and rapidly in order to substantiate a zone. The need for rapid collation and analysis of data is even more important when the data is used for real-time risk forecasting. A tempero-spatial model is under development to predict the risk of bluetongue virus activity, and this depends on up-to-date information from the field.

It was in this context that the need for a centralised national database of arbovirus sentinel herd monitoring and vector trapping data was realised. The requirements were for a system that:

- Could manage the large volume of historical vector trapping and sentinel herd seroconversion data, as well as being regularly updated with new observations;
- Enabled rapid incorporation of new data into the database;
- Was able to be used by a small number of users, with widely varying computer skill levels, distributed across the entire continent, submitting data only once a month on average;
- Ensured continued ownership of the data by those generating it, and allowing access to relevant subsets of the national database;
- Was able to accommodate a range of different state-level data storage formats (spreadsheets and databases);
- Was able to be developed and maintained at a cost proportional to the functional requirements;
- Was able to limit unauthorised access to provisional data.

In response to these requirements, it was decided that an Internet-based system using a Web interface met the requirements for access from widely distributed sites, low cost, and ease of use.

The system is made up of three major components: a Web interface, a simple server-based mail script, and a customised management program for processing data. The Web interface contains a number of html pages linked by a main menu, which give users the ability to submit data, download data, and view data, summaries, analyses and maps. The need for rapid access to data means that some preliminary data is submitted to the system. Initial results may not be able to confirmed until one or two months after the observation, so the system allows editing of any previously submitted data. To prevent misinterpretation of preliminary results, and avoid malicious or accidental submission of spurious data, access to the site is restricted by password to registered users. Once the data has been confirmed, summaries are released in an annual synoptic report.

Data storage format was standardised, based on a spreadsheet format being used by most states. To enable data to be submitted with as little effort as possible, the system is designed to allow users to copy a block of data from their local spreadsheet (or database, in some cases) and to paste it into a text box on the data submission web page. Before submission, this is parsed using a Javascript routine to check for completeness and consistency, and the user is notified if errors are detected. Submitted data is then sent to a dedicated email address using a simple publicly available mail script.

The customised management program forms the heart of the system. This was developed using the Delphi programming language<sup>1</sup>, and operates on a stand-alone PC, connected to the Internet via a dial-in line. The decision to host the system on a

stand alone PC instead of a server was based on several factors, including ease of development, cost of development, data security, and the update speed required by the users. The most significant disadvantage is that the database is not automatically updated in real time, but by batch updates, performed typically once or twice per week. This has proven to meet the needs of users for up-to-date data.

The management program automatically performs all the functions required for routine management of the system, including:

- Checking the email address for new data submissions,
- Downloading, parsing and adding new data to the main databases,
- Generating html format data summaries and reports,
- Producing and compressing subsets of the main database files,
- Linking to a GIS and generating maps of vector and virus distribution,
- Uploading all updated files via FTP to the web site.

At the time of writing, the system had been successfully operating for one year. The system's ongoing role in supporting the work of the scientists in the National Arbovirus Monitoring Program has been assured through the incorporation of the system into the routine operation of the Program.

### **Discussion**

The system described demonstrates the potential of the Internet as a platform for widely distributed animal health information systems. It is felt that the success of the system is due to several key factors during development. Firstly, extensive consultation was undertaken to understand the needs of the user groups, and the nature of existing data management systems in place in the different states. The system was developed in response to the expressed needs of the users, paying careful attention to ease of use, as well allowing contributors to maintain ownership of submitted data, while sharing it with other stakeholders.

The system was also developed in a step-wise fashion, allowing users to understand its functions and outputs, and then refine the specification of their required outputs as the potential of the system became clearer. For example, after development, the system was modified to allow automatic generation of quarterly reports, including summary tables and distribution maps. Another aim during development was not to impose a new way of doing things on the users, but to harmonise the approaches used, and accept input from a variety of existing local data input systems.

Finally the system was developed at low cost, without the need for extensive investment in hardware or communications infrastructure. As with many animal health information systems, the volume of data handled is very low, so a simple, low cost solution is more than adequate to meet the needs.

### **References**

- <sup>1</sup> Inprise Corporation 1998. Borland Delphi Professional version 4 (software program)