surveying technology helps energise a wind farm

WHITE ON GREEN

inside

Un-manning surveying
Let’s throw out gender stereotypes

Snakes and latitudes
National GIS mapping of snake bites

Land Tasmania
Spatially enabling Tasmanians
National GIS mapping of snake bite envenoming in Australia

Venoms and venomous animals hold a fascination across history and cultures, with the serpent being at the forefront of human myth and legend. The first century of European habitation in Australia proliferated myth over fact when it came to venomous animals and their bites. Advances in technology and science in the 1900s launched a new understanding of these oft-maligned animals, their venoms and the treatment of injury, including the development of antivenom immunotherapy.

Despite these advances, venomous bites and stings continue to cause a significant global impact and burden on populations and communities. This burden doesn’t just include the immediate and long-term impacts upon the envenomed victims and their families (illness, death, and in survivors – disability and psychological sequelae), but leads to wider consequences for communities (poverty, lost productivity and reduced GDP), particularly in nations where the burden is greatest. The significance of one form of envenoming – snake bite - has been recognised by World Health Organisation (WHO), Drugs for Neglected Diseases Initiative (DNDi), Medicins sans Frontieres (MSF) and has even lead a Global Snakebite Initiative to engender change and foster research into snake bites and their treatments.

In Australia, the national importance of venomous bite and sting injuries has long been recognised by federal and state governments. Through 70 years of Commonwealth investment in venomous injury and antivenom research and development, Australia has had amongst the largest range and highest quality of antivenoms globally. Despite this track record, only fragmentary data has been available from which to estimate the overall burden and determinants of this type of injury.

There is a paucity of adequately analysed, high-resolution data that can be interrogated to answer fundamental public health questions about the reasons why venomous injuries occur, and what determines the outcomes. A community of researchers is involved in studying the clinical toxinology of envenoming and mortality from specific organisms.

Reports with individual hospital data, or with individual state and territory injury surveillance data, have been produced. In 2009, an Australian government injury surveillance unit released the first and only report “Venomous bites and stings in Australia to 2005”. This document reported coded Australian hospital records from 2002-2005 and provided an overview of Australian admitted hospital trends. Despite this, our knowledge of national morbidity and mortality due to envenoming remains fragmentary, and this lack of understanding confounds research priorities and the development of public policy and health standards.

Part of the reason for this gap is that despite Australia’s reputation as having an abundance of venomous fauna, the case burden is relatively low, making robust epidemiological analysis problematic. For example, in 2000, a clinical case review of Australian mortality from wasps and ants was undertaken, extending back to 1979. A total of 13 cases were identified in this 21 year period, and while describing well the clinical, syndromes there was difficulty in identifying and assigning causality with such a small number.

The Australian Venom Research Unit (AVRU) at the University of Melbourne has been tasked by the Federal Government to acquire, collate and investigate available national, state and territory data on venomous injury, and has established the Australian...
Venomous Injury Project (AVIP) to develop a dynamic approach that incorporates epidemiological, clinical and environmental data into a geospatially relevant dataset - the first of its kind.

The purpose of this work is to contribute to building an accurate and up-to-date picture of the burden of venomous injury on Australian populations, using initial surveillance data as a basis to frame questions about the reasons why venomous injuries occur, and what determines the outcomes. In combination, this information can be used to generate a number of outcomes that both guide the directions of future research priorities, contribute to new interventions, prevention strategies, education directions and public health policy decision-making. This framework has the potential to be expanded to other regions, particularly sub-Saharan Africa, Papua New Guinea or Asia - areas where the burden of injury is the greatest at global level, and where absence of interpreted data severely curtails efforts to alleviate this most neglected of all neglected tropical diseases.

Back to basics
The first step in developing this platform has been understand the Australian burden of injury due to envenoming at a national level and to use this data to develop a range of ‘if-then’ scenarios. Ethics applications for Australian mortality and morbidity statistics were developed and approved by the University of Melbourne Human Research Ethics Committee, the National Coronial Information System (NCIS), Western Australian Coronial System and the Australian Institute of Health and Welfare (AIHW) Australian Coordinating Registry (ACR) ethics committees. In addition, applications were made to the AIHW for national hospital admissions with national and each state and territories approvals required prior to data release.

An ArcGIS 10.2.1 desktop account was used to develop a geodatabase (Figure 1). NCIS records were interrogated using keyword, code and coronial documents searches. These records were crosschecked against a separate national mortality database held through the ACR with NCIS data, the only data that could be geocoded.

Coronal data was migrated into a spatial database, with each case assigned a unique primary key (PK) record identification per case. The coronal record tables include information about the envenoming incident, death, residence and hospital locations. Because the relevant data was now consolidated with a common spatial projection, all the datasets could be re-projected into an Albers projection for alternative analysis, e.g. distance or adjacency functions.

The process of using ‘identity’ to preserve all of the data values in the combined data fields could only be accomplished by the use of spatial data processing. The combined spatial locations of mortality associated by Australian Bureau of Statistics data boundaries could then be linked back to the coronial data table, which held all of the details of the mortality event. The resultant ‘identity’ tables incorporated socioeconomic (SEIFA) or remoteness boundary values, which were then exported to conduct further statistical analysis, or to produce charts and graphs. To date, national hospital admissions data has yet to be acquired on a level to allow geospatial research with local data ‘sentinel’ sites, but efforts are being made to acquire this level of detail to enhance future GIS analysis.

Geospatial representation of information is not prevalent within government health reporting. GIS systems offer the possibility to improve the interpretation of data and ... can provide more accurate risk analysis and resource allocation, and lead to the development of prospective risk mapping.

GIS systems offer the possibility to improve the interpretation of data and ... can provide more accurate risk analysis and resource allocation, and lead to the development of prospective risk mapping.

Australian national burden of mortality caused by envenoming from bees, wasps, ants, ticks, snakes and jellyfish, 2000-2013.

“GIS systems offer the possibility to improve the interpretation of data and ... can provide more accurate risk analysis and resource allocation, and lead to the development of prospective risk mapping.”

Background to research, she is currently utilising the power of geospatial analysis to determine injury correlations within a public health framework.

Dovey Dee has 25 years’ experience as a spatial engineer and consultant. With a passion for spatial statistics and the natural environment, she has worked within environmental consulting firms in both the United States and Australia.

David Williams, BSc, GDipResMeth, PhID is not only a herpetologist, he also manages a clinical trial in Papua New Guinea researching Taipan snake antivenom development. He runs health worker education and an emergency retrieval service for snakebite in PNG.