Could you provide a brief overview of your research career? What sparked your initial interest in preventive and occupational medicine?

After graduating from college, I was drafted into the army where I worked as a medical laboratory technician. I was attracted to the power of medical knowledge – identifying a malaria parasite on a blood smear could save someone’s life! While in medical school, I attended a talk by Dr Alfred K Neumann, then Chairman of the School of Public Health at the University of California, Los Angeles (UCLA), which motivated me to work in public health and prevention. My Master’s thesis in public health focused on occupational asthma and medical informatics.

As new infectious diseases research is published, how do you ensure that the IDdx software contains the most up-to-date information?

I now limit my references to 12 regularly revised sources. Last year, it took me several hours a day for about six months to review all 249 diseases in these 12 primary sources and to revise the findings (signs and symptoms) of each disease. A new table in the database was used to record the findings from each reference for each disease and count the total number of times that the finding occurred in each of the 12 references. This new table enables the colour-coding of findings, a new feature entitled ‘weighted findings’. For example, a small blue font indicates that only one reference has cited the finding to describe the disease, while a regular font indicates two references and a bold font indicates three or more references.

Can you explain ‘knowledge coupling’ and why this is a particular problem in infectious diseases and toxicology?

Knowledge coupling is a concept popularised by Dr Larry Weed. The problem is caused by a combination of the limits of human memory and the explosion of medical knowledge.

To solve this problem, the clinician needs all pertinent medical information that has been comprehensively mapped and indexed in a way that shows the unique features of each diagnosis. Ideally, this indexing will be linked to computerised patient records. This requires a controlled medical terminology that is expressive enough to describe relevant distinctions between patients’ symptoms, yet is unambiguous and formally defined so that it can be processed by computers. Structured data entry by physicians in real time will then trigger advice from the computer database. As the complexity of information increases, so does the value of knowledge coupling.

How do you see your relational databases progressing in the future?

Haz-Map – a database designed to assist health and safety professionals by providing easy access to key information about chemicals, exposure assessment and the diagnosis of occupational diseases – is freely available on the US National Library of Medicine website and another version is published by EBSCO. In the future, I plan to continue updating Haz-Map with new information as it becomes available. I foresee IDdx as being owned by a public health organisation with a team dedicated to making daily updates.

With a background in family practice and preventive medicine, Dr Jay Brown is committed to revolutionising the support clinicians receive in their day-to-day decision making. Through the development of superior databases of medical information, he is aiming to improve clinical practice and public health outcomes.
A consultant for the US Department of Labor and the US National Library of Medicine in Seattle has devoted the past few decades to the development of decision support software that aids in the diagnosis of infectious diseases.

IN A WORLD that is witnessing unprecedented technological developments, new medical knowledge is constantly being created. Yet while this unceasing march of progress is giving rise to multiple discoveries and advances in the field, it is also generating a vast backlog of data that is impossible for physicians and public health professionals to take full advantage of. Indeed, the breadth and depth of available medical information today can be counterproductive, causing doctors to become lost in the details so that they lose sight of the bigger picture. There is, therefore, an urgent need to index information about health and disease, enabling speedy access to the facts as well as facilitating quicker diagnoses and the faster implementation of treatment strategies.

INFECTIOUS DISEASE QUERIES

One influential researcher who is committed to responding to this need is Dr. Jay Brown. Inspired by the relational databases often used by large companies to store and organise their information, he has developed relational databases for mapping medical knowledge. One of the databases, entitled Infectious Disease Queries (IDdx), provides frontline medical professionals with decision support in the diagnosis of infectious diseases. It emerged from an earlier prototype – OutbreakID – which was created in response to the terrorist attacks on New York City’s Twin Towers in 2001: “OutbreakID was designed as a decision support system to help doctors and public health professionals identify outbreaks of any kind: chemical, radiological or biological,” Brown outlines. “It focused on different syndromes and agents that could cause them. However, in 2010 I decided to concentrate my energies on IDdx.”

Certified by the American Board of Preventive Medicine, Brown is currently working as a consultant for the US Department of Labor and the National Library of Medicine. With a background in family and occupational medicine, his overriding mission is to unleash the power of relational databases in the medical field – and to demonstrate that their usage aids in the ready retrieval of the right information at the right time.

A POWERFUL TOOL

Now available as a free iPhone, iPad or Android app, IDdx was developed in Microsoft Access, an easy-to-use relational database. IDdx contains 249 infectious diseases mapped into the related tables of the database. “The results of a query are all diseases that match one or more search criteria,” Brown discloses. “The disease search criteria include 105 signs and symptoms, seven incubation periods, 94 occupations, 16 regions of the world and 39 epidemiological factors.” Importantly, the information is also bidirectional, allowing the user to see all the symptoms associated with a particular disease and all the diseases associated with a particular symptom.

Unsurprisingly, Brown devotes a significant amount of time and attention to ensuring the database results remain complete and accurate. Drawing on 12 regularly revised infectious disease sources – including the Control of Communicable Diseases Manual (CCDM) and Principles and Practices of Infectious Diseases (PPID) – he incorporates new and revised information into IDdx. Although much of the information, including...
incubation periods and risk factors, remains relatively static, the signs and symptoms of the different diseases are often more challenging to identify. To address this, the only signs and symptoms included in IDdx are those that are documented in one or more of the 12 sources. Nonetheless, updating the database is an extremely time-intensive task.

Since its inception in 2001, Brown has added additional features to his database in order to improve its performance. For instance, ‘weighted findings’ colour-code the frequency of findings [signs and symptoms] for each disease, with different colours indicative of how often the finding is listed in the 12 references. ‘Ranked diseases’ is another new feature, added last year: “Each query in IDdx results in a differential diagnosis list,” Brown outlines. “For example, 10 of the 249 diseases match the criteria of ‘jaundice’ and ‘ticks’. In the old version of IDdx, the list was sorted alphabetically. In the new version, the list is sorted with the most common diseases first.”

This ranking system is generated as a result of two new fields included in the database – global cases per year and US cases per year – with the user given the option to select ‘US Sort’ or ‘Global Sort’. Crucially, both of these features enhance the performance of IDdx as a decision support tool by improving the clarity of both differential diagnosis lists and the findings associated with each disease.

IMPROVING DIAGNOSIS AND PREVENTION

As a comprehensive relational database that provides contextual, user-responsive information, IDdx is an extremely powerful app that supports complex decision making in the medical domain. It represents a new and innovative way to instantaneously update information about infectious diseases and communicate this information to doctors. “Today, with the internet and phone apps, we have robust tools to disseminate and feedback information about infectious diseases,” states Brown. “If the World Health Organization (WHO) was in charge of maintaining the case definitions on an app like IDdx, and this app was distributed to healthcare professionals around the world, consider the impact that this would have on helping to diagnose and prevent infectious diseases.” Indeed, going forwards, the goal is that IDdx will continue to grow and mature as an advanced medical database, proving a useful tool for frontline physicians and fuelling the eradication or control of infectious diseases around the world.

CHARTING OCCUPATIONAL HAZARDS

In addition to creating IDdx, Brown has also developed A Relational Database of Hazardous Chemicals and Occupational Diseases [Haz-Map] for the purpose of identifying and preventing occupational diseases. With the aim of mapping information about occupational exposures and diseases into one database, Brown started working on Haz-Map back in 1991. 11 years later, this database was published on the National Library of Medicine’s website – and in 2012 it was ‘mobile-enabled’. At present the 10,641 chemical and biological agents in Haz-Map are classified into 12 major categories and 287 minor categories with 240 occupational diseases in the database, each connected to symptoms, hazardous job-tasks and agents.

Spring 2015 will see the completion of a seven-year project to add over 5,000 new agents to Haz-Map, derived from the US Department of Labor’s highly comprehensive Site Exposure Matrices (SEM) database. Ultimately, the goal of Haz-Map is to reduce the incidence of occupational diseases by preventing exposure to harmful agents in the workplace. As Brown points out: “The early recognition of an occupational disease in one worker can lead to prevention of the disease in co-workers”.