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You need the right support.

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knowledge. diagnosis. treatment.

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Isabel is an award-winning and validated clinical decision support system designed to help reduce and manage diagnosis error at the point of care. First conceived in the UK five years ago, Isabel is a direct response to the near-fatal misdiagnosis of then three-year-old Isabel Maude, a little girl who developed necrotising fasciitis, a well described complication following chicken pox. Isabel was seen by both the general practitioner and the local NHS hospital's clinicians, all of whom failed to recognize the clinical features of necrotising fasciitis, and sent the child home.

Isabel's life-threatening ordeal highlighted the need for an advanced diagnosis reminder and knowledge system—one that would be easy to use in the clinical workflow. The Isabel system was created by physicians to offer clinicians decision support at the point of care, reducing the incidence of missed or delayed diagnosis and leading to an improvement in the quality of patient care.

## Isabel : A Unique Diagnosis Reminder System

Isabel addresses the causative factors that have a significant impact on the level and quality of patient care:

### Little use of decision support by knowledge workers

It is estimated that the average clinician carries in the mind 2 million pieces of information—and that over 50 million clinical decisions are made for every one million members of the population. But despite the fact that biomedical knowledge is increasing exponentially, clinicians use very little, if any, diagnosis decision support systems at the point of care. Isabel is a near patient diagnosis reminder system that gives clinicians an instant checklist of likely diagnosis and causative drugs for a given set of clinical features. If clinicians have a hunch as to what the diagnosis might be, Isabel offers related diagnoses. In addition, Isabel mobilises knowledge into the clinicians workflow using unique pattern recognition techniques as opposed to standard key word searches.

### The inverted knowledge pyramid in healthcare

A patient's first contact is often with a general practitioner or physician-in-training—two caregivers whose broad knowledge base cannot, by definition, be expected to be sufficiently deep across all medical specialties. Potentially critically ill patients are several steps away from the knowledge and wisdom that exists at the top of the pyramid. Isabel delivers in depth and specialty knowledge at the point of care, giving clinicians timely access to potentially life-saving decision support and knowledge.

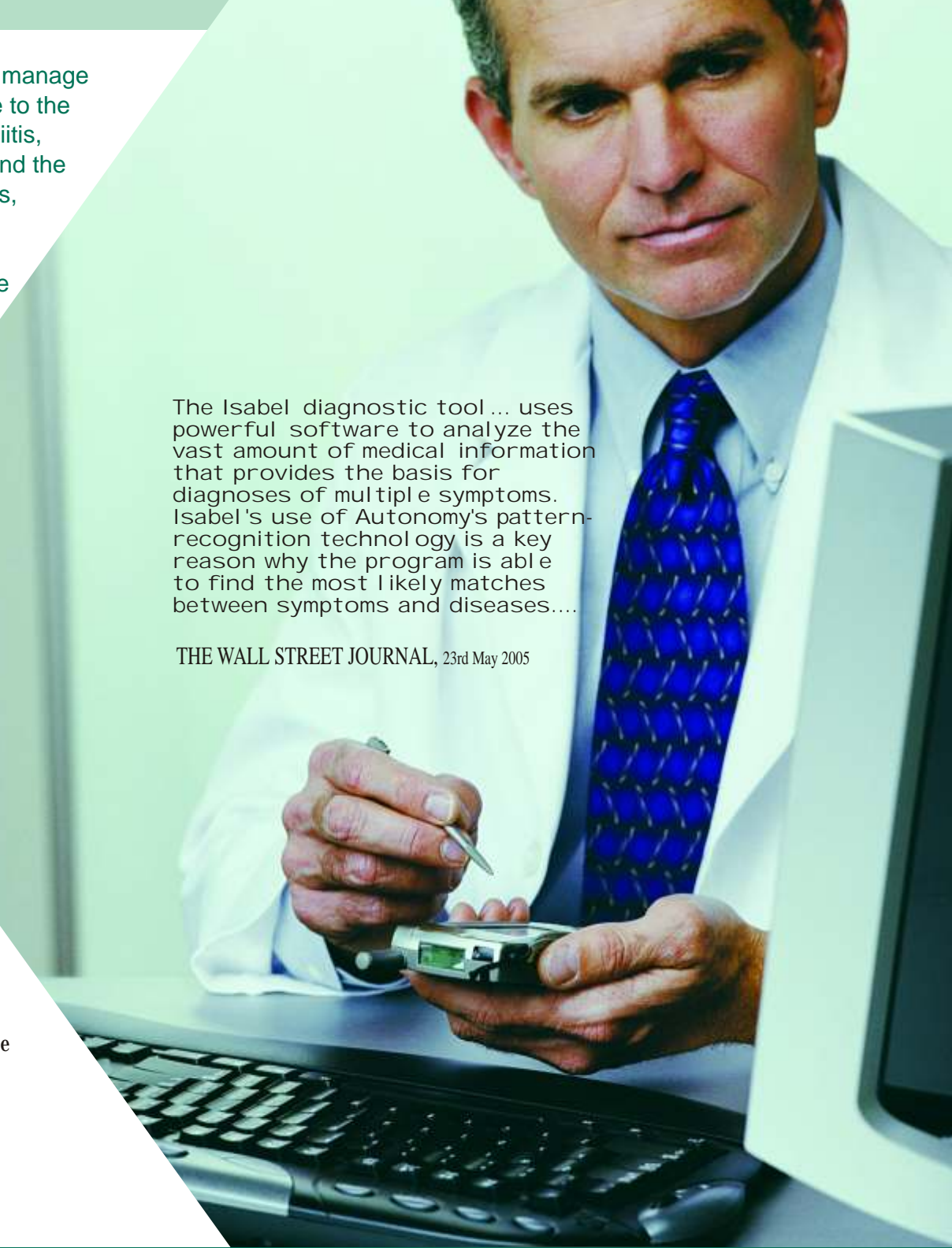
## Medical Error and Misdiagnosis: The facts are clear

The Quality in Australian Healthcare study showed that nearly 17% of hospital admissions were associated with a medical adverse event, half of them were considered preventable.<sup>1</sup>

57% of medical adverse events that were attributed to a medical delay were related to diagnostic delay. 86% of these diagnostic delays were highly preventable, and more than a third of diagnostic delays resulted in permanent disability.<sup>2</sup>

Overall, a third of adverse events were judged as highly preventable in a large national New Zealand adverse events study. Nearly 75% of adverse events related to diagnosis were preventable.<sup>3</sup>

“38% of patients reported experiencing at least one specific error-related concern, most commonly misdiagnosis (22% of all patients).”<sup>4</sup>



The Isabel diagnostic tool... uses powerful software to analyze the vast amount of medical information that provides the basis for diagnoses of multiple symptoms. Isabel's use of Autonomy's pattern-recognition technology is a key reason why the program is able to find the most likely matches between symptoms and diseases....

THE WALL STREET JOURNAL, 23rd May 2005

Isabel benefits more than patients, clinicians, and institutions.

Isabel also gives EMR vendors and insurance providers a way to successfully address the priority of patient safety with their health care clients—a top priority in hospitals across the United Kingdom and around the globe.

## Who does Isabel benefit ?

### Clinicians

- Professorial quality diagnosis support that includes emerging bioterrorism diagnoses around the clock
- Improved quality of decision making
- Immediate access to diagnosis and drug specific knowledge in near-patient settings
- Reduced insurance premiums
- Reinforced decision making backed by up to date knowledge

### Institutions

- Valuable continuing education for medical staff
- Increased competitive advantage
- Preferred image as a quality-oriented and high-tech health care provider
- Reduced insurance premiums and costs associated with misdiagnosis
- Enhanced referral network

### EMR vendors

- Enhance product offering to current and future customers
- Provide diagnosis support direct from the EMR interface
- Value addition to a static EMR by interactive diagnosis support
- Assist clients in reducing medical error, specifically misdiagnosis.

### Insurance providers

- Provide proactive participation with clinicians to reduce claims
- Assist clinicians to increase patient safety
- Be seen to be a driver of improved quality of care
- Provide greater value to current and future clients

1. Wilson RM, Runciman WB, Gibberd RW, Harrison BT, Newby L, Hamilton JD. The Quality in Australian Health Care Study. Med J Aust. 1995 Nov 6;163(9):458-71.
2. Wilson RM, Harrison BT, Gibberd RW, Hamilton JD. An analysis of the causes of adverse events from the Quality in Australian Health Care Study. Med J Aust. 1999 May 3;170(9):411-5.
3. Davis P, Lay-Yee R, Briant R, Ali W, Scott A, Schug S. Adverse events in New Zealand public hospitals II: preventability and clinical context. N Z Med J. 2003 Oct 10;116(1183):U624.
4. Burroughs TE, Waterman AD, Gallagher TH et al. "Patient Concerns About Medical Errors in Emergency Departments." Acad. Emerg. Med., Jan 2005.

Isabel differs from other decision support and knowledge systems by starting at the same point a patient's journey frequently begins—with symptoms, signs and results of tests. Most decision support systems require that the clinician know the diagnosis or condition being dealt with. Isabel is able to assist clinicians to arrive at a diagnosis or causative drug. Isabel's user-friendly interface enables clinicians to quickly input a patient's key signs and symptoms using free text. A list of differential diagnoses including bioterrorism and causative drugs are then instantly provided, determined by the pattern of the data entered, rather than by keywords alone. Corroboration is provided by clicking on each suggested diagnosis or drug. Clinicians can view additional medical and pharmacological text, annotated images, pertinent clinical investigations and up to date bioterrorism clinical information. Once a diagnosis has been determined, or a drug implicated clinicians can follow their own institution's treatment guidelines and formulary.

The screenshot shows the Isabel interface with the following fields: age (adult (30 - 40 years)), gender (female), pregnancy (not-pregnant), from (Western Europe), speciality (General). Under 'Enter your terms', there are two options: 'On separate lines - we will use synonyms' and 'On a single line - we will NOT use synonyms'. The search results list 'haematuria', 'hypertension', and 'abdominal pain'. Buttons for 'Suggest diagnosis', 'Suggest causative drugs', 'Suggest related diagnosis', and 'Read up textbooks' are visible.

Patient's clinical features - symptoms, signs, results of tests entered or populated from EMR fields.

This screenshot shows a 'Have you considered...?' section with various medical categories and their associated conditions, each with a 'RD' (Read) button. Categories include Rheumatic Diseases (SLE, Acute Aortic Syndrome), Gastrointestinal Disorders (Cirrhosis, Pancreatitis), Neuromuscular Disorders (Guillain-Barre Syndrome), Cardiorespiratory System (Ischemic Heart Disease, Hypertension Disorders), Nephrology (Hemolytic Uremic Syndrome), Orthopedic and Trauma Disorders (Head Injury), and Sarcoidosis. There are also sections for 'CAUSATIVE DRUGS' and 'BIOTERRORISM DIFFERENTIAL'.

Using advanced statistical language processing and real-time data processing, Isabel asks the clinician to consider a list of likely diagnoses and causative drugs.

Clicking on each suggested diagnosis, bioterrorism diagnosis, related diagnosis or causative drug offers the clinician the ability to access an updated and comprehensive knowledge package of textbooks, journal abstracts and annotated images to corroborate decision making.

The screenshot shows a page from the 'Oxford Textbook of Medicine' (4th Edition, 2003) discussing Takayasu arteritis. It includes an 'Introduction' section and a corresponding medical image showing a CT scan of the aorta.

"As a consultant, faced with a range of symptoms, I may think of over five conditions that the patient could be suffering from. When I type the symptoms into Isabel it will come up with ten to fifteen conditions - it's therefore a much wider search, which makes it less likely that I'll overlook something.

Having access to Isabel reduces so much risk when diagnosing patients, the information is there at your fingertips. If Isabel is used correctly there is no need to consult text books - they are all online in one immediate source - it's like having a diagnostic specialist with you at all times.

The immediacy is fantastic - if you needed the same information before Isabel, the situation was rather like 'Who Wants to be a Millionaire'; you would have to phone a friend, which takes time and often you can't get hold of the right people. Isabel is an immediate second opinion - 24 hours a day, at the patients' bedside.

We need systems like Isabel that will bring a wealth of diagnoses to the junior doctor at the bedside, this will help prevent misdiagnosis of unusual cases and reduce the number of adverse events."

Dr. Warren Hyer, Consultant Paediatrician and Paediatric Gastroenterologist, Northwick Park Hospital, London, UK.

## Diagnosis Reminder System

Isabel, either as a standalone system or interfaced with your EMR system gives clinicians dynamic clinical decision support, allowing them to:

- Quickly obtain a list of likely diagnoses including bioterrorism diagnoses and causative drugs for a given set of clinical features
- Learn more about each diagnoses and drugs, either through a cursory quick-read or a more detailed read or clinical information on bioterrorism.
- Access the clinical lessons learnt and errors that have been reported in relation to the diagnosis and drugs being considered
- View diagnosis specific annotated images or helpful list of investigations that can be performed to confirm or rule out a diagnosis
- Stay up to date with recent advances clinically sorted into diagnosis categories—and avoid time consuming office research using online and library resources

## How does Isabel Work ?

Isabel's clinical decision support system has 2 sophisticated components that support clinicians at the point of care:

**Isabel Diagnosis Reminder System (IDRS)**  
The IDRS applies cutting-edge pattern recognition software (statistical natural language processing) to a proprietary database of medical knowledge and algorithms. This allows the system to provide a reasonable and relevant list of likely diagnoses and causative drugs, interpreting patient signs and symptoms within the context of medical literature. From entering an initial query to receiving the first list of differential diagnoses, bioterrorism diagnoses and drugs, the process takes, on average, less than one minute.

**Isabel Knowledge Management (IKMS)**  
Integrating an institution's treatment guidelines and algorithms within the framework of Isabel's own knowledge package, the IKMS delivers a total diagnosis support solution that is unsurpassed. Isabel offers an integrated, comprehensive knowledge package that compiles information from sources such as respected medical and pharmacological textbooks and journal abstracts, and makes available annotated images, treatment algorithms and more. Isabel's knowledge package includes a "Lessons Learned" section that showcases the lessons learned and pitfalls to be avoided as reported in medical journals, and a "What's New ?" feature that highlights the most recent advancements in the diagnosis and management of disease. Clinicians also have the option of organizing and mobilising their institution's own treatment guidelines and knowledge resources.

## Advanced clinical decision support

Isabel has set a new benchmark, enhancing the quality of decision making and quality of care using sophisticated pattern-recognition software that complements a clinician's inherent diagnostic abilities—a cutting-edge, cost-effective approach that has transformed the way the health care community sees, uses, and benefits from diagnosis reminder systems. Acting as a natural extension of a clinician's behavior, Isabel is capable of producing a list of differential diagnoses instantly—with an unprecedented accuracy rate of 90 percent or higher. In addition, Isabel is highly interactive and will offer additional diagnoses and indicate clinical synonyms and phrases used.


**Isabel and electronic medical records**  
Although Isabel is used as a stand-alone system, it is web-based and designed to interface seamlessly with and be interfaced with EMR systems. Isabel's Application Program Interface is customizable and specifically designed to work with all the major EMR vendors' systems. Embedded in a patient's EMR, Isabel can use clinical features and results of investigations to provide diagnosis support 24 hours a day 365 days a year. Current EMR systems that lack dynamic and interactive diagnosis reminder systems will be enhanced through offering Isabel as a value-added tool to their current and future customers. Institutions could also opt for an Isabel audit function, meaning that an audit trail of whatever Isabel components each clinician accessed (differential diagnoses, treatment guideline, knowledge package etc.) could be recorded to indicate clinical diligence.

## awards & recognition

Isabel has had editorials and reviews in key medical journals, including The Lancet, the British Medical Journal, Archives of Disease in Childhood and Journal of the American Medical Informatics Association.

Peer reviewed articles and results of clinical studies have been published in Archives of Disease in Childhood, Journal of the American Medical Informatics Association, Medinfo 2004, Journal of Intensive Care Medicine and Health Management Technology.

- Recognized as one of the "outstanding and innovative developments within the IT sector" at the 2002 British Computer Society IT Professional Awards
- Awarded the "best example of technological innovation" at the 2003 Healthcare IT Effectiveness Awards
- Acknowledged as a "futuristic medical problem solving device" by the UK Department of Health in 2003



"Isabel is an excellent system because if you are a doctor on duty in a hospital, particularly at night and if you are not particularly experienced, if a child comes in with an unusual problem it is very nerve wracking for you.

Finding your way through text books is very time consuming and often does not tell you what you want to know whereas Isabel is very quick at dealing with things."

Dr. Harvey Marcovitch, Paediatrician and spokesman for the Royal College of Paediatrics and Child Health, UK.

"As a support system it gives you the confidence that you have thought of everything and are going down the correct path. It gives you the confidence to follow your own diagnosis.


And as well as giving reassurance when you are fairly certain of the diagnosis, it can also trigger you to think of something, which may not have been immediately obvious to you. This can save valuable time.

Isabel is used most frequently in A&E because this is where patients are provisionally diagnosed, however, I have found the system very useful where there is a doubt over treatment."

Dr. Mike Coren, Consultant Paediatrician, St. Mary's Hospital, London, UK

## Return On Investment

## Clinical Trial Evidence



In addition to its peerless capabilities, Isabel is also extremely cost-effective and offers a high return on investment — saving the NHS millions of pounds per year by arming clinicians with an expert opinion 24 hours a day, 365 days a year.

Since Isabel is a ready-made application that is centrally managed and updated by Isabel Healthcare Ltd., the total cost of ownership for subscribers is kept to an absolute minimum.

Studies have shown that for the average 600-bed hospital (with an accident and emergency department and outpatient facilities), Isabel can save over £2 million per year. These savings result from not only the reduction of diagnostic errors and the time spent reaching the correct diagnosis, but also from fewer wasted patient bed days and the potential savings from decreased insurance and litigation costs, staff efficiencies, and continuing education. However, this number doesn't even include the additional revenue that can be generated from producing a higher quality of care and enhanced patient safety.

Isabel has undergone a robust validation process and has been tried and tested by over 25,000 clinicians worldwide in live clinical settings. No previous diagnosis system has been validated to such an extent.

- Peer reviewed and published studies have shown that in 91 to 95 percent of cases, Isabel includes the correct final diagnosis when provided with the initial clinical features.
- In 45 percent of cases, frontline clinicians failed to consider all relevant diagnoses in clinical trials using an independent panel of experts. However, in 30 percent of these cases, Isabel prompted the frontline clinician to consider all important diagnoses.
- In a retrospective study of primary care—using data from the Medical Protection Society, UK—Isabel included the correct final diagnosis in 69 percent of delayed / misdiagnosed cases where patient compensation was required.
- In 40 percent of cases involving tertiary hospital critical care units in the UK and US, Isabel suggested "clinically important" alternate diagnoses that were missed by the admitting team.
- Clinical trials showed that in one out of seven instances, the clinicians using Isabel were reminded of a significant diagnosis that they had not previously considered—one that turned out to be the correct final diagnosis in the majority of cases, judged by an independent expert panel.
- The clinicians and institutions that currently use Isabel agree that if the system were readily accessible at the point of care and used across all hospitals, that far fewer diagnosis errors would be made—and the quality of patient care would ultimately be improved.

" A boy was admitted suffering from acute myelocytic leukemia. He had been seen by several other doctors and two other pediatric oncologists. All signs pointed to acute myelocytic leukaemia, and the oncoming physician was prepared to do a bone marrow and start aggressive chemotherapy.

I decided to consult Isabel and entered leukemia, neurofibromatosis, and fevers into in the Isabel query box and was surprised to be reminded of Juvenile Chronic Myelogenous Leukaemia / Juvenile Myelomonocytic Leukemia. We had not considered this rare diagnosis, which requires a marrow transplant. Aggressive chemotherapy would not have been helpful, and potentially very dangerous.

The Isabel system prevented a serious error in diagnosis and is likely to have saved this patient's life. I am aware of three other instances in which Isabel made a positive difference to patient care."

John Bergsagel, MD. Leukemia/Lymphoma Service, Children's Healthcare of Atlanta & Emory University School of Medicine, Georgia, USA. May 2005

The process below provides an overview of how Isabel is implemented when purchased for unlimited institutional access:

### Getting started

Implementing Isabel as a diagnosis reminder system is easy. That's because Isabel is an application service provider, which means that the system can be accessed from any computer or mobile technology device with an Internet connection—anytime, anywhere. In addition, there's no software installation or ongoing maintenance. All that's required is a network infrastructure and Web-enabled devices that are equipped with Microsoft® Internet Explorer 5.5 or higher. And since many institutions already have the necessary equipment in place, capital expenditures are minimal. Isabel automatically handles upgrades, giving subscribers the benefit of uninterrupted, seamless use.

### Getting to know our clients

Once system access has been purchased, an Isabel representative will offer to spend necessary time with the new subscriber. Our team will spend time getting a full understanding of the institution's clinical workflow and networks, along with the goals and targets it wants to achieve with the incorporation of the Isabel system. Isabel representatives will work within an institution's current technological capabilities and make recommendations regarding key access points.

### Getting clients connected

The next phase requires the institution to select how and where its clinicians will access Isabel. If an institution should choose to give its clinician referral network access to Isabel, the systems representative is able to conveniently link these satellite users to.

### Awareness and training

Once the system has been successfully integrated, training sessions and awareness presentations are provided so that all institutional providers can fully benefit from using Isabel at the point of patient care.

### Continuing success

As clinicians become more familiar with using Isabel, customised levels of support will continue to be available. Isabel activity and usage data can be captured and made available to the subscriber. A dedicated account manager will be assigned to the institution, and he or she will be able to offer the option of integrating Isabel with an institution's existing EMR and other practice management systems.

Empower clinicians and help give patients greater peace of mind.

Call: +61(0)411 180 236 or e-mail [alison.hart@hcn.com.au](mailto:alison.hart@hcn.com.au) for more information.