T. Kerr to Productivity Commission

Study of the Impact of Advances in Medical Technology on Healthcare Expenditure in Australia

This is an individual submission. I am employed full-time as medical microbiologist in the Victorian public hospital system. These views are not intended to represent my employer. I do not derive any income or benefits from financial interests in any corporation, nor from any commercial items that may be mentioned in this document. I am member of Food Safety Council Victoria.

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Section 1 INTRODUCTION

This annotated bibliography represents my personal views of how infectious diseases surveillance can be improved greatly by the consistent use of, and continuous exploration of, innovations in technology.

The purpose of this submission is to uphold the case for significant investment in information technology (IT) for health, and specifically the requirements for control of infectious diseases. These needs have been addressed in various contexts, over the last few years. The greatest impetus to review the current status of systems, and implement reforms and innovations, resulted from the terrorist attacks on the US, September 2001, and the anthrax dispersions of October 2001[1]. The will and motivation of the US administration, to shift resources onto these projects, will have significant effects on both the direction of systems development and the availability of knowledge capital, for our region. In short, the application of IT to surveillance systems in Australia will occur in an environment forged by (1) our unique geography (2) the need to manage large public-private partnership (3) the will to retain ownership of crucial data.

Exploration of the common pathways through the IT domain lead me to believe Identity Management (IM) is the key to the next wave of reforms. The way IM is handled, politically and commercially, will determine the enthusiasm for, and the pace of uptake of essential innovations.

There are compelling reasons for the health professionals in certain high intensity areas to have robust proof of identity. Medical disciplines that administer potent, potentially lethal, medications, and most types of surgery, should be capable of being monitored and audited to the best of our ability. Where there is a risk of impairment in health care workers causing harm to patients, the professional bodies associated with that type of service would want to be able to bring their own controls into play. However, the kinds of identity verification that could be brought into the operating theatre should be looked at for their usefulness in other areas of health-care. Would the methods of identification used by surgeons be applicable to patients of a remote indigenous community, or to clients of a mental health service?

Achieving rapid successes means being aware of the significant risks of change, due to availability of new tools, within the world of IT. Therefore, I work through some examples, where different types of behaviour are getting in the way of equitable progress. I do make several (unfavourable) comparisons between the energy with which the task is being tackled in the U.S., and the feeble and piecemeal efforts in Australia. It is a continual surprise, to hear almost every day about our proximity to the evolutionary foci of frightening, new infections, and the apparent lack of concern from the infectious disease (ID) community. This is, perhaps, a symptom of the failure of application of information technologies to achieve the necessary degree of collaboration, before a unified voice can be raised. It would be a fairly simple matter to get all the opinion leaders from ID in a room, and agree on the top ten priorities. However, it may be more difficult to get them to stick to the agreed agenda, ahead of their own personal ambitions, even if it was in the national interest to do so.

[1] 'Creating a Trusted Network for Homeland Security', Markle Foundation 2003 <http://www.markletaskforce.org/> accessed Dec 09 2004

Section 2 COMMON THEMES IN HEALTH POLICY

A *"…the problem is big and complex."*

> *The health care industry may have spent generously on medical technology, like M.R.I. machines or Dr. Fogarty's catheters, but it has not spent much on information technology - computer hardware, software and services - for storing, processing and analyzing patient histories, drug regimens, claims and billing. So all the big computer technology companies, like I.B.M. and Microsoft, and many smaller ones, are eager to cash in on an expected surge in health care spending on everything from handheld computers to software. There is a new attitude toward information technology and health care, and no one is arguing any more about whether we should do this," said Neal Patterson, chief executive of Cerner, which produces software for health care automation. "But the problem is big and complex. It's going to take a lot of investment."*[2]

B *… the whole patient (John Paterson):*

> *Many of the elements of the wider program of reform require that hospitals begin the transition to enterprise-level electronic clinical support systems and electronic patient records as soon as possible. There will be no outcome-driven healthcare system until the system recognises the whole patient — a person with a past, a present, and a future. Ambitions for major gains in safety and quality of healthcare will come to very little until every patient encounter with any healthcare provider is supported by the patient's personal health record.*[3]

C *… consolidate (Martin van der Weyden):*

> *The dream, surely, is to consolidate this enterprise and other ventures, such as the Health Leaders' Network (www.hln.com.au), into a policy flagship. Is it dreaming too much to envisage a John Deeble Institute of Australian Health Policy?*
> *Australia is currently blessed with an array of internationally acclaimed medical research institutes. In light of this, the stark absence of an internationally recognised Australian institute for health policy is a damning national disgrace.*[4]

The HLN will cease to function soon (E-mail circular from R.Michael, CEO, Dec 10 2004). Perhaps the strong commentary in media[5] [6] and the push for an Australian Health Care Alliance/Commission (or similar top level body) will result in much more government support for unified policy.

D *Informatics and policy are inseparably intertwined.*

In the U.K. and the U.S., national governments have recognised the need for substantial funding to lay down the tracks for ongoing integration. [7] [8] Moves are being made at State level [9] [10] in

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[2] Steve Lohr, 'Health Care Costs Are a Killer, but Maybe That's a Plus', *New York Times*, Sep 26 2004,
[3] J. P. Paterson, 'Australian Health Care Agreements 2003-2008: a new dawn?' *Medical Journal of Australia*, 177/6 (2002), 313-5
[4] M. B. Van Der Weyden, 'Australian health policy research and development: where is it?' *Medical Journal of Australia*, 177/11-12 (2002), 586
[5] Clara Pirani, 'Healing the money wound', *The Australian*, Oct 30 2004,
[6] 'On health, it's a case of lost opportunities', *The Australian*, Oct 06 2004, Editorial
[7] 'Better healthcare through partnership: a programme for action', Healthcare Industries Task Force, Department of Health (Britain) 2004 <http://tinyurl.com/56aoy> accessed Dec 09 2004
[8] T. Thompson and D. Brailer, 'Framework for Strategic Action', Office of the National Coordinator for Health Information Technology (DHHS, U.S. Government) 2004 <http://tinyurl.com/3tl4l> accessed Dec 09 2004
[9] V. Fitzgerald and M.A. O'Loughlin, 'Governments Working Together: A better future for all Australians', Department of Premier and Cabinet (Victorian Government) 2004 <http://tinyurl.com/5c6e9> accessed Dec 09 2004
[10] 'NSW Health: Focusing on Patient Care', Independent Pricing and Regulatory Tribunal of New South Wales 2003 <http://tinyurl.com/6abg3> accessed Dec 09 2004

Australia, but the head of IT for the NHS (Richard Granger) observed[11] a lack of leadership at national level.

> *Health Informatics in Aust is being held up by (1) striving for perfection (2) no empowerment at national level (3) distributed management causes cash problems (4) the Fed-State quagmire impedes ability of private to interact at State level; he is looking at 3-5 years to build, through ~3 iterations and 10-15% profit to private partners; mid scale suppliers are critical to the equation, and the source of failures*

The Safety and Quality movement is sponsoring integration of IT in the U.S. [12] [13] [14] [15]

The Wanless Report (U.K.)

> *…found that improving the use of information and communication technology in the Health Service is a key issue in improving quality and productivity.*[16]

Service delivery is driving the IT reforms in the NHS. [17] [18]

The Australian Government's establishment of a National e-Health Transition Authority (NEHTA) [19] will provide a channel for focussing collection of factual data, and a firm direction for ongoing discussions.

*E **Risks***

1 Experts on devices

Until recently, the Prostheses Schedule of Benefits (Reimbursement) set the 'value' of medical services for implantation of devices. It can be presumed that experts (eg, cardiologists and orthopaedists) advised the setting of benefits. The same medical experts, or their College brethren, are employed in public hospitals (sessional rates) and run private practices. Public hospitals were held captive by these arrangements, and members of private health funds were at the mercy of powerful self-interest.

> **Should patients be threatened with paying a gap, corrective action may be required.** [20]

There are others who can explain how this particular rort operated, but the prosthetics industry has not enjoyed entirely favourable press. [21] [22]

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[11] T. Kerr, Synopsis of the Health Leaders Network Information Management Conference, Melbourne, May 2004, May 28 2004 2004

[12] Donald M. Berwick, 'Errors Today and Errors Tomorrow', *New England Journal of Medicine*, 348/25 (2003), 2570-2572

[13] David W. Bates and Atul A. Gawande, 'Improving Safety with Information Technology', *New England Journal of Medicine*, 348/25 (2003), 2526-2534

[14] 'The State of Health Care Quality', National Committee for Quality Assurance (US Government) 2004 <http://tinyurl.com/6fr6o> accessed Dec 09 2004

[15] L. C. Burton, G. F. Anderson and I. W. Kues, 'Using electronic health records to help coordinate care', The Milbank Quarterly 2004 <http://tinyurl.com/5qll5> accessed Dec 09 2004

[16] Paterson, 'Australian Health Care Agreements 2003-2008: a new dawn?'

[17] 'Key announcements on National IT Programme', Information Policy Unit, NHS 2003 <http://tinyurl.com/6sjh8> accessed Dec 08 2004

[18] 'What one patient wants from the NHS IT Tsar', Parliamentary Information Technology Committee 2002 <http://tinyurl.com/4llam> accessed Dec 08 2004

[19] 'National Health Information Management and Information & Communications Technology Strategy', Boston Consulting Group 2004 <http://www.ahic.org.au/downloads/bcg.pdf> accessed Dec 09 2004

[20] 'Private Health Insurance Circular 35/04', Australian Government Department of Health and Ageing 2004 <http://tinyurl.com/56pbv> accessed Dec 08 2004

[21] Zosia Kmietowicz, 'Companies offer surgeons incentives to use their prostheses', *BMJ*, 328/7448 (2004), 1091-a-

[22] 'The Health Report - Medical Devices', Australian Broadcasting Corporation 2004 <http://tinyurl.com/66jjs>

We could hope the current Minister is going to make the reforms work. [23] [24] [25] [26]

Some medical experts are willing to provide the public with factual data about the cost differences between public and private systems.

> *In 2000, we published a study in The Medical Journal of Australia showing that the average charges to a patient for a coronary angioplasty and stent procedure in a private hospital were $14,978, of which the Federal Government paid $6201 and private health insurance the bulk of the remainder. The same procedure in a public hospital cost the State Government $5664.*[27]

Experts, in the U.S., are also willing to debate the incentives that are behind the enthusiasm for new technologies.

> *Dr. Garcia's colleague, Dr. Steven Nissen, head of clinical cardiology at the Cleveland Clinic, has a very different opinion.*
> *"To me, it's a nightmare waiting to happen," said Dr. Nissen, who is calling for strict guidelines overseeing use of the new machines. "I am concerned that it is going to be difficult to control and it could bust the health care system in terms of cost."*
> *It is, medical experts agree, an extraordinary time in cardiology. Depending on which way the scanning market goes, the nation could save a fortune on diagnostic tests, and medical care could be improved. Or expenses could soar and patients could be harmed. The question is, how, if at all, can the technology be controlled?*[28]

> "Even if you could take all the waste out of health care, the spending would still go up because we have a technology-intensive system that will continue and it is delivering a lot of benefits in terms of longer, healthier lives," said David Cutler, a health care economist at Harvard University.[29]

There is room for more honest and open debate in this country, between peers and in public, about the costs and prices of innovations.

2 Experts on drugs

> London: The House of Commons Health Committee held its first public hearing this week as part of a wide ranging inquiry into the influence of the pharmaceutical industry over the health system. The committee is investigating drug companies' influence on medical research, the education of doctors, health information, and drug evaluation. It will specifically look at the industry's influence on the NHS, the National Institute for Clinical Excellence and other regulatory authorities, universities, professional societies, and the media. The inquiry has already sparked public attention, after the release of a strongly worded submission from the Royal College of General Practitioners describing "unhealthy" industry influence over drug testing, medical education, and information for patients. While stressing the value of the industry to the economy and the health of patients, the submission accused drug companies of "disease mongering"—inappropriately widening the boundaries of illness, leading to the over-consumption of drugs. [30]

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[23] 'Private Health Insurance Circular HBF 687/ PH 427', Australian Government Department of Health and Ageing 2001 <http://tinyurl.com/6hwnw> accessed Dec 08 2004
[24] 'Private Health Industry Medical Devices Expert Committee', Australian Government Department of Health and Ageing 2002 <http://tinyurl.com/46yy2> accessed Dec 08 2004
[25] 'Private Health Insurance Circular 44/04', Australian Government Department of Health and Ageing 2004 <http://tinyurl.com/69asp> accessed Dec 08 2004
[26] 'National Health Amendment (Prostheses) Bill', Hansard (House of Representatives, Commonwealth of Australia) 2004 <http://tinyurl.com/3j6zw> accessed Dec 08 2004
[27] 'High cost of private health care (Letter: R.W.Harper)', *The Age*, Aug 28 2004,
[28] Gina Kolata, 'Heart Scanner Stirs New Hope and a Debate', Free Republic 2004 <http://tinyurl.com/5jwmx> accessed Dec 08 2004
[29] Lohr, 'Health Care Costs Are a Killer, but Maybe That's a Plus'
[30] Ray Moynihan, 'MPs launch inquiry into influence of drug industry', *BMJ*, 329/7466 (2004), 587-a-

3 Marketing of antimicrobials through special interest medical groups

> *We are grateful to Abbott Laboratories, Aventis Pharma, Bayer Pharmaceuticals Division, GeneSoft and GlaxoSmithKline for their support of this programme.*[31]

> The global collaboration founded by APUA includes Bristol-Myers Squibb, GlaxoSmithKline, AstraZeneca and Focus Technologies. [32]

> *We welcome all parties interested in moving the resistance debate forward to participate in this innovative and influential meeting sponsored by the Dannemiller Memorial Educational Foundation and Adelphi Communications. IFAR and the global white paper have been made possible by an unrestricted educational grant from Aventis Pharma.*[33]

Case Study

In December 2003, the Australian Government released its plans to set up a central coordinating unit (CCU) to follow antimicrobial resistance in Australia. This intention was published in Communicable Diseases Intelligence Vol 27 No 4, December 2003.[34]

These coordinating functions may be contracted out to private corporations. If so, it may be that the responsibility for collecting, storing and analysing data about bacteria and their susceptibility profiles will be done under the cloak of "commercial-in-confidence". The implications for ownership of the data, accountability and open audit are serious matters of concern for the public interest.

The environment has several ready-made triggers, such as MRSA, VRE and pneumococci, to heat up the public imagination. A recent example was the meningococcal scare campaign that led to hundreds of millions spent on vaccinations. Special interest groups abound, and medical opinion leaders get themselves tangled up in the marketing web.

In the editorial to Communicable Diseases Intelligence supplement for May 2003 (Antimicrobial resistance in Australia), it is stated

> *Australian laboratories are part of regional surveillance networks monitoring AMR in the Asia Pacific region and South Africa through the SENTRY antimicrobial surveillance program.*
> *Rapid and timely data on antimicrobial resistance has been difficult to achieve in Australia. Turnidge and members of The Surveillance Network (TSN), describe a recent development in the automatic collection and analysis of data from Australian laboratories. TSN has accumulated more than 14 million results since 1996 and provides subscribers with an interactive access to a database, which is growing at 300,000 records per month. Unfortunately access to these data are limited, although the collection is now undoubtedly the most comprehensive in Australia.*[35]

Other articles in the supplement state:

> *The SENTRY Program is funded by an educational grant from the Bristol-Myers Squibb Pharmaceutical company.*[36]

> 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.[37]

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[31] 'Antimicrobial Resistance Surveillance Programmes', British Society for Antimicrobial Chemotherapy 2004 <http://tinyurl.com/3ok7o> accessed Dec 08 2004

[32] 'GAARD Study Finds Early Signs of Resistance ...' Alliance for the Prudent Use of Antibiotics (APUA) 2001 <http://tinyurl.com/5bgew> accessed Dec 08 2004

[33] ProMED-mail, 'Symposium - Global white paper on bacterial resistance in community acquired respiratory tract infections', 20011124.2884, International Society for Infectious Diseases 2001 <http://tinyurl.com/3vb2v> accessed Dec 09 2004

[34] 'Strategy for antimicrobial resistance surveillance in Australia', Department of Health and Ageing (Australian Government) 2003 <http://tinyurl.com/4gwuc> accessed Dec 11 2004

[35] P. Roche and J. Spencer, 'Antimicrobial resistance in Australia', Department of Health and Ageing (Australian Government) 2003 <http://tinyurl.com/4dbzg>

[36] J. Bell and J. Turnidge, 'SENTRY Antimicrobial Surveillance Program Asia-Pacific region and South Africa', Department of Health and Ageing (Australian Government) 2003 <http://tinyurl.com/5kxfm> accessed Dec 11 2004

In Acknowledgments -

> *We would like to thank the members of the TSN Australia Advisory Board and the participating institutions.* [38]

But those Board members are not disclosed. Focus Technologies (formerly MRL), a private company, owns TSN.

The strategy[39] proposed by the Joint Expert Technical Advisory Committee on Antibiotic Resistance (JETACAR) highlights

> *…the establishment of a central coordinating unit (CCU) at the Australian Government Department of Health and Ageing (DoHA) that will act as a central site for collation, analysis and reporting of national surveillance data. (P.V)*

> Some of the more well established surveillance systems currently collecting antimicrobial resistance data nationally from hospitals and the community include: the Australian Group on Antimicrobial Resistance (AGAR), the Australian Gonococcal Surveillance Programme (AGSP), the Australian Meningococcal Surveillance Programme (AMSP), the Australian Mycobacterium Reference Laboratory Network (AMRLN) and the National Enteric Pathogen Surveillance Scheme (NEPSS). (P.10)

Eli Lilly sponsored AGAR until 2002.

TSN is not mentioned in the JETACAR strategy, despite it being known to have harvested a vast collection of data on Australian bacteria, over several years. TSN was not invisible, far from it, and it has not gone away. This is the same data that is essential for tracking serious communicable diseases. Are we going to discover that a private corporation has contracts and patents to prevent us from improving our own security against outbreaks? That data was piped out from public hospitals' laboratory computer systems, and given away to Focus Technologies, the owners of TSN. Focus Technologies is closely allied to manufacturers of antimicrobials, and collations of susceptibility data are valuable resources for research and marketing.

The building of our own national surveillance network must not be outsourced to the lowest bidder.

4 Commercial bias

Biotechnology is going to be an important industry for the economic development of Australia. Because the target is human medicine, ethics comes into every application. Business groups should make an effort to be aware of the ethical component, during campaigns to evangelise the idea of profits[40] from investment in biotechnology. Perhaps universities should put more emphasis on teaching ethics as part of basic biomedical research.

5 Administration costs

> *In 1999, health administration costs totalled at least 294.3 billion dollars in the United States, or 1,059 dollars per capita, as compared with 307 dollars per capita in Canada. After exclusions, administration accounted for 31.0 percent of health care expenditures in the United States and 16.7 percent of health care expenditures in Canada.*[41]

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[37] J. Turnidge et al., 'TSN®Database Australia, a new tool to monitor antimicrobial resistance in Australia'2003 accessed Dec 11 2004

[38] Ibid.

[39] 'Strategy for Antimicrobial Resistance (AMR)Surveillance in Australia', Department of Health and Ageing (Australian Government) 2003 <http://tinyurl.com/4aat9> accessed Dec 11 2004

[40] Michael Vitale, 'Commercialising Australian Biotechnology', Australian Business Foundation 2004 <http://www.abfoundation.com.au/pdf/biotech.pdf> accessed Dec 09 2004

[41] S. Woolhandler, T. Campbell and D. U. Himmelstein, 'Costs of health care administration in the United States and Canada', *New England Journal of Medicine*, 349/8 (2003), 768-75

It is important to keep a close watch on this aspect, as the Australian system evolves, so consumers can see where their dollars are going.

6 Corporate influence

ATOS Origin is partner in a consortium involved with the U.K. biometric passport project.[42] Atos has many corporate clients, including several from the pharmaceutical field. [43]

Lockheed Martin, logistics branch, is partner in a consortium running Victoria's E-tag vehicle identification system. [44]

The global logistics company, KBR:

> *When NHS IT chief Richard Granger announced at HC2003 that Kellogg Brown and Root had been recruited to help manage the National Programme for IT in the NHS (NPfIT), there can have been few people in the NHS who'd heard of the company. After all, KBR has had no previous involvement with NHS computing. Nor is it known in the wider IT community. It appeared that a largely unknown company had been appointed to oversee the management of the whole £2.5bn NHS IT-development programme.* [45]

Major pharmaceutical companies subsidise the cornerstone of Health IT, HL7:

> *Health Level Seven, Inc. (HL7) today announced that Pfizer, Inc. has become one of the organization's latest HL7 benefactor members. By becoming a benefactor member Pfizer, Inc., along with other HL7 benefactors, helps to provide the support needed for HL7 to continue developing its industry-critical standards and work products. Pfizer, Inc. joins the list of 22 other HL7 benefactor members including: Booz Allen Hamilton, Inc., CAP Gemini Ernst & Young U.S. LLC, Eclipsys Corporation, Eli Lilly & Company, the Food and Drug Administration, GE Medical Systems, Guidant Corporation, HIMS Solutions, Inc., IBM, IDX Systems Corporation, McKesson Information Solutions, Microsoft Corporation, Misys Healthcare Systems, NHS National Programme for IT, Oracle Corporation, Partners HealthCare System, Inc., Philips Medical Systems, Quest Diagnostics Inc., Science Applications International Corporation, Siemens Medical Solutions Health Services, the U.S. Department of Veterans Affairs and Wyeth Pharmaceuticals.* [46]

7 Enthusiasm for gadgets

> *Since more than 50% of information systems either fail or people fail to use the system to its full capacity, the preparation, action, and maintenance stages need to be completed properly. If not, frustration may result and lead to a higher probability of failure. Unfortunately, we have no magic dust to make the transition to ehealth applications easy. But if the issues outlined here are ignored, you might end up continuously reinventing the wheel.*[47]

> The first research objective was to determine if PDAs would represent an efficient and secure mechanism for clinicians to record real-time data at the bedside in the emergency department setting. Our experience in this phase I, two-hospital study demonstrated that **PDAs presented unexpected complexities that eroded our enthusiasm**. The clients were clinicians with variable levels of technical sophistication. Despite our use of a relatively standard process, clinicians found it difficult to download the e-form from the website onto their PDAs, and many needed help from the study authors. Clinicians frequently forgot to bring their PDA devices to work, and during the one-year course of this study, 10 of 48 clinicians bought new PDA devices.

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[42] 'SchlumbergerSema* Selected By the UK Passport Service to Conduct its Six Month Biometric Pilot', ATOS origin 2003 <http://tinyurl.com/58zfg> accessed Dec 11 2004

[43] 'Case Studies: Pharmaceutical:' Atos Origin 2004 <http://www.atosorigin.com/corporate/casestudies.htm> accessed Dec 08 2004

[44] 'Customers in Australia', Lockheed Martin 2004 <http://tinyurl.com/6w7t4> accessed Dec 08 2004

[45] William Payne, 'The quiet hand behind the hand on the tiller: KBR', British Journal of Healthcare Computing & Information Management 2003 <http://www.bjhc.co.uk/journal/1/2003/5003.htm> accessed Dec 08 2004

[46] 'HL7 Announces New Benefactor: Pfizer, Inc.' Health Level Seven, Inc. 2004 <http://www.hl7.org/press/20040323.asp> accessed Dec 08 2004

[47] Nancy M Lorenzi, 'Beyond the gadgets', *BMJ*, 328/7449 (2004), 1146-1147

> Clinicians consistently reported difficulty with the small screen size and data entry with a stylus. Unfortunately, we did not quantify this opinion using a structured survey. We believe this represents the first published experience at using PDAs to collect research data in the emergency department setting. Our results are somewhat less positive than other studies that have reported the use of hand-held computers to maintain clinical databases [48]

F ***Requirements for EHR***

1 Federated

For the U.S., Brailer and other IT leaders have indicated preference for a federated model.

> *The NHIN could be developed and operated in many ways. It could include state-of-the-art web technologies or more traditional clearinghouse architectures. It could be highly decentralized or somewhat centrally brokered. It could be a nationwide service, a collection of regional services or a set of tools that share common components. It could be overseen by public organizations, by private organizations, or by public-private consortia. Regardless of how it is developed, overseen or operated, there is a compelling public interest for a NHIN to exist.* [49]

> The NHII is a work in progress which imagines, in Yasnoff's words, "anywhere, anytime health care information and decision support." The NHII is *not* a central database of medical records. It is a decentralised, federated architecture building upon interoperable regional networks. Under the NHII, Personal Health Information (PHI) will reside where it does now, primarily with hospitals and healthcare providers. The new NHII element is an index of pointers to the location of patient information, but which contain no PHI (or at least only enough to uniquely identify the patient). The index knows where records are, not what is in them. Decisions about sharing information are made at the edges of the network by patients and providers together on a case by case basis. When needed, the PHI is assembled at the point of care by querying the network. Individual EHR systems are *not* the NHII; they are the building blocks queried by the NHII tools to provide truly portable access to PHI. The NHII will be assembled from smaller building blocks known as the Local Health Information Infrastructure (LHII). The use of open standards for PHI data exchange allows connectivity between LHIIs and the NHII. [50] [51]

2 Standards

Institute of Medicine recently reported on safety and quality in healthcare.

> *The ICT session emphasized the need for the federal government to provide leadership in four areas: (1) promulgating national data standards for the transfer of electronic health data, (2) setting rules and regulations for the use of EHRs, (3) increasing consumer awareness of the importance of these tools, and (4) financing EHRs.* [52]*(P.41)*

The numerous Safety and Quality projects spoken off and written about, and the proposals for preventive health, will rely on high quality information about individuals' lifestyles and the interventions. [53] [54] [55] [56] [57] [58] [59]

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[48] J. A. Kline et al., 'Prospective study of clinician-entered research data in the Emergency Department using an Internet-based system after the HIPAA Privacy Rule', *BMC Med Inform Decis Mak*, 4/1 (2004), 17

[49] 'Request for Information - Development and Adoption of a National Health Information Network', Office of the National Health Information Technology Coordinator (US Government) 2004 <http://tinyurl.com/5ywau> accessed Dec 09 2004

[50] 'National Health Information Infrastructure (NHII) Conference', U.S. Department of Health & Human Services 2004 <http://www.hsrnet.net/nhii/welcome.htm> accessed Dec 09 2004

[51] Will Ross, 'NHII Tutorial', LinuxMedNews 2004 <http://tinyurl.com/5dz37> accessed Dec 09 2004

[52] K. Adams, A.C. Greiner and J.M. Corrigan, '1st Annual Crossing the Quality Chasm Summit: A Focus on Communities', National Academies Press 2004 <http://books.nap.edu/catalog/11085.html> accessed Dec 09 2004

[53] Ibid.

[54] Rob Moodie, 'Here's a way to reduce those waiting lists', The Age, Nov 10 2004,

[55] 'High cost of private health care (Letter: R.W.Harper)'

Health IT, hence the Australian EHR project, will have to conform to international standards, under the terms of the 'services markets' of the Aus-US Free Trade Agreement.[60]

3 Identity Management

The EHR must be constructed around Identity Management.

> *The National Community Services Data Dictionary (NCSDD) is the authoritative source of community services data definitions where national consistency is required. Similarly, the National Health Data Dictionary (NHDD) is the authoritative source of health data definitions where national consistency is required under the National Health Information Agreement, while the National Housing Assistance Data Dictionary (NHADD) is the authoritative source of housing-related data definitions. The NCSDD, the NHDD and the NHADD include the national standard for Indigenous status, which was developed to improve the quality, availability and comparability of Indigenous statistics across data collections, and which includes a standard Indigenous status question module.* [61]

> Distributed identity schemes are identification and authentication systems that may operate as alternatives to centralised national identification schemes. They include the concepts of federated identity and identity broking. Distributed identity is being considered as a privacy positive alternative to national identification schemes. This paper argues that while distributed identity may be a reasonable alternative to national identification schemes, distributed identity is not necessarily a privacy positive initiative in its own right. The level of privacy intrusion depends on numerous technical factors and the effective management of privacy issues during design, implementation and the active life of distributed identity systems.[62]

> *Ensuring the accuracy of anonymised data presents additional challenges. For example, databases for cancer or congenital anomaly need to be assessed for quality and kept free of duplicates. It is still unclear whether information technology solutions that have been implemented in other countries can provide data of adequate quality.10 There may be no alternative, for some purposes, to identifiable data being quality checked by specially trained and supervised NHS staff. Patients will expect the data on which their health services depend to be of high quality and, indeed, the maintenance of accuracy is one of the principles of the Data Protection Act. One further ingredient will be required and that is trust. In general, when NHS patients are asked about respect for personal privacy, satisfaction is high. But trust relating to the use of data needs to be earned. In practice this means health professionals need to understand current anxieties about the ways in which health information is handled; they need to learn the rules and apply them and accept that unfettered access to personal health information is a thing of the past and that, among the many tools they need for modern clinical practice are those of skilled information management.* [63]

> By incorporating into the design of a DNA database a third-party trusted intermediary (a "Gene Trustee") between the person volunteering a DNA sample and the authority (or researcher) maintaining a DNA database, a "fail safe" can be built in. [64] [65]

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[56] R. S. Taylor et al., 'Inclusion of cost effectiveness in licensing requirements of new drugs: the fourth hurdle', BMJ, 329/7472 (2004), 972-5

[57] K. Abbasi, 'Is drug regulation failing?' BMJ, 329/7477 (2004), 0-g-

[58] Frank R. Lichtenberg, 'Pharmaceutical Knowledge-Capital Accumulation and Longevity', National Bureau of Economic Research 2004 <http://tinyurl.com/6kaph> accessed Dec 09 2004

[59] Rosalind Raine, Gill Walt and Ian Basnett, 'The white paper on public health', BMJ, 329/7477 (2004), 1247-1248

[60] 'United States - Australia Free Trade Agreement - Services', Australian Government 2004 <http://tinyurl.com/4oass> accessed Dec.14 2004

[61] 'Data Quality of Aboriginal and Torres Strait Islander Identification', Australian Institute of Health and Welfare 2004 <http://tinyurl.com/4p9mz> accessed Dec 08 2004

[62] 'Distributed Identity - Case Studies - Part 1', Galexia Consulting 2004 <http://tinyurl.com/5ztsu> accessed Dec 09 2004

[63] J. Chalmers and R. Muir, 'Patient privacy and confidentiality', BMJ, 326/7392 (2003), 725-726

[64] L. Burnett, 'Making national DNA databases safer', Lancet, 362/9397 (2003), 1761-2

The centralised civil register in Denmark was set up on 2 April 1968 on the basis of the previously manually compiled municipal registers. The CRS, which serves as a national register, has thus existed for more than 25 years. The CRS Office of the Ministry of the Interior administrates the system, which contains data on about 7.7 million persons, of whom about 5.4 million currently are residents of Denmark and Greenland. Furthermore, the register contains information about approximately 2.9 million dwellings, about 106,000 roads and about 3,000 authorities. The data content of the Civil Registration System currently amounts to about 27 Gigabyte which equals about 27 billion characters.[66]

The NHS Numbers For Babies (NN4B) service was launched at midnight on 29 October 2002. Implementation of NN4B means that babies now have an NHS number from birth, for life. This makes the process of building a true life-long electronic health record possible.[67]

4 Affordable and Protected

But, to keep it affordable, we will have to adopt non-proprietary software (Free and Open Source Software).[68] [69] [70] Therefore, our own, purpose-written, software will need government protection under Crown Copyright.

In relation to new technologies on government ownership of copyright material as raised under Issue 15, Health would be interested in this being more fully explored. This may be particularly useful in terms of the provision of information owned by the Government to the public sector, especially where it might be used for secondary research purposes. If copyright laws change approval processes for the release of information, then Health would need to consider more closely the ramifications of this in terms of continuing to provide vital health data and the downstream processing of health research information. Any question of changes to Copyright law to make more widely available Crown owned copyright would need to satisfy the test of continuing to represent the interests of the public, including consideration of the use of waivers similar to raised at Issue 13 of the Issues Paper[71]

Kranz [72], then employed at DHS (Victoria), and with technical experience of major integrations, made these estimates (slide 25):
HealthConnect estimated EHR cost $300-450million over 10 years
State-based feeder systems not included – approx $1billion for Victoria

If the last figure is only half right, it is clear the capital injection is going to be achieved through Public-Private Partnerships (PPPs), but not forgetting there is a good argument for government to retain core technical capacity and governance of key functions, in public hands. It is most likely the providers will negotiate contracts that allow them to levy transaction charges. On that basis, it may be possible to predict how much capital will be made available, in order to set up the systems that collect the cash. That it to say, a large global IT complex may be happy to pay the $5 billion to set

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[65] L. Burnett et al., 'The "GeneTrustee": a universal identification system that ensures privacy and confidentiality for human genetic databases', J Law Med, 10/4 (2003), 506-13
[66] 'Civil Registration System in Denmark', Det Centrale Personregister 2001 <http://tinyurl.com/4re8p> accessed Dec 10 2004
[67] 'NHS Numbers For Babies', NHS Information Authority (U.K.) 2002 <http://www.nhsia.nhs.uk/nn4b/pages/default.asp> accessed Dec 10 2004
[68] D. Carnall, 'Medical software's free future', BMJ, 321/7267 (2000), 976
[69] T. Benson, 'Medical software's free future. All software developed at public's expense should be licensed as open source', BMJ, 322/7290 (2001), 863
[70] 'Open Source Software', Office of Government Commerce (U.K.) 2004 <http://www.ogc.gov.uk/index.asp?id=2190> accessed Dec 09 2004
[71] 'Submission from Department of Health and Ageing to Crown Copyright Inquiry', Copyright Law Review Committee, Attorney-General's Department (Australian Government) 2004 <http://tinyurl.com/4c62m> accessed Dec 09 2004
[72] K. Kranz, 'Electronic (Virtual) Health Record', Australian College of Health Services Executives (Victorian Branch) 2002 <http://www.achse.org.au/vic/presentations/9aug02.pdf> accessed Dec 10 2004

up a nationwide EHR infrastructure of hardware and software, over five years, if it can recoup that amount in two years of full operation.

But the magnitude of recent failures[73] does inform the argument for better measurement.

How much should have been invested in surveillance, to prevent Merck suffering billions of dollars of losses over the withdrawal of Vioxx? Financial institutions have written off millions of dollars in failed IT projects, all for the want of better tools to measure business processes. Therefore, it is clear the business world expects to invest in IT, in order to remain competitive. It is useful to look at how much is invested in IT systems for hospitals. Figures are available from a recent survey[74] in the US. It is often said Australia is a long way behind.

[73] Simon Hayes, 'High price for software calamities', The Australian IT2004,
[74] 'The 100 Most Wired Vroom!' July, Hospitals & Health Networks 2004 <http://tinyurl.com/53scu> accessed Dec 09 2004

Section 3 INFECTION CONTROL

A Tools for epidemiology

The microbiology laboratory of a public hospital processes specimens of various kinds, to detect the presence of pathogenic viruses, bacteria, fungi and eucaryotic parasites. The laboratory information system (LIS) is the "nerve centre" of all pathology operations, private or public, and has been so for at least two decades. It is the repository of essential information that is being collected about the majority of cases of acute illnesses in the community. Without all those individual, separate systems, there would be little data to pass on to the public health authorities.

Some microorganisms are of greater public health concern, for example, the "community-acquired" S.aureus that are resistant to oxacillin (NORSA); penicillin-resistant pneumococci; linezolid-resistant staphylococci; noroviruses in schools and aged care facilities; emergent viruses, such as West Nile Virus; VRE and problem gram-negative bacilli in specialist care units of acute hospitals.

The paradigm that crystallises thinking about the need to be able to track people with communicable infections is a simple one. Imagine the situation where a single person suffering from Variola major (Smallpox) comes to the emergency department of one of our busy public hospitals. It is obvious while that person is mixing with others, in the waiting area, or in a treatment cubicle, he will continue to be the source of further infections.[75] The ability of systems, to accurately track the persons who have been in contact, will play a large part in determining the extent of the outbreak. That is, the more information on exactly who was where, and why and for how long, the sooner will the potential outbreak be brought under control.

The quality and type of data needed to control outbreaks[76] [77] [78] is no different from that needed to better manage acute infections, such as community-acquired pneumonia (CAP). The persons who manage events in an episode of care, and the nature of the events, whether administering medications or requesting laboratory tests and imaging studies, should all be traceable with as much accuracy as the technology allows. It seems intuitively obvious that the key event in treatment of severe CAP is the injection of the appropriate antimicrobial(s). In the US, it is intended that this time interval, marked from presentation of the sick person to the agency of care, be measured and analysed for improvement. [79] It is just one of several obvious quality markers that could be pursued in Australia, to good effect.

Better management of infections devolves into two independent parts.
1. The ability to identify and track the human agents, both the infected and the carers. [80]
2. The ability to identify and track the infectious agent.

The status of laboratory computing, in relation to main hospital systems, is a story of its' own. I will describe three aspects of LIS function from my situation. This pathology laboratory purchased a Canadian LIS, LabVision, in 1993. At the time, the parent company (HealthVision) was trying to establish clients in Australia and New Zealand. Ours is the only installation in this country. The

[75] Chad J. Roy and Donald K. Milton, 'Airborne Transmission of Communicable Infection -- The Elusive Pathway', *New England Journal of Medicine*, 350/17 (2004), 1710-1712
[76] R. M. Douglas, 'Disease control in the information era', Medical Journal of Australia, 174/5 (2001), 241-3
[77] D. L. Heymann, R. B. Aylward and C. Wolff, 'Dangerous pathogens in the laboratory: from smallpox to today's SARS setbacks and tomorrow's polio-free world', Lancet, 363/9421 (2004), 1566-8
[78] John P. Burke, 'Infection Control -- A Problem for Patient Safety', New England Journal of Medicine, 348/7 (2003), 651-656
[79] 'Overview of the Community Acquired Pneumonia (CAP) Core Measure Set', Joint Commission on Accreditation of Healthcare Organizations 2002 <http://tinyurl.com/7yh3z> accessed Dec 08 2004
[80] 'A Background Paper on Confidentiality and Privacy in Public Health Legislation With a Focus on Infectious Notifiable Diseases', National Public Health Partnership 2002 <http://tinyurl.com/5p3uf> accessed Dec 08 2004

“engine” is a database written in M (or Mumps). The main failings of LabVision are noted in Appendix 2.

Effective utilisation of new technologies demands investments in staffing and training. For example, new knowledge about sources of specific subtypes of salmonella in specific foods will require enhanced monitoring, and extra staff to investigate until effective controls are discovered and applied.

Section 4 OUTBREAK CONTROL

Senator McLUCAS—Can you give me some information about the secure information sharing network? It talks about the development of a web based outbreak reporting system. Can you give me some understanding of what a web based outbreak reporting system is?
Ms Murnane—Again, I will not talk in technical terms, but this is, in a sense, another way of describing the real-time system I talked about. We would be asking state public health authorities to post information onto a system that would come into a central point in the Australian government that they got from laboratories, emergency departments and from sentinel GPs. The information they gave us would be the raw data and their analysis of that information. The important thing is not only to post the information in a sense that is timely but also to then analyse patterns so that we can be alerted early to what might be an unusual pattern. It could either be some naturally caused event that we need to respond to from a public health point of view, or it might even be something that comes from a malign source. Again, this is something that countries to which we compare ourselves are also doing. In other words, we are keeping up with the needs of the times.
Senator McLUCAS—What do we have now to give us that sort of national information?
Ms Murnane—What we have now is a National Notifiable Diseases Surveillance System that we keep in Canberra. It is based on information we receive from the states and territories. We collate that information, post it back to the authorities and use it for analysis and policy development. That is very much supplemented by real-time information that comes via telecommunication links and email. For example, in the SARS outbreak, and when we were monitoring whether there were any cases of avian flu in Australia, we were not relying on information that had a lag. We were basically getting real-time information, sometimes by email. What we want is the economy of being able to have a system that presents the information to us so that it can be readily analysed and discussed, and response can be decided. Professor Horvath has just reminded me that another aspect of surveillance that is primarily being undertaken by the Department of Agriculture, Fisheries and Forestry is animal surveillance, because the emerging infectious diseases that are presenting such challenges to us now have animal hosts. So we are working closely with the Department of Agriculture, Fisheries and Forestry to make sure that we are able to link the two systems. We also have a food surveillance system that we fund—OzFoodNet—and that surveys food-borne illnesses in Australia and enables a quick response to them. [81]

It was clear, however, from repeated comments that this reliance on informal arrangements is also a weakness. Respondents felt that it reflects the lack of workable structures through which states can communicate with each other and with the Commonwealth. Respondents appeared less convinced that Australia's surveillance networks would be sufficiently 'robust' to handle a major infectious disease crisis.

Lack of timely reporting was identified as a serious problem by several respondents. One respondent claimed that official notification of the SARS outbreak took six weeks to reach general practitioners in some states. This is a long delay when health authorities are attempting to control a serious disease outbreak. It was also claimed that the time taken for reports to pass from local hospitals or other health care facilities, to state health departments and on to the Commonwealth means that a cross-border outbreak (with the potential to become a national health emergency) could potentially take weeks to identify. Although this was believed to be partially mitigated by the fact that alerts about unusual diseases or symptoms would pass quickly through informal channels, there was, however, a strong view that detection and reporting mechanisms need to be more streamlined.

Another aspect of Australia's surveillance network that attracted some criticism is laboratory capacity. It was felt that there are not enough laboratories around Australia to be useful in the rapid identification of a disease, and many are not equipped to detect SARS, one of the latest threats to public health

However, even with better facilities, many of our respondents commented that outbreaks are unlikely to be detected in a laboratory. Clinicians, such as doctors and nurses, are more likely to raise the alarm about a new infection, and laboratories would then be used to confirm the case. In other words, few respondents felt that routine reporting through current surveillance systems

[81] 'Budget Estimates, 3 June 2004', Community Affairs Legislation Committee, Senate, Australian Government 2004 <http://tinyurl.com/5aw9m> accessed Dec 09 2004

was sufficient for early detection of a disease outbreak, whether it is naturally-occurring or deliberately introduced. [82]

Selected List of Systems and Networks Engaged in Disease Surveillance (U.S.):[83]

BioSense:
Electronic Laboratory Exchange Network (eLEXNET):
Electronic Surveillance System for the Early Notification of Community-based Epidemics ESSENCE):
Epidemic Information Exchange (Epi-X):
Foodborne Disease Active Surveillance Network (FoodNet):
Global Outbreak Alert and Response Network (GOARN):
Global Public Health Intelligence Network (GPHIN):
Health Alert Network (HAN):
Infectious Diseases Society of America Emerging Infections Networks (IDSA-EIN):
Laboratory Response Network (LRN):
National Animal Health Reporting System (NAHRS):
National Electronic Disease Surveillance System (NEDSS):
National Electronic Telecommunications System for Surveillance (NETSS):
National Retail Data Monitor (NRDM):
National Veterinary Services Laboratories (NVSL):
PulseNet:
Real-time Outbreak and Disease Surveillance (RODS):
Sexually Transmitted Disease Management Information System (STD*MIS):
Systematic Tracking of Elevated Lead Levels & Remediation (STELLAR)

Recommendation 10: Contribute to the monitoring of antibiotic resistance. OzFoodNet can play a key role in the proposed Australian Action Plan for Antibiotic Resistance Surveillance under development by the Infection Management Section of DoHA. The network can provide valuable data on antibiotic usage, resistance, and risk factors from the case-control studies and outbreak investigations. In addition, OzFoodNet can prioritise recording information about antibiotic profiles on the National Outbreak Register, and conduct surveys of antibiotic profiles for organisms not currently covered by NEPSS.[84]

Knowledge of disease patterns in real time may also help clinicians to manage patients, and assist health plan administrators in allocating resources efficiently.[85]

For the 2004--05 influenza season, CDC has added two new surveillance systems: one that tracks naturally reported pediatric deaths associated with laboratory-confirmed influenza infections and another that tracks hospitalizations associated with laboratory-confirmed influenza infections in children aged <18 years. The latter system, which will continue at a minimum of nine sites through CDC's Emerging Infections Program, augments CDC's ongoing surveillance at the three National Vaccine Surveillance Network sites of children aged <5 years hospitalized with fever or respiratory illness.[86]

*A **Tracking of point-source outbreaks***

[82] Nigel Brew and Kate Burton, 'Critical, but stable: Australia's capacity to respond to an infectious disease outbreak', Parliamentary Library (Parliament of Australia) 2004 <http://tinyurl.com/3nqrv> accessed Dec 09 2004
[83] 'Infectious Disease Preparedness: Federal Challenges in Responding to Influenza Outbreaks', Government Accountability Office (U.S. Government) 2004 <http://www.gao.gov/new.items/d04877.pdf> accessed Dec 09 2004
[84] 'Report of the External Review Team', OzFoodNet, Australian Government 2002 <http://tinyurl.com/3ufn7> accessed Dec 09 2004
[85] R. Lazarus et al., 'Using automated medical records for rapid identification of illness syndromes (syndromic surveillance): the example of lower respiratory infection', BMC Public Health, 1/1 (2001), 9
[86] 'Update: influenza activity--United States and worldwide, May-October 2004', Centers for Disease Control and Prevention Oct 29 2004 <http://tinyurl.com/4fc78> accessed Dec 09 2004

Comment: The ASM agrees that an international consensus regarding foods that do not support growth is emerging, and that Canada, Denmark, the United Kingdom, Australia, and New Zealand all have either formal or informal regulatory limits for L. monocytogenes that depart from a "zero tolerance" approach. If indeed "zero tolerance" for L. monocytogenes is not sound science, it may be viewed as a trade barrier and a failure of the United States to meet its obligations under the Sanitary and Phytosanitary Measures Agreement of the Uruguay Round of Trade Agreements. In summary, the ASM supports the request that FDA amend the current regulations in 21 CFR part 109 to establish a regulatory limit for L. monocytogenes of 100 colony forming units per gram in foods that do not support growth of the microorganism. Such a regulatory limit is supported by the current scientific understanding of foodborne disease caused by L. monocytogenes and is consistent with a general approach to risk and science-based standards for food safety.[87]

In conclusion, this study confirmed the nosocomial outbreak of ESBL-producing E. coli in southern Stockholm in 2002, which is the first documented hospital-acquired ESBL outbreak in Sweden. Through molecular epidemiological investigations it was disclosed that the outbreak actually consisted of two clones, one of which had already circulated in the same area 1 year before the outbreak. The study also revealed that both clones were CTX-M-type ESBL producers; besides, one of the clones expressed OXA-type ESBLs as well. The close relationship between ESBL production and ciprofloxacin resistance observed in the study poses the necessity of continued surveillance on these clinically important coresistant strains.[88]

B ***Ability to track "new" pathogens***

Few countries or regions in the developed or developing world have responded optimally to recent epidemics and health scares. The continued circulation of H5N1 in poultry in Asia, with sporadic transmission to humans, suggests that we are far from controlling the current epidemic. It is probable that the next influenzavirus capable of causing a global pandemic will arise and spread from a developing country in Asia. Further investment in health care infrastructure and consideration of new paradigms for public health are required to address the emergence of such threatening diseases. Considering the potential death toll of a 1918-like influenza pandemic, such collective global investments must be a top priority.[89]

Australia's primary producers have been told they need to be more vigilant to protect themselves against bio-terrorism. The Federal Department of Agriculture is working on a project to determine the risk to the food chain from on-farm production to consumption.[90]

DR GARDNER MURRAY: The biggest concern I have is that there is no immediate reporting of a suspect condition. Farmers and the public must on suspicion of anything let us know. Because as I said earlier. If a disease gets away, it spreads so quickly it's hard to catch up. So, my biggest concern is a lack of rapid reporting of any suspicious circumstances. That's the first thing. The second thing of course is if it does get into feral animals, that adds a new dimension to the disease management and eradication.[91]

Clinical microbiology laboratories at the local level have an increasing responsibility to provide rapid and accurate diagnostic services for emerging (new) and re-emerging infectious diseases, especially those diseases for which significant mortality or morbidity may occur as the result of a delay in diagnosis. Rapid, accurate diagnosis of emerging and re-emerging infectious diseases may also be critical at the local level to ensure optimal infection control. Detection of these

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[87] 'Establishing a regulatory limit on Listeria monocytogenes (Letter from American Society for Microbiology)', Food and Drug Administration (US Government) 2004 <http://tinyurl.com/6wmsm> accessed Dec 09 2004

[88] Hong Fang et al., 'Molecular Epidemiological Analysis of Escherichia coli Isolates Producing Extended-Spectrum {beta}-Lactamases for Identification of Nosocomial Outbreaks in Stockholm, Sweden', Journal of Clinical Microbiology, 42/12 (2004), 5917-5920

[89] T.T. Hien, M. de Jong and J. Farrar, 'Avian Influenza -- A Challenge to Global Health Care Structures', New England Journal of Medicine, 351/23 (2004), 2363-2365

[90] 'Farmers warned of bio-terrorism risk', ABC News Online (Australian Broadcasting Corporation) 2004 <http://tinyurl.com/5dnod> accessed Dec 09 2004

[91] 'Quarantine precautions (ABC Lateline)', Australian Broadcasting Corporation 2001 <http://tinyurl.com/63sy8> accessed Dec 10 2004

pathogens has often required esoteric procedures like conventional PCR, which could be performed only at referral laboratories or, recently, at public health laboratories.[92]

In conjunction with local, state, and federal health agencies, the hospital-based clinical microbiology laboratory is expected to play a primary role in determining if a biocrime or bioterrorism event has occurred. While this role will not compromise the routine operations of the clinical laboratory, it will enhance their capabilities and awareness. The primary focus is to raise the index of suspicion related to a biocrime or bioterrorism event. In the event that the laboratory encounters a suspected biothreat agent, the bioterrorism response plan is enacted. This plan includes event recognition, access to and interaction with the various LRN level laboratories, communication protocols, safety guidelines, training of personnel to ensure competence and awareness, packaging and shipment of infectious substances, and laboratory security. [93]

Over the past century, three influenza pandemics occurred because of the emergence of novel influenzaviruses to which little or no immunity existed. In 1918 and 1919, the "Spanish" influenza pandemic killed more than 20 million people, with many of the deaths due to an unusually severe, hemorrhagic pneumonia. Now, Kobasa and colleagues have used modern molecular methods to show that the hemagglutinin antigen from this strain (HAsp) is a key determinant of virulence.[94]

NLIS can minimise the impact of animal disease outbreaks and residue incidents

A recent Commonwealth government study estimated the overall economic loss as a result of an FMD outbreak to be between $2 billion and $13 billion. Though NLIS will not prevent a disease outbreak or residue incident, it will be able to reduce the financial and social impact of a disease epidemic due to its accurate identification and rapid traceability capabilities.[95]

Trained scientists are familiar with the hazards of microbial escape, a risk entailed during any manipulation of a microorganism. If highly pathogenic organisms are being handled, scrupulous attention must be applied to biosafety in the laboratory.[96] [97]

C Computing power

For this discussion, we will define data about an isolate and the patient from whom it was obtained as describing one infection event. A typical hospital may have 20 common clinically significant organisms, 20 hospital locations, 10 specimen sources, 10 physicians and/or services, and 12 antibiotics tested for each bacterial isolate, each with an interpreted result of susceptible, intermediate, or resistant. Consequently, a staggering 21,257,640,000 (20 x 20 x 10 x 10 x 312) potential events exist from bacteriology culture data alone. The manual review of this event space using traditional surveillance methods is prohibitive. Additionally, patterns of events develop over time and geography, increasing the complexity of pattern discovery. As a result, searching for significant occurrences is often limited to focused surveillance of a small subset of events (eg, VRE, methicillin-resistant Staphylococcus aureus [MRSA], and National Nosocomial Infection Surveillance events), serendipitous observations by hospital staff, and the manual review of culture data for outliers. Thus, it is not surprising many small infection outbreaks that are potentially amenable to intervention are not suspected and go undiscovered. This is the current state of traditional hospital epidemiology.[98]

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[92] F. R. Cockerill, 3rd and T. F. Smith, 'Response of the clinical microbiology laboratory to emerging (new) and reemerging infectious diseases', Journal of Clinical Microbiology, 42/6 (2004), 2359-65

[93] J. W. Snyder, 'Role of the hospital-based microbiology laboratory in preparation for and response to a bioterrorism event', Journal of Clinical Microbiology, 41/1 (2003), 1-4

[94] Daniel F. Hoft and Robert B. Belshe, 'The Genetic Archaeology of Influenza', New England Journal of Medicine, 351/24 (2004), 2550-2551

[95] 'National Livestock Identification System', Meat & Livestock Australia (.) <http://www.mla.com.au/content.cfm?sid=1350> accessed Dec 10 2004

[96] 'Safety Considerations in Recombinant DNA Research with Pathogenic Viruses', National Institutes of Health 2004 <http://www.webconferences.com/nihoba/21_sep_2004.html> accessed Dec 09 2004

[97] Y. Kawaoka, 'Reverse Genetics Techniques to Generate Recombinant Viruses', National Institutes of Health 2004 <http://tinyurl.com/3tfgf> accessed Dec 09 2004

[98] L. R. Peterson and S. E. Brossette, 'Hunting health care-associated infections from the clinical microbiology laboratory: passive, active, and virtual surveillance', Journal of Clinical Microbiology, 40/1 (2002), 1-4

> Traditionally, large surveillance studies have been analyzed by the use of the MICs at which 90% of isolates tested are inhibited (MIC90s), MIC50s, frequency distributions, and percent susceptibility. In the past, these approaches have proved satisfactory for the monitoring of resistance. From these traditional uses, one can readily detect an increase in MICs for organism and drug combinations. Now that large surveillance studies have been conducted for a number of years and databases have grown to include a large number of datum points, new approaches to the extraction of useful information from these studies are needed. The present study proposes approaches, including the use of antibiotypes, principal components analysis, phylogenetics, and population genetic analysis, to the evaluation of data from large multinational surveillance studies. Application of these types of analyses can be used to describe genetic diversity, analyze changes in susceptibility patterns over time, and possibly, shed light on the origins and evolution of antimicrobial resistance. As global surveillance studies become more common and new questions concerning the evolution of resistance are raised, innovative approaches to analysis of the data will increase in importance.[99]

D ***Networked labs***

The presentations for one day[100] of the four-day Public Health Information Network (PHIN) Conference are listed in Appendix 1.

> *Effective public health surveillance is essential for detecting and responding to emerging public health threats, including terrorism and emerging infectious diseases. New surveillance methods are being developed and tested to improve the timeliness and completeness of detection of disease outbreaks. One promising set of approaches is syndromic surveillance, in which information about health events that precede a firm clinical diagnosis is captured early and rapidly from existing, usually electronic, data sources, and analyzed frequently to detect signals that might indicate an outbreak requiring investigation. To provide a forum for scientists and practitioners to report on progress in developing and evaluating syndromic surveillance systems, the New York City Department of Health and Mental Hygiene, the New York Academy of Medicine, and CDC convened the second annual National Syndromic Surveillance Conference in New York City during October 23--24, 2003. The conference, supported by the Alfred P. Sloan Foundation, was attended by more than 460 public health practitioners and researchers, who had the opportunity to hear 41 oral presentations and view 50 poster presentations.* [101]

> Several health plans and other organizations are collaborating with the Centers for Disease Control and Prevention to develop a syndromic surveillance system with national coverage that includes more than 20 million people. A principal design feature of this system is reliance on daily reporting of counts of individuals with syndromes of interest in specified geographic regions rather than reporting of individual encounter-level information.[102]

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[99] J. Poupard et al., 'Methods for data mining from large multinational surveillance studies', Antimicrobial Agents and Chemotherapy, 46/8 (2002), 2409-19

[100] 'PHIN Conference Presentations: May 26', Centers for Disease Control and Prevention (US Government) 2004 <http://www.cdc.gov/phin/04conference/05-26-04/> accessed Dec 09 2004

[101] 'Syndromic Surveillance (Reports from a National Conference, 2003)', Centers for Disease Control and Prevention 2004 <http://tinyurl.com/5l7wd> accessed Dec 09 2004

[102] R. Platt et al., 'Syndromic surveillance using minimum transfer of identifiable data: the example of the National Bioterrorism Syndromic Surveillance Demonstration Program', Journal of Urban Health, 80/2 Suppl 1 (2003), i25-31

Section 5 PREVENTION OF ANTIMICROBIAL RESISTANCE.

The major determinants of selective pressure caused by exposure of microorganisms (bacteria and fungi) to manufactured antimicrobial agents are overuse of antibiotics in human medicine, and use of antibacterials in the food chain. [103]

> *We can speculate that the selective pressure may lead to the emergence of plasmid-mediated extended-spectrum ß-lactamases harbored by enteric bacteria which could subsequently be transferred to Salmonella spp. The finding that tetracycline, streptomycin, or sulfamethoxazole-trimethoprim resistance genes reside on the same plasmid as blaCTX-M-9 raises the possibility that the use of these common antibiotics could coselect this extended-spectrum ß-lactamase phenotype.*
> *In conclusion, our investigation documented that Salmonella spp. producing the CTX-M-9 extended-spectrum ß-lactamase have been identified in poultry and poultry product in France. Active surveillance of antimicrobial use in animal husbandry is important to reduce selective pressure and subsequent dissemination of multiresistant Salmonella spp. to humans.*[104]

> The alarming reports of community-acquired urinary tract infections caused by fluoroquinolone-resistant E. coli strains in some parts of the world suggest that we will see an evolution of resistance to these agents just as we have with sulfonamides, ampicillin, oral cephalosporins, and now trimethoprim–sulfamethoxazole unless we take a much more aggressive approach to the control of antimicrobial resistance.[105]

> *Patients with pansusceptible strains of S. Typhimurium were 2.3 times more likely to die 2 years after infection than persons in the general Danish population. Patients infected with strains resistant to ampicillin, chloramphenicol, streptomycin, sulfonamide, and tetracycline were 4.8 times (95% CI 2.2 to 10.2) more likely to die, whereas quinolone resistance was associated with a mortality rate 10.3 times higher than the general population.* [106]

> The prevalence of antimicrobial resistance among 4,940 U.S. pneumococcal isolates collected during 1999 was as follows: penicillin, 16.2%; amoxicillin-clavulanate, 12.2%; cefuroxime, 28.1%; ceftriaxone, 3.6%; trimethoprim-sulfamethoxazole, 30.3%; azithromycin, 21.4%; levofloxacin, 0.6%; and moxifloxacin, 0.1%. Compared to the previous 1997-1998 study (Jones et al., Antimicrob. Agents Chemother. 44:2645-2652, 2000), increases were noted for resistance to penicillin (3.7%; P < 0.001), amoxicillin-clavulanate (3.9%; P < 0.001), cefuroxime (5.7%; P < 0.001), azithromycin (2.4%; P = 0.014), trimethoprim-sulfamethoxazole (15.4%; P < 0.001), and levofloxacin (0.3%; P = 0.017). Resistance to ceftriaxone (0.1%; P = 0.809) and moxifloxacin

[103] 'Virginiamycin review', Australian Pesticides and Veterinary Medicines Authority 2004 <http://tinyurl.com/5o944>
[104] Francois-Xavier Weill et al., 'Emergence of Extended-Spectrum-{beta}-Lactamase (CTX-M-9)-Producing Multiresistant Strains of Salmonella enterica Serotype Virchow in Poultry and Humans in France', Journal of Clinical Microbiology, 42/12 (2004), 5767-5773
[105] W. E. Stamm, 'An epidemic of urinary tract infections?' New England Journal of Medicine, 345/14 (2001), 1055-7
[106] M. Helms et al., 'Excess mortality associated with antimicrobial drug-resistant Salmonella typhimurium', Emerging Infectious Diseases, 8/5 (2002), 490-5

(0.03%; P = 0.570) decreased. Concurrently, multidrug resistance increased (P < 0.001) from 6.3% to 11.3%.[107]

*The default settings on computerised prescribing packages result in **a significant increase in the use of antibiotics**. We estimate these settings result in about 500 000 additional prescriptions being filled annually in Australia for the four antibiotics in the study.*[108]

[107] M. E. Jones et al., 'Longitudinal assessment of antipneumococcal susceptibility in the United States', Antimicrobial Agents and Chemotherapy, 46/8 (2002), 2651-5

[108] D. A. Newby, J. L. Fryer and D. A. Henry, 'Effect of computerised prescribing on use of antibiotics', Medical Journal of Australia, 178/5 (2003), 210-3

Section 6 COMMUNICATION

Modes of communication are changing constantly, and peer groupings need to keep up with the technology.

> *Welcome to Australia and New Zealand Health Policy.*
> *This open access, online journal publishes papers on all aspects of contemporary health policy developments in Australia and New Zealand, aiming to improve the interaction between policy practitioners and academics, and to promote debate and understanding.* [109]

> In the 1980's and 1990's HIV/AIDS was the emerging infectious disease. In 2003-2004 we saw the emergence of SARS, Avian influenza and Anthrax in a man made form used for bioterrorism. Emergency powers legisaltion in Australia is a patchwork of Commonwealth quarantine laws and State and Territory based emergency powers in public health legislation. It is time for a review of such legislation and time for consideration of the efficacy of such legislation from a country wide perspective in an age when we have to consider the possibility of mass outbreaks of communicable diseases which ignore jurisdictional boundaries.[110]

> *EIN and other listservs have great potential to help identify infectious-disease outbreaks and assist in case identification. Although serendipity and the presence of an uncommon pathogen obviously contributed to the identification of this international outbreak, the use of the EIN listserv was the proximate cause of the discovery of the outbreak. By periodically accessing EIN and other e-mail lists, members throughout the world participate in the passive surveillance of infectious-disease outbreaks.*[111]

But, sharing of knowledge[112] is becoming more at odds with the perceived need to keep an edge ahead of colleagues who may be competing in the next round of research grants.

> *The National Institutes of Health has proposed a major policy change that would require all scientists who receive funding from the agency to make the results of their research available to the public for free.*[113]

Good quality vertical communication, from experts to consumers, is hard to find.[114] [115]

As the new health technologies come along, there is great risk that ordinary people will be left further behind. How will they cope with complex instructions about medications? How will they be informed about the risks of complex procedures? How will their rights be protected, if they agree to take part in trials and studies? [116] [117] [118] [119]

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[109] 'Australia and New Zealand Health Policy', BioMed Central 2004 <http://www.anzhealthpolicy.com/> accessed Dec 12 2004
[110] G Howse, 'Managing emerging infectious diseases: Is a federal system an impediment to effective laws?' Australia and New Zealand Health Policy 2004 <http://tinyurl.com/4e9lu> accessed Dec 09 2004
[111] E.V. Granowitz, A. Srinivasan and N.D. Clynes, 'Using the Internet to identify infectious-disease outbreaks.' New England Journal of Medicine, 351/24 (2004), 2558-9
[112] 'Keeping science open: the effects of intellectual property policy on the conduct of science', The Royal Society 2003 <http://tinyurl.com/43fqu> accessed Dec 09 2004
[113] Rick Weiss, 'NIH Proposes Free Access For Public to Research Data', Washington Post 2004 <http://tinyurl.com/3ndtw> accessed Dec 08 2004
[114] 'Bloodlines: Technology Hits Home', Public Broadcasting Service (PBS) 2003 <http://www.pbs.org/bloodlines/> accessed Dec 08 2004
[115] 'Colon cancer overview', iMedConsent (.) <http://www.dialogmedical.com/gasn0933.pdf> accessed Dec 10 2004
[116] J. Newton and S. Garner, 'Disease Registers in England', Institute of Health Sciences, University of Oxford 2002 <http://www.ihs.ox.ac.uk/register.pdf> accessed Dec 09 2004
[117] K. Barlow-Stewart et al., 'A genetic screening programme for Tay-Sachs disease and cystic fibrosis for Australian Jewish high school students', Journal of Medical Genetics, 40/4 (2003), e45
[118] J. R. Carapetis, J. W. Passmore and K. A. O'Grady, 'Privacy legislation and research', Medical Journal of Australia, 177/9 (2002), 523
[119] 'Molecular Medicine Informatics Model', Bio21 Australia Ltd <http://tinyurl.com/4h2at> accessed Dec 14 2004

In order to keep the trust of the community during building of the Health IT infrastructure urgent attention must be given to the management of Conflict of Interest.

> *Increasingly, biomedical studies receive funding from commercial firms, private foundations, and government. The conditions of this funding have the potential to bias and otherwise discredit the research.* [120]

> > The NIH seeks to eliminate the possibility that the activities of its employees could harm its public health mission because of real or perceived conflicts of interest. "The biggest challenge for all of us is the uncertainty," Kington said. "We are in the midst of drafting the final proposed regulations. We are in the midst of completing some of the investigations that are under way. I am optimistic that once we finalize what the rules will be, this will be behind us." For the moment, however, it is still unclear how restrictive the new rules will be and how many employees will be affected. The NIH has made progress, but its conflict-of-interest problem has yet to be resolved. [121]

> *The pharmaceutical industry may be facing the same kind of sea change in business practices and industry oversight that other segments of corporate America faced in the wake of Enron and other corporate scandals. In these cases, high-stakes, widely publicized government investigations exposed practices that passed neither ethical nor legal muster, provoking an intense regulatory response. The pharmaceutical and health care industries have the opportunity to maximize the extent to which they are leaders, rather than targets, of regulatory initiatives by continuing to develop and enforce stronger ethical standards regarding relationships between physicians and pharmaceutical companies. The increasingly long arm of anti-kickback law should remove any doubt that such proactivism is overdue.* [122]

> > Indirect pecuniary interest - again, common law requires that members should consider whether participation in the discussion or determination of a matter would suggest a real danger of bias. This should be interpreted in the sense that members might unfairly regard with favour or disfavour the case of a party to the matter under consideration. In considering whether a real danger of bias exists in relation to a particular decision, members should assess whether they, a close family member, a person living in the same household as the Authority member, or a firm, business or organisation with which the member is connected are likely to be affected more than the generality of those affected by the decision in question. (A 'close family member" is regarded here as personal partners, parents, children brothers, sisters and personal partners of any of these.) [123]

> *In order to provide the reassurance to readers and people using the guidelines, authors and contributors to documents written by or for, or endorsed by the New Zealand Guidelines Group should contain a statement recording the receipt of any benefit, sponsorship or financial interests of*

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[120] F. Davidoff et al., 'Sponsorship, authorship, and accountability', Lancet, 358/9285 (2001), 854-6

[121] Robert Steinbrook, 'Conflicts of Interest at the NIH -- Resolving the Problem', New England Journal of Medicine, 351/10 (2004), 955-957

[122] David M. Studdert, Michelle M. Mello and Troyen A. Brennan, 'Financial Conflicts of Interest in Physicians' Relationships with the Pharmaceutical Industry -- Self-Regulation in the Shadow of Federal Prosecution', New England Journal of Medicine, 351/18 (2004), 1891-1900

[123] 'HFEA Members Code of Conduct', UK Government - Human Fertilisation and Embryology Authority (HFEA) 2003 <http://tinyurl.com/4jtxq> accessed Dec 08 2004

the authors and the disclosure of any sort of competing interest that could embarrass either the author or call into question the impartiality of the information, if it was disclosed after publication. [124]

> Lord Warner said: "It is important that the MHRA is open and transparent. … To further ensure we get completely impartial advice, experts concerned with the authorisation and surveillance of medicinal products will now have to prove that they have no financial interests in the pharmaceutical industry. **They will also have to declare any other interests, including any that they are aware of that members of their immediate family hold,** and any other matter that affect their impartiality or could be perceived as affecting their impartiality." [125]

[124] 'NZGG Policy: Perception of Bias and Declaration of Competing Interests', New Zealand Guidelines Group 2004 <http://tinyurl.com/49cwl> accessed Dec 08 2004

[125] 'Pharmaceutical regulation to be more open and transparent', Department of Health, England 2004 <http://tinyurl.com/4ofj8> accessed Dec 08 2004

Section 7 IDENTITY MANAGEMENT

Finally, a plea to have Identity Management (IM) on our national agenda, as in the U.K. [126]

> *The federal government wants to create a single number to complement or replace the existing ones, that will be used by each person from cradle to grave. The identifier will track patients in the private and public sector and will be used by GPs, specialists and possibly dentists. The introduction of a "universal identifier" has been debated within the health system for several years but the issue is being brought to a head by efforts to develop electronic medical records across Australia. Federal Department of Health and Ageing chief information officer Rob Wooding has told a health industry conference that the patient numbering scheme will be one of the department's top priorities.* [127]

> Biometric technologies don't just involve collection of information about the person, but rather information of the person, intrinsic to them. That alone makes the very idea of these technologies distasteful to people in many cultures, and of many religious persuasions. In addition, each person has to submit to examination, in some cases in a manner that many people regard as demeaning. For example, the provision of a quality thumbprint involves one's forearm and hand being grasped by a specialist and rolled firmly and without hesitation across a piece of paper or a platen; and an iris-print or a retinal print require the eye to be presented in a manner compliant with the engineering specifications of the supplier's machine. Some technologies, such as those based on DNA, go so far as to require the person to provide a sample of body-fluids or body-tissue. [128]

> **What, then, is good identity management?**
> **Good identity management involves processes that meet the same goals – confidence to the degree appropriate for the occasion that the organisation is dealing with the right person – but in a way that does not facilitate inappropriate, unnecessary data linkage. In particular, good identity management means only authenticating identity when it is absolutely necessary to do so. 129 (P.16)**

[126] 'Identity Cards: A Summary of Findings from the Consultation on Legislation on Identity Cards', Home Office (U.K. Government) 2004 <http://tinyurl.com/5xzpu> accessed Dec 09 2004
[127] Ben Woodhead, 'Health ID system raises heartbeats', Australian Financial Review August 30 2003 <http://tinyurl.com/6fr8m> accessed Dec 08 2004
[128] R. Clarke, 'Biometrics and Privacy', Xamax Consultancy Pty Ltd 2001 <http://tinyurl.com/5cblt> accessed Dec 09 2004
[129] M. Crompton, 'Proof of ID required? Getting Identity Management Right', Office of the Federal Privacy Commissioner (Australian Government) 2004 <http://tinyurl.com/46xy3> accessed Dec 09 2004

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Section 9 APPENDICES

A Appendix 1

PHIN Conference Presentations: May 26, 2004

- Use of Countermeasure Administration Data in State Preparedness
- Integrating Laboratory Systems Within an Organization
- Early Event Detection Systems
- National Electronic Disease Surveillance System (NEDSS) Base System Deployment, Implementation, and Support Activities
- Getting the Message (and Sending It, Too): Perspectives on ELR from Health Departments and Laboratories
- Workforce Development
- Child Health Information Systems
- NEDSS Base System, Release 1.1.3: An Overview of Existing Functionality and Future Plans
- Countermeasure Administration in Widespread Events
- Creation of Standards Based Messages from Clinical Sources
- Security Technologies
- Specifications for Interorganizational Alerting: Cascade Protocol and Vocabulary
- PHIN Certification
- Strategies for Directory De-duplication
- Tools for Outbreak Management - Part I
- Future NEDSS Program Area Modules
- Codes and Mappings for Public Health Reporting of Laboratory Test Results
- Panel Discussion: Partnering for Interoperability - Part I
- PHIN and the Rest of the Department, Getting Them to Help Each Other
- Tools for Outbreak Management - Part 2
- PHIN Compliance in Public Health Labs
- Extending the PHIN Components: Development and Reuse in Application Modules
- Partnering for Interoperability - Part II
- Optimizing Use of Existing State Web-based Data Query/Dissemination Tools in the PHIN Environment
- Investigation of Agent Specific Data Collection Requirements to Support Countermeasure Administration
- Strategies for Managing Change in IT Systems
- Compliance and Usability
- NEDSS Base System Locally Defined Fields and Collaboratively Defined Fields
- Putting PHIN Standards to Work
- Concepts for Designing Dynamic/Configurable Outbreak Management Systems
- State Alerting Solutions
- Distance Learning
- Technical Roundtable on HL7 Version 3 Messaging: Experience, Message Handling and Implementation Guide
- Early Event Detection and Emergency Response Systems
- Developing Requirements for Analysis, Visualization and Reporting in the NEDSS Base System and Other NEDSS/PHIN Components
- Hands-on Demonstrations of Outbreak Management Tools
- NEDSS Base System Hands-On Demonstrations

B Appendix 2

1 LabVision problems

- The Enquiry facility is awful. That is, if doctors need to look up results, they have to scroll through every test, from the top. Every line of verbose histopathology, every single line in every blood gas result, chemistry panel and haematological parameters. In the case of a patient with positive blood cultures, I will want to review only some previous results, say CRPs, results of surgery, other cultures. There is no facility to pick results from a rolling summary listing of episodes, and that is apparently prevented by the original design of the database.
- It is next to impossible to extract significant microbiology results, for charting and tabulation. I organised one monthly task, to print a list of patients from whom we had isolated bacteria that attracted an additional reimbursement code under the ICD9AM. The tortuous process is described in Appendix 3. The design of LabVision prevents extraction of collated data on antibiotic susceptibilities. We are unable to give our users a regular update on the current percentage of common bacteria, say E.coli, that are resistant to trimethoprim.
- We have tried, but failed, to import results of work that is performed at a reference laboratory. The reasons for this are not clear. The latest (Dec 9) offer is that the LabVision maintainer could ignore the HL7 method, and simply add the imported results as a block of formatted text in a new test-field.

C Appendix 3

1 Procedure for making an extract from LabVision, for presentation to Clinical Coding.

- I request the system operator to send me a single comma-delimited file, criteria previously chosen and coded into an M program.
- On a PC, I scan the file for a string of ‘awkward’ text that is incompatible with MS-Access.
- The text file is opened in MS-Excel. Some field names are edited, and columns that have been flagged as numeric are changed to alpha format. The file is saved in Excel.
- The Access database is opened. A table is renamed for archiving. The Excel file is imported. Importing errors are checked, and rows with certain null values are deleted.
- An Update query is run on this table of raw data, to change the status of episodes coming from Casualty into Inpatient.
- Three special cases are looked for and edited, if needed.
- Another Update is run, to put a column of abbreviated organism code at the front, for easier manipulation.
- Then the major clean-up query is run, to eliminate duplicates (according to arbitrary rules)
- Another two yes/no fields are added, for ease of further extraction via queries.
- Nine queries are run, to update fields according to specific criteria. For example, all of the staphylococci in blood cultures that are not S.aureus, are flagged to be rejected from the final report, unless they are known to have been true infections.
- That month’s data is appended to the main table, and the report is run.

END
Trevor Kerr, MBBS, FRCPA; Friday, 17 December 2004