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## Health care services and information systems

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Health care service delivery could be described as an information intensive industry. In contrast the banking industry is transaction intensive. Both are able to benefit greatly from the use of computing, information and communications technology. Yet the banking industry is much further advanced in this regard. A transaction based system relies predominantly on data. These are observations or facts which when collected, evaluated and organised become information or knowledge. Data are computer input elements. Information on the other hand consists of data which are:

‘processed, organised or classified into categories to serve a useful purpose. Nobel Laureate Kenneth Arrow defined information as ‘a reduction in uncertainty’. Information as an intellectual construct is subject to constant change. Its importance depends on who makes any information based transactions and when. It is both resource and commodity but unlike matter and energy is not consumed by use. Communications is central to information flow and essentially subsumed in it. ‘Information’ depends heavily on ‘information technology’ (IT) but is a far wider concept, with educational, social, economic, employment and cognitive implications. Data, information, knowledge and intelligence ascend hierarchically. The concept of encoded data organised as ‘information’ is the common feature of genetics, biotechnology, language, communications, mathematics, electronics, computing and robotics’. (The Parliament of the Commonwealth of Australia 1991 p.vii)

In the banking industry data consists of numbers whilst in the health care industry data takes many forms including numbers, text, concepts (coded data), graphics, images, physiological measures (signals), and sound. Health care professionals rely on all their senses, including smell to collect assessment data from individuals. These data are recorded in a person’s medical history or health record. Now that technology has progressed to the point where all types of data, with the exception of smell, may be produced in digital form it has become feasible to develop fully integrated health information systems. This should assist greatly in meeting the functional needs for health information. Dick (1992 p.294) noted that ‘we lack the evidence to make more informed decisions in health care today across the spectrum from the bedside up to the formulation of national health care policy’. He went on to say that ‘most of the evidence needed to make more informed decisions remains embedded in fragmented, irretrievable, and often illegible paper-based patient records’.

To define the health problem one must be able to identify and describe the population or groups for whom the problem exists as well as various aspects denoting health status, such as incidence of disease, ill health, and deaths, quality of life, plus functional, emotional and mental health status. An understanding of the problem requires data which are identified as being determinants of health such as reasons for occurrence, predisposing factors, causes, access to health care services and risk factors. Arriving at solutions to the problem requires the identification of effective interventions provided directly to individuals and to communities, including management protocols, resource and service utilisation. All interventions must therefore be identified and described and linked to defined outcomes in order to determine effectiveness. In essence outcome measures are identical to problem identification measures. These then are the functional health information requirements irrespective of the economic, political, philosophical or organisational considerations of any country's health care system. The latter will determine the health information systems detailed architectural framework, although in broad terms this should be standardised to suit any health care system.

The Australian Institute of Health and Welfare (AIH&W), has as its mission to inform community discussion and to support public policy-making on health and welfare issues by coordinating, developing, analysing and disseminating national statistics on the health of Australians, and health and welfare services, and by undertaking and supporting related research and analysis. An important mechanism for improving Australia's health information has been the National Health Information Agreement between the Commonwealth, State and Territory health authorities, the Australian Bureau of Statistics and the AIH&W. This has resulted in a National Health Information Work Program (AIH&W 1993) which incorporates those health information activities that both meet agreed national priorities and have either a national focus or national implications. Projects cover data collections describing health service institutions, primary care and community health, mental health, medical services, health service outcomes, pharmaceuticals, health insurance, national health expenditure, health labourforce, vital statistics, population surveys, surveillance, population health outcomes, national health information policy and infrastructure. In the process a health data dictionary has been developed and is expanding. This represents a major initiative towards the provision of an authoritative set of national definitions. The AIH&W is developing a national health information plan designed to overcome identified deficiencies in its data collections to support its mission (AIH&W 1994 p.xi). For example Harper et al (1994 p.12) note that quality of life and most of the behavioural aspects of illness are very poorly described and not available for whole populations.

Similar activities are taking place in other countries. For example in the United States of America the Agency for Health Care Policy and Research (AHCPR) consists of several components one of which is the Office of Science and Data Development which supports and conducts activities designed to increase the amount and usefulness of data (such as that from health insurance claims data bases and computer based patient research) for outcomes and other health services research. The Computer-Based Patient Record Institute (CPRI) was established in 1991 following a report by the Institute of Medicine's committee for improving the patient record to provide a sustained, coordinated and concentrated effort to establish the widespread use of computer-based patient records (Dick 1992 p.294). One of a number of high priorities for the CPRI is the development of health data standards.

Three factors have determined the characteristics and development of health information systems. These are, economic considerations, technological advances and changes in philosophies regarding health service delivery. The last decade has seen enormous change in all three areas. Various approaches aimed at controlling health care expenditure have emerged. Technological advances in medicine, computing, and communications technology can only be described as explosive. Global changes regarding social structures, attitudes and values are influencing and changing the expectations of recipients of health care services. In Australia and elsewhere a paradigm shift from a medical model with a physical ill health focus of health service delivery, towards a social, community based model is clearly evident. A state of health may be defined as a general sense of physical, social and psychological well being. Whereas ill health denotes a deficiency in well being in one or more of these aspects which may result in an inability to function at one's usual level.

The structure and type of health information systems developed and implemented tend to reflect a country's health care system. This in turn is greatly influenced by the philosophical, political and economic underpinnings of that system. The dominant value driving information system development in industrialised countries has been that of economic constraints, competing pressures regarding resource allocation whilst focusing on the treatment of ill health from a medical perspective. Thus systems have tended to support administrative and financial activities associated with the treatment of disease and physical ill health. Until more recently clinical management considerations did not feature in most health information system development efforts.

## **Economic and political influences**

In 1992 the Organisation for Economic Co-operation and Development (OECD) noted that 'in recent decades, the growth in health care expenditures has exceeded the growth in gross domestic product across the OECD area' (OECD Social Policy Studies No.7 p.5). This has resulted in a growing emphasis on, and interest in efficiency and effectiveness of health service delivery. It is the concern about effectiveness which is finally stimulating the development of clinical information systems. To maximise the benefits of these systems they must link with other health focused systems to gain a thorough understanding of the many variables which influence the general health of a population and of the measures or circumstances which successfully improve health.

The Commonwealth, State and Territory health authorities have committed themselves to improving the health outcomes of Australians. Their aim is to achieve optimal individual and population health within available resources through this focus. The Australian Health Ministers Advisory Council (AHMAC) defined a health outcome as 'a change in the health of an individual, a group of people or population, which is attributable to an intervention or series of interventions' (DHS&H 1994 p.1). As a result of this initiative national goals and targets for making significant improvements in the health status of Australian were established. These focus on cardiovascular disease, cancers, mental health and injuries. These were chosen because they are of major concern as a result of their contribution to a high level of death, illness or premature loss of life. Furthermore effective interventions to improve health outcomes were perceived to be possible and the measurement of progress towards these were seen to be feasible.

Other components of the AHCPR include the Medical Treatment Effectiveness Program (MEDTEP), the Office of Health Technology Assessment which evaluates the safety, efficacy, effectiveness and where possible, the cost effectiveness of health care technologies and the Office of the Forum for Quality and Effectiveness in Health Care. The latter arranges for the development, periodic review, and updating of clinical practice guidelines. This office also supports the development of performance measures, standards of quality, and medical review criteria for use by health care practitioners and others in reviewing health care quality and services. McCormick (1992 p.30) notes that the impetus for practice guideline development comes from identified practice pattern variations, concern with inappropriateness of care and high healthcare costs.

The United States of America implemented output based funding based on patient classification, diagnosis related groups (DRGs), in 1983 to control health care expenditures. Their prospective payment system using DRGs was mandated by the passage of the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA) (Shaffer 1985 p.8). In Australia the second round of Medicare Agreements negotiated in 1988 between the Commonwealth, State and Territory health authorities, included the introduction of the Casemix Development Program. Its purpose was to develop casemix (output) based approaches to hospital management and financing which was a component of micro-economic reform within the health care industry. The third round of Medicare Agreements negotiated in 1993 provided for the continued development of casemix related activities. Victoria was the first State to introduce casemix funding in July 1993. NSW uses casemix as a component of its Resource Allocation Formula which is used to fund all health services. It is also a major component of the NSW Efficiency Index used to compare relative efficiency between areas and districts. Casemix based budgeting and funding models are used within NSW Area Health Services, districts and hospitals. South Australia introduced casemix based funding in July 1994 and the Queensland Government intends to do so from January 1995. In Tasmania casemix information is used for program reporting and evaluation and as a component of the Tasmanian Resource Allocation Model (TRAM) used for the purpose of costing inter-regional patient flows. Western Australia uses casemix as a performance indicator to appraise and compare provider organisations as well as to monitor hospital performance.

In Australia a number of different casemix systems have been developed or are in use including the Australian National Diagnosis Related Groups (AN-DRGs), Australian Paediatric Ambulatory Classification (APAC), Australian Ambulatory Classification (AAC), Major Ambulatory Diagnostic Categories (MADCs), Major Diagnostic Categories (MDC), Non-acute Inpatient Classification System (NAIPs), Neonatal DRGs, Nursing home type (NHT), Paediatric modified DRGs (PM-DRGs), Patient Assessment and Information System (PAIS) which is a patient/nurse dependency system, Psychiatric Patient Classes (PPCs), Resident Classification Instrument (RCI) used by nursing homes and Urgency Related Groups (URGs) for emergency services. These casemix systems combined with their intended usage greatly influence the types of data collected throughout the health care system.

The United Kingdom initiated a series of projects designed to introduce business practices regarding financial control and budgeting following a management inquiry into the National Health Service (NHS) in the late 80s. Recommendations included the use of classification systems such as ICD9, ICD9-CM, and DRGs to provide clinical workload information (Catterall 1988 p.33). This marked the beginning of major structural reforms within the NHS. Their Resource Management initiative introduced a new approach to

resource management within the NHS aimed demonstrating measurable improvements in patient care ( D of H RM 1989 p.1). The UK now uses Healthcare Resource Groups (HRGs) which represent a UK modification of DRGs. Other countries including New Zealand, Canada and Sweden have experienced similar major reforms to their health system. Canada uses Case-Mix Groups (CMGs) as its output measure. These and similar policy initiatives have had a significant impact upon health information system development and the discipline of health informatics.

## **Philosophical aspects**

There is a growing realisation that social structures, the economic, social, occupational and environmental circumstances of individuals, methods of health service delivery plus public health measures, greatly influence the incidence of disease and ill health episodes and the quality of life experienced. Disease and ill health may be defined by the prevalence of physical, social or psychological problems experienced. Medical interventions are designed to respond to the physical aspect of ill health and to a lesser extent to the mental aspect of ill health. Health outcomes, as measured by the general health and well being of a population or the impact of disease or ill health upon daily living, are determined not only by the possible underlying disease or medical interventions but also by the management of the response to these problems within the context of the whole person in their environment. Thus a population's health is not a discrete domain of medical practice (Harper, Holman and Dawes 1994 p.3). According to Harper et al (1994 p.11) health data serve three broad purposes, to define the problem, to understand the problem and the identification of effective interventions, preventative and curative.

The political influences and financial considerations together with an underlying desire by Governments towards a philosophy of a health service delivery system which has a primary health care focus, are driving health care services away from institutional care towards community based care. This reorientation of the health care system from a medical model of health care towards a social model began in 1977 at the 30<sup>th</sup> World Health Assembly, followed by the 1978 Declaration of Alma Ata; the 1986 Ottawa Charter for Health Promotion; the 1988 Adelaide Conference Statement on Healthy Public Policy and the 1991 Supportive Environments for Health: The Sundsvall Statement. Australia is a signatory to the Global Strategy for Health for All by the Year 2000, thus accepting international obligations (DHH&CS 1993 p.3). Thus increasingly more health services are expected to promote health and there is an expectation to involve the community in health care decision making. Health care services required for any one episode of care may be provided by any number and combination of community and institution based services. Consequently there is a greater need to inform the community about health related concepts and interventions and to make provision for the continuity of care. This has major implications for health information systems including data definitions and collections.

## **Technological advances**

Advances in computing, communications and medical technologies are explosive. It is increasingly difficult to keep up with the enormous volume of new knowledge created by medical advances and needed for the purpose of informed decision making. Medical advances are forcing changes in attitudes and values regarding the sanctity of human life, creating many

dilemmas associated with resource allocation. Much is possible but is it worth doing? Computing and communications technological advances on the other hand are making what wasn't realistically possible previously more feasible, cost effective and in some instances common place. High performance computing and networking technology plus advanced software technology and algorithms will provide enormous benefits to health care in the areas of research, imaging and telemedicine. Communications technology needs to be embraced to ensure continuity of care as health care recipients move through the system and are serviced by any number of providers during any one episode of care.

## Conclusion

It may be concluded that health informatics provides the most significant infrastructure needed to manage health care in the future. This infrastructure should not be dependent upon existing economic, political, or philosophical considerations. It must be capable of accommodating future changes at the lowest possible cost. Notwithstanding this requirement, it is noted that the developments in technology, philosophical transitions, and the desire to contain cost whilst improving the health of any nation, are all interdependent. They are the drivers of health information system specification, development, implementation and usage. The next chapter explores health information characteristics and its role in communication within the health sector in greater detail.

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