

HEALTH INFORMATION AND MEDICAL INFORMATICS

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HEALTH INFORMATION - General Overview

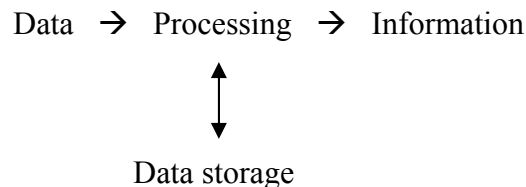
Basic concepts

Data are non-random symbols which represent quantities, actions, objects, concepts, and so on. For example: numbers, letters, other symbols (e.g. π , €, ♂, ♪). The context may change the meaning of a symbol.

Information is data that have been processed into a form that is meaningful to the recipient and is of real or perceived value in current or prospective actions or decisions.

This definition recognises both the value of information in a specific decision *and* the value of information in motivation, model building, and background building affecting future decisions and actions.

An information system is a system for data collection, data storage, data processing and dissemination of information to its intended recipients.



An information system may or may not be computerised.

Health information

- A term which can have many meanings:

- 1) Information about the **health status** of a population [Mortality, Morbidity, Disability, Risk factors, Self-perception of health]
- 2) Information on prevention or treatment of disease [Health Education/Health Promotion]
- 3) Information about health services [esp. Structure – e.g. health resources / Process – e.g. health service activity]
- 4) Information required for the management of health services

5) Information about the health status of an individual [the Medical Record]

Donabedian's Structure/Process/Outcome Model

“We can only get the most complete, credible and useful information by studying structure, process and outcome in conjunction” (Donabedian, 1980)

Avedis Donabedian's structure/process/outcome (SPO) model is frequently cited in research on measures of healthcare quality (Donabedian 1966; Burns 1995). Donabedian defines **structural** measures of quality as the professional and organizational resources associated with the provision of care, such as staff credentials and facility operating capacities. **Process** measures of quality refer to the things done to and for the patient by practitioners in the course of treatment (Gustafson and Hundt 1995). **Outcome** measures are the desired states resulting from care processes, which may include reduction in morbidity and mortality, and improvement in the quality of life (Kane and Kane 1988). Donabedian (1988) noted a distinction between two types of outcomes. **Technical outcomes** encompass the physical and functional aspects of care. Examples of technical outcomes include the absence of postsurgical complications and the successful management of hypertension and other chronic conditions. **Interpersonal outcomes** encompass dimensions of the "art" of medicine. These include patient satisfaction with care and the influence of care on the patient's quality of life as perceived by the patient.

Donabedian asserted that these three categories of quality measures are not independent but are linked in an underlying framework. Good structure should promote good process and good process in turn should promote good outcome. This provides a theoretical rationale for linking outcome with structure.

The Health Field Concept

A 1974 report by Canadian Health Minister Mark Lalonde emphasised that health depends on more than the health care system. That report recognised the importance of **health determinants** in the overall health picture. Despite the insights of Lalonde, some of those determinants have continued worsening, such as the environment and socio-economic inequalities, whereas generally speaking the focus of healthcare has remained primarily on the healthcare system *per se*, especially secondary and tertiary care.

The Health Field Concept encompasses four domains:

- Human Biology (esp. Genetics)
- Environment
- Lifestyle
- Healthcare Organisation

For this reason information on the health status of a population is not complete unless environmental and lifestyle factors are measured and described.

Evidence-based medicine

Evidence-based medicine (EBM) has been defined as "the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research." (David Sackett, et al. "[Evidence Based Medicine: What It Is and What It Isn't](#)," *BMJ* 312, no.7023 (1996)).

More recently it has been described as the "integration of best research evidence with clinical expertise and patient values." (David Sackett, et al. *Evidence-Based Medicine: How to Practice and Teach EBM* (New York: Churchill Livingstone, 2000), 1.)

The [Oxford Centre for Evidence-Based Medicine](#) offers numerous resources to assist evidence-based practice.

[The Cochrane Collaboration Homepage](#): The Cochrane Collaboration is an international network of individuals and institutions committed to preparing, maintaining, and disseminating systematic reviews of the effects of health care. In pursuing its aims, the Cochrane Collaboration is guided by six principles: collaboration, building on people's existing enthusiasm and interests, minimizing duplication of effort, avoidance of bias, keeping up to date, and ensuring access. This Web site contains important contact information, the Cochrane library, as well as a description of the evidence-based methodology adopted by the group, which is described in the Cochrane Handbook.

The US [National Guideline Clearinghouse™](#) is a public resource for evidence-based clinical practice guidelines. NGC is sponsored by the [Agency for Healthcare Research and Quality \(AHRQ\)](#), U.S. Department of Health and Human Services, in partnership with the [American Medical Association](#) and the [American Association of Health Plans](#).

Other [AHRQ clinical guidelines](#) are also available online.

The [Centre for Evidence-Based Medicine](#) (Mount Sinai Hospital) website also provides materials to help develop, disseminate, and evaluate resources that can be used to practise and teach EBM for undergraduate, postgraduate and continuing education for health care professionals from a variety of clinical disciplines.

Openclinical provides a good summary of [key evidence-based medicine publications](#).

HEALTH INFORMATION - The Situation in Malta

DEMOGRAPHY

Population/Housing

The last census in Malta was taken on 26 November 1995. Several volumes of statistics were published by the National Statistics Office (www.nso.gov.mt) (NSO) (formerly known as the Central Office of Statistics (COS)). See: www.nso.gov.mt/publications/Census'95/index.htm. 'Ad hoc' analyses of Census data are possible – contact the NSO Librarian.

Births

Official national statistics on births are collected and published by the NSO in the annual Demographic Review of the Maltese Islands. A copy may be purchased from the Publications Office of the Department of Information (DOI) (www.doi.gov.mt) at 3 Castille Place, Valletta.

Migration

Migration statistics are published by the NSO in the annual Demographic Review.

The NSO contact person for Demography is Mr Anthony Briffa (anthony.briffa@gov.mt).

MORTALITY

Death statistics are published in the Demographic Review (NSO), in the World Health Statistics Annual published by WHO-Geneva, and in the Annual Mortality Report published by the Department of Health Information (DHI). The head of the DHI Mortality Registry is Dr Kathleen England. URL: www.health.gov.mt/ministry/dhi/nmr.htm

The DHI is located at 95, G'Mangia Hill, G'Mangia (opposite the mortuary).

MORBIDITY

CANCERS

The National Cancer Registry is part of the DHI. It publishes detailed Annual Reports on cancer incidence, mortality and survival. The head of the Registry is Dr Miriam Dalmas, Principal Medical Officer. URL: www.health.gov.mt/ministry/dhi/mncr.htm

CONGENITAL ANOMALIES

The national Malta Congenital Anomalies Registry (MCAR) is part of the DHI. It publishes yearly and half-yearly reports on the incidence of congenital anomalies in the population. The head of the Registry is Dr Miriam Gatt, PMO. See www.health.gov.mt/ministry/dhi/mcar.htm

INFECTIOUS DISEASES

Since July 1997, all statistics concerning infectious disease are kept by the Disease Surveillance Branch of the Department of Public Health (contact Dr Charmaine Gauci, PMO). The Department (located at 37/39, Rue d'Argens, Msida) prepares a weekly report on the number of notifications received and monthly and annual reports on confirmed cases of infectious disease and deaths from infectious disease. See www.health.gov.mt/dsu.

OBSTETRIC DATA (national)

Statistics on clinical aspects of obstetric activity in all public and private hospitals and clinics in Malta and Gozo may be obtained from the Department of Health Information (PMO in charge of the National Obstetric Information System: Dr Miriam Gatt). An Annual Report is published, as well as *ad hoc* reports. See <http://www.health.gov.mt/ministry/dhi/nois.htm>.

OTHER NATIONAL MORBIDITY/RISK FACTOR DATA

2002 National Health Interview Survey

The preliminary results of the National Health Interview survey held in 2002 were published in July 2003. Contact: Dr Renzo Pace Asciak (Consultant, Health Information). See www.health.gov.mt/ministry/dhi/survey/his.html.

National Injury Database

On 28 September 2004 it was announced by the Minister for Health that the DHI would be coordinating a National Injury Database. Contact: Dr Renzo Pace Asciak (Consultant, Health Information).

National Organ Transplant Register

Since 1999, the DHI has kept a national register of organ transplants. This Register is taken care of by Dr Kathleen England.

DISABILITY DATA

The best source is the Kummissjoni Nazzjonali Persuni b'Dizabilta': www.knpd.org.

HOSPITAL ACTIVITY DATA

HOSPITAL ACTIVITY ANALYSIS (HAA)

The SLH Data Management Unit (a new Unit created in 2004) keeps a database of admissions to St Luke's Hospital, including discharge diagnoses, as reported on HAA forms. (This database was first created in 1992 and was formerly managed by the DHI). Monthly and annual reports are prepared for hospital staff and managers. *Ad hoc* reports are also prepared (PMO in charge: Dr Alexandra Distefano).

OPERATIONS DATA

The DHI has kept a computerised Surgical Operations Register for St Luke's Hospital since 1 January 1995. In 2004 the responsibility for the Register moved to the new SLH Data Management Unit (PMO in charge: Dr Lina Janulova).

HEALTH SERVICE STATISTICS

Each branch and section within the health services compiles an Annual Report on the services delivered during the year. A summary of these reports is collated and published as part of the Annual Report on the Workings of Government Departments, which is published by the DOI (Department of Information) of the OPM (Office of the Prime Minister). Unfortunately only a small part of the individual branch/section reports is utilised in this Report.

Particularly important items are: admissions / discharges / deaths in hospital, number of operations carried out in hospital, number of deliveries in hospital.

Since 1990 the Dept of Obstetrics and Gynaecology has issued its own Annual Report, and the Department of Medicine has issued printed Annual Reports since 1994.

The DHI has an internal database of items of health service information that may be useful to health managers and researchers, e.g. hospital bed complements, number of registered medical and dental practitioners, number of pharmacists.

MEDICAL INFORMATICS – General Overview

What is medical informatics?

Medical informatics is a developing body of knowledge and a set of techniques concerning the management of information in support of medical research, education and patient care.

It promotes the perception of information technology as part of the infrastructure of medical practice.

Patient care requires the collection, processing and communication of large amounts of information. The rapid increase of clinical information, medical research and new patterns of care involving multi-disciplinary teams require quick and efficient information-sharing systems. Often new technology is seen as a new way of doing the same things, rather than as an opportunity for a radical revision of processes and practices. Medical informatics does not represent IT as a substitute for knowledge acquisition but as a means to advance the practice, teaching and administration of medicine and thus contribute to the quality of patient care.

(Source: BMA)

COMPUTER-BASED PATIENT RECORDS (CPR)

The vision for a CPR encompasses a mainly virtual computer-based medical record that includes all information (clinical and administrative) and covers all practitioners ever involved in a person's health care, independent of medical specialties. Therefore, it includes linked bits and pieces of a person's health history from the dentist to the psychiatrist. It also is longitudinal, ideally including prenatal and postmortem information. A CPR is the basis for and an integral part of decision support. This distinguishes the CPR from the paper-based medical record, which is mostly a passive recording tool. The achievement of this vision is heavily influenced by the need to safeguard patient privacy and by technical constraints.

An **Electronic Health Record (EHR)** is a computer-stored collection of health information about one person linked by a person identifier. Ideally it would constitute the entirety of the **Electronic Patient Records** known to exist for a patient, from birth to death in summary form, to be used to achieve continuity of care across the whole healthcare system.

An **Electric Patient Record** is a Patient Record held in electronic form whose data custodian(s) work within a single autonomous healthcare organisation

Some issues with implementation of EPR's/EHR's

- Should the EPR supplement or replace the manual record?
- What data are important to record (are all hard data important, are all soft data unimportant?)
- Should any data be stored as free text, or should all data be coded?
- How should the data be organised? (source-oriented vs problem-oriented)?
- Should the user be able to interact directly with his/her EPR/EHR?
- Should the physician accept data entered into the EPR/EHR directly by the patient?

Potential benefits of CMRs

- Automatic indexing by time, diagnosis, medication, procedure, results (coding and classification is an important prerequisite for this benefit to be realised)
- Automatic summary of important past and current medical history (facilitating problem-oriented and holistic care)
- Reminders about possible conflicts in therapy or about scheduled tasks (e.g. drug interactions, immunisation schedules, allergy warnings)
- Legible, available records (potential of instant access to record at any site and by several providers simultaneously)
- Multiple display formats (the same information can be shown in different ways, and different providers can have different "views" of the same record)

HOSPITAL COMPUTER SYSTEMS

The administrative and clinical domains overlap greatly in hospital systems.

Administration

PATIENT ADMINISTRATION SYSTEM (PAS)

- Master Index of all patients with hospital files (incl. label printing)
- Tracking of (paper-based) medical files and images
- Record of inpatient admissions, discharges, transfers
- Scheduling / records of outpatient encounters
- Record of A&E encounters
- Measurement of bedstate, inpatient populations
- Determination of case-mix

“Standard” administrative systems and IT facilities

- HR
- Payroll
- Accounts
- Supplies/stores/inventory
- Email/Internet/Office automation (MS Office, etc.)

Clinical departments

Radiology

- Radiology Information System (RIS)
- Picture Archiving and Communication System (PACS)

Operating Theatres System

Pathology/Laboratory System

Pharmacy System

Clinical care

Electronic Patient Records (EPR)

Nursing Management System (Drawing Up Of Care Plans)

Order Communication Systems

Order Entry
Results Reporting

"Hotel systems"

Patient meals management
Engineering services

HEALTH CARE CLASSIFICATION SYSTEMS AND TERMINOLOGIES

General concepts

- Classification is the grouping of entities into classes or categories on the basis of some shared attribute or quality.
- Ideal classes or categories are those which are objective and discrete and thus both include all information which is relevant and exclude all which is not.
- Several classification systems have been designed, each to fulfil a particular purpose. It is rarely necessary to create a classification system.
- In choosing a classification, it is necessary to make sure that its design is appropriate and adequate for the job in hand.

Specific classifications and terminologies

International Classification of Disease (ICD-10)

Full name: [International Statistical Classification of Diseases and Related Health Problems, tenth revision](#). It was developed and is supported by the [World Health Organization](#). It is the most commonly used disease classification. It was originally developed as an epidemiological tool (esp. for classification of deaths) but later editions were adapted for more general use in medicine. It uses alphanumeric codes (e.g. lung carcinoma = C34.9). In Malta it was implemented in 1995 for Mortality and in 1999 for Hospital morbidity

Clinical Modification of ICD-9 (ICD-9-CM)

This was developed by the US National Committee on Health & Vital Statistics, based on ICD, and is more suitable than ICD for clinical, as distinct from epidemiological, use, especially in the hospital setting. It includes a comprehensive Procedures section that is used in the US for the classification of surgical operations.

International Classification of Primary Care (ICPC)

<http://www.who.int/classifications/icd/adaptations/icpc2/en/>

This does not cover just one "axis" (e.g. diagnosis) but the whole "process of care" (including investigations and treatment). This renders it more suitable for use in primary care. Developed by Lamberts and Wood, its restricted size makes it particularly useful for manual coding. Its independence from ICD has allowed a more logical structure at the price of preventing comparison with information using ICD-based classifications. One drawback is that the restricted size has resulted in the introduction of a degree of culture specificity -

several important diseases common in developing countries are allocated to residual categories

International Classification of Functioning, Disability and Health (ICF)

<http://www.who.int/classifications/icf/en/>

<http://www3.who.int/icf/icftemplate.cfm>

This classification was developed by the World Health Organisation; when it was first published in 1980 it was called **International Classification of Impairments, Disabilities and Handicaps (ICIDH)**. It is a triaxial classification that describes how individuals cope with their health condition. It is useful for the measurement of health outcomes.

Classification of surgical operations and procedures (OPCS-4)

4th rev OPCS 1987: this procedure classification is used in the UK

Physicians' current procedural terminology (CPT-4)

4th rev American Medical Association 1988: used in the US

At St Luke's Hospital the **BUPA Schedule of Procedures** has been used for categorisation of operations.

Systematized nomenclature of medicine (SNOMED)

This was developed by the College of American Pathologists mainly to classify morphology of neoplasms. Its latest incarnation is **SNOMED Clinical Terms (SNOMED CT / SCT)**, which combines the content and structure of the SNOMED Reference Terminology (SNOMED RT) with the United Kingdom's Clinical Terms Version 3 (formerly known as the Read Codes). The [NHS Information Authority](#) and [SNOMED](#) both provide web sites to support SCT.

Unified Medical Language System

[The Unified Medical Language System \(UMLS\) Project](#) is a large research activity funded by the US National Library of Medicine. The UMLS itself is actually a number of interlocking resources for the management of medical languages, and is designed to allow uniform access to machine-readable medical resources.

Diagnosis-Related Groups (DRG's)

DRG's are homogeneous groupings of patients who require roughly equivalent regimes of care in terms of resources (esp. financial). There are 467 DRGs in the original system of DRGs developed in the USA. There have been several adaptations worldwide, e.g. Germany, Australia.

MEDICAL INFORMATICS IN MALTA

Hospital / Health Centre information systems

In 1992, the then Minister for Health approved a National Health Information Systems Strategy. The largest system envisaged by the strategy was the Healthcare Information System, designed to include all Government hospitals and Health Centres, in 3 phases:

- Phase I: Patient Administration System / Order Communications Systems (PAS / OCS)
- Phase II: Departmental Systems: Pathology, Radiology, Theatres, Pharmacy
- Phase III: Clinical Information Systems/Electronic Patient Records (full)

Of these phases, it was the Patient Administration System that was implemented. The contract for Phase I systems has been with iSoft (formerly Torex Health (UK), formerly SMS (Ireland)) since January 1996. On 28 April 1997, the Patient Master Index (PMI) went live. On 30 September 1997, computerised File Tracking went live. The Outpatient Appointments Booking and Registration module went live in June 1998, while Inpatient Admissions, Discharges & Transfers (“ADT”) went live at SLH on 7 December 1999. Other modules that went live after this were Accident and Emergency, and Patient Billing (for foreign patients).

The definition of Phase II requirements was overtaken by events. Two tenders for the Pathology System were issued but had to be abandoned because of contractual issues.

Another operational hospital-related system is the Blood Transfusion System for the National Blood Transfusion Centre. [Contractors: MAK Systems – France]

Another long-standing computerisation project is the one running at the Government Pharmaceutical Services - this aims to computerise stock control and purchase procedures at the Medical Stores.

Other systems:

- Schedule V system (Up and running; presently undergoing a technology refresh)
- Cardiac Investigations and Patient Records (CIPR) System (Up and running)
- Diabetes System (Up and running)
- Corporate applications (e.g. Common Database / E-mail / Internet / Intranet)
- Accounting systems (Boffa Hospital / Mount Carmel Hospital) (Up and running)

In 2002 an Information Systems Strategic Plan (ISSP) was commissioned for Mater Dei Hospital. It is expected that on the basis of this plan a tender will be issued for new systems at Mater Dei Hospital, as well as for other parts of the health care sector.

Computerised medical literature search and Internet

Searching of the Index Medicus (Medline) is available free on the Internet from a number of sites, such as PubMed Central (<http://www.pubmedcentral.nih.gov>). The Internet is now virtually indispensable as a tool for medical literature search. Most leading journals (e.g. New England Journal of Medicine – www.nejm.com, The Lancet – www.lancet.com) make their contents page and selected articles freely available on Internet. The British Medical

Journal (www.bmj.com) till now provides the Full Monty, but soon this will no longer be the case.

The Ministry of Health's website (www.health.gov.mt) contains information on health in Malta, as well as useful links. Note, in particular, the Disease Surveillance Unit's new website within the Health website: www.health.gov.mt/dsu.

Another important site for Maltese health professionals is The Synapse - visit this at www.thesynapse.net. Contact: Dr Wilfred Galea – cns@synapse.net.mt.

Computing in general practice

Development in this field in Malta was limited for several years. In 2000 the Malta College of Family Doctors backed the introduction of a computerised program called TRANSHIS for structured record keeping in general practice. It makes use of ICPC – International Classification of Primary Care – for the coding of GP encounter data. The programme was developed by experts in the Netherlands and donated by the Department of Family Practice of the Academic Medical Center, University of Amsterdam. By 2003, at least 15 GP's were making use of TRANSHIS. The data collected by some of these doctors is collated into a database of episodes of care, which is being used to study Family Practice in Malta. By 2003, it contained data for 10,000 patients, 32,000 episodes of care, 57,000 reasons for encounter and 84,000 interventions. Contact: Dr Jean Karl Soler – jksoler@synapse.net.mt.

Computing in public health

The Epi-Info program and the WHO-EURO Health For All database are both free, in the public domain, and downloadable over the Internet.

CDC web page for Epi-Info: <http://www.cdc.gov/epiinfo/>
European HFA database: <http://www.who.dk/hfadb>
Centers for Disease Control (Atlanta, US): www.cdc.gov
WHO (Regional Office – Copenhagen): www.who.dk

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