



**NATIONAL OPEN UNIVERSITY OF
NIGERIA**

SCHOOL OF SCIENCE AND TECHNOLOGY

COURSE CODE:- DAM 463

**COURSE TITLE:-
HEALTH DATA MANAGEMENT**

**DAM 463
HEALTH DATA MANAGEMENT**

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The course, Health Data Management, is a core course for students studying towards acquiring the Bachelor of Science in Data Management. In this course we will study about Health Data Management as an important aspect of Data Management. Various aspects of Health Data Management are discussed in this course.

The overall aim of this course is to equip you with the techniques of Health Data Management in this era of advanced ICT.

In structuring this course, we commence with a general overview of Health Data Management and move to Health Data Management Life Cycle, Components of Health Data Management Systems, and finally Types of Health Data Management Systems.

There are four modules in this course, module 1 consists of five units of topics; module 2 consists of five units of topics; module 3 consists of three units; and module 4, four units. You are expected to complete each unit of topic in 3 hours. The four modules and their units are listed below.

What You Will Learn in this Course

The overall aims and objectives of this course provide guidance on what you should be achieving in the course of your studies. Each unit also has its own unit objectives which state specifically what you should be achieving in the corresponding unit. To evaluate your progress continuously, you are expected to refer to the overall course aims and objectives as well as the corresponding unit objectives upon the completion of each.

Course Aims

The overall aims and objectives of this course will help you to:

1. Develop your knowledge and understanding of the health care systems
2. Build up your capacity on health data representation and coding
3. Develop your competence in health data management and systems

Course Objectives

Upon completion of the course, you should be able to:

1. Describe the basic concepts of health data
2. Explain the various aspects of health data representation
3. Organize, store and retrieve health data and information
4. Describe the process of health data management, its components and systems

Working through this Course

We designed this course in a systematic way, so you need to work through it from Module one, Unit 1 through to Module four, Unit 4. This will enable you appreciate the course better.

Course Materials

Basically, we made use of textbooks and online materials. You are expected to search for more literature and web references for further understanding. Each unit has references and web references that were used to develop them.

Online Materials

Feel free to refer to the web sites provided for all the online reference materials required in this course.

The website is designed to integrate with the print-based course materials. The structure follows the structure of the units and all the reading and activity numbers are the same in both media.

Study Units

Module 1 Overview of Health Data Mnaagement

- Unit 1 What is Health Data?
- Unit 2 The Health Care Setting
- Unit 3 Health Care Delivery System
- Unit 4 Health Data Structure
- Unit 5 Health Data Representations and Coding

Module 2 Health Data Management Life Cycle

- Unit 1 Overview of Health Data Management Life Cycle
- Unit 2 Health Data Acquisition and Collection
- Unit 3 Health Data Processing
- Unit 4 Health Data Storage
- Unit 5 Health Data Retrieval

Module 3 Components of Health Data Management Systems

- Unit 1 Input to the Health Care Systems
- Unit 2 Processes of the Health Care Systems
- Unit 3 Outputs from the Health Care Systems

Module 4 Types of Health Data Management Systems

- Unit 1 Subject-based Health Care Systems
- Unit 2 Task-based Health Care Systems
- Unit 3 Administrative Health Care Systems
- Unit 4 User Profiles

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From the preceding, the content of the course can be divided into four major blocks:

Module one gives an overview of Health Data Management

Module two explains Health Data Management Life Cycle

Module three discusses the components of Health Data Management Systems

Module four describes the types of Health Data Management Systems

Equipment

In order to get the most from this course, it is essential that you have in hand a computer system, which has internet access, with various computer storage devices and accessories. In addition to this you are expected to have access to a University library and /or a virtual library.

Recommended System Specifications:

Processor

2.0 GHZ Intel compatible processor

1GB RAM

80 GB hard drive with 5 GB free disk

CD-RW drive.

3.5" Floppy Disk Drive or USB Flash Drive

TCP/IP (installed)

Operating System

Windows XP Professional (Service Pack

Microsoft office 2007

Norton Antivirus

Monitor*

19-inch

1024 X 768 resolution

16-bit high color

*Non Standard resolutions (for example, some laptops) are not supported.

Hardware

Open Serial Port (for scanner)

120W Speakers

Mouse + pad

Windows keyboard

Laser printer

Hardware is constantly changing and improving, causing older technology to become obsolete. An investment in newer, more efficient technology will more than pay for itself in improved performance results.

If your system does not meet the recommended specifications, you may experience considerably slower processing when working in the application.

Systems that exceed the recommended specifications will provide better handling of database files and faster processing time, thereby significantly increasing your productivity.

Assessment

The course, Health Data Management entails attending a three-hour final examination which contributes 70% to your final grading. The final examination covers materials from all parts of the course with a style similar to the Tutor-Marked Assignments (TMA).

The examination aims at testing your ability to apply the knowledge you have learned throughout the course, rather than your ability to memorize the materials. In preparing for the examination, it is essential that you receive the activities and Tutor-Marked Assignments you have completed in each unit. The other 30% will account for all the TMA's at the end of each unit.

Tutor-Marked Assignment

About 20 hours of tutorials will be provided in support of this course. You will be notified of the dates, time and location for these tutorials, together with the name and phone number of your tutor as soon as you are allotted a tutorial group.

Your tutor will mark and comment on your assignments, keep a close watch on your progress and on any difficulties you might encounter and provide assistance to you during the course. You must mail your TMAs to your tutor well before the due date (at least two working days are required). They will be marked by your tutor and returned to you as soon as possible.

Do not hesitate to contact your tutor by phone, e-mail if you need help. The following might be circumstances in which you would find help necessary. You can also contact your tutor if:

- you do not understand any part of the study units or the assigned readings
- you have difficulty with the TMAs
- you have a question or problem with your tutor's comments on an assignment or with the grading of an assignment

You should try your best to attend tutorials, since it is the only opportunity to have an interaction with your tutor and to ask questions which are answered instantly. You can raise any problem encountered in the course of your study. To gain maximum benefit from the course tutorials, you are advised to prepare a list of questions before attending the tutorial. You will learn a lot from participating in discussions actively.

Course Overview

This section proposes the number of weeks that you are expected to spend on the four modules comprising of 17 units and the assignments that follow each of the unit. We recommend that each unit with its associated TMA is completed in one week, bringing your study period to a maximum of 16 weeks.

How to Get the Most from this Course

In order for you to learn various concepts in this course, it is essential to practice. Independent activities and case activities which are based on a particular scenario are presented in the units. The activities include open questions to promote discussion on the relevant topics, questions with standard answers and program demonstrations on the concepts.

You may try to delve into each unit adopting the following steps:

1. read the study unit
2. read the textbook, printed or online references
3. perform the activities
4. participate in group discussions
5. complete the tutor-marked assignments
6. participate in online discussions

This course makes intensive use of materials on the world-wide web. Specific web address will be given for your reference. There are also optional readings in the units. You may wish to read these to extend your knowledge beyond the required materials. They will not be assessed.

Summary

The course, Health Data Management is intended to develop your understanding of the concepts of health data management, thus enabling you acquire skills in the data management in the health sector. This course also provides you with practical knowledge and hands-on experience in managing health data.

We hope that you will find the course enlightening and that you will find it both interesting and useful. In the longer term, we hope you will get acquainted with the National Open University of Nigeria and we wish you every success in your future.



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Module 1 Overview of Health Data Management

Unit 1 What is Health Data?

Unit 2 The Health Care Setting

Unit 3 Health Care Delivery System

Unit 4 Health Data Structure

Unit 5 Health Data Representations and Coding

UNIT 1 WHAT IS HEALTH DATA?**CONTENTS**

1.0 Introduction

2.0 Objectives

3.0 Main Content

3.1 Data and Information?

3.2 Health Data

3.3 Health Information

4.0 Conclusion

5.0 Summary

6.0 Tutor-Marked Assignment

7.0 References/Further Readings

1.0 INTRODUCTION

In this unit you will consider what health data is. You will also learn about data and information, as well as health data and health information.

2.0 OBJECTIVES

After going through this unit, you should be able to:

- explain what health data is
- describe the similarities between data and information
- distinguish between health data and health information.

3.0 WHAT IS HEALTH DATA?

Data can be defined as a formal representation of facts, concepts or instructions in a formalized manner, suitable for communication, interpretation or processing by manual or electronic means. In health care, these facts describe specific information about individual patients or a population.

3.1 Data and Information

In order to make sense of and use the facts of data, the data items need to be organized. Once organized, data become information. Therefore information is defined as data which has been processed so as to make a meaning to the person receiving it. Data is poor or useless as a tool for decision making whereas information is an essential tool for decision making. However, in many cases both terms are used interchangeably.

3.2 Health Data

Health data or health care data are items of knowledge about an individual patient, a group of patients or a population. It can also be defined as a collection of health-related facts from which information is constructed via processing or interpretation and conclusions drawn.

In health care, data are captured about a patient in paper or electronic format during his or her attendance at a hospital, a clinic, community health centre, or his or her admission to a hospital. The data collected whether manually or electronically usually include all relevant findings relating to the patient's condition, diagnoses, treatment, if any, and other events as they occur.

In collecting the health data, it is important to ensure that it is correct at the point of entry. This is to ensure data quality. Here, there are two key principles to ensure data quality: data accuracy and data validity. Data must be accurate to be useful. Also data must be valid to conform to an expected range of values and for communication to be effective.

Generally, there are two types of data – primary and secondary data. In the context of health care, primary data are obtained from the original data source, including documentation in the patient's medical/health record collected by staff at either a hospital, clinic or health centre.

On the other hand, secondary data are data sets derived from primary data. They include individual or aggregate health care data found in summary reports produced from the source like the master patients' index, disease and procedure indexes, health care statistics, disease registries, patients' name index and statistics.

3.3 Health Information

Health information is health care data that have been organized into a meaningful format. It may refer to organized data collected about an individual patient, or the summary of information about that patient's entire experience with his or her health care provider. Health information, therefore, can encompass the organization of a limitless array and combination of possible data items. Health care service providers need health information both at the point of service and at the point of decision making in a format that maximizes the decision-making process.

Information from health data is generally needed on health status and risks, health resources availability (including services), and health system performance. The health situation analysis provided by an assessment of the health data should be regularly up-dated on the basis of the information from ongoing situation monitoring and early warning system reports.

The information and knowledge generated by the health data collected should usually be disseminated, in time to inform decisions on the health planning and management of response activities. At the global level health data is expected to be disaggregated by geographical area, population group, age and sex, as much as possible.

The starting points for health care information are data and the collection of data, whether maintained manually or electronically at a large teaching hospital, health centre or outlying clinic. Demographic and clinical data stored in a patient's medical/health record are the major

source of health information and are of no value to medical science or health care management if they are not accurate, reliable and accessible.

4.0 Conclusion

In this unit you have been introduced to health data. You have also been introduced to the similarities and differences between health data and information.

5.0 Summary

In this unit, Health data are items of knowledge about an individual patient, a group of patients or a population. In health care, data are captured about a patient in paper or electronic format during his or her attendance at a hospital, a clinic, community health centre, or his or her admission to a hospital. Generally, there are two types of data – primary and secondary data.

Health information is health care data that have been organized into a meaningful format. It may refer to organized data collected about an individual patient, or the summary of information about that patient's entire experience with his or her health care provider. The information and knowledge generated by the health data collected should usually be disseminated, in time to inform decisions on the health planning and management of response activities.

6.0 Tutor-Marked Assignment

1. Define Health data
2. Describe the types of health data
3. Discuss situations where health data can be used interchangeably with health information.

7.0 References/Further Readings

1. The Concept of Information by R. Capurro et al Hochschule der Medien, University of Applied Sciences Wolframstr. 32, 70191 Stuttgart, Germany available online at <http://www.db.dk/bh/publ_uk.htm>
2. Stansfield SK et al. Information to improve decision-making for health. in: Jameson et al. eds. *Disease control priorities for the developing world*. 2006, April, chapter 54.
3. Adrian G. Barnett, Annette J. Dobson, 2009, *Analysing Seasonal Health Data*, Springer Publications
4. PAHO, 1999, *Setting Up Healthcare Services Information Systems*, PAHO Publications
5. Heather Grain and Paula Procter, 2009, *Using Health Data: Applying Technology to Work Smart*, Churchill Livingstone, Elsevier Australia, 2009

UNIT 2 THE HEALTH CARE SETTING

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
- 3.1 Health Care
- 3.2 Health Care Setting
- 3.3 Health Care Facilities
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In this unit you will consider the health, health care, its setting and facilities.

2.0 OBJECTIVES

After going through this unit, you should be able to:

- explain what health is
- describe health care
- discuss what health care settings and facilities are all about.

3.0 MAIN CONTENT

The World Health Organisation (WHO) had defined *health* as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity". That is to say, even if you don't have any disease, you may not be said to be healthy if you are not completely well including socially.

3.1 Health Care

Health care is the diagnosis, treatment and prevention of disease, illness, injury, and other physical, mental and social impairments in humans. Health care is delivered by practitioners in medicine, dentistry, nursing, pharmacy and allied health. The exact configuration of health care varies from country to country, but in all cases requires a robust financing mechanism; a well-trained and adequately paid workforce; reliable information on which to base decisions and policies; and well maintained facilities and logistics to deliver quality services. The setting of modern health care depends on an expanding group of trained professionals coming together as an interdisciplinary team – the healthcare team.

Health care generally consists of hospital activities; medical and dental practice activities; and other human health activities. The first and second classes of activities are performed by or in the hospital while the last class consists of all activities for human health not performed by hospitals, physicians or dentists. This last class involves activities of, or under the supervision of, nurses,

midwives, physiotherapists, scientific or diagnostic laboratories, pathology clinics, home, or other para-medical practitioners in the field of optometry, hydrotherapy, medical massage, yoga therapy, music therapy, occupational therapy, speech therapy, chiropody, homeopathy, chiropractics, acupuncture, etc.

3.2 Health Care Setting

The health-care setting incorporates healthcare facilities with several sectors that are dedicated to providing health care services and products. The setting includes health care equipment, information systems and services as well as biotechnology, diagnostic substances, drug delivery, drug manufacturers, hospitals, medical equipment and instruments, diagnostic laboratories, nursing homes, providers of health care plans and home health care.

3.3 Health Care Facilities

Healthcare facilities include hospitals, clinics, dental offices, out-patient surgery centers, maternity and nursing homes. There are numerous health and safety issues associated with healthcare facilities. They include bloodborne pathogens and biological hazards, potential chemical and drug exposures, waste anesthetic gas exposures, respiratory hazards, ergonomic hazards from lifting and repetitive tasks, laser hazards, hazards associated with laboratories, and radioactive material and x-ray hazards.

Healthcare facilities in addition to the medical staff, employ a wide variety of trades that have health and safety hazards associated with them. These include mechanical maintenance, medical equipment maintenance, housekeeping, food service, building and grounds maintenance, laundry, and administrative staff.

4.0 Conclusion

In this unit you have been introduced to healthcare, its setting and facilities.

5.0 Summary

In this unit, health care generally consists of hospital activities; medical and dental practice activities; and other human health activities. Its setting incorporates healthcare facilities with several sectors that are dedicated to providing health care services and products. Then its facilities include hospitals, clinics, dental offices, out-patient surgery centers, maternity and nursing homes.

6.0 Tutor-Marked Assignment

1. Write short note on health care.

7.0 References/Further Readings

1. Stansfield SK et al. Information to improve decision-making for health. in: Jameson et al. eds. *Disease control priorities for the developing world*. 2006, April, chapter 54.
2. Organisation for Economic Co-operation and Development, 2009, *Health at a Glance 2009: OECD Indicators*, OECD Publishing
3. PAHO, 1999, *Setting Up Healthcare Services Information Systems*, PAHO Publications
4. Heather Grain and Paula Procter, 2009, *Using Health Data: Applying Technology to Work Smart*, Churchill Livingstone, Elsevier Australia, 2009.

UNIT 3 HEALTH CARE DELIVERY SYSTEM

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Definition of Health Care Delivery System
 - 3.2 Levels of Health Care Delivery
 - 3.3 Resources of Health Care Delivery System
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In this unit you will consider what health care delivery system is. You will also learn about levels and resources of health care delivery system.

2.0 OBJECTIVES

After going through this unit, you should be able to:

- explain what health care delivery system is
- describe the various levels of health care delivery system in Nigeria
- discuss the various resources in the health care delivery system.

3.0 MAIN CONTENT

3.1 Definition of Health Care Delivery System

A health care delivery system is an organizational framework for the distribution or servicing of the health care needs of a given community. It is a fairly complex system of inter-related elements that contribute to the health of people - in their homes, educational institutions, in work places, the public (social or recreational) and the psychological environments as well as the directly health and health-related sectors.

3.2 Levels of Health Care Delivery

Every country operates its health care delivery system in line with its health policies. In Nigeria and in line with WHO coordination, there is a three-tier system of health care delivery, namely: primary, secondary and tertiary health care systems.

The primary health care provides the primary health and is largely the responsibility of Local Governments with the support of state ministries of health and within the overall national health policy. The health services, based on primary health care, include among other things: education concerning prevailing health problems and the methods of preventing and controlling them; promotion of food supply and proper nutrition; maternal and child care, including family

planning; immunisation against the major infectious diseases; prevention and control of locally endemic and epidemic diseases; and provision of essential drugs and supplies.

The secondary health care provides specialized services to patients referred from the primary health care level through out-patient and in-patient services of hospitals for general medical, surgical, pediatric patients and community health services. Secondary health care is available at the district, divisional and zonal levels of the states. Adequate supportive services such as laboratory, diagnostic, blood bank, rehabilitation and physiotherapy are also provided.

Then the tertiary health care consists of highly specialized services provided by teaching hospitals and other specialist hospitals which provide care for specific diseases such as orthopedic, eye, psychiatric, maternity and pediatric cases. Care is taken to ensure an even distribution of these hospitals. Also, appropriate support services are incorporated into the development of these tertiary facilities to provide effective referral services.

3.3 Resources of Health Care Delivery System

The healthcare delivery system encompasses a wide range of resources such as providers, facilities, and agencies. The complexity in healthcare delivery is in large part due to the “different kinds of personnel working in a variety of settings using many resources and generating and using multiple flows of information.”

The types of healthcare providers range from nurses and medical assistants to physicians, surgeons, and specialists. Other staff directly involved in the care-delivery process include: translators, pharmacists, laboratory technicians, registration personnel, and medical billing clerks. Healthcare facilities include outpatient or ambulatory clinics, hospitals, emergency care facilities, long-term care facilities, hospice care sites, and public health departments. The range of healthcare agencies include hospital systems, insurance agencies, and state and federal agencies such as the State Environmental Protection Agencies, the Ministries of Health and Human Services, the Nigerian Institute for Medical Research (NIMR), Centers for Disease Control and Prevention (CDC), and the National Agency for Food Drug Administration and Control (NAFDAC) and National Health Insurance Scheme (NHIS).

Aside from these, health care delivery usually involves a myriad of stakeholders, including patients, direct health care providers, researchers and managed care organizations. These stakeholders often have considerable differences in objectives, concerns, priorities and constraints, making data management in health care organizations a challenging endeavor. The planning, management, and delivery of health care services include the manipulation of large amounts of health data or information and the corresponding technologies are becoming increasingly embedded in all aspects of the health care.

4.0 Conclusion

In this unit you have been introduced to health care delivery system, its levels as well as resources.

5.0 Summary

Health care delivery system is a fairly complex system of inter-related elements that contribute to the health of people. Every country operates its health care delivery system in line with its health policies. As an example, in Nigeria, there is a three-tier system of health care delivery, namely: primary, secondary and tertiary health care systems.

The healthcare delivery system encompasses a wide range of resources such as providers, facilities, and agencies. The types of healthcare providers range from nurses and medical assistants to physicians, surgeons, and specialists. Healthcare facilities include outpatient or ambulatory clinics, hospitals, emergency care facilities, long-term care facilities, hospice care sites, and public health departments. The range of healthcare agencies include hospital systems, insurance agencies, and state and federal agencies.

6.0 Tutor-Marked Assignment

1. Define Health Care Delivery System
2. Itemize the various levels of Health Care Delivery System
3. What are the main resources of the Health Care Delivery System.

7.0 References/Further Readings

1. World Health Organization. *International Health Regulations (2005): Areas of work for implementation*. Geneva, World Health Organization, 2005 (WHO/CDS/EPR/IHR/2007.1). <available online at http://www.who.int/csr/ihr/IHR_Areas_of_work.pdf>
2. Organisation for Economic Co-operation and Development, 2009, *Health at a Glance 2009: OECD Indicators*, OECD Publishing
3. Adrian G. Barnett, Annette J. Dobson, 2009, *Analysing Seasonal Health Data*, Springer Publications
4. PAHO, 1999, *Setting Up Healthcare Services Information Systems*, PAHO Publications
6. Gary L. Kreps, Elizabeth N. Kunimoto, 1994, *Effective Communication in Multicultural Health Care Settings*, SAGE Publications, Inc
7. Heather Grain and Paula Procter, 2009, *Using Health Data: Applying Technology to Work Smart*, Churchill Livingstone, Elsevier Australia, 2009

UNIT 4 HEALTH DATA STRUCTURE

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.1 Textual Description
- 3.2 Numerical measurements
- 3.3 Recorded signals
- 3.4 Images
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In this unit you will consider what makes up a health data structure. You will also learn the different categories of health data.

2.0 OBJECTIVES

After going through this unit, you should be able to:

- explain what non bibliographic information is
- discuss the differences between bibliographic and non bibliographic information
- describe how to search for non bibliographic information

3.0 HEALTH DATA STRUCTURE

Health data have tremendous variety, all of which are important in patient and human care and have different implications for the performance required in health data management. Health data are generally categorized into four:

- Textual description
 - Medical signs/symptoms descriptions and narrative reports
 - Treatment plan
 - Prognosis
 - Case studies etc
- Numerical measurements
 - Temperature
 - Laboratory results
 - Population survey etc
- Recorded signals
 - Blood pressure
 - Electrocardiogram (ECG) etc
- Images
 - Computed tomography (CT) scan
 - Magnetic resonance imaging (MRI) scan

Positron emission tomography (PET) scan
Ultrasound imaging etc

3.1 Textual Description

Most of the health data available today are in textual form as narrative reports. Several medical areas or health departments generate reports about specific procedures or tests. For instance discharge summaries or medical reports explain the entire episode of the patient's stay in the hospital; operative reports explain the procedure followed during surgical operations. These reports range from a few sentences (say in a specific type of pathology report) to several pages (example, autopsy reports).

3.2 Numerical Measurements

Some departments use peculiar terminologies or numerals to represent their health data or measurements. As an example, laboratory data tend to be in coded form, where each data item is represented as a code (alphanumeric, integers). This is very useful as health providers need to look at trends in data over time (examples include temperature readings and anion count in blood). Again in computer-based clinical decision support, more data need to be in coded form so that a computer-based expert system can understand the values and act upon them to send alerts to providers, if necessary.

3.3 Recorded Signals

In health-related academic institutions, like the teaching hospitals, a large amount of computer-based educational information come in as recorded signals in graphical form and are video-based. Many stand-alone educational products are being actively used today. In institutions with ICT, these data (example, a topic such as how to conduct a physical examination on a patient) will be available over a computer network and on demand to all students, faculty, and health practitioners. This is an example of e-health. The Electrocardiogram (ECG) as an example records the electrical activity of the heart over time, which is measured by an array of electrodes placed on the body surface.

3.4 Images

Health institutions recently use a large amount of multimedia data. All radiologic tests are performed as visual interpretation of images and video sequences. Examples include the Computed Tomography (CT) Scan, which is a diagnostic procedure that takes a detailed cross-sectional x-ray picture with the computer processing this picture into a "slice" of the body; the Magnetic Resonance Imaging (MRI) Scan, which is a diagnostic procedure that uses magnetic/radio waves to affect the body's atoms and so used to visualize structure and function of the body; the Positron Emission Tomography (PET), which is a nuclear medicine imaging technique in 2 or 3 dimension used for early detection and monitoring of cancer, neurological diseases and assessment of cardiovascular disease; and the Multi-Modal Imaging, which is a combination of PET with CT and MRI and so combines the advantage of CT and MRI scans (provides anatomic information) with that of PET scan (provides metabolic information).

4.0 Conclusion

In this unit you have been introduced to health data structure. You also learnt about the different categories of health data.

5.0 Summary

Health data are important in patient and human care and have different implications for the performance required in health data management. They are generally categorized into four: textual description, numerical measurements, recorded signals and images.

Most of the health data available today are in textual form as narrative reports. These reports range from a few sentences (say in a specific type of pathology report) to several pages (example, autopsy reports). Some departments use peculiar terminologies or numerals to represent their health data or measurements. As an example, laboratory data tend to be in coded form, where each data item is represented as a code (alphanumeric, integers). In health-related academic institutions, like the teaching hospitals, a large amount of computer-based educational information come in as recorded signals in graphical form and are video-based. All radiologic tests are performed as visual interpretation of images and video sequences. Examples include the Computed Tomography (CT) Scan, the Magnetic Resonance Imaging (MRI) Scan, the Positron Emission Tomography (PET), and the Multi-Modal Imaging, which is a combination of PET with CT and MRI and so combines the advantage of CT and MRI scans (provides anatomic information) with that of PET scan (provides metabolic information).

6.0 Tutor-Marked Assignment

1. Briefly discuss the different categories of health data

7.0 References/Further Readings

1. The Concept of Information by R. Capurro et al Hochschule der Medien, University of Applied Sciences Wolframstr. 32, 70191 Stuttgart, Germany available online at <http://www.db.dk/bh/publ_uk.htm>
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UNIT 5 HEALTH DATA REPRESENTATIONS AND CODING

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
- 3.1 Health Data Representations and Coding
- 3.2 WHO Family of International Classifications
- 3.3 Health Data Coding
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In this unit you will consider what health data representations are. You will also learn about health data coding.

2.0 OBJECTIVES

After going through this unit, you should be able to:

- explain what health data representation is
- describe health data coding
- discuss WHO Family of International Classifications.

3.0 MAIN CONTENT

3.1 Health Data Representations and Coding

Health or Clinical data representations have been widely used to document clinical diagnoses and procedures. There are over 150 known systems of representations (or codes). Internationally endorsed systems of representations facilitate the storage, retrieval, analysis, and interpretation of health data. They also permit the comparison of data within populations over time and between populations at the same point in time as well as the compilation of nationally consistent data.

The World Health Organisation as the official coordinator of health globally came up with a Family of International Classifications (WHO-FIC) provides for international classifications on health so that there is a consensual, meaningful and useful framework which countries and healthcare providers and consumers can use as a common language. The purpose of the WHO-FIC is to promote the appropriate selection of classifications in the range of settings in the health field across the world.

3.2 WHO Family of International Classifications

The WHO Family of International Classifications comprises of two types of Classifications:

1. *Reference Classifications:*

These are main classifications on basic parameters of health. The classifications was prepared by the WHO and approved by their governing bodies for international use. These Reference classifications are:

- a) International Classification of Diseases (ICD)
- b) International Classification of Functioning, Disability and Health (ICF)
- c) International Classification of Health Interventions (ICHI)

2. *Derived classifications*

Derived classifications are based on the reference classifications (i.e. ICD and ICF) .

More information on the derived and related classifications

Classifications and Clinical Terminologies

These International Classifications enables adequate health data management and subsequently provide views of population health using such parameters as death, disease, functionality, disability, health and health interventions, which inform management and decision making process in the health system. Over time they also provide insight on trends, which informs the planning and decision making processes by health authorities.

3.3 Health Data Coding

Aside from the WHO Family of Classification, some countries accept and use a wide variety of codes in health data representations. In the United States of America (USA) for instance, the codes with the widest acceptance which are also in use in many countries are the following:

- *International Classification of Diseases* (ICD) codes, maintained by the World Health Organization (WHO) and are accepted worldwide. In USA, there is a proposal to develop a clinical modification of the ICD codes (called ICD-9-CM).
- *Current Procedural Terminology* (CPT) codes, maintained by the American Medical Association (AMA) and are widely used in USA for reimbursement and utilization review purposes. The codes are derived from medical specialty nomenclatures and are updated annually.
- The *Systematized Nomenclature of Medicine* (SNOMED), maintained by the College of American Pathologists and is widely accepted for describing pathologic test results. SNOMED has been proposed as a candidate to become the standardized vocabulary for computer-based patient record systems.
- *Digital Imaging and Communications* (DICOM), maintained by the American College of Radiology-National Electronic Manufacturers' Association (ACR-NEMA). It sets forth standards for indices of radiologic diagnoses as well as for image storage and communications.
- *Diagnostic and Statistical Manual of Mental Disorders* (DSM), now in its fourth edition (DSMIV), is maintained by the American Psychiatric Association. It sets forth a standard set of codes and descriptions for use in diagnoses, prescriptions, research, education, and administration.
- *Diagnostic Related Groups* (DRGs), maintained by HCFA. They are derivatives of ICD-9-CM codes and are used to facilitate reimbursement and case-mix analysis. They lack the clinical specificity to be of value in direct patient care or clinical research.
- *Unified Medical Language System* (UMLS) is maintained by the National Library of Medicine (NLM). It contains a metathesaurus that links clinical terminology, semantics, and formats of the major clinical coding and reference systems. It links medical terms (e.g., ICD, CPT, SNOMED,

DSM, CO-STAR, and D-XPLAIN) to the NLM's medical index subject headings (MeSH codes) and to each other.

4.0 Conclusion

In this unit you have studied health data representation and coding. You also learnt about WHO Family of International Classifications.

5.0 Summary

In this unit, over 150 known systems of representations (or codes) are used to facilitate the storage, retrieval, analysis, and interpretation of health data. The World Health Organisation has come up with a Family of International Classifications (WHO-FIC) to provide a consensual, meaningful and useful framework which countries and healthcare providers and consumers can use as a common language. The WHO Family of International Classifications comprises of two types of Classifications: Reference and Derived classifications.

A wide variety of codes in health data representations are used all over the world. These include: International Classification of Diseases (ICD) codes; Current Procedural Terminology (CPT) codes; Systematized Nomenclature of Medicine (SNOMED); Digital Imaging and Communications (DICOM); Diagnostic and Statistical Manual of Mental Disorders (DSM); Diagnostic Related Groups (DRGs); Unified Medical Language System (UMLS).

6.0 Tutor-Marked Assignment

1. Briefly discuss health data representation
2. List and briefly discuss the commonly used health data codes in USA

7.0 References/Further Readings

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Module 2 Health Data Management Life Cycle

Unit 1 Overview of Health Data Management Life Cycle

Unit 2 Health Data Acquisition and Collection

Unit 3 Health Data Processing

Unit 4 Health Data Storage

Unit 5 Health Data Retrieval

UNIT 1 OVERVIEW OF HEALTH DATA MANAGEMENT LIFE CYCLE**CONTENTS**

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Health Data Management Life Cycle
 - 3.1 Health Data Acquisition and Collection
 - 3.2 Health Data Processing
 - 3.3 Health Data Storage
 - 3.4 Health Data Retrieval
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In this unit you will consider the general overview of health data management life cycle, including the components of the life cycle.

2.0 OBJECTIVES

After going through this unit, you should be able to:

- discuss the general overview of health data management life cycle
- describe each component of the health data management life cycle.

3.0 HEALTH DATA MANAGEMENT LIFE CYCLE

The Health Care Data Management involves the evolution of the database infrastructure required to handle clinical, managerial, and population-based data in the health care arena. In health data management, it is important to note that the value of data or its transform, information, is variable. Some health data are always valuable, such as ‘HIV/AIDS without cure continues to be a global scourge’; other health data has a defined period of time when it's valuable, such as ‘an epidemic in a population’; and still other health data (information) has value only periodically, such as ‘outbreak of measles during early rainy season’.

Nevertheless, every health data or information has a life cycle during which it's collected or acquired, processed, stored, and eventually retrieved when needed. Figure 1 illustrates these four principal steps in the health data management life cycle.

Generally, health data like other types of data or information is fragile. The situation is worse when it is considered that we are in the digital age, where data is fragile in ways that differ from traditional technologies, such as paper or microfilm. It is more easily corrupted or altered without recognition. Digital storage media have shorter life spans, and digital health data requires access technologies that are changing at an ever-increasing pace.

Some of the health data, such as multimedia, are so closely linked to the software and hardware technologies that they cannot be used outside these proprietary environments. Because of the speed of technological advances, the time frame in which we must consider the health data management life cycle - acquisition, processing, storage and retrieval - becomes much shorter. That is, the time between acquisition and storage is shrinking.

Health Data Management Life Cycle

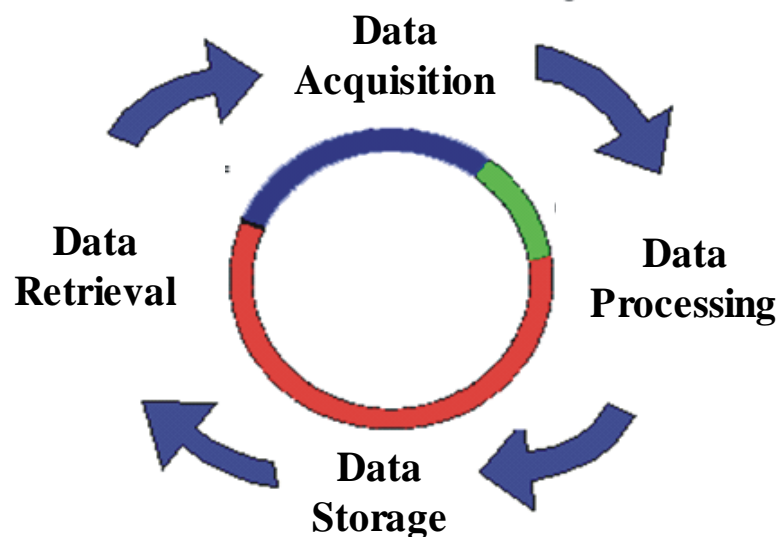


Figure 1: Health Data Management Life Cycle

3.1 Health Data Acquisition and Collection

The first step in health data management is the acquisition of the data to be managed. The process of acquisition or collection of the data also provides you with an understanding of the data source, which may be easy or difficult to manage, depending on the form and period of time between updates.

The main source of health data is the patient's medical/health record, which should contain essential data used in the health care decision-making process. A patient's medical/health record usually provides information on the following:

- who the patient is and who provided health care;
- what services were provided;
- when and where the services were provided;

- why the services were provided;
- how effective the services were; and
- what the outcome was of care and treatment.

Another important collection of data by hospitals is the bed census, which is collected daily and processed monthly and annually to produce statistics on the utilization of hospital services. Health care facilities, regardless of type or size, collect data processed as statistics for specific external reporting to meet the various needs of health care authorities, local and national governments, and funding organizations.

3.2 Health Data Processing

Data processing refers to methods of rendering large amounts of data into a form that can be stored, retrieved and manipulated by users or computer system. It involves data or information organisation, which is the process of structuring of data prior to content storage and archiving. Therefore, effective data processing pre-supposes that the information content has to be structured.

The principal attribute of data processing consists in its classification. Classification brings like things together with respect to one or more specified attributes. Any number of attributes can be used to form classes of documents - size, color, subject, author, etc. Therefore, the most important attribute for information organisation is the attribute of "embodying the same work". No other attribute can match it in collocating power because documents that share this attribute essentially have the same data content.

Classification here not only means bringing all the same information together, but also in pinpointing the differences and assisting the user in selecting from the alternatives. The concept of 'work' of an author and its embodiment in different documents and the concept of different 'editions' of a document have been used and it is suggested that bibliographic systems should not only aim at bringing different works and editions together, but also point out the differences to help the user in selecting the right document and edition.

3.3 Health Data Storage

When the data is collected and processed, the next step is to store the data in a retrievable repository, where the content format dramatically affects the storage needs. There are two kinds of data storage: the primary data storage, where data can be store temporarily for ready access; and the secondary data storage, also called data archiving where data is stored permanently mainly for preservation purposes.

Data storage involves organization of data content in a way that all information must be tagged in some fashion so that users can readily locate it later. This tagging may be as simple as document title or as sophisticated as the Library of Congress metacategory method. In either case, it's a good idea to develop a controlled vocabulary in a formal metadata definition document to guide both the initial repository development and the acquisition of new materials.

3.4 Health Data Retrieval

Health care data is considered sensitive information and in some countries is by an Act of Parliament. As a result of improved technology, healthcare providers have information at their fingertips, and so desire to be able to retrieve or have access to information about patients and billed charges quickly and securely. Therefore, data retrieval is an important stage of the health data management life cycle.

Healthcare providers and facilities need immediate access to patient information and demographics. This is crucial for record keeping and patient collections. And in the event of an audit, it is also important that a physician is able to provide documentation to support all charges billed.

4.0 Conclusion

In this unit you have studied the general overview of health data management life cycle.

5.0 Summary

In this unit, Health care data management involves the evolution of the database infrastructure required to handle clinical, managerial, and population-based data in the health care arena. Every health data or information has a life cycle during which it's collected or acquired, processed, stored, and eventually retrieved when needed.

6.0 Tutor-Marked Assignment

1. Discuss the components of the health data management life cycle.

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UNIT 2 HEALTH DATA ACQUISITION AND COLLECTION

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Health Data Acquisition and Collection
- 3.1 Primary Health Data Collection
- 3.2 Secondary Health Data Collection
- 3.3 The Process of Health Data Collection
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In this unit you will consider how to organize bibliographic information. You will also learn the objective and standards of information organisation and storage.

2.0 OBJECTIVES

After going through this unit, you should be able to:

- explain how to organize bibliographic information
- enumerate on the objectives of information organisation
- discuss the standards of information organisation and storage.

3.0 HEALTH DATA ACQUISITION AND COLLECTION

Statistical data are collected from hospitals and other healthcare institutions on the number, type and age of patients attending the facility, the types of conditions treated, tests conducted and referrals. The collection of the original source data must have in-built procedures to ensure that they meet the required quality standards and also the requirements of the patient, health care provider, health care facility and government.

Data collection can be carried out manually, on paper or automatically in a computer. In a computerized database, patient information is generally organized in a systematic, predetermined format. The collection of data in a manual medical record should also be systematically collected in a predetermined format. The type of health data to be collected can be primary or secondary data.

3.1 Primary Health Data Collection

The main source of health data as note above is primary data. The type of primary health care data collected about a patient in either a manual medical/health record or electronic patient record at all levels of health care fall into two major categories: *Administrative and Clinical data*.

Administrative Data

Administrative data – can be divided into four sections: demographic, legal, financial and provider.

1. Demographic and socioeconomic data – These are personal data elements about a patient. It is essential that these data are accurately recorded at the initial point of contact of the patient and are sufficient to identify an individual patient. Demographic data include the name of the patient, sex, date of birth, place of birth, the patient's permanent address and a unique personal identifier. This is usually a number, whether for national identification, social security or another piece of information that will uniquely identify the patient.

2. Legal data – These should include a signed consent by the patient for health care services at a hospital or primary health centre and a signed and dated authorization for the release of information. A signed and dated authorization for specific procedures and treatment is also required. In addition, in the event of the patient's death, an authorization for an autopsy signed and dated by the patient's next of kin should be in the medical record.

3. Financial data – These are data relating to the payment of fees for services rendered should include the primary source of payment, name and identification number of private health care insurance, if applicable, as well as the national health insurance number.

4. Data from the provider, that is the doctor or other health care professional – The data collected on the person providing care should include the name of the principal medical officer and other health care workers providing services to the patient.

The above data are usually contained in the first section or pages of a patient's medical/health record. The rest of the record should contain clinical data, which are those elements specific to the patient's present and continuing care.

Clinical data: inpatient

Clinical data on a patient whether admitted to a health care facility or treated in a primary health care environment must also be accurately recorded and can be divided into the following segments:

1. Main condition or principal diagnosis, other conditions or problems and surgical procedures – This segment contains an up-to-date summary of diagnoses and procedures performed, recorded on the first sheet of the patient's medical/health record, below the demographic data. It is dated and signed by the attending health care provider.

2. Patient medical history – This contains a detailed history of the patient's past health/illness including social history and habits. This section should also include a family medical history, presenting signs and symptoms, and the history of present illness or problem, recorded in the patient's own words.

3. *Physical examination and assessment* – This segment includes the results of a physical examination with findings and objective observations recorded, along with a provisional or working diagnosis, signed and dated by the attending health care provider.

4. *Orders and treatment plans* – These include detailed data on the orders and treatment plans, with date and time of entry, and signature of the person writing the order, duration of the order, date and time of treatment plan, and results.

5. *Diagnostic tests* – data in this segment should include the name of tests and/or X-ray, date and time the test was performed, reported findings and signature of the person completing the report, and date and time result was reported.

6. *Medications* – This section contains the name of the medication, date and time of order; dose and medication instructions; signature of the person ordering the medication; and for inpatients, the date and time when administered and signature of the person administering the medication.

7. *Progress notes* – This segment forms the bulk of the medical/health record both for inpatients and patients treated at primary health care level and gives an ongoing chronological picture and analysis of the clinical condition of the patient. It serves as a means of communication and interaction between health care providers. All entries should be dated and signed at the time of entry.

8. *Nursing notes* – these should contain data recorded by nurses during the continuing care of an inpatient, including a patient care plan, graphic charts for blood pressure, temperature and respiration, special observation charts, and signatures of attending nurses, plus date and time of each entry.

9. *Operative procedures* – this segment should contain significant data elements relating to all procedures performed in an operating room or day surgery for diagnostic, exploratory or definitive treatment. Anaesthetic and recovery room reports are also be included and signed and dated by the attending surgeon and/or anaesthetist.

10. *Disposition (completion of episode of care, discharge or death)* – concluding data are recorded on the completion of an episode of care at a clinic or health centre, or discharge or death of an inpatient. Such data contain the date of completion of the service or time of discharge or death. If discharged, prognosis and follow-up instructions are clearly stated along with a final diagnosis and appropriate signatures. In the event of the death of a patient, if an autopsy has been performed, a full autopsy report is included.

Clinical data: Non-inpatient

Data collected for an emergency patient, outpatient, clinic or aid post medical/health record should include:

- patient identification as for inpatients;
- relevant history of presenting illness and physical findings;

- clinical observations;
- reports of tests and procedures performed, such as immunization, health screening, etc.;
- the outcome of the visit. For example, follow-up for further treatment, admission to hospital, no further treatment, etc.;
- growth chart for children;
- referral information – correspondence from a local doctor or community nurse; and
- the signature of the health care provider seeing the patient to indicate their responsibility for the written information.

Clinical data: Specialist Non-inpatient

In many countries, specialist clinics are held for patients who need to see a consulting specialist for a specific condition.

- A specialist outpatient is often a patient with a chronic problem (hypertension, diabetes, etc.), a paediatric patient or a recent inpatient. There is usually an appointment book for making appointments for each specialist.
- On the day of the clinic, the appointments are noted as attended or did not attend. This information is needed to measure the workload of each clinic and determine the number of appointments made and not kept.
- At the end of the month, the number of patients who *attended* and *did not attend* are counted for each clinic and included in the monthly report.
- Other statistics would be collected in the same way as for the general outpatients.

Clinical data: Patient-held Health Record

In some countries, outpatient medical records are not kept by the health care facility. In these situations, the health care worker documents the visit in a *Patient-held health record*. The patient-held health record may consist of the maternal/baby health record, or patients can be asked to purchase an exercise book (sold by the hospital). The use of patient-held health records reduces the huge daily filing problem for general outpatient records.

Problems associated with using *Patient-held health record* often outweigh their usefulness. Some of these problems include:

- the patient does not bring the health record to the outpatients;
- the health record has been lost; or
- the health record has been tampered with.

In addition, it is difficult to monitor the quality of such health records, so education on quality requirements for health care personnel writing in the record is essential.

Hospital census data

In addition to data collected in the patient's medical/health record, health care facilities also collect daily census data on inpatients, emergency patients and ambulatory patient attendance. These data must also be accurate and reliable to maintain the quality of information generated. The type of inpatient data that should be collected by nursing staff is recorded on the daily bed census and processed by the admission office staff or a member of the medical record staff and should include the following:

1. Daily inpatient census – The count of all inpatients at the census taking time each day, that is, the number of inpatients present in the facility at a given time. Patients admitted and discharged the same day are also included;
2. Daily number of admissions;
3. Daily number of transfers in and out of wards; and
4. Daily number of discharges and deaths.

It is essential that the information is accurate and reliable so that it can be used by the facility with confidence to monitor the volume of patients treated on a daily, weekly, monthly and yearly basis, and to plan future services.

3.2 Secondary Health Data Collection

Data can be abstracted from the daily inpatient census and used:

- to accurately compile monthly and annual statistics such as the length of stay of inpatients and the inpatient occupancy rate; and
- to calculate the gross and net death rates, autopsy rates, maternal, foetal, newborn and neonatal death rates, hospital infection rates, and others as required.

The accuracy of the information is important, as the facility uses it to review the utilization of health care facility services, the workload of doctors, nurses, and other staff, and to plan for future development and human resource management.

The healthcare facility, whether a hospital or primary health centre, must also abstract data:

- on diseases treated and procedures performed using a classification system to complete government required morbidity statistics;
- on vital statistics (births and deaths) for the production of national death and birth rates.

Standard birth and death certificates should be used for the collection of these data; and

- for special registries related to patients with a specific diagnosis, condition or procedure, for example, diabetes, HIV/AIDS, birth defects, infectious and contagious diseases, and organ transplants.

Registries may be developed for any type of disease or condition for which specific data are collected and forwarded by the facility, local doctor or outlying clinic to the registry. Cancer registries have been operating in many countries for some time and rely on accurate data being collected and forwarded by the facility or person treating a patient. Information gathered by such a registry has been used, and is still being used, to identify trends and changes in the incidence of cancer within the population it serves.

Most governments require facilities offering health care services to forward accurate and reliable morbidity, mortality and utilization statistics to the appropriate government department for processing. From this pool of information, nationwide statistics are produced to enable comparison between facilities, states or provinces, and from country to country.

3.3 The Process of Health Data Collection

A frequently updated health data source that has an inaccessible format requires a much more sophisticated scheme than one that is periodically updated in a readily accessible form. This

approach also provides scope to the effort, which prevents trying to manage everything having to do with developing a new system or modifying an existing system.

The process of collecting health data is usually in form of paper documents, forms and e-documents, which is then transformed during data processing into accurate, retrievable information, and eventually delivered into health system applications and databases for storage and further action.

The acquisition of data is key to the health data management life cycle. If the life cycle for instance for a clinical data is to support an integrated patient record, then its ability to acquire data from a variety of sources directly affect its ability to support the patient evaluation and management functions to be described.

An integral part of health data acquisition is the act of producing the data or information product. The producer may be a human author or originator, or a piece of equipment such as a sensing device, satellite or laboratory instrument. Many data processors or managers acknowledged that creation is where health data acquisition starts and for data durability and security, long-term storage, archiving and preservation must start here.

With the health data created, data acquisition follows. In this case the created data is 'incorporated' physically or virtually into the data archive. This process is influenced by factors such as the prevailing data collection policies, the gathering procedures to be followed and intellectual property concerns.

In the issue of the prevailing data collection policies, considerations will be made like selecting what to collect or archive; determining the extent to go in what is being collected; whether to also collect the links to what is being collected; and whether to refresh archived contents in case of on-going websites.

There are two general approaches to the gathering of relevant data, especially internet-based. These are hand-selected and automatic. In some cases, the sites are reviewed and hand-selected. Here, they are monitored for their persistence before being included in the archive. In other cases, materials are acquired by periodically running a robot to capture sites for certain project without making value judgments.

Intellectual property remains a key issue in the health data acquisition process. The approaches to intellectual property vary based on the type of organization doing the data acquisition and archiving. In the case of data centers or corporate archives where there is a close tie between the center and the owner or funding source, there is little question about the intellectual property rights related to acquisition. However, in the case of national libraries, the approaches to intellectual property rights differ from country to country. The differences are based on variant national data acquisition policies or legal deposit laws.

4.0 Conclusion

In this unit you have studied health data acquisition and collection.

5.0 Summary

In this unit, the collection of the original source data must have in-built procedures to ensure that they meet the required quality standards and also the requirements of the patient, health care provider, health care facility and government. Data collection can be carried out manually, on paper or automatically in a computer. The type of health data to be collected can be primary or secondary data.

6.0 Tutor-Marked Assignment

1. Explain briefly what secondary health data collection entails
2. Enumerate on the major categories of primary health data collection
3. Discuss the processes of health data collection

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UNIT 3 HEALTH DATA PROCESSING

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Health Data Processing
- 3.1 Data Processing and Compilation
- 3.2 Transforming Data into Information
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In this unit you will study how to process health data. You will also learn the transformation of data into information.

2.0 OBJECTIVES

After going through this unit, you should be able to:

- explain what health data processing is
- enumerate the procedures in data processing and compilation
- discuss the process of transformation of data into information.

3.0 HEALTH DATA PROCESSING

Data processing refers to methods of rendering large amounts of data into a form that can be stored, retrieved and manipulated by users or computer system. It involves data or information organisation, which is the process of structuring of data prior to content storage and archiving. Therefore, effective data processing pre-supposes that the information content has to be structured.

The principal attribute of data processing consists in its classification. Classification brings like things together with respect to one or more specified attributes. Any number of attributes can be used to form classes of documents - size, color, subject, author, etc. Therefore, the most important attribute for information organisation is the attribute of "embodying the same work". No other attribute can match it in collocating power because documents that share this attribute essentially have the same data content.

Classification here not only means bringing all the same information together, but also in pinpointing the differences and assisting the user in selecting from the alternatives. The concept of 'work' of an author and its embodiment in different documents and the concept of different 'editions' of a document have been used and it is suggested that bibliographic systems should not only aim at bringing different works and editions together, but also point out the differences to help the user in selecting the right document and edition.

3.1 Data Processing and Compilation

The essence of data processing and compilation is the extracting and integrating of data. This involves extracting data from data sources, ensuring data consistency and quality, and achieving conformity through data transformation so that data from separate sources can be used together. Data transformation may include aggregation, calculation, cleaning, normalizing or merging tables, translating code values, or transposing values. Data can then be delivered to an integrated data repository in formats that allow various query methods to generate tangible outputs that health information system actors can use to inform their decisions.

The whole process of data extraction and transformation adds significant value to the source data by:

- removing mistakes and correcting for missing data;
- providing documented measures of degree of confidence in data;
- capturing the flow of transactional data for safe keeping;
- adjusting data from multiple sources to allow them to be used together;
- structuring data to be usable by end-user tools; and
- tracking all the above actions to tangibly support data-quality assessments.

Whatever the source of a data item, it is essential to pay special attention to the activities and subsystems concerned with data collection, storage, analysis and dissemination. The aim is to carefully assemble data from a variety of disparate sources – both within the health system and beyond – and to ensure its quality by cleaning and checking prior to releasing information to a broader public.

Data processing also has a number of other broad requirements, among which are ensuring that relevant and appropriate information is made easily accessible and its contents understandable. At the same time, this also means securing and protecting the information assets of the system. For example, a system may contain disaggregated patient information which may be affected by privacy and security considerations. It is therefore essential to control access to confidential information.

The ultimate impact of data processing however is measured by the extent to which it can provide targeted information for action. Reporting mechanisms should therefore be designed with intuitive interfaces for accessing information, tuned to the particular needs of key health information system actors.

Developing such an integrated information storage area following data processing offers many important benefits, including making best use of complementary data and synergies from multiple sources. Health facilities, districts and programmes can view their own data and compare them to information from other sources at the same level. Districts can compare facilities within their area and against facilities in other districts. Similarly, information can be aggregated at national level to give an overall picture or to compare regions. Since the repository contains all information from every level, various tasks are possible. These include aggregating data, examining more-detailed information at local level, and comparing areas.

The repository also provides an ideal tool for the immediate feedback of information to facilities and district levels. Its use will improve data access and use at local levels by providing immediate access to high-level data-analysis tools. Nationally, the repository provides a convenient central location where all data are available for analysis, evaluation and research, thereby influencing policy, planning and management decisions.

3.2 Transforming Data into Information

Although data are the raw materials of a health information system, they have little intrinsic value in themselves. Only after data have been compiled, managed and analysed do they produce information. Information is of far greater value, especially when it is integrated with other information and evaluated in terms of the issues confronting the health system. At this stage, information becomes an evidence that can be used by decision-makers.

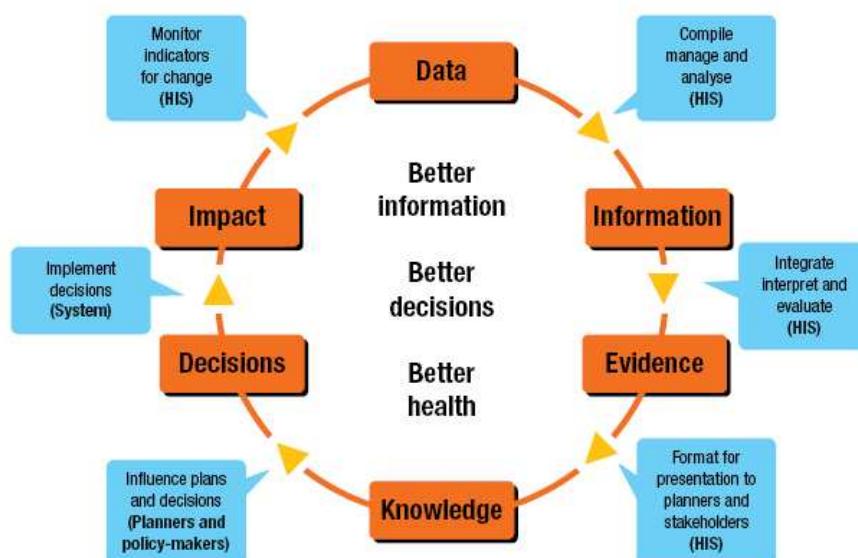


Figure 4: Transforming Data in Information (adapted from Framework and Standards for Country Health Information Systems)

This synthesis of information evidence becomes even more powerful when it is formatted for presentation, communication or dissemination to decision-makers in a form that changes their understanding of health issues and needs. This is the process of transforming evidence into knowledge, and once applied can result in decisions which will directly impact upon health and health equity. The actual impact on health can then be monitored by the health information system by measuring changes in health indicators.

Figure 4 is an ideal situation of a Health Information System as visualized by Health Metrics Network (HMN) of WHO. This involves the enabling of a culture of iterative and evidence-based decision-making built on a comprehensive country health information system. Unfortunately, at present, the health information systems in many low- and middle-income countries tend to be “data-rich” but “information-poor”. This is a consequence of the belief that

data can be used directly for decision-making without the value-added approach outlined in figure 4.

In reality, raw data alone are rarely useful. The point of a health information system is not just to generate high-quality data and hope that it will be used, but to convert it into credible and compelling evidence that informs local health system decision-making. High-quality data stored in a well-structured repository is of little value if it cannot be accessed by users to generate information for decision-making.

If data are extracted and then integrated into a data repository as outlined previously, they can be synthesized and triangulated with other sources and compiled into usable statistics and information for deeper analysis and comparison. A key aspect of this is the integration, synthesis, analysis and interpretation of information from multiple sources, examining inconsistencies, identifying and accounting for biases, and summarizing health situations and trends. Such analysis provides estimates (such as knowledge of disease burden, risk-behaviour patterns, health service coverage, trends in indicators, and health system performance). These can then be made available through user dashboards, reports, queries and alerts.

Such formatting or packaging of information for decision makers is a core function of the health information system in demonstrating the value of the data it contains. In these and other ways, the data held by a health information system can be extensively tapped to transform what is generally perceived to be “merely data” into information and evidence for action.

However it must be emphasized that although reliable information is an invaluable tool for improving health, its availability alone does not guarantee that it will be used for improved decision-making. Once the health information system has started converting data into information, the information produced should be used regularly at meetings and displayed where staff and the public can see it. Following such use, the health information system and the quality and usability of its information can gradually be improved by a cyclical learning process. Hands-on experience can identify problems, define new needs and add features to be refined and improved upon in the next cycle. This conversion of primary data to information and evidence requires an appropriate and simple toolkit of targeted methods aimed at providing relevant feedback.

4.0 Conclusion

In this unit you have studied health data processing, how data can be compiled and transformed to information.

5.0 Summary

In this unit, data processing refers to methods of rendering large amounts of data into a form that can be stored, retrieved and manipulated by users or computer system. The essence of data processing and compilation is the extracting and integrating of data. This involves extracting data from data sources, ensuring data consistency and quality, and achieving conformity through data transformation so that data from separate sources can be used together.

Although data are the raw materials of a health information system, they have little intrinsic value in themselves. Only after data have been compiled, managed and analysed do they produce information.

6.0 Tutor-Marked Assignment

1. Explain briefly what health data processing is
2. Enumerate on the procedures of data processing and compilation
3. Discuss the process of transformation of data to information.

7.0 References/Further Readings

1. Bath, P.A. (2004) Review of: William Hersh, *Information retrieval: a health and biomedical perspective* (2nd ed.) New York, NY: Springer, 2003 *Information Research*, **9**(2), review no. R117 [Available at: <http://informationr.net/ir/reviews/revs117.html>]
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UNIT 4 HEALTH DATA STORAGE

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
 - 3.1 Data Storage Media
 - 3.2 Standards for Data Organization and Storage
 - 3.3 Data Storage and Archiving
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In this unit you will consider how health data is stored. You will also learn about data storage media, standards for data organisation and storage as well as data storage and archiving.

2.0 OBJECTIVES

After going through this unit, you should be able to:

- explain what health data storage entails
- describe the importance of data storage media
- enumerate on the standards for data organisation and storage
- discuss data storage and archiving

3.0 MAIN CONTENT

3.1 Data Storage Media

Storage is often treated as a passive stage in the life cycle of data management, but it constitutes a major aspect of the life cycle. Generally, storage needs are similar regardless of the mechanism (database, network device [tape], or file system). Remember that you must provide sufficient scaling for future needs and sufficient bandwidth to accommodate user downloads of the content.

As for processor power, if the metadata associated with a file is properly indexed to the searches (hitting only the indexes), then processor needs tend to scale linearly with the user load. Assuming all the health data of interest is binary, then the primary questions of storage will be size and bandwidth. The size of the data files determines the principle storage needs (including backup) and the level of bandwidth required for capture and eventual display. Large files, like video or music, require a much larger storage space and delivery capacity.

However, storage media and formats have changed with legacy information perhaps lost forever. Block sizes, tape sizes, tape drive mechanisms and operating systems have changed over time. Most organizations that responded to the question about the periodicity of media migration anticipate a 3-5 year cycle. The most common solution to this problem of changing storage

media is migration to new storage systems. This is expensive, and there is always concern about the loss of data or problems with the quality when a transfer is made.

The most rigorous media migration practices are in place at the data centers. For instance, the Atmospheric Radiation Monitoring (ARM) Center at the Oak Ridge National Laboratory plans to migrate to new technologies every 4-5 years. During each migration, the data is copied to the new technology. Each migration will require 6-12 months. This trend will likely become continuous as the size of the archive increases.

3.2 Standards for Data Organization and Storage

For effective data organization and storage, the following standards must be followed:

- Catalogue data resources
- Classify data resources
- Create and manage databases
- Process data resources physically
- Store data resources
- Analyze and organize specialist data

Catalogue data resources

- Describe the principles of cataloguing and the suitability of Anglo-American Cataloguing Rules, Second Edition (AACR 2) standards to type of collection
- Locate and edit copy-cataloguing records for library and other data resources
- Determine cataloguing standards for library and data resources
- Maintain catalogue records for library and data resources.

Classify data resources

- Describe the way in which knowledge is organized in library classification systems
- Describe the principles of classification and subject analysis of the item in hand
- Apply a classification system to material held in library and data services

Create and manage databases

- Analyze a body of information to which access is required
- Select and develop an LIS database and collect and record data
- Maintain, monitor, and evaluate the database and implement improvements
- Review new systems to organize and access data

Process data resources physically

- Ensure the processing of the item is correct in terms of the addition of library stationery, labels, ownership stamps and barcodes
- Ensure the covering of the item with protective covering is appropriate to required standards of presentation

Store data resources

- Prepare newly acquired resources

- Undertake basic processing of data
- Arrange material to facilitate access to resources for clients

Analyze and organize specialist data

- Identify the requirements for descriptions of material
- Analyze material
- Describe material and format description
- Monitor and review analysis and description practices and procedures
- Contribute to enhancements of systems for describing material

3.3 Data Storage and Archiving

Now, the goal of archiving is preservation rather than ready access. Health data reaches the end of its life cycle when it begins to lose direct value to the user community. At this point, it's no longer cost-effective to have the data take up space in the primary information store; you should move the data to an archival location where the long-term maintenance cost is reduced. Currently, that means moving the content to either tape or disk-archive arrays.

In archiving, you're looking for data or information that isn't frequently accessed by the user community and migrating that data to the archive, freeing up space for new acquisitions.

Various periodical or ad hoc reports derived from surveys, statistical summaries, epidemiological bulletins, special research studies and evaluation reports are carefully stored in a dedicated library or other resource centre. These documents and publications frequently represent the major reference source for programme and intervention evaluation.

Archiving is the aspect of data storage in health data management life cycle that preserves the content as well as the look and feel of the data object. The time frame of long-term preservation can be thought of as long enough to be concerned about changes in technology and changes in the user community. Depending on the particular technologies involved, the data managers estimated the cycle for hardware/software migration at 2-10 years.

4.0 Conclusion

In this unit you have studied what health data storage entails. You also learnt the importance of data storage media as well the standards for data organisation and storage and data storage and archiving.

5.0 Summary

In this unit, storage is often treated as a passive stage in the life cycle of data management, but it constitutes a major aspect of the life cycle. Generally, storage needs are similar regardless of the mechanism (database, network device [tape], or file system). For effective data organization and storage, the standards to be followed include: cataloguing of data resources, classification of data resources, creation and management of databases, processing of data resources physically, storage of data resources, and analysis and organization of specialist data.

6.0 Tutor-Marked Assignment

1. Explain briefly what health data storage entails
2. Describe the importance of data storage media
3. Enumerate on the standards for data organisation and storage
4. Discuss data storage and archiving

7.0 References/Further Readings

1. Bath, P.A. (2004) Review of: William Hersh, *Information retrieval: a health and biomedical perspective* (2nd ed.) New York, NY: Springer, 2003 *Information Research*, 9(2), review no. R117 [Available at: <http://informationr.net/ir/reviews/revs117.html>]
2. ITU-UNCTAD. World Information Society Report 2007, Beyond WSIS, Figure 2.6, p. 22–26. <http://www.itu.int/wisr>
3. World Health Organisation, *Framework and Standards for Country Health Information Systems*, Second edition, 2008, Health Metrics Network, World Health Organization, Geneva, Switzerland.
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UNIT 5 HEALTH DATA RETRIEVAL

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
- 3.1 Health Information Retrieval
- 3.2 The Retrieval Process
- 3.3 Retrieval of Health Information
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In this unit you will consider what health data or information retrieval is, the retrieval process and how to retrieve health information.

2.0 OBJECTIVES

After going through this unit, you should be able to:

- enumerate on health data and information retrieval
- itemize the retrieval process
- explain how to retrieve health information .

3.0 MAIN CONTENT

3.1 Health Information Retrieval

Information Retrieval (IR) has been defined as the science of searching for documents, for information within documents and for metadata about documents, as well as that of searching relational databases and the World Wide Web. In the healthcare setting it deals with the representation, storage, organisation of, and access to healthcare data and information items. The representation and organisation of the health information items should provide the user with easy access to the information in which he is interested.

Health information retrieval can be manual or automatic. Automated health information retrieval systems are used to reduce *information overload*. Many hospitals medical schools and public libraries use information retrieval systems to provide access to medical records, clinical books, journals and other health-related documents. Web search engines are the most visible information retrieval applications.

The effective retrieval of relevant health information is directly affected by two factors: the *user task* and the *logical view of the documents*. The user task may be information retrieval or information browsing. Classic information retrieval systems (such as web interfaces) normally allow information retrieval alone, while hypertext systems provide quick browsing. Modern

digital library and Web interfaces might attempt to combine these tasks to provide improved retrieval capabilities.

The logical view of the document is provided by representative keywords or index terms, which are frequently used historically to represent documents in a collection. In modern computers, retrieval systems adopt a full text logical view of the document. However, with very large collections, the set of representative keywords may have to be reduced. This process of reduction or compression of the set of representative keywords is called *text operations* (or transformation).

3.2 The Retrieval Process

The retrieval process for health data is the same as for any other data. To describe the retrieval process, we use a simple and generic software architecture as shown in figure 1 below. Steps in the Retrieval Process are the following:

- *definition* of the text database (specification of document, operation and text model)
- text operations *transform* original documents and *generate* a logical view of documents
- database manager *builds* an index of the text (using the database Manager Module)
- the retrieval process is *initiated*
- the user *specifies* a user need, which is *described* and *transformed* by same text operations applied to the text
- *query operations* (which provides a system representation for the user need) are

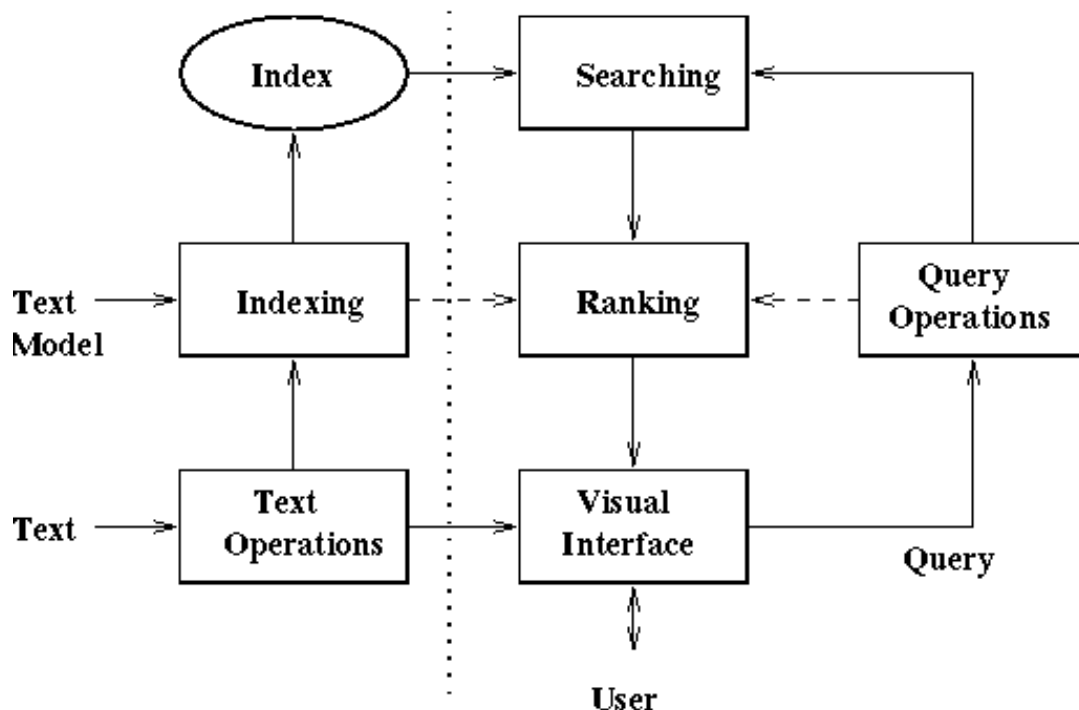


Figure 1: The Retrieval Process

- the query is then *processed* to obtain the *retrieved documents*
- the retrieved documents are *ranked* according to a *likelihood* of relevance
- user *examines* the set of ranked documents in the *search* for useful information
- user might *pinpoint* a subset of the documents of interest and *initiate* a user feedback cycle
- the system *uses* the documents selected by the user in such a cycle to *change* the query formulation (this modified query may be a better representation of the real user need)

3.3 Retrieval of Health Information

The movement towards evidence-based medical practice makes explicit the need for access to current best evidence to improve health. Advances in electronic technologies have made health information more available, but availability may not affect the rate of use of evidence in practice

Healthcare professionals and healthcare providers need access to the latest research to help them take care of their patients or help them improve their health and medical knowledge. On the other extreme, health care consumers and patients also need access to health information to do a lot of things including ascertaining a specific disease or medical condition, a particular medical treatment or procedure, diet, nutrition and supplements, exercise or fitness, prescription and non-prescription drugs, a particular doctor or hospital, health insurance, alternative medicine or treatments, mental health issues and environmental health hazards.

Health information means research evidence on health matters from a reliable source. Electronic access to the latest health information means being able to find and read articles and other materials using a computer and an Internet connection. Both health providers and consumers might read this information on the computer screen or in paper form. They may have training on how to find health information or they may not.

4.0 Conclusion

In this unit you have studied how to retrieve health data and information. You also learnt the retrieval process and how to retrieve health information.

5.0 Summary

In this unit, information retrieval is the science of searching for documents, for information within documents and for metadata about documents, as well as that of searching relational databases and the World Wide Web. The retrieval process for health data is the same as for any other data. We use a simple and generic software architecture to describe the retrieval process.

6.0 Tutor-Marked Assignment

1. Enumerate on health data and information retrieval
2. Itemize the retrieval process
3. Explain how to retrieve health information.

7.0 References/Further Readings

1. Bath, P.A. (2004) Review of: William Hersh, *Information retrieval: a health and biomedical perspective* (2nd ed.) New York, NY: Springer, 2003 *Information Research*, **9**(2), review no. R117 [Available at: <http://informationr.net/ir/reviews/revs117.html>]
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Module 3 Components of Health Data Management Systems

Unit 1 Inputs to the Health Care Systems

Unit 2 Processes of the Health Care Systems

Unit 3 Outputs from the Health Care Systems

UNIT 1 INPUTS TO THE HEALTH CARE SYSTEMS**CONTENTS**

1.0 Introduction

2.0 Objectives

3.0 Overview of Components of Health Data Management Systems

3.1 Health information system coordination and leadership

3.2 Health information system information policies

3.3 Health information system financial and human resources

3.4 Health information system infrastructure

4.0 Conclusion

5.0 Summary

6.0 Tutor-Marked Assignment

7.0 References/Further Readings

1.0 INTRODUCTION

In this unit you will consider what constitutes the inputs into health data management systems.

2.0 OBJECTIVES

After going through this unit, you should be able to:

- give an overview of the components of health data management systems
- explain what constitutes the inputs into health data management systems

3.0 OVERVIEW OF COMPONENTS OF HEALTH DATA MANAGEMENT SYSTEMS

Health Data Management Systems, Health Management Information Systems or Health Information System are one and the same thing. They are systems used to collect, analyze, retain, retrieve and evaluate health information. The World Health Organisation defined health information system as a system that incorporates all the data needed by policy makers, clinicians and health service users to improve and protect population health.

Health Data Management Systems are not an end in themselves but a support for the management and delivery of health services. Therefore, they should be able to anchor the relational interaction between the health services resources and disease patterns or health needs and subsequent strengthen of the health systems.

In 2007, the World Health Organisation (WHO) drafted a framework to guide efforts to strengthen health systems. This framework identified six components needed to establish, sustain, and strengthen a health system, while allowing it to provide needed services, universal access to those services, and universal coverage of health care benefits. These components are:

Service delivery, Financing, Medical Products and Technologies, Health Information System, Leadership and Governance, Health Workforce.

The fourth component, *Health Information System* is used to mean the production, analysis, dissemination, and use of reliable and timely information on health determinants, health systems, and health status. Its goal of health information system is to produce relevant information that health system stakeholders can use for making transparent and evidence-based decisions for health system interventions. So health information system performance is measured not only on the quality of data produced, but on evidence of the continued use of data to improve health system performance, to respond to emergent threats, and to improve health.

The health information system can be divided into six components, which are further subdivided into its inputs, processes and outputs. These components, each of which interact with the other to produce better information for better decisions and better health are: health information system resources, indicators, data sources, data management, information product, and dissemination and use. Here, inputs refer to resources, while processes touch on how indicators and data sources are selected and data is collected and managed. Outputs deal with the production, dissemination and use of information.

Inputs to the Health Care Systems

The components of the health information system composing the input are the resources. The health information system resources include the legislative, regulatory and planning frameworks required to ensure a fully functioning health information system, and the resources that are prerequisites for such a system to be functional. Such resources involve personnel, financing, logistics support, information and communications technology (ICT), and coordinating mechanisms within and between all the six components.

3.1 Health information system coordination and leadership

Developing and strengthening health information systems depends upon how key units and institutions including ministry of health central health information unit, disease surveillance and control units, and the central statistics office function and interact. These are responsible for designing, strengthening or supporting data collection, transmission, analysis, and reporting and other dissemination. Institutional analysis can be useful in identifying constraints that undermine policy or hamper the implementation of key strategies for developing the information system.

The coordination and leadership of the health information system done mainly by the stakeholders represented by health ministry with help from the academia and other non-governmental bodies in order to guide the development and maintenance of the health information system, and to ensure that data is shared across programmes and institutions.

It is recommended that the country health information system environment encourages local innovation and entrepreneurship among stakeholders. A national health information system strategic plan is also essential for this coordination. This will guide health information system investments, with indications of the timeline and anticipated activities budget to be completed in the short term (1–2 years), intermediate (3–9 years) and long term (10 years and beyond).

3.2 Health information system information policies

The legal and regulatory contexts in which health information is generated and used are important as they enable mechanisms to be established to ensure data availability, exchange, quality and sharing. Legislation and regulation are particularly significant in relation to the ability of a health information system to draw upon data from both the private and public health services, as well as non-health sectors. Particular attention to legal and regulatory issues is needed to ensure that non-state health-care providers are integral to the health information system, including the use of accreditation where appropriate.

A legal framework can also define the ethical parameters for data collection, and information dissemination and use. The health information policy framework should identify the main actors and coordinating mechanisms, ensure links to programme monitoring, and identify accountability mechanisms. There is an institutional policy defining the respective roles of health and statistics institutions to ensure the independence of data from external influences, and to facilitate accountability.

3.3 Health information system financial and human resources

The investment levels needed to ensure a sound health information system can vary according to a country's overall level of development. Estimates of the annual cost of a comprehensive health information system range from US\$ 0.53 to US\$ 2.99 per capita. Improvements to health information systems also require attention to be given to the training, deployment, remuneration and career development of human resources at all levels.

At national level, skilled epidemiologists, statisticians and demographers are needed to oversee data quality and standards for collection, and to ensure the appropriate analysis and utilization of information. At peripheral levels, health information staff are accountable to data collection, reporting and analysis. Too often, such tasks are given to overburdened care providers who see this as an unwelcome additional task that detracts from their primary role.

Deploying health information officers within large facilities and districts (as well as at higher levels of health-care systems) results in significant improvements in the quality of data reported and in the understanding of its importance by health-care workers.

Appropriate remuneration is essential to ensure the availability of high-quality staff and to limit attrition. Within statistics offices, measures should be taken to retain well-trained staff. Establishing an independent or semi-independent statistics office should allow for better remuneration and subsequent retention of high-level staff. Targeted capacity development is needed, and training and educational schemes is used to address human resource development in areas such as health information management and use, design and application, and epidemiology. Such training should be for all levels of competency, ranging from the pre-service training of health staff and continuous education, to public health graduate education at the Masters and PhD levels.

3.4 Health information system infrastructure

The infrastructural needs of the health information system can be as simple as pencils and paper or as complex as fully integrated, web-connected, ICT. At the level of the most basic record keeping, the health information system needs the ability to store, file, abstract and retrieve records. Many countries describe overflowing storerooms filled with mouldering patient records, facility logbooks and paperwork that is never sorted or analysed.

Emerging technologies can help countries to dramatically increase their storage and performance capacities and accelerate the processing timeframes previously required. As a result, the availability, quality, dissemination and use of health-related data can be radically improved by ICT.

While information technologies can improve the amount and quality of the data collected, communications technology can enhance the timeliness, analysis and use of information. A communications infrastructure is therefore needed to fully realize the potential benefits of information that may already be available.

Health managers are expected to have access to an information infrastructure that includes computers, e-mail and Internet access. Although access to the Internet is increasingly essential, basic telephone (landline or mobile) facilities still remain highly useful. Similarly, national and regional statistics offices should be equipped with transport and communications equipment to enable the timely collection and compilation of data at subnational levels.

In many healthcare settings, computers are already used in discrete vertical health information programmes and electronic medical records systems, resulting in many non-compatible systems being used within countries or regions. This often aggravates rather than alleviates duplication and overlap. However, coherent capacity building in electronic and human resources throughout the health system is a far more effective and cost-efficient approach. This must be supported by clear data-management policies that protect privacy and confidentiality.

4.0 Conclusion

In this unit you have studied the overview health data management system components. The constituents of the input into health data management systems were considered as well.

5.0 Summary

In this unit, Health Data Management Systems are systems used to collect, analyze, retain, retrieve and evaluate health information. The components of the health information system composing the input are the resources. Developing and strengthening health information systems depends upon how key units and institutions including ministry of health central health information unit, disease surveillance and control units, and the central statistics office function and interact.

The legal and regulatory contexts in which health information is generated and used are important as they enable mechanisms to be established to ensure data availability, exchange, quality and sharing. The investment levels needed to ensure a sound health information system

can vary according to a country's overall level of development. The infrastructural needs of the health information system can be as simple as pencils and paper or as complex as fully integrated, web-connected, ICT.

6.0 Tutor-Marked Assignment

1. Write briefly on the overview of the components of health data management systems
2. Explain what constitutes the inputs into health data management systems

7.0 References/Further Readings

1. World Health Organisation, *Framework and Standards for Country Health Information Systems*, Second edition, 2008, Health Metrics Network, World Health Organization, Geneva, Switzerland.
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UNIT 2 PROCESSES OF THE HEALTH CARE SYSTEMS

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Processes of the Health Care Systems
- 3.1 Health Information Indicators
- 3.2 Health Information Data Sources
- 3.3 Health Information Data Management
- 4.0 Conclusion
- 5.0 Summary
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1.0 INTRODUCTION

In this unit you will consider what constitutes the processes of the health information system.

2.0 OBJECTIVES

After going through this unit, you should be able to:

- explain what constitutes the processes of the health information system
- enumerate on the health information indicators
- itemize the various data sources
- discuss briefly health information management.

3.0 PROCESSES OF THE HEALTH CARE SYSTEM

Processes of the health information system involves how *indicators* and *data sources* are selected as well as how *data* is collected and *managed*. A core set of indicators and related targets for the three domains of health information is the basis for a health information system plan and strategy. Indicators need to encompass determinants of health; health system inputs, outputs and outcomes; and health status.

Data sources can be divided into two main categories: population-based approaches (censuses, civil registration and population surveys) and institution-based data (individual records, service records and resource records). It is noted that a number of other data-collection approaches and sources do not fit neatly into either of the above main categories but can provide important information that may not be available elsewhere. These include occasional health surveys, research, and information produced by community based organizations (CBOs).

Then data management covers all aspects of data handling from collection, storage, quality-assurance and flow, to processing, compilation and analysis. Specific requirements for periodicity and timeliness are defined where critical – as in the case of disease surveillance.

3.1 Health Information Indicators

3.1.1 Domains of Health Information

The boundaries of a health information system are not confined to the healthcare setting alone and overlap with information systems in other fields. Health information systems should offer data for various needs, including information for the provision of services to individual clients, statistics for planning and managing health services, and measurements for formulating and assessing health policy.

The three major domains of health information are determinants of health, health system and health status. Core indicators are needed to assess change in these three major domains.

Indicators of *determinants of health* include socioeconomic, environmental, behavioural, demographic and genetic determinants or risk factors. Such indicators characterize the contextual environments in which the health system operates. Much of the information is generated through other sectors, such as agriculture, environment and labour.

Health system indicators include inputs to a health system and related processes such as policy, organization, human resources, financial resources, health infrastructure, equipment and supplies. There are also output indicators such as health service availability and quality, as well as information availability and quality. Finally there are immediate health system outcome indicators such as service coverage and utilization.

Health status indicators include levels of mortality, morbidity, disability and wellbeing. Health status variables depend upon the efficacy and coverage of interventions and determinants of health that may influence health outcomes independently of health service coverage. Health status indicators should be available stratified or disaggregated by variables such as sex, socioeconomic status, ethnic group and geographical location in order to capture the patterns of health in the population.

3.1.2 Defining core indicators

The core indicators of a health system reflect changes over time in each of the three health information domains. As with any indicator, health indicators should be valid, reliable, specific, sensitive and feasible/affordable to measure. They must also be relevant and useful for decision-making at data-collection levels, or where a clear need exists for data at higher levels. Carefully selected and regularly reviewed core indicators are vital to strengthening a health information system and can be viewed as the backbone of the system, providing the minimum information package needed to support macro and micro health system functions.

The main challenge will be to identify a small set of indicators. Individual programme areas will each have a defined “minimal” list of indicators, often at the instigation of external partners and donors. When combined, these indicators can create a huge burden in terms of data collection, analysis and interpretation. A rational selection of a minimum set of core health indicators is therefore essential.

A framework for choosing core indicators is needed to ensure that they make the comprehensive

monitoring and evaluation of health and health systems possible. This framework should identify key management functions and strategic decisions, and then classify them according to whether they involve inputs/resources, processes, outputs and results. When choosing an indicator and its attributes (such as frequency of measurement and level of disaggregation) consideration must be given to national and subnational measurement capacities – indicators for which no statistic can be generated will be of little use.

3.2 Health Information Data Sources

Health system data are usually generated either (figure 2):

1. directly from *populations* (population-based sources) or
2. from the operations of health and other *institutions* (institution-based sources).

Population-based sources generate data on all individuals within defined populations and include total population census, civil registration and population surveys. The common feature for all these data sources is their relation to the whole population, not only to groups using institutional services. Such data sources can either be continuous and generated from administrative records (such as civil registers) or periodic (such as cross-sectional household surveys).

Institution-based sources generate data as a result of administrative and operational activities. These activities are not confined to the health sector and include police records (such as reports of accidents or violent deaths), occupational reports (such as work-related injuries), and food and agricultural records (such as levels of food production and distribution). Within the health sector, the wide variety of health service data includes morbidity and mortality data among people using services; services delivered; drugs and commodities provided; information on the availability and quality of services; case reporting; and resource, human, financial and logistics information.

Most data on the provision of clinical services or health status at the time of clinical encounters are generated “routinely” during the recording and reporting of services delivered. Health facility surveys provide another important methodology for collecting data on health services and for validating routine health service data by observing service delivery, inspecting facilities, interviewing staff and clients, and reviewing archives.

An essential source of data for health decision-making is *health research*. Health research typically covers the following broad spectrum:

- biomedical;
- public health;
- health policy and systems;
- environmental health;
- social and behavioural sciences; and
- operations research into health ICT as part of general “science and technology.



Figure 2: Health Data Sources (adapted from Framework and Standards for Country Health Information Systems)

No single data-collection or research method can provide the broad range of health data required by any countries or state. The most appropriate data sources will depend upon the information required and the cost-effectiveness and feasibility of individual methods. Any effective country health data or information systems usually draw on a set of core data sources. The contribution of each source will vary due to differences in the types of data best collected. In many cases, using a combination of sources leads to better quality information while maintaining efficiency.

3.2.1 Population-based Sources

Censuses

The population and housing census is the primary information source for determining the size of a population and its geographical distribution, plus the social, demographic and economic characteristics of its people. Censuses is ideally held every 10 years, and can provide vital statistical data on population and housing situations.

From the health perspective, information on population numbers and distributions by age, sex and other characteristics is essential for national and local planning, estimating target population sizes and trends, and evaluating service-coverage rates and future needs. Information on major determinants and risk factors, such as poverty, housing conditions, water supply and sanitary facilities may also be included. The nature of the census allows for small-area estimation and disaggregation by key stratifiers, such as socioeconomic status. The census can also provide additional information on health and mortality.

Civil registration

Civil registration is the continuous, permanent, compulsory and universal recording of the occurrence and characteristics of vital events (live births, deaths, foetal deaths, marriages and divorces) and other civil status events pertaining to the population as provided by decree or regulation, in accordance with the legal requirements in each country.

The primary purpose of civil registration is the establishment of legal documents as required by law. However, the records generated also provide a major and most effective source of vital statistics on births, deaths and changes in marital status. When the civil registration system is coupled with medical certification of cause of death using the principles and standards set out in the *International Statistical Classification of Diseases and Related Health Problems (ICD)*, obtaining accurate data on cause of death is possible.

Civil registration provides information on size and characteristics of a population, live births over time, deaths by age and sex and others. Such information is invaluable for assessing and monitoring the health status of populations, and planning interventions. Unfortunately, in many settings, particularly low and lower middle income countries, civil registration is weak or non-existent and cannot serve as the source of vital statistics.

Population surveys

In many developing countries, population surveys are the single most important source of population health data. Of the 23 health-related MDG indicators, 17 are currently generated through household surveys, such as the USAID-supported Demographic and Health Surveys (DHS) and the UNICEF-supported Multiple Indicator Cluster Surveys (MICS).

Population surveys are used to generate data on:

1. child and maternal mortality and health, nutrition, service use, and knowledge and practices related to health care;
2. health status evaluations, descriptions and determinants;
3. knowledge, beliefs and practices related to disease prevention and transmission (especially of HIV);
4. household expenditures on health; and
5. inequalities in health outcomes and access to health services.

Population surveys conducted to assess non-health issues (such as incomes and expenditures, the labour force, agriculture or education) may also generate statistics on factors of major importance to human health.

3.2.2 Institution-based Sources

Resource records

Resource and administrative records focus on the quality, availability and logistics of health service inputs. This includes data on the density and distribution of health facilities, human resources for health, budgets and expenditures, drugs and other core commodities, and key services.

The minimum requirement is a database of health facilities and the key services they provide. Further development will involve mapping facilities, human resources, budgets and expenditures, core commodities and key services at national and district levels. This typically involves the use of Global Positioning System (GPS) equipment and Geographic Information System (GIS) software to determine the location of service delivery sites and administrative boundaries and place these on a computerized map.

Mapping the availability of resources, specific interventions, and disease patterns can then provide important data from an equity perspective, and promote efforts to ensure that needed interventions reach peripheral areas and do not remain concentrated in urban centres.

Information on human-resource levels and distributions of key staff is also essential and should be monitored at central, district and facility levels. Such data on doctors, paraprofessional clinicians, midwives, nurses, nurse auxiliaries and laboratory technicians should be complemented by further information such as health worker attrition through mortality, resignation and possibly migration, plus outputs from health-training institutions.

Service records

Service records cover not only the records of health service providers but also the records of events with important health consequences produced in other sectors. These include records made by the police, veterinary services, environmental health authorities, insurance companies and occupational health agencies. The type of events covered will include unintentional injuries, homicides, suicides, road traffic accidents, environmental and meteorological incidents and alerts on food and product safety. It is essential to capture the service statistics from the private sector and from community and civil society organizations as well as public sector institutions.

The focus of health service records is typically on subnational information used to manage health services. These records are based on service-generated data derived from health facilities and patient-provider interactions covering care offered, quality of care, treatments administered, and so on. A major characteristic and strength of health service statistics is their local use for facility management.

Individual records

Individual health records typically consist of:

- documentation of the provision of health services (for example, of growth monitoring, or antenatal and delivery care) to individual clients;
- case reports and disease records routinely produced by health workers (of consultation and discharge); and
- information held in special disease registries (such as those for cancer).

Such records should also include the notification and documentation of individual cases of disease and other health events captured by surveillance systems and vertical disease programmes. One of the main purposes of individual records is to help care providers to deliver health services to individuals in a facility, or through outreach activities in the community.

The content and format of individual records vary depending upon the services to be provided, which include:

- preventive services for children under 5 or pregnant women;
- acute curative care;
- follow-up of chronic diseases;
- inpatient care in a hospital setting;
- laboratory or radiographic examinations (requests and results); and
- referral of the patient to other care providers.

The outpatient management of many acute health problems is often recorded by the health provider using simple diagnostic and treatment notes, either on plain paper or simple medical record forms. These notes then act as a memory aid to the provider if the patient returns.

3.3 Health Information Data Management

Data Storage

Ensuring the proper storage and accessibility of all the routine paper health data recorded and collected through registers, cards, aggregation or reporting forms over the medium to long term will facilitate its validation (accuracy, timeliness, completeness and reliability); analysis of disease trends; assessment of quality of care; comparison of different service performance; and ultimately the equitable distribution of resources.

Patient medical records provide one of the best examples of the importance of data storage in the healthcare setting. These are vital in managing disease trajectory and for clinical decision-making in individual cases. Medical records should be classified and coded during (or immediately after) clinical visits, then properly kept in an appropriate location (archive) in a way that makes them easily retrievable.

Hospital and health-facility archives can vary in size from a single room to a dedicated floor. However, a well organized archive usually:

- restricts access to authorized staff to protect the confidentiality and privacy of the patient/client;
- codes the system to make records retrievable;
- follows clear procedures for record distribution and re-filing; and
- observing mandatory rules for the minimum period of maintenance and dispatch times at ward, hospital and facility level, and in national archives.

Data registers and reporting forms are filed and stored properly at each administrative level and classified according to date, geographical location, title and/or national code. The unified storage of different forms in a single setting facilitates retrospective investigations and studies, and supervisory activities.

Ensuring data quality

A wide range of policies and process are needed to ensure data quality. One guiding principle is to reduce the necessary amount of information to a “minimum dataset”. This will then reduce the

burden of data collection and this alone should improve data quality. Other management actions to improve data are regular local quality control and data-use checks, the use of clear definitions of data elements, up-to-date training, and frequent feedback to data collectors and users. When electronic communication facilities are available, data can be entered at decentralized locations to provide immediate reporting to all levels.

Strong health information systems ensure that data meet high standards of reliability, transparency and completeness. It is important to assess source data and the statistical techniques and estimation methods used to generate indicators. Building on the IMF Data Quality Assessment Framework (DQAF) and IMF General Data Dissemination System (GDDS), the following criteria can be used to assess the quality of health-related data and indicators:

- timeliness – the period between data collection and its availability to a higher level, or its publication;
- periodicity – the frequency with which an indicator is measured;
- consistency – the internal consistency of data within a dataset as well as consistency between datasets and over time; and the extent to which revisions follow a regular, well established and transparent schedule and process;
- representativeness – the extent to which data adequately represent the population and relevant subpopulations;
- disaggregation – the availability of statistics stratified by sex, age, socioeconomic status, major geographical or administrative region and ethnicity, as appropriate; and
- confidentiality, data security and data accessibility – the extent to which practices are in accordance with guidelines¹ and other established standards for storage, backup, transport of information (especially over the Internet) and retrieval.

Data processing and compilation

The procedures of data processing and compilation are meant for the extraction and integration of data. This process is composed of extracting data from data sources, ensuring data consistency and quality, and achieving conformity through data transformation so that data from separate sources can be used together. Data processing and compilation have been treated exhaustive in ? Module 2, Unit 3

4.0 Conclusion

In this unit you have studied what constitutes the processes of the health information system.

5.0 Summary

In this unit, processes of the health information system involves how *indicators* and *data sources* are selected as well as how *data* is collected and *managed*. A core set of indicators and related targets for the three domains of health information is the basis for a health information system plan and strategy. Indicators need to encompass determinants of health; health system inputs, outputs and outcomes; and health status.

6.0 Tutor-Marked Assignment

1. Explain briefly what constitutes the processes of the health information system

2. Enumerate on the health information indicators
3. Itemize the various data sources
4. Discuss briefly health information management

7.0 References/Further Readings

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UNIT 3 OUTPUTS FROM THE HEALTH CARE SYSTEMS

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Outputs from the Health Care System
 - 3.1 Information products
 - 3.2 Dissemination and use
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In this unit you will consider what constitutes the outputs from the health information system.

2.0 OBJECTIVES

After going through this unit, you should be able to:

- explain what constitutes the outputs into the health information system
- enumerate on health information products
- discuss briefly the dissemination and use of health information.

3.0 OUTPUTS FROM THE HEALTH CARE SYSTEMS

The main outputs from the health information system are *information production and dissemination and use of information*. In information production, data must be transformed into information that will become the basis for evidence and knowledge to shape health action. The value of health information can be enhanced by making it readily accessible to decision-makers (giving due attention to behavioural and organizational constraints) and by providing incentives for information use.

3.1 Information products

Information is produced from data only after data have been compiled, managed and analysed. This makes information evidence that can be used by decision-makers. The process of transforming data into information products has been covered in ? Module 2 Unit 2

3.2 Dissemination and use

3.2.1 Use of Information for Decision-Making

Information is used at various levels of the health system for health service and system management, planning, advocacy and policy development. Each level has a broad range of users from different technical disciplines and vocations with associated vocabularies and communication methods. WHO recommends that country information should be made a core part of the day-to-day management of health system planning and delivery. Thus, access and use should be integral to health information system strengthening activities.

The dynamic links between demand, supply and quality of information should be addressed by encouraging a culture in which information is demanded and its use promoted. In practical terms, this will require the establishment of institutional mechanisms and incentives to create a culture of evidence-based decision-making. Experience shows that the most effective mechanisms involve linking data/information to actual resource allocation (budgets) and developing indicator-driven planning.

One important function of the health information system is to connect data production with its use. Those responsible for collecting data should also benefit from its use. Users comprise those delivering care and managing and planning health programmes. More broadly, users include those financing health-care programmes both within countries (health and finance ministries) and externally (donors, development banks and technical support agencies). Users of health data are not confined to health-care professionals, managers or statisticians. Decision-making around country health priorities necessarily involves the wider community (including civil society) as well as policy-makers at senior levels of government.

Health-care planners and managers responsible for tracking epidemiological trends, and the response of the health system generally, need more detailed data than policy-makers who require it for broader strategic decision-making and investments.

3.2.2 Institutionalizing Information Use and Demand

It is simplistic to assume that a linear relation exists between evidence and policy – that good data will automatically lead to better decisions that will in turn result in enhanced health. In practice, no linear sequence necessarily exists from good data to better health.

Various types of data are obtained at different levels of the health system, to be used by several actors for many reasons. Providers generate and use information in the context of patient care; managers need data to enhance efficiency and effectiveness; planners rely on statistics for operational decisions; and policy-makers use information to prioritize and allocate resources.

At the level of clinical practice, good quality of care is greatly facilitated by well-kept records of patient characteristics and provider responses. Yet good clinical record-keeping remains far from universal. In a large and complex society, policy-making is fragmented and decisions are sometimes difficult to make because of the competing interests of different players and agencies. It has been postulated that the scarcity of evidence-based decision-making is not the result of technical issues related to data generation but of institutional and behavioural barriers that impede the effective use of information.

Certain interventions can be applied to improve the use of information. Examples of organizational and behavioural interventions for improving the use of information in decision-making and planning include:

- mechanisms linking data/information to actual resource allocation (budgets and expenditure);
- indicator-driven, short- (1 year) and medium-term (3–5 years) planning;

- organizational routines where managers are held accountable for performance through the use of results-based indicators at all levels of the health system;
- a programme addressing behavioural constraints to data use, for example through applying incentives for data use, such as awards for best service delivery performance, best/most-improved district or best health information system products/use; and
- a supportive organizational environment that places a premium on the availability and use of well-packaged and well-communicated information and evidence for decision-making.

4.0 Conclusion

In this unit you have studied what constitutes the outputs into the health information system.

5.0 Summary

In this unit, the main outputs from the health information system are *information production and dissemination and use of information*. In information production, data must be transformed into information that will become the basis for evidence and knowledge to shape health action. The value of health information can be enhanced by making it readily accessible to decision-makers (giving due attention to behavioural and organizational constraints) and by providing incentives for information use.

6.0 Tutor-Marked Assignment

1. Explain what constitutes the outputs into the health information system
2. Enumerate on health information products
3. Discuss briefly the dissemination and use of health information.

7.0 References/Further Readings

1. World Health Organisation, *Framework and Standards for Country Health Information Systems*, Second edition, 2008, Health Metrics Network, World Health Organization, Geneva, Switzerland.
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Module 4 Types of Health Data Management Systems

Unit 1 Overview of Types of Health Data Management Systems

Unit 2 Subject-based Health Care System

Unit 3 Task-based Health Care System

Unit 4 Administrative Health Care Systems

UNIT 1 OVERVIEW OF TYPES OF HEALTH DATA MANAGEMENT SYSTEMS**CONTENTS**

1.0 Introduction

2.0 Objectives

3.0 Overview of Types of Health Data Management Systems

3.1 Subject-Based Health Care Systems

3.2 Task-Based Health Care System

3.3 Administrative Health Care Systems

4.0 Conclusion

5.0 Summary

6.0 Tutor-Marked Assignment

7.0 References/Further Readings

1.0 INTRODUCTION

In this unit you will consider an overview of types of health data management systems.

2.0 OBJECTIVES

After going through this unit, you should be able to:

- describe an overview of types of health data management systems

3.0 OVERVIEW OF TYPES OF HEALTH DATA MANAGEMENT SYSTEMS

Health Data Management Systems or Health Information Systems are information management systems that capture and display data related to the delivery of health care services. A health information system is not just a system of patients' paper chart or most recently a system of computers and software. It includes clinical guidelines, medical terminology dictionaries, and interfaces the various diagnostic devices and other clinical and business information databases, such as laboratory, pharmacy and diagnostic imaging. It is also used for public health and medical research purposes.

The goal of a Health Data Management System or health information system is to check health quality by comparing perceptions of health services delivered with the expected standards and to provide timely and accurate information leading to better health care planning and improved diagnosis and more patients getting access to health services for an entire country.

A health information system usually describes one of these several separate subsystems containing data:

- Disease surveillance and outbreak notification.

- Data generated through household surveys.
- Registration of vital events and censuses (births, deaths and causes of death).
- Data collection based on patient and service records and reporting from community health workers, health workers and health facilities.
- Programme-specific monitoring and evaluation (example for TB, HIV/AIDS, and EPI).
- Administration and resource management (including budget, personnel, and supplies).

The function of a health information system is to bring together data from all these different subsystems, to share and disseminate them to the many different audiences for health information, and to ensure that health information is used rationally, effectively and efficiently to improve health action. A strong health information system is an essential component of sound programme development and implementation, and is a requirement for strategic decision making, providing the basis upon which improved health outcomes depend.

Health Information System is generally divided into the following types:

- Subject-based Information System
- Task-based Information System
- Care Access Internet System
- Administrative Health Care Systems

3.1 Subject-based Health Care Systems

A subject-based health information system is a system which is related to a particular thing in the organisation such as a patient or doctor. The most well-known subject-based health information system is the Patient Medical Record (PMR), which can be Paper-Based Medical Record (PBMR) or Electronic Medical Record (EMR). The PBMR is a patient's paper chart where information on a patient is recorded. The EMR is the electronic version of the PBMR that captures and stores information based on a patient's name or medical record number. It may also display information based on a physician's name. For example, a physician can view lists of all her patients who are currently in the hospital.

Another subject-based information health information system is the Master Patient Index (MPI). This type of system lists all the patients who have ever been treated in a hospital or clinic. Typically, the MPI system serves as the foundation database for all other patient-related systems, both clinical and administrative, such as patient scheduling, medical records, billing, claims processing and business decision support.

3.2 Task-based Health Care Systems

Task-based systems are those that capture and report information about specific health care-related tasks such as laboratory, diagnostic imaging and medication management (pharmacy) systems. These systems are driven by the master patient indexing (MPI) system and they capture information and copy it to the electronic health record system.

3.3 Administrative Health Care Systems

Administrative health care systems extract information from clinical systems and use it to manage daily operations, such as scheduling appointments and billing insurance carriers or patients for services rendered. Decision support systems extract data from various clinical and administrative systems and compile it in various ways to identify trends, analyze costs, or solve problem areas in operations. For example, an increase in the number of patients with a diagnosis of adult onset diabetes (Type II diabetes) may indicate that a health care provider must expand its diabetes education services.

Administrative health care systems sometimes called hospital information system (HIS) or financial Information Systems (FIS) are computer systems that manage mainly the business and administrative aspects of a hospital or a healthcare setting. Although the primary priority of healthcare institutions is to save lives and not making profits, they do acquire running costs from day to day operations; including purchases and staff payroll. Therefore, healthcare business activities can be quite complex and the introduction of Financial Information Systems aims to ease that daunting task that faces hospitals.

4.0 Conclusion

In this unit you have studied an overview of the types of health data management systems.

5.0 Summary

In this unit, Health Data Management Systems are information management systems that capture and display data related to the delivery of health care services. A health information system is not just a system of patients' paper chart or most recently a system of computers and software. It includes clinical guidelines, medical terminology dictionaries, and interfaces the various diagnostic devices and other clinical and business information databases, such as laboratory, pharmacy and diagnostic imaging. It is also used for public health and medical research purposes.

6.0 Tutor-Marked Assignment

1. Describe an overview of types of health data management systems

7.0 References/Further Readings

1. World Health Organisation, *Framework and Standards for Country Health Information Systems*, Second edition, 2008, Health Metrics Network, World Health Organization, Geneva, Switzerland.
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UNIT 2 SUBJECT-BASED HEALTH CARE SYSTEM

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Main Content
- 3.1 Patient Medical Record
- 3.2 Master Patient Index
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In this unit you will consider the subject-based information system and the various types.

2.0 OBJECTIVES

After going through this unit, you should be able to:

- describe an overview of the subject-based information system
- enumerate on the various types of patient medical records
- Discuss the important features of the master patient index

3.0 MAIN CONTENT

3.1 Patient Medical Record

3.1.1 *Paper-Based Medical Record*

The patient medical record (PMR) has traditionally been a paper record, which contains diverse data, accumulated over a single or multiple episodes where the patient interacted with the health system. The paper-based medical record (PBMR) is generally bundled into a single (occasionally multiple) file(s) and kept in a central repository often called the Medical Record Department.

The individual file is identified by a coding system that links patient demographics to a unique number called medical record number (MRN). Staff in the Medical Record Department are responsible for filing, updating, retrieving, and maintaining the PBMR. The PBMR will often contain details of hospital inpatient and outpatient admissions; hand-written file notes from medical, nursing, and allied health staff; results of laboratory, pathology, and imaging investigations; operation reports; and copies of correspondence sent to referring and local medical officers. In some instances, paper copies of imaging tests, operative findings, and endoscopy results will also be included.

Data contained in a PBMR are complex and diverse. At a simple level, these data can be separated into demographic and clinical historic information. Demographic data include details such as the patient's name, date of birth, the unique medical record number (MRN) or patient

identification number (PID), address and contact details, next-of-kin, mother's maiden name, and names/address/contact details of the referring doctors and/or local medical practitioners.

Meanwhile, the clinical historic data include information relevant to the medical domain such as: the current clinical diagnosis, medical history, medications, allergies, examination findings, treatment plan, results of investigations, nursing observations, and treatment plans and notes from other allied health professionals including physiotherapists, occupational therapists, and social workers.

Over time, the clinical historic data contain sequential events that chronicle the development of various diseases and the investigations, complications, and treatment of these disease states. Although reports of various investigations may be found appended to the PBMR, in the past it was not possible to include images from the various tests that were performed. For example, departments of medical imaging would maintain their own physical archive of previous X-rays, which were linked to the PBMR by the medical record number.

Problems with PBMR include different sets of handwriting with varying degrees of legibility, abbreviations, and author identification, difficulty in reading handwritten notes. It has been suggested that handwritten reports or notes, manual order entry, nonstandard abbreviations, and poor legibility are sources of medical error

However, the most appropriate tool to capture medical data is still to some extent controversial because in some surveys, interpretation of information from paper was ranked higher than that from a computer display. Some studies suggest that a paper-based approach is a more effective method of communication between clinicians and there is high satisfaction level, but this is surely tempered by the quality and legibility of the notes.

Another consideration is that a paper-based approach is still regarded in legal circles as the primary data source, and insurance companies rely on a PBMR to evaluate appropriateness of admission and length of stay.

3.1.2 Electronic Medical Record

The improvements in information technology coupled with the increasing volume of data that need to be stored in a medical record and the need for these data to be transferred across multiple sites where different medical services are accessed by patients have become important reasons for seeking an electronic solution to manage these critical data.

An electronic medical record (EMR), which is the electronic equivalent of a patient's paper chart (or PBMR), is a computerized medical record created in an organization that delivers health care, such as a hospital and or other health institutions. Electronic medical records tend to be a part of a local stand-alone health information system that allows storage, retrieval and modification of records.

An Electronic Medical Record is an assembly of standardized documents, ordered and concise, directed to the register of actions and medical procedures; a set of information compiled by

physicians and other health professionals; a register of integral facts, containing all the information regarding patient health data; and a follow up of the risk values and clinical profile.

It is obvious that effective management, processing, and communication of patient data in medical records to the relevant staff improves the quality of healthcare. So it is reasonable to think that if a digital medical record (Electronic Medical Record) were able to overcome the limitations of a Paper-Based Medical Record, it follows that the quality of care should also improve.

Important considerations in EMR are the quantity and complexity of the data, the marked diversity in the information infrastructure and databases within and across hospitals (public, private, and university-based) and the community (local general practice, medical center, rural or community center). Heterogeneity in system and infrastructure within and across health institutions is also likely to grow because of lack of uniform terminologies and standards as more institutions embrace digital medical record.

Features of Electronic Medical Records

The Electronic Medical Record (EMR) is a subject-based electronic medical record that includes health documentation for a patient covering all services provided within an enterprise. In the earliest phase of an EMR, the main effort is to convert patient records into digital format for archiving by scanning reports, letters, and other parts of the record.

A more advanced form of EMR requires the application of processing and analytic methods. In this, the first step in the development of an EMR is the introduction of a standard terminology, classification, and rules for communication. Though, lack of a uniform terminology for even common disorders has been a longstanding issue in health care.

There are certain common attributes of an EMR. The digital nature of an EMR allows data contained within it to be searched and retrieved. Other attributes include system quality (e.g. accessibility, usability), information quality (e.g. readability, accuracy), and decision support (e.g. data analysis).

Accessibility describes the degree to which a system is reliable. Although the EMR has the potential to be accessed by multiple users at multiple locations, these same users are then dependent upon the electronic medium for critical data. An unreliable system could lead to medical errors.

Usability describes the ability of the EMR to be integrated into the clinical workflow in a seamless manner. Everyone is familiar with poor software that does not deliver the desired outcomes or delivers them at such a cost in time and frustration that users no longer use the software.

Legibility is not an issue with an EMR although scanned documents can be problematic. However, a criticism remains that complex data are often easier to read from a piece of paper

rather than from a computer monitor. Data storage via electronic media is far less space- and weight-expensive.

Accuracy is difficult to define in this context but can be defined as the degree (measured as a percentage) of correctness, completeness, and inclusiveness in a dataset. Computer-defined fields, when appropriately designed for data entry, provide a mechanism for an EMR to be more comprehensive than a PBMR.

Benefits of an Electronic Medical Record

The main benefits of an electronic medical record include the following:

- Ready access, rapid searching, secure storage, and safe transmission of patient data.
- Replacement of paper-based medical records which can be incomplete, fragmented (different parts in different locations), hard to read and (sometimes) hard to find.
- Provision of a single, shareable, up to date, accurate, rapidly retrieveable source of information, potentially available anywhere at any time.
- Requirement of less space and administrative resources.
- Potential for automating, structuring and streamlining clinical workflow.
- Provision of integrated support for a wide range of discrete care activities including decision support, monitoring, electronic prescribing, electronic referrals radiology, laboratory ordering and results display.
- Maintenance of a data and information trail that can be readily analysed for medical audit, research and quality assurance, epidemiological monitoring, disease surveillance
- Support for continuing medical education

Barriers of Electronic Medical Records

Widespread implementation of EMRs has been hampered by many perceived barriers including:

- Technical matters (uncertain quality, functionality, ease of use, lack of integration with other applications)
- Financial matters - particularly applicable to non-publicly funded health service systems (initial costs for hardware and software, maintenance, upgrades, replacement)
- Resource issues, training and re-training; resistance by potential users; implied changes in working practices.
- Certification, security, ethical matters; privacy and confidentiality issues
- Doubts on clinical usefulness
- Incompatibility between systems (user interface, system architecture and functionality can vary significantly between suppliers' products)

3.2 Master Patient Index

Master Patient Index (MPI), a database, is an electronic medical record system that maintains a unique index (or identifier) for every patient registered at a health care institution. The MPI is used by each registration application (or process) within the health care institution to ensure a patient is logically represented only once and with the same set of registration demographic / registration data in all systems and at an organizational level. It can be used as enterprise tool to

assure that vital clinical and demographic information can be cross-referenced between different facilities in a health care system.

An MPI correlates and cross-references patient identifiers and performs a matching function with high accuracy in an unattended mode. It is considered an important resource in a healthcare facility because it is the link tracking patient, person, or member activity within an organization and across patient care settings.

The MPI system is characterized by a structured format that permits instantaneous access to medical patient records and eliminates all paper medical records, allowing accurate, quick documentation and retrieval of patients' visits.

MPI has been created to identify patients encountered at healthcare facilities. MPI has the responsibility of administering the generation and utilization of appropriate health information that assists in decision making, management of health services and their delivery. The MPI functionalities are fostered on the national and sub-national levels, and are based on an explicit analysis of the needs of information.

Some recommended core data elements for master patient indexing and searching records include:

- Internal patient Identification
- Patient Name
- Date Of Birth
- Date Of Birth qualifier
- Gender
- Race
- Ethnicity
- Address
- Alias/pervious name
- Facility identification
- Universal patient identifier (if available)
- Account number
- Admission date
- Discharge date
- Service type
- Patient disposition

4.0 Conclusion

In this unit you have studied what subject-based information system is.

5.0 Summary

In this unit, patient medical record (PMR) has traditionally been a paper record, which contains diverse data, accumulated over a single or multiple episodes where the patient interacted with the health system. The paper-based medical record (PBMR) is generally bundled into a single

(occasionally multiple) file(s) and kept in a central repository often called the Medical Record Department.

Master Patient Index (MPI), is an electronic medical record system that maintains a unique index (or identifier) for every patient registered at a health care institution. The MPI is used by each registration application (or process) within the health care institution to ensure a patient is logically represented only once and with the same set of registration demographic / registration data in all systems and at an organizational level.

7.0 Tutor-Marked Assignment

1. Describe an overview of the subject-based information system
2. Enumerate on the various types of patient medical records
3. Discuss the important features of the master patient index

7.0 References/Further Readings

1. World Health Organisation, *Framework and Standards for Country Health Information Systems*, Second edition, 2008, Health Metrics Network, World Health Organization, Geneva, Switzerland.
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UNIT 3 TASK-BASED HEALTH CARE SYSTEMS

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Task-based Health Care System
- 3.1 Laboratory Information System
- 3.2 Radiology Information System
- 3.3 Pharmacy Information System
- 3.4 Nursing Information System
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In this unit you will consider the task-based information system and the various types under it.

2.0 OBJECTIVES

After going through this unit, you should be able to:

- describe in detail what task-based information is all about
- discuss the various types of task-based information system

3.0 TASK-BASED HEALTH CARE SYSTEM

Task-based systems are those that capture and report information about specific health care-related tasks such as laboratory, diagnostic imaging and medication management (pharmacy) systems. These systems are driven by the master patient indexing (MPI) system and they capture information and copy it to the electronic health record system.

3.1 Laboratory Information System

A laboratory information system (LIS) is a computer information system that manages laboratory information for all the laboratory disciplines such as clinical chemistry, haematology and microbiology, immunology, blood bank (Donor and Transfusion Management), surgical pathology, anatomical pathology, flow cytometry and microbiology. It is a class of software that receives, processes, and stores information generated by medical laboratory processes.

Laboratory Information Systems provide modules for sending laboratory tests order to the instruments through its multiple instrument interfaces, some are known as to have as many as five hundred, track those orders and then capture the results as soon as they become available.

The result can then be analysed and a report the generated from it. This report can be sent off for printing at a specific point, sent off to other systems either to be added to patient's electronic medical record or for billing.

Features of laboratory Information Systems include:

- *Patient management* - Patient details like the admission date, admitting physician, and admission number can be maintained by a Laboratory Information System. Other information concerning the patient's specimen including the ordering physician, department ordering the test, specimen type, date/time of collection and receipt, and the initials of the collecting technician, can also be managed in a Laboratory Information System.
- *Decision Support* - Laboratory orders can be cross-referenced against classification codes such as ICD-9 and LONIC, and also verified that the correct test is being carried out.
- *Patient Tracking* - A patient tests can be catalogued and called up when the need to review them comes up.
- *Quality Assurance* - Ensures that the tests are carried out using the currently available standards.

Basic operation

Laboratory Information Systems (LISs) are often part of an integrated informatics solution which involves many disparate applications. Use of an LIS contributes significantly to the overall care given to patients. The LIS is used in inpatient and outpatient settings and in many cases is designed to support both.

From an outpatient/ambulatory perspective, LIS interaction frequently begins after a physician has arrived at an initial diagnosis. For example, a patient enters the hospital looking pale and complaining of fatigue. The physician, suspecting anemia, might decide to order a complete blood count (CBC). In an inpatient setting when that patient is admitted into the hospital, the system is used to order tests, provide specimen processing assistance, receive the results from analyzers and deliver lab reports to the attending physician.

Order entry and check in

An order is placed in the system usually by a physician or laboratory scientist. The order or lab request contains a list of tests to be performed on one or more patient specimens (e.g., blood or urine). In many cases, each order is tracked with a unique identifier. This identifier (which is usually a number) is often referred to as Lab ID.

Most LIS systems can be configured to download the specimen data to an analyzer either after the order is placed or when a specimen is received in a testing lab. When the specimen's barcode is read by the instrument, the unique ID from the specimen label is matched with the order previously downloaded to the instrument. This system is often called "Batch Download".

When results of lab tests are available, they are entered into the system manually or automatically downloaded from an instrument. Once these results are double-checked by the Medical Laboratory Scientist or autoverified, they are released. Released results are often automatically printed or written on lab reports which are delivered to the attending physician or clinic. Results must be verified and released to attending physicians as soon as possible.

Lab Reports are the final output of all LIS systems and, in many cases, the primary LIS interaction with healthcare professionals outside the lab. The reports can either be printed or faxed in paper-based labs; they can be delivered via email or file in paperless labs. The degree to which an LIS supports customizable lab reports and flexibility in modes of delivery of results is one major factor in determining its success in the marketplace.

3.2 Radiology Information System

A radiology information system (RIS) is a computer system that assists radiology services in the storing, manipulation and retrieving of information. It is a computerized database, which generally consists of patient tracking and scheduling, result reporting and image tracking capabilities.

RIS complements Hospital Information Systems (HIS) and is critical to efficient workflow to radiology practices. It is especially useful for managing radiological records and associated data in multiple locations and is often used in conjunction with a picture archiving and communication system (PACS) to manage work flow and billing.

Some of the areas that can be addressed by radiology information systems are:

- **Patient Management:** radiology information systems can be used to manage a patient's entire workflow within the radiology department, images and reports can be added to and retrieved from electronic medical records (EMRs) and viewed by the authorized radiology staff.
- **Scheduling:** Patient appointments for inpatients and outpatients can be scheduled when an order is received. Functions for scheduling the various available radiology staff with the allocated time slots can also be handled by the radiology information system.
- **Patient Tracking:** The patient can be tracked from admission to discharge, with all the radiology procedures carried out recorded. This would include the patient's past, present and future appointments.
- **Results Reporting:** Reports concerning the results of an individual patient, a group of patients or a particular procedure can be generated using a radiology information system.
- **Film Tracking:** Individual films can be tracked.
- **Billing:** An RIS facilitates detailed financial record-keeping, electronic payments and automated claims submission.

3.3 Pharmacy Information System

Pharmacy Information Systems (PIS) are complex computer systems that have been designed to meet the needs of the pharmacy department. Through the use of such systems, pharmacists can supervise and have inputs on how medication is used in a hospital.

Some of the activities which Pharmacy Information Systems have been employed in pharmacy departments include:

- **Clinical Screening:** The Pharmacy Information System can assist in patient care by the monitoring of drug interactions, drug allergies and other possible medication-related complications.

When a prescription order is entered, the system can check to see if there are any interactions between two or more drugs taken by the patient simultaneously or with any typical food, any

known allergies to the drug, and if the appropriate dosage has been given based on the patient's age, weight and other physiologic factors. Alerts and flags come up when the system picks up any of these.

- **Prescription Management:** The Pharmacy Information System can also be use to mange prescription for inpatients and/or outpatients. When prescription orders are received, the orders are matched to available pharmaceutical products and then dispensed accordingly depending on whether the patient is an inpatient or outpatient.

It is possible to track all prescriptions passed through the system from who prescribed the drug, when it was prescribed to when it was dispensed.

It is also possible to print out prescription labels and instructions on how medication should be taken based on the prescription.

- **Inventory Management:** Pharmacies require a continuous inventory culture in order to ensure that drugs do not go out of stock. This is made even more difficult when there are multiple dispensing points. When don manually it is very difficult to maintain an accurate inventory.

Pharmacy Information Systems aid inventory management by maintaining an internal inventory of all pharmaceutical products, providing alerts when the quantity of an item is below a set quantity and providing an electronic ordering system that recommends the ordering of the affected item and with the appropriate quantity from approved suppliers.

- **Patient Drug Profiles:** These are patient profiles managed by the Pharmacy Information System and contain details of their current and past medications, known allergies and physiological parameters. These profiles are used for used for clinical screening anytime a prescription is ordered for the patient.
- **Report Generation:** Most Pharmacy Information Systems can generate reports which range from determining medication usage patterns in the hospital to the cost of drugs purchased and /or dispensed.
- **Interactivity with other systems:** It is important that Pharmacy Information Systems should be able to interact with other available systems such as the clinical information systems to receive prescription orders and financial information system for billing and charging.

3.4 Nursing Information System

Nursing information systems (NIS) are computer systems that manage clinical data from a variety of healthcare environments, and made available in a timely and orderly fashion to aid nurses in improving patient care.

To achieve this, most Nursing Information Systems are designed using a database and at least one nursing classification language such as North American Nursing Diagnosis (NANDA), Nursing Intervention Classification (NIC) and Nursing Diagnosis Extension and Classification (NDEC).

Some of the features that are provided by Nursing Information Systems include:

- **Patient Charting:** A patient's vital signs, admission and nursing assessments, care plan and nursing notes can be entered into the system either as structured or free text. These are stored in a central repository and retrieved when needed.
- **Staff Schedules:** Nurse can self schedule their shifts using scheduling rules provided in shift modules. The shifts can later be confirmed or changed by a scheduling coordinator or manager. Shift modules are designed to handle absences, overtime, staffing levels and cost-effective staffing.
- **Clinical Data Integration:** Here clinical information from all the disciplines can be retrieved, viewed and analysed by nursing staff and then integrated into a patient's care plan.
- **Decision Support:** Decision support module can be added to Nursing Information Systems, and they provide prompts and reminders, along with guides to disease linkages between signs/symptoms, etiologies/related factors and patient populations. Online access to medical resources can also be made available.

There are benefits to be enjoyed by implementing Nursing Information Systems and they include:

- **Improved workload functionality:** Staffing levels and appropriate skill mix per shift can be more easily determined by the shift modules. This leads to less time spent in designing and amending rosters.
- **Better care planning:** Time spent on care planning is reduced, while the quality of what is recorded is improved. This makes for more complete care plans and more complete assessments and evaluations.
- **Better drug administration:** Electronically prescribed drugs are more legible, thus making it less likely that drugs would be wrongly administered to patients.

Despite the benefits Nursing Information Systems have to offer, they are not widely used in healthcare and where they have been installed, they have not been readily accepted. This could probably be due to lack of adequate training and failure to educate the end-user on what the reasons are for its introduction. Moreover, very little research has been done to determine the cost benefits or cost effectiveness of such information systems.

4.0 Conclusion

In this unit you have studied the task-based information system and the various types under it.

5.0 Summary

In this unit, task-based systems are those that capture and report information about specific health care-related tasks such as laboratory, diagnostic imaging and medication management (pharmacy) systems. These systems are driven by the master patient indexing (MPI) system and they capture information and copy it to the electronic health record system.

6.0 Tutor-Marked Assignment

1. Describe in detail what task-based information is all about
2. Discuss the various types of task-based information system

7.0 References/Further Readings

1. World Health Organisation, *Framework and Standards for Country Health Information Systems*, Second edition, 2008, Health Metrics Network, World Health Organization, Geneva, Switzerland.
2. World Health Organisation, 1993, *Guidelines for the development of health management information systems*, World Health Organization, Geneva, Switzerland.
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UNIT 4 ADMINISTRATIVE HEALTH CARE SYSTEMS

CONTENTS

- 1.0 Introduction
- 2.0 Objectives
- 3.0 Administrative Health Care Systems
- 3.1 Features of the Administrative Health Care Systems
- 3.2 Benefits of Administrative Health Care System
- 4.0 Conclusion
- 5.0 Summary
- 6.0 Tutor-Marked Assignment
- 7.0 References/Further Readings

1.0 INTRODUCTION

In this unit you will study administrative health care systems with its features and benefits.

2.0 OBJECTIVES

After going through this unit, you should be able to:

- discuss administrative health care systems
- describe the benefits of administrative health care systems
- enumerate on the features of administrative health care systems.

3.0 ADMINISTRATIVE HEALTH CARE SYSTEMS

Administrative health care systems extract information from clinical systems and use it to manage daily operations, such as scheduling appointments and billing insurance carriers or patients for services rendered. Decision support systems extract data from various clinical and administrative systems and compile it in various ways to identify trends, analyze costs, or solve problem areas in operations. For example, an increase in the number of patients with a diagnosis of adult onset diabetes (Type II diabetes) may indicate that a health care provider must expand its diabetes education services.

Administrative health care systems sometimes called hospital information system (HIS) or financial Information Systems (FIS) are computer systems that manage mainly the business and administrative aspects of a hospital or a healthcare setting. Although the primary priority of healthcare institutions is to save lives and not making profits, they do acquire running costs from day to day operations; including purchases and staff payroll. Therefore, healthcare business activities can be quite complex and the introduction of Financial Information Systems aims to ease that daunting task that faces hospitals.

3.1 Features of the Administrative Health Care Systems

Features of the Administrative Health Care Systems include:

- Payroll: Handles all the recurring and non-recurring payments and deductions for employees. All recurring transactions can be automatically generated each payroll period with

non-recurring transactions such as overtime added to the payroll upon approval. It is also possible to maintain employee pay rates, entitlements, full salary movements and payroll histories.

- **Patient Accounting:** This concentrates on financial transactions generated during a patient's visit to the hospital. These include inpatient and outpatient charges, doctors' fees generated across the hospital, the cost of procedures, operations and medications.
- **Accounts Payable:** Handles the processing of invoices and payments within the hospital.
- **Accounts Receivable:** This provides support for and the maintenance of the records of all clients, invoices and payments.
- **General Ledger:** This handles the collection, processing and reporting of financial data generated by all transactions, enabling a current, accurate and instant view of the financial status of the hospital at any point in time.
- **Fixed Asset Management:** This deals with asset data retention and depreciation forecasting. The transfer of fixed assets between locations, cost centres or departments; reclassification of assets and reassessments of asset values can functions that can be done by the Financial Information System.
- **Claims Management:** Manages all claims that are made to insurance companies
- **Contract Management:** Keeps track of all ongoing contracts.

3.2 Benefits of Administrative Health Care System

- Easy Access to Patient Data to generate varied records, including classification based on demographic, gender, age, and so on. It is especially beneficial at ambulatory (out-patient) point, hence enhancing continuity of care. As well as, Internet-based access improves the ability to remotely access such data.
- It helps as a decision support system for the hospital authorities for developing comprehensive health care policies.
- Efficient and accurate administration of finance, diet of patient, engineering, and distribution of medical aid.
- Improved monitoring of drug usage, and study of effectiveness. This leads to the reduction of adverse drug interactions while promoting more appropriate pharmaceutical utilization.
- Enhances information integrity, reduces transcription errors, and reduces duplication of information entries.

4.0 Conclusion

In this unit you have studied administrative health care systems, their features and benefits.

5.0 Summary

In this unit, administrative health care systems extract information from clinical systems and use it to manage daily operations, such as scheduling appointments and billing insurance carriers or patients for services rendered. Decision support systems extract data from various clinical and administrative systems and compile it in various ways to identify trends, analyze costs, or solve problem areas in operations.

6.0 Tutor-Marked Assignment

1. Discuss administrative health care systems

2. Describe the benefits of administrative health care systems
3. Enumerate on the features of administrative health care systems.

7.0 References/Further Readings

1. World Health Organisation, *Framework and Standards for Country Health Information Systems*, Second edition, 2008, Health Metrics Network, World Health Organization, Geneva, Switzerland.
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