Draft Study Material

Tele Health Service Coordinator

(Qualification Pack: Ref. Id. HSS/Q5801)

Sector: Health & Paramedical Science

(Grade XI)

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PSS CENTRAL INSTITUTE OF VOCATIONAL EDUCATION
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Preface

Vocational Education is a dynamic and evolving field, and ensuring that every student has access to quality learning materials is of paramount importance. The journey of the PSS Central Institute of Vocational Education (PSSCIVE) toward producing comprehensive and inclusive study material is rigorous and time-consuming, requiring thorough research, expert consultation, and publication by the National Council of Educational Research and Training (NCERT). However, the absence of finalized study material should not impede the educational progress of our students. In response to this necessity, we present the draft study material, a provisional yet comprehensive guide, designed to bridge the gap between teaching and learning, until the official version of the study material is made available by the NCERT. The draft study material provides a structured and accessible set of materials for teachers and students to utilize in the interim period. The content is aligned with the prescribed curriculum to ensure that students remain on track with their learning objectives.

The contents of the modules are curated to provide continuity in education and maintain the momentum of teaching-learning in vocational education. It encompasses essential concepts and skills aligned with the curriculum and educational standards. We extend our gratitude to the academicians, vocational educators, subject matter experts, industry experts, academic consultants, and all other people who contributed their expertise and insights to the creation of the draft study material.

Teachers are encouraged to use the draft modules of the study material as a guide and supplement their teaching with additional resources and activities that cater to their students' unique learning styles and needs. Collaboration and feedback are vital; therefore, we welcome suggestions for improvement, especially by the teachers, in improving upon the content of the study material.

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Date: 20 June 2024

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Module 1 — Introduction of Tele Health Services

Introduction

A Telehealth services coordinator, a service and component important in the Healthcare sector which is going rapidly over the years. India has a shortfall of 6 million health care professionals and India is far behind the global standards in term of availability of health care services. The job role of Telehealth services coordinator is one such area where the shortage of this kind of manpower is felt.

Learning Outcomes

After completing this module, you will be able to:

- Explain anatomy and physiology of human body system.
- Discuss about the healthcare delivery system in India.
- Distinguish between private, public and non-profit healthcare delivery systems.
- Differentiate between various healthcare services- primary, specialty, hospice, emergency, etc.
- Explain the role and responsibilities of the Telehealth team at different sites and how to operate electronic equipment.
- Discuss the challenges of various types of Telehealth services and clinical applications used in the services.

Module Structure

Session 1: Tele Health services
Session 2: Tele Medicine
Session 3: Human Body Structure and Functions
Session 4: Human Anatomy and Physiology
Session 5: Healthcare Delivery System
Session 6: Hospital
Session 7: Hospital Management Information System

Session 1: Tele Health services

Telehealth is the distribution of health-related services and information via electronic information and telecommunication technologies. It allows long-distance

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patient and physician contact, care, advice, reminders, education, intervention, monitoring, and remote admissions.

Telehealth services are sometimes used as a synonym, or are used in a more limited sense to describe remote clinical services, such as diagnosis and monitoring. When rural settings, lack of transport, a lack of mobility, conditions due to outbreaks, epidemics or pandemics, decreased funding, or a lack of staff restrict access to care, Telehealth may bridge the gap as well as provide distance-learning, meetings, supervision, and presentations between practitioners; online information and health data management and healthcare system integration.

Fig.1.1 Tele health service

Telehealth could include two physician discussing a case over video conference a robotic surgery occurring through remote access, physical therapy done via digital monitoring instruments, live feed and application combinations, tests being forwarded between facilities for interpretation by a higher specialist, home monitoring through continuous sending of patient health data, client to practitioner online conference or even videophone interpretation during a consult with clients.

Definition

Teleconferencing means meeting by means of telecommunication. It is a general term for connecting people between two or more places by electronics. There are at least six types of teleconferencing: audio, audio graphic, computer, video, business television (BTV), and distance education. The methods used in the technology differ, but common factors contribute to the shared definition of teleconferencing.

Fig.1.2 Tele health communication

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Types of Telecommunication

1. Audio Telecommunication

Sometimes this is simply called voice conference calling. Connects people interactively over long distances through telephone lines. Distance learning can be conducted by audio conference. In fact, it is one of the most underutilized, yet cost-effective methods available for education. Telehealth service coordinator should receive training on how to best use audio conferencing to enhance other forms of distance learning.

2. Audio graphics Teleconference

Use narrow-band telecommunication channels to transmit visual information such as graphics, alpha-numeric, documents, and video images as an adjunct to voice communications. The equipment used during Teleconsultation includes electronic tablets, computers, fax, slide projectors, optical graphic scanners.

3. Computer Teleconference

Uses telephone lines to connect two or more computers and modems. Using electronic mail (e-mail), reports, updates, and newsletters can be sent to anyone on a local area network (LAN) or wide area network (WAN). Computer conferencing is an emerging field for distance health education. The medical institutions offer credit programs entirely through computers. Where doctors communicate directly with patients and provide them medical treatment at home. Additionally, students receive study materials and workbooks via mail and teachers upload courses, lectures, and other information.

4. Video Telecommunication

Video telecommunication in the health sector, often referred to as Telehealth or telemedicine, involves using video technology to provide healthcare services remotely. It's like bringing the doctor's visit to your screen.

Benefits of using telecommunication

Telecommunication has brought about significant advantages in the health sector, revolutionizing the way healthcare services are delivered. Here are some key benefits:

- **Remote Consultations:** Patients can access healthcare services from the comfort of their homes, especially beneficial for those in remote or rural areas. This increases accessibility to medical care.
- **Time and Cost Savings:** Telehealth eliminates the need for patients to travel to healthcare facilities, saving time and reducing travel expenses. This is particularly crucial for individuals with chronic conditions who require frequent follow-up appointments.

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- **Specialized Care Access:** Telecommunication allows patients to consult with specialists regardless of geographical distances. This is particularly important for rare conditions where specialists may be located in specific regions.
- **Emergency Consultations:** In emergency situations, telecommunication enables swift communication between healthcare professionals, allowing for quick assessments and coordination of care even when physical presence is not possible.
- **Follow-up Care:** Telehealth facilitates regular follow-up appointments without the need for patients to visit the clinic. This is particularly beneficial for post-surgery or post-treatment monitoring.
- **Health Monitoring Devices:** Integration with telecommunication allows for remote monitoring of patients using wearable devices or specialized medical equipment. This is valuable for managing chronic diseases and maintaining overall health.
- **Reduced Healthcare Costs:** Telehealth can contribute to cost savings by minimizing the need for physical infrastructure and reducing the burden on healthcare systems.
- **Health Education and Training:** Telecommunication is used for medical education and training, allowing healthcare professionals to participate in remote learning sessions and stay updated on the latest advancements.
- **Increased Efficiency:** Healthcare providers can streamline administrative tasks and share patient information more efficiently through telecommunication, leading to improved overall efficiency in healthcare delivery.
- **Patient Engagement:** Telehealth encourages patient engagement by providing easier access to healthcare resources, educational materials, and facilitating communication between patients and healthcare providers.

Disadvantages of using telecommunication

While telecommunication brings about numerous advantages, it's not without its challenges. Understanding these disadvantages is essential for mitigating potential challenges and optimizing the benefits of telecommunication. Balancing technological advancements with considerations for privacy, security, and human connection is crucial for a well-rounded approach to communication. Here are some disadvantages associated with the use of telecommunication:

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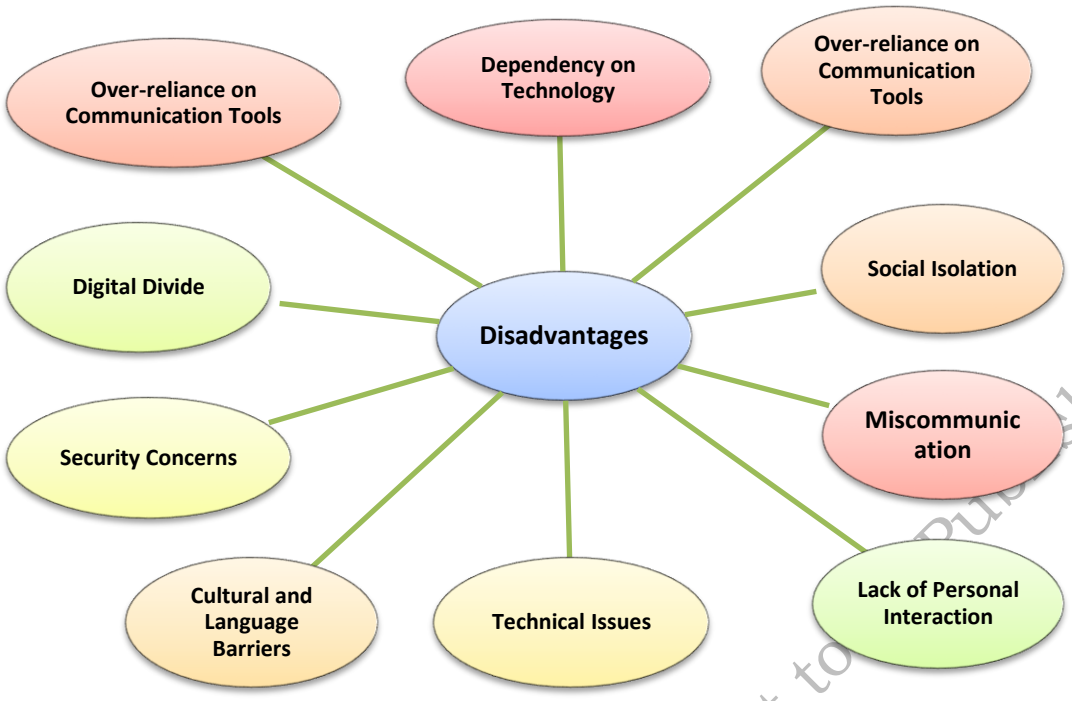

Fig.1.3 Disadvantages of Telecommunication

Technical Issues: Telecommunication relies on technology, and technical glitches such as poor internet connectivity, dropped calls, or software malfunctions can disrupt communication.

Security Concerns: Transmitting sensitive information over telecommunication channels raises concerns about data security and privacy. Unauthorized access, data breaches, and cyber-attacks are potential risks.

Digital Divide: Not everyone has equal access to telecommunication technology. The digital divide creates disparities in access to healthcare, education, and employment opportunities, among other essential services.

Lack of Personal Interaction: Telecommunication cannot fully replicate the richness of face-to-face communication. The absence of physical presence may lead to a lack of personal connection and understanding.

Dependency on Technology: Society's increasing reliance on telecommunication makes it vulnerable to disruptions. Any technological failure or outage can have widespread consequences, affecting various aspects of daily life.

Miscommunication: Non-verbal cues, which are an essential part of communication, may be lost in telecommunication. This can lead to misunderstandings, misinterpretations, and a lack of clarity in communication.

Over-reliance on Communication Tools: Depending too heavily on communication tools can lead to a decrease in interpersonal skills and face-to-face

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communication abilities, as individuals may become more accustomed to virtual interactions.

Health Concerns: Prolonged use of electronic devices for telecommunication can contribute to health issues such as eye strain, musculoskeletal problems, and mental health issues related to screen time and digital fatigue.

Social Isolation: Despite connecting people over long distances, excessive reliance on telecommunication may contribute to social isolation, as individuals may spend more time communicating virtually than engaging in in-person social interactions.

Cultural and Language Barriers: Telecommunication may exacerbate cultural and language barriers, especially in global communication. Differences in time zones, language proficiency, and cultural norms can impede effective communication.

Activities

Activity 1: - Discuss: Even though most of the Indian population still lives in villages/rural areas but there are more hospitals in urban areas why? Give reasons.

Activity 2: - Visit sub-canters, primary health care and community health care centres near your locality observe the facilities available there and healthcare workers. Collect pictures.

Check Your Progress

A. Fill in the Blanks.

1. Telehealth is the distribution of health-related services and information via .....
2. Telehealth may bridge the gap as well as provide..... meetings, supervision.
3. Teleconferencing means meeting by means of .....

B. Short Answers Questions.

1. Define Telehealth services?
2. What is the importance of Telehealth services in modern time?
3. Write the type of telecommunication and their importance in telehealth care services?

C. Long Answers Questions.

1. Explain benefits of telecommunication in Telehealth care services?
2. Write the disadvantages of using telecommunication?

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Session 2: Tele Medicine

India is the world's seventh largest country, spanning around 3.2 million square kilometres. This huge South Asian country endowed with diverse landscapes such as mountain regions, deserts, green plains, and the far-flung hilly regions in Jammu & Kashmir, Uttaranchal, the North Eastern Region, and the outlying islands of Andaman's and Lakshadweep. One of the priorities of the Health Administration has always been to offer the bare minimum of healthcare to India's rural population, which is scattered ``across vast geographical areas. Despite significant advancements in the medical sector, the benefits are still available to the affluent few who dwell primarily in urban areas in today's world.

Fig.1.4 Telemedicine Application

We now have the ability to extend the benefits of advanced medical sciences to remote and inaccessible locations due to the advancement in communication technology, particularly satellite communications (SatCom) integrated with information technology. It is well known that 75% of qualified doctors work in urban areas, despite the fact that the largest portion of India's population resides in rural areas. The Indian Space Programme is motivated by the country's developmental requirements and has made an effort to reach out to the people. National space systems, which are composed of advanced communication and remote sensing satellites, are being used to meet a variety of national demands, such as communications and natural resource management.

ICTS offer the potential to address some of the obstacles that developed and developing countries confront in providing accessible, cost-effective, and high-quality health care services. Telemedicine makes use of information and communication technologies (ICTs) as well as space-based facilities to overcome geographical obstacles and improve access to health-care services. This is especially advantageous for helping develop rural and underserved communities, which have typically had limited access to health care. Telemedicine makes it easier to provide medical services from afar. It is a cost-effective approach for providing speciality healthcare to rural patients in the form of greater access and lower costs,

as well as reduced professional isolation for rural doctors. Ordinary practitioners are able to achieve extraordinary feats with the help of telemedicine.

What is Telemedicine?

"The delivery of healthcare services, where distance is a critical factor, by all healthcare professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of healthcare providers, all in the interests of advancing the health of individuals and their communities"

The Telemedicine system includes tailored hardware and software at both the patient and specialist doctor's ends, as well as diagnostic devices such as an ECG, X-ray, and pathology microscope/camera at the patient's end. They are linked via a Very small Aperture Terminal (VSAT) system, which is managed by ISRO's Network Hub station.

Medical scans and other data about patients can be transferred to specialist doctors via satellite link in the form of Digital Data Packets using a Telemedicine system consisting of a simple computer with communication devices, either in advance or in real time.

Fig.1.5 Telehealth services

These data packets are delivered to the specialist centre, where they are reconstructed using Telemedicine image technology along with other information so that the specialist doctor can study the data, diagnose, interact with the patient, and recommend the best treatment during a Video Conference with the patient.

Thus, a telemedicine system allows a specialist doctor and a patient separated by long distances to see and communicate visually. This allows the expert doctor to analyze the patient's physical and psychological status and propose treatment advice. In this manner, the systematic use of Information and Communication Technologies to clinical practice significantly expands the healthcare system's outreach.

Telemedicine Technology - Evolution

- Point to Point System: One patient end connects to one specialist doctor within the hospital via a point-to-point system.
- Point to Multi point System: One patient end at a time connects to any of the specialist doctors' ends within the hospital.
- Multi-point to Multi-point System: Several patients' ends simultaneously connect to different doctors' ends at different hospitals at different geographical locations.

Telemedicine Technology Adoption in Major Areas

- Tele-consultation, Tele-treatment, Tele-diagnosis The patient consults specialist with his or her local doctor and receives a treatment plan.
- Tele-education, Tele-training Training for doctors and paramedics from a higher-level hospital and institution for Continued Medical Education.
- Tele-monitoring - Regular monitoring for intensive and emergency care.
- Tele-support- Assistance in the event of a disaster.

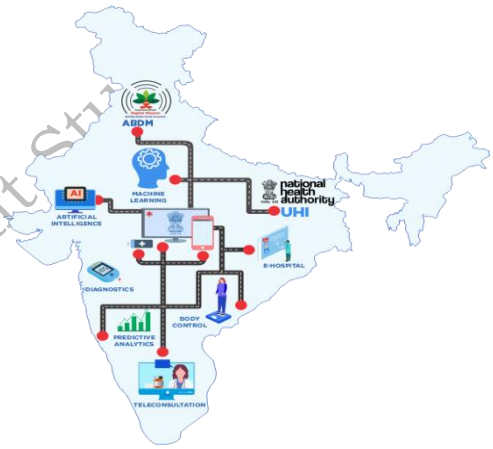

Fig.1.6 India roadmap digital Health

Potential roadblocks to telemedicine adoption

Telemedicine applications have had various degrees of success, despite their potential. Telemedicine has yet to be systematically used in the health care system to deliver everyday healthcare in both developed and developing countries, and few pilot initiatives have been able to sustain themselves after initial seed financing had expired. The complexity of human and cultural variables is one such obstacle. Some patients and healthcare personnel are hesitant to adopt service models that are different from traditional or indigenous practices, while others lack the ICT literacy

needed to properly use telemedicine. Language and cultural disparities between patients (especially those who are under served) and service providers are the most difficult to overcome.

Increased access to health care is one of the most significant benefits of telemedicine. Providing health care access to communities in such underserved countries has the potential to help address previously overlooked needs and have a positive impact on health services.

Telemedicine in India

India is a big country, having a population of around 121 million people. As a result of this, equal distribution of healthcare resources has repeatedly seen to be a key consideration in public health management. Adding to this is the current tendency of medical services being concentrated in cities and towns (including 75 percent of the population of doctors), away from rural India, where 68.84 percent of the population lives.

In 2001, ISRO (Indian Space Research Organization) made a modest beginning in telemedicine in India with a Telemedicine Pilot Project, linking Chennai's Apollo Hospital with the Apollo Rural Hospital at Aragonda village in the Chittoor district of Andhra Pradesh. ISRO, the Department of Information Technology (DIT), the Ministry of External Affairs, the Ministry of Health and Family Welfare, and state governments all made significant contributions to the development of telemedicine services in India.

The WHO recommended a doctor-to-population ratio of 1:1000, however India's current ratio is barely 1:1500. Because training new doctors takes time and money, the doctor-to-patient ratio is likely to be low for a long time. The active telemedicine services in different parts of the country help to compensate for this shortfall.

The Ministry of Health and Family Welfare and the Department of Information Technology are jointly responsible for telemedicine services in the country. The Telemedicine Division of the Ministry of Health and Family Welfare, Government of India, has set up a National Telemedicine Portal to carry out a greenfield project on e-health by establishing a National Medical College Network (NMCN) for e-Education and a National Rural Telemedicine Network for e-Healthcare delivery.

Village Resource Center (VRC): ISRO devised the VRC idea to deliver tele-education, telemedicine, online decision support, interactive farmers' advisory services, tele fishery, e-governance services, weather services, and water management, along with other services. The VRCS not only serve as learning centers, but they also connect to speciality hospitals, providing expert doctors' services to the communities. Almost 500 VRCS have been established across the country.

AROGYASREE is another internet-based mobile telemedicine conglomerate that connects hospitals, medical professionals, and rural mobile units/clinics. The project is the brainchild of the Indian Council of Medical Research (ICMR). They collaborated with a team of scientists from the University of Karlsruhe in Germany on the design of an ECG jacket that could be used to continuously monitor a patient's ECG without needing hospitalization.

Telemedicine can be classified into 5 basic types

A. According to the timing of the information transmitted

- Real-time or synchronous telemedicine (when the sender and recipient are both online at the same time and information is transferred 'live').
- Asynchronous telemedicine or store-and-forward (where the sender stores the information databases and sends it to the receiver at a convenient point of time, and the receiver can review the data according to his convenience).
- Remote Monitoring, often known as self-monitoring or self-testing, is a type of telemedicine. Remote monitoring employs a variety of technical devices to keep track of a patient's health and clinical symptoms from afar.

B. According to the interaction between the individuals involved

- Health professional to Health professional (giving them easier access tospecialty care, referral and consultation services).
- Health professional to patient (providing healthcare to the unreachedpopulation by giving them direct access to a medical professional).

Applications of Telemedicine

1. Educational

- **Tele-education:** A flexible and interactive long-distance learning programme that allows for easier training and updates on latest breakthroughs in treatment procedures that are more accurate and successful.
- **Tele-Conferencing:** Discussion and interaction amongst doctors in a virtual room environment during workshops, conferences, seminars, or continuing medical education programmes.
- **Tele-Proctoring:** Using advanced video-conferencing equipment, surgical trainees are mentored and evaluated from a distance.

2. Healthcare Delivery

- **School-Based Health Centers:** Assists with the management of chronic illnesses such as bronchial asthma, diabetes, and obesity. Telemedicine allows a school nurse to consult an expert medical opinion from a distance.

- **Correctional Facilities:** Handle inmates' healthcare needs without incurring the costs and risks of inmate transportation or requiring a specialty doctor to enter.
- **Mobile Health Clinics:** Provides immediate access to a physician or healthcare specialist who is located elsewhere.
- **Shipping and Transportation:** Assists in avoiding evacuations and unplanned detours in the event of a medical emergency.
- **Industrial Health:** Medical management and triage guidance are provided on - site.

3. Healthcare Management

- Tele-health care: The use of ICTs for preventative and promotional healthcare; it is segmented into tele consultation and tele-follow up.
- Tele-home health care: With the use of a Computer Telephone Integrated (CTI) system, monitor patients from a central station (Remote patient monitoring) for 24-hour vitals monitoring.
- Tele-ophthalmology, tele-psychiatry, tele-cardiology, and tele-surgery are examples of specialties.
- Tele-radiology and tele-endoscopy are forms of diagnostic services.

4. Screening of Diseases

- Diabetic screening project by MDRF: The Chunampet Rural Diabetes Prevention Project.
- Ophthalmology screening by Aravind Hospitals at Andipatti village.

5. Disaster Management

- In a disaster-stricken area when all other modes of access have been disrupted, a mobile and portable telemedicine system with satellite connectivity and tailored telemedicine software is ideal.

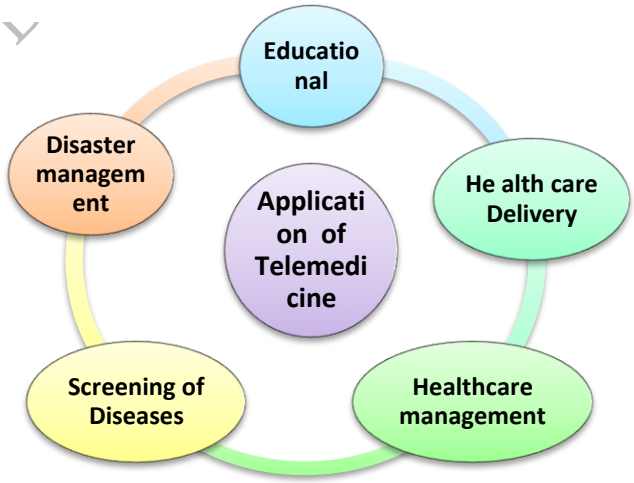

Fig.1.7 Application of Telemedicine

Examples: in

- NASA tele-medicine services were provided during the 1985 Mexico City earthquake and the 1988 Soviet Armenia earthquake.
- Amrita hospital tele-medicine services were provided during the 2004 Tsunami disaster.

Activities

Activity 1: - Use the internet and collect the recent developments in the field of Telemedicine in India.

Check Your Progress

A. True or False.

a) Current doctor population ratio in India is only 1:1000. (T/F)
b) Telemedicine service in the country comes under the jurisdiction of Ministry of Health and Family Welfare only. (T/F)
c) AROGYASREE is another internet-based mobile telemedicine conglomerate that integrates multiple hospitals, mobile medical specialists and rural mobile units/clinics. (T/F)
d) Village Resource Centres act as learning centres and provide connectivity to specialty hospitals, thus bringing the services of expert doctors to the villages. (T/F) e)
e) In Real time or synchronous telemedicine, the sender is online and receiver Receive the information according to his convenience. (T/F)
f) In asynchronous telemedicine, the sender stores the information databases and sends it to the receiver at a convenient point of time, and the receiver can review the data according to his convenience. (T/F)

B. Short Answer Questions.

a) What do you understand by Telemedicine?
b) Enumerate types of telemedicine.
c) Enlist applications of Telemedicine.
d) Explain the scenario of telemedicine in India.

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Session 3: Human Body Structure & Functions

The excitement of understanding about body parts and its functions has developed from the beginning of life when humans have experienced hunger and thirst at birth. A trained Home Health Aide can understand the demands of a prescribed medical condition, only if it is aware of the basic structure and function of the human body. This unit provides brief knowledge about basic human structure and various body systems and the role of nutritive food in the growth and development of human body.

Anatomy

It is a branch of medical science in which deals with the structure of human body and the functional relation of different parts to each other is known as Anatomy. Human anatomy is basic essential science of human body structure, size and shape. It is very important for understanding the functions of the body. The human anatomy is divided into gross anatomy and micro anatomy. Gross anatomy is, in which human organs are studied in a gross form that can be seen with the naked eye with normal vision. Microscopic anatomy involving the in-depth study of human structure and organs that are made up of tissue and cells and using a microscopic examination scale for study, and is also called cytology and histology.

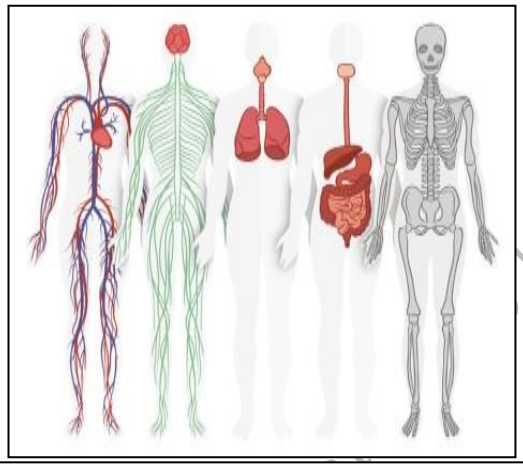

Fig. 1.8 Diagram of the Human body organ system

Physiology

It is a branch of medical science in which relates to the study of the functions of organs and explains how different organs and systems work together. All organs functioning as a single unit is called physiology. Human physiology is the science of the physical, mechanical and biochemical functions of normal human tissues and organs. The study of anatomy and physiology is interrelated as anatomy deals with the study of structure and physiology with the study of organs functioning.

There are medical terms which are used in the study of anatomy and physiology:

- Histology - the study of Tissues
- Cytology - Study of Cells
- Myology - Study of body Muscles
- Osteology - Study of Bones
- Arthrology - Study of Joints
- Neurology - Study of Nervous System
- Splanchnology - Study of Visceral Organs
- Cardiology - Study of heart
- Dermatology - Study of skin
- Endocrinology - Study of the endocrine gland
- Gastroenterology - Study of the stomach and intestine
- Gynecology - Study of the female genital organ
- Ophthalmology - Study of the eye

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- Urology - Study of the renal system
- Hepatology - Study of the liver
- Hematology - Study of the blood

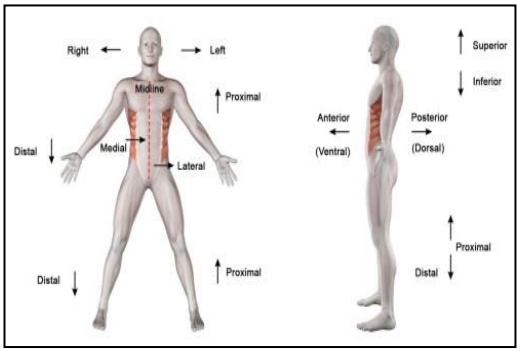

Fig. 1.9 Region of Human Body

Specific medical terminology is a system of words that are helpful to medical health workers and describe specific medical aspects and diseases. Often chosen to highlight the relative location and structure and the human anatomy can be described as per the following:

Median Line: The central plane which divides the body into two halves i.e. right and left.

Medial	:	Nearby to the median line.
Lateral	:	Away from the median line.
Anterior	:	Towards the front surface of the body, also called Ventral.
Posterior	:	Towards the back surface of the body, also called Dorsal.
Superior	:	Nearer to the head, also called skull.
Inferior	:	Nearer to the foot, also called Caudal.
Proximal	:	Position that is closer from the trunk of the body.
Distal	:	Position that is further from the trunk of the body.
Superficial	:	Nearer to the skin and surface.
Deep	:	Deeper from the skin and surface.

Human Cell and Tissue

Composition of Body

The human body is organized into different levels that start from very small and basic and come together to form the whole body whose different parts work together. At the simplest level, a body consists of atoms.

Cell

Just like the buildings are built of bricks, our body is made of unit structures called cells. Cells are specialized to form various tissues and organs of the body. So it is necessary to know briefly about the structure of the cell. The cell is the basic unit of body structure. It is outer layer of cell membrane like a brick of a wall which is

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the outer covering. All cells for its living and functioning needs food, water and oxygen. The cells metabolize food and oxygen, they release carbon dioxide and other wastes. The cell consists of a cell membrane. It surrounds the cell and helps to hold its shape. The nucleus is the control centre. It directs the cell's activities. The cytoplasm surrounds the nucleus. Organelles are structures that are suspended in the cytoplasm. Protoplasm refers to all structures, substances and water within the cell. Generally human cell containing organelles have their own membrane covering the cytoplasmic fluid and organelles present inside the cell are:

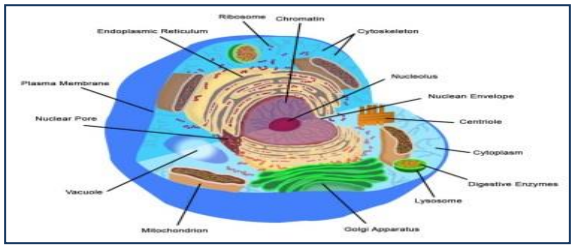

Fig. 1.10 Animal cell

In Human Cell

A cell is a mass of living material enclosed by a wall called cell membrane. It has the following parts.

Cell membrane: Forms the outer wall for the cell. Exchange of substances takes place between the protoplasm inside and tissue fluid outside the cell.

Mitochondria: Mitochondria are also called the powerhouse of the cell. This provides energy to the cell in the form of ATP (Adenosine Triphosphate) to perform various chemical activities to sustain life.

Protoplasm: Is the mass of living substance inside the cell membrane. It consists of small globular and more solid portion called the Nucleus near the middle and fluid component called cytoplasm.

Cytoplasm: Is a jelly like substance consisting chemically of protein, lipids, inorganic salts, water and cell inclusions. Cytoplasm presents the appearance of a network called spongioplasm; the more fluid portion which occupies the meshes of the reticulum is called the hyaloplasm. The pigment granules, fat globules, watery fluid in vacuoles and glycogen present in the protoplasm constitute the paraplasm.

Centrosome: Is a small spherical mass of protoplasm and lies near the nucleus. One or two minute particles called centrioles are present in its interior. These play an important part in cell division.

Chondriosomes: Consist of minute particles of rods, granules or filaments called mitochondria. They are the store-houses of energy.

Golgi bodies: Consists of a group of canal like structures near the nucleus. Protein synthesized in the cell is concentrated or processed here for secretion.

Endoplasmic reticulum: It is a network of membranous structure scattered throughout the cytoplasm. These are concerned with protein synthesis.

The Nucleus

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It is a round or oval mass in the protoplasm. Usually four distinct parts may be differentiated in the nucleus.

- Nuclear membrane bounds the nucleus and separates it from the cytoplasm.
- Nucleoplasm is the fluid component containing granules called chromatin.
- Nucleolus is a highly refracting body in the nucleoplasm.
- Chromatin granules, when condensed, form rod like structures called chromosomes. These chromosomes carry the genes which carry hereditary characters of the individuals. There are 46 chromosomes in the human cell.
- During the process of growth and maintenance cells divide to form new generations. This process of reproduction mainly takes place in two ways in the human body.
- Mitosis: Here the cell divides into 2, each of which have the same number of chromosomes and other structures.
- Meiosis: The result of this type of division is 4 cells. This type of division takes place in germ cells and the resulting cells have only half the number of chromosomes.

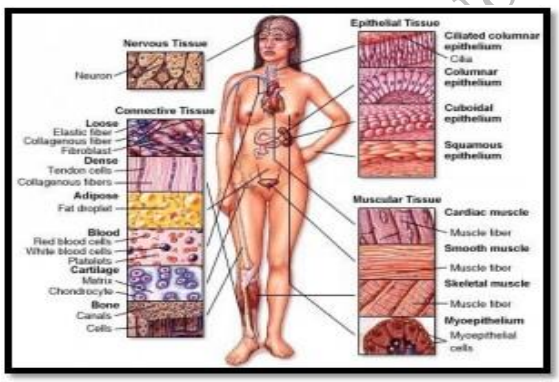

Fig. 1.11 Tissues of human Body

Basic Tissues

Human body consists of billions of cells. They are derived from the single fertilized egg cell in the mother's womb. The fertilized egg cell divides and re-divides and differentiates to form various tissues, organs and systems of the body. As development of the individual proceeds, groups of cells become differentiated from one another and are built up in different patterns to form the tissues of the body, in which the constituent cells are immobilized.

There are five widely distributed basic tissues which are built up, in varying proportions, to form the organs within the body, the body wall and the appendages of the body. These primary tissues are:

1. Epithelial tissue
2. Connective tissue
3. Sclerous tissue

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4. Muscular tissue
5. Nervous tissue

Epithelium tissue

These are Consists of a layer of cells lying on a basement membrane made up of connective tissue. Epithelium covers the surface of the body or lines the interior of hollow organs. Epithelium with the subjacent connective tissue form a functional unit called a membrane. Epithelium consisting of a single layer of cells is called simple epithelium. When contains many layers it is called stratified epithelium and is protective in function. Simple epithelium is classified according to the shape of its cells as follows:

- Columnar epithelium-tall cells, secretory or absorptive in function;
- Cuboidal epithelium -short and broad cells;
- Squamous epithelium-flat and thin cell.

2. Connective tissue

Consists of fibers in a ground substances (cement). The fibers are of mainly three types:-

a) Collagen fibers which give tensile strength,
b) Elastic fibers which give elasticity and
c) Reticular fibers.

Apart from these, the connective tissue contains different cell types like fibroblasts which produce the connective tissue fibers, plasma cells, macro phages, fat cells etc. Connective tissue exists in different densities in different parts of the body.

3. Sclerous tissue

Consists of bones and cartilages. Bone is hard, rigid and forms the most of the skeletal system of the body. Bones contain bone cells called osteocytes, fibrous tissue and inorganic salts, mainly phosphate of calcium. Bones have the following important functions:

- Give support to the body.
- Act as lever for the action of muscles.
- Provide the sites of formation of blood cells.
- Act as storehouses of calcium.

There are 206 bones in the body. These together constitute (1) axial skeleton forming an axial support to the body and (2) an appendicular skeleton supporting the limbs. These bones are joined by ligaments; the Interior of bones is filled by a soft tissue called bone marrow. This marrow is of yellow or red variety. Red marrow produces the blood cells. In the adult red marrow is present only in certain bones like sternum (breast bone), ribs, vertebrae etc.

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Vertebral column forming the main component of axial skeleton is of smaller segments called vertebrae, on the top the vertebral column is joined to the skeleton of the head and face called skull.

In the middle of the back of the neck is a vertical depression called nuchal furrow. Its lower end presents a bony elevation produced by the spine of 7th cervical vertebra. This can be used as a landmark to count the spines at the lower levels. A horizontal line corresponding to the highest point of iliac crest corresponds to 4th lumbar vertebra. This plane can be used to count the vertebrae from below.

4. Muscular tissue

Muscle is the contractile tissue which by its contraction results in various movements of the body like:

- movements of different joints;
- peristaltic movements, respiratory movements,
- uterine contraction etc. and
- pumping of the heart.

There are three types of muscles:

Skeletal muscle: Here the muscle cells or fibers have many nuclei and show transverse striations. They are mostly voluntary. Each muscle is surrounded by a connective tissue sheath called epimysium. Within each muscle, bundles of muscle fibers are surrounded by another sheath called perimysium.

Cardiac muscles: Present only in the heart. It is involuntary. Its fibers are also striated but branched and they join with that of adjacent fiber. Each cell in the fibre has one nucleus.

Smooth muscle: It is involuntary. It forms the muscular wall of the organs in the body. Muscle fiber has a single nucleus and is in the centre. Fibers are spindle shaped.

5. Nervous tissue

Nervous tissue consists of neurons and connective tissue. Connective tissue of nervous system is called neuroglia. Neuron consists of cell body and its processes called nerve fibers. Nerve fibers are of two types-

- Dendrites which carry the impulses to the cell body and
- Axons which carry the impulses away from the cell body.

Nervous system consists of a central nervous system and peripheral nervous system. Central nervous system includes brain and spinal cord.

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Central Nervous System: Brain is situated in a bony case called cranium. It is surrounded by three protective covering from within outwards they are pia mater, arachnoid mater and dura mater. It contains larger blood vessels supplying the brain and a fluid called cerebrospinal fluid. Cerebrospinal fluid provides a floating medium for protection and partly gives nutrition.

Brain is continued down into the vertebral canal as the spinal cord as far as the level of lower border of 1st lumbar vertebra. Coverings of the brain also continued around the spinal cord as far as the level of lower border of 2nd sacral vertebra.

There are 12 pairs of cranial nerves attached to the brain and 31 pairs of spinal nerves attached to the spinal cord.

Activities

Activity 1:- The teacher should take the students to the biology lab and help them prepare slides of cheek cells, etc.

Activity 2:- The teacher should take the students to the anatomy lab and organize a group discussion on human cells and tissue.

Check Your Progress

A. Fill in the Blanks.

1. The cell is the basic unit of……
2. The outer layer of cell membrane like a ……
3. …… is also called powerhouse of the cell.
4. The study of human tissue is called ……
5. Brain is situated in a bony case called ……

B. Multiple Choice Questions.

1. Study of cells is ……
   a. Mycology
   b. Osteology
   c. Cytology
   d. Arthrology

2. The cells metabolize food and oxygen they release ……
   a. CO_2 and other wastes
   b. O_2 and energy
   c. Nitrogen and wastes
   d. All the above

3. Which organelle is not found in human cell?
   a. Cytoplasm
   b. Centrosome

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c. Chloroplast
d. Golgi bodies

4. Number of chromosomes present……
   a. 23 Chromosomes
   b. 46 Chromosomes
   c. 21 Chromosomes
   d. 47 Chromosomes

5. Functions of the human cells.
   a. Protection
   b. Absorption
   c. Secretion and sensory reception
   d. All the above

6. All these are tissues except……
   a. Epithelial
   b. Connective
   c. Nucleus
   d. Sclerous

7. There are all types of connective tissue except one.
   a. Collagen fibers
   b. Elastic fibers
   c. Reticular fibers
   d. Nerve fibers

8. Skeletal muscles are….
   a. Voluntary muscle
   b. Involuntary muscle
   c. Both a &b
   d. None of the above

C. Match the Column A and B

Colum A	**Colum B**
Epithelium tissue	Act as store house of calcium
Connective tissue	Present on the heart
Sclerous tissue	Neurons and connective tissue
Smooth muscles	Reticular fibers
Nervous tissue	Involuntary muscle
Cardiac muscles	Stratified

D. Write the Short Answer Questions

1. Define the human cell and tissue.
2. Write the functions of human cell.
3. Write a short note on human cell.
4. Write the important functions of sclerous tissue.
5. Write a short notes on nervous tissue.

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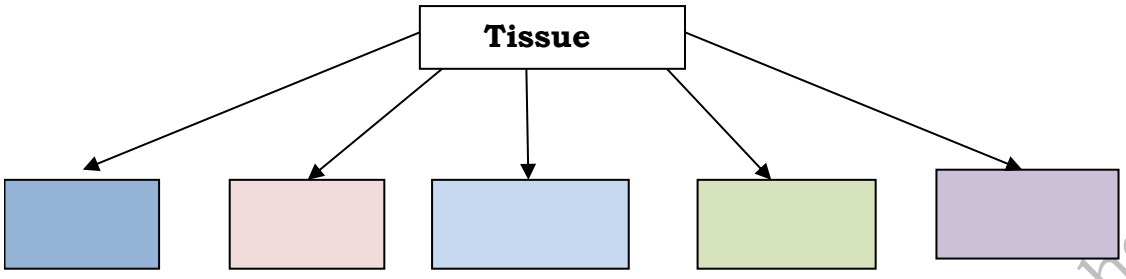
E. Write the Name of the Primary Tissues



Session 4: Human Anatomy And Physiology

Organ System

Digestive system deals with the reception of food and with the preparation of it for assimilation by the body. Alimentary canal consists of the following parts: Mouth, Pharynx, Esophagus, Stomach, Small and large intestine. The entire alimentary canal is lined by mucous membrane. During the process of digestion food is broken down into simple substances which can be absorbed and used by the cells of the body tissues. These various changes in the food are brought about by the fermentation or by activity of the enzymes contained in different digestive fluids.

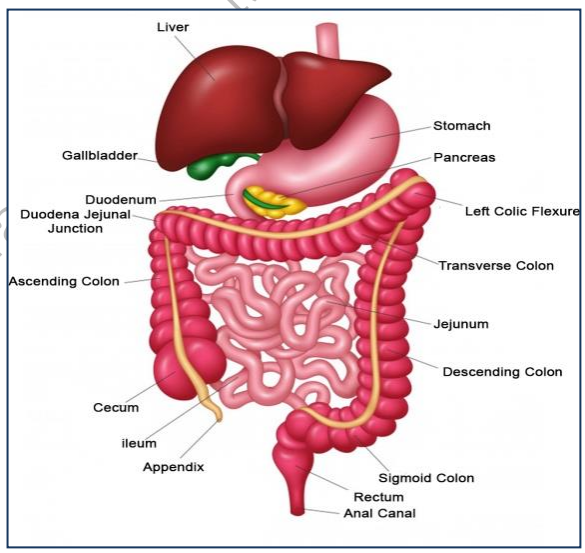


Fig.1.12AlimentaryCanalandAssociated organs

The Mouth

The mouth is an oral cavity at the beginning of alimentary canal. It consists of two parts an outer vestibule and the inner cavity of the mouth. Vestibule is the space

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between the gums and teeth inside and the lips and cheeks outside. Cavity of the mouth is bounded at the sides by maxillary bones, the teeth and lower jaw.

Mucous membrane of the mouth is vascular. Beneath the mucous membrane lie tiny glands, which secrete mucous. Palate consists of two parts, anterior hard palate formed by bone and posterior soft palate formed by fibrous tissue and muscles covered by mucous membrane. Its movements are controlled by its own muscles.

Teeth are used to cut, chew and grind the food in the mouth. In children there are 20 temporary or milk teeth, ten in each jaw, named from the mid line on each side, two incisors, one canine, two molars. An adult has 32 permanent teeth, and 16 in each jaw-named from the centre, two incisors, one canine, two premolars, three molars.

A tooth possesses (a) crown, projecting beyond the gum, (b) root, surrounded by the gum and (c) neck, at the junction between the two. Mastication is the process of biting and grinding of food between the upper and lower teeth.

Salivary glands

These are the glands which secrete the saliva. They are composed of groups of sac-like alveoli, like the bunches of grapes which constitute the lobules of the gland. Parotid glands are the largest salivary glands. They lie one on each side below and in front of the ear. Secretion of the parotid gland is carried by the parotid duct which opens on the oral surface of the cheek opposite the crown of upper 2nd molar tooth.

Submandibular glands are the next largest glands. They lie one on each side beneath the lower jaw-bone, and they are about the size of a walnut. Their secretion is poured into the mouth through Submandibular or Wharton's duct which opens into the floor of the mouth.

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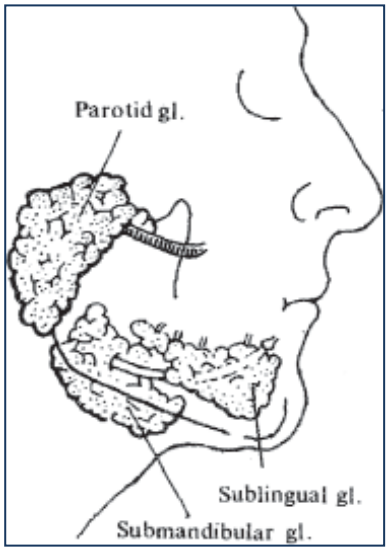

Fig. 1.13 Salivary Glands

Pharynx and esophagus

Pharynx is mucus membrane passage lying behind the nose, mouth and larynx. It is about 5" long. Tonsils are collections of lymphoid tissue in the lateral walls of oropharynx. They are permeated with blood vessels, lymph vessels and contain masses of lymphocytes. Surface of the tonsil is covered by mucous membrane.

esophagus is a muscular tube connecting the pharynx to the stomach. It is 9 to 10" long. In the neck it lies behind the trachea and in front of vertebral column. It passes through the diaphragm which is a muscular partition between thoracic and abdominal cavities and enters the abdomen to open into the stomach. The remaining larger part of the alimentary canal is present in the abdomen.

Abdomen

The abdomen is the lower part of the trunk. Abdominal cavity is bounded above by diaphragm and below by the pelvic brim. In front and at the sides it is bounded by abdominal muscles, iliac bones and the lower ribs, at the back by vertebral column and some muscles. The pelvic cavity is continuous below the abdominal cavity. Contents of the abdomen: The main organs that occupy the abdominal cavity are the greater part of alimentary canal, liver, pancreas, spleen, kidneys.

Liver occupies upper and right part of the abdomen just beneath the diaphragm. It overlaps the stomach and first part of small intestine. Gall bladder lies on the under surface of the liver in a depression.

Pancreas lies across the posterior abdominal wall behind the stomach. The spleen lies near the tail of pancreas. Kidneys and adrenals lie on each side of the vertebral column. From the kidney Ureter pass downwards through the abdomen. In addition abdomen also contains lymph glands and vessels, nerves, peritoneum and fat.

Stomach

Stomach is the most dilatable portion of alimentary canal. It lies in the epigastric region. Stomach consists of an upper part called fundus which normally contains air. Below the fundus are the main body and a lower horizontal part, the pyloric portion. Its communication with the esophagus and its opening into intestine is the pyloric orifice.Gastric glands are also present with distinct peptic cells producing pepsinogen and oxyntic cells producing HCL (hydrochloric acid). The pepsinogen is converted to pepsin by the action of HCL (hydrochloric acid). Partial digestion of food takes place in the stomach.

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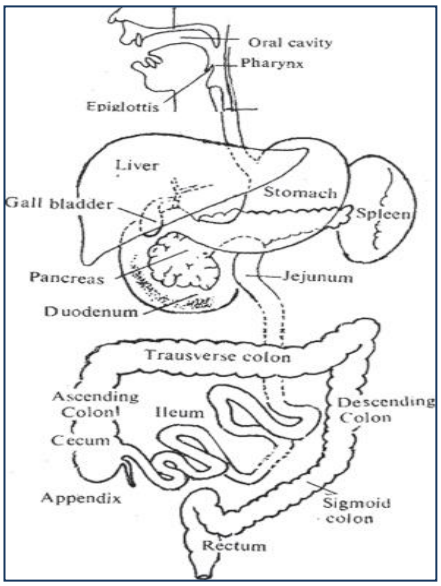

Fig.1.14Digestive System

Small Intestine

Small intestine is a tube about 18 feet long. In the cadaver it is about 20 feet due to the loss of tone of the muscle. It starts from the pyloric orifice of the stomach. The junction between the two being guarded by pyloric sphincter. Small intestine terminates at the ileocolic junction where it joins the large intestine.

Small intestine is divided into three parts.

Duodenum is the first 10 inches of the small intestine. It forms a C-shaped curve which encircles the head of pancreas. Bile and pancreatic ducts open into the duodenum on a small projection called major duodenal papilla.

Large Intestine

Large intestine or colon is about 5 feet long. It is continuous with the small intestine. It receives the residual food from the ileum. Rectum is the lowest 5 inches of the large intestine and ends in the anal canal. It ends in an aperture called the anus. Rectum and anal canals are empty except during the passage of faeces.

Peritoneum

Peritoneum is the largest of the serous membranes in the body. It is double layered, one layer lining the walls of abdominal cavity is the parietal layer, the other layer covering the organs in the abdomen is called visceral layer. Both the layers are continuous with each other. Potential space between these two layers is called the peritoneal cavity or sac. In the males it is a closed sac. In the female the uterine tubes open into the peritoneal cavity.

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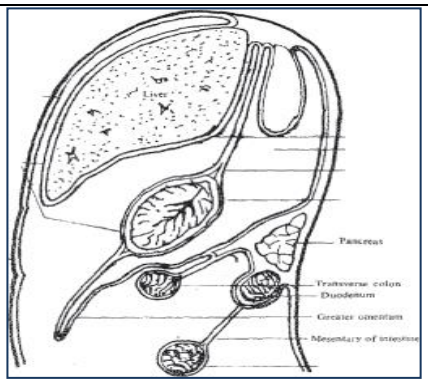

Fig. 1.15 Peritoneum

Liver Anatomy

The liver is the largest gland in the body, situated in the upper most part of the abdominal cavity on the right side below the diaphragm. It is largely protected by the ribs. It is about 3 pounds in weight. Liver consists of two main lobes, right and left. The upper surface is convex and lies beneath the diaphragm. A longitudinal fissure separates the right and left lobes. Large number of vessels within the liver is united together by connective tissue. Liver has a double blood supply by means of hepatic artery and portal vein. The hepatic artery supplies the oxygenated blood and Portal vein brings the blood rich in nutrients. Bile capillaries collect the bile from the liver cells and unite to from the bile duct containing large number of enzymes.

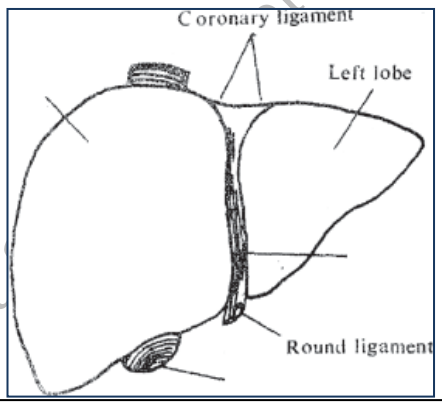

Fig. 1.16 The liver from the Anterior

Gall-Bladder

It is a pear-shaped membranous bag, lying in a fosse on the under surface of the liver. It is about 3 to 4 inches in length and holds about 50 ml. of bile. Gall bladder stores the bile and concentrates it. Gall bladder and bile duct are supplied by branches of hepatic artery.

Pancreas

Pancreas is a soft, lobulated, greyish pink gland, 5 to 6 inches long. It is situated across the posterior abdominal wall. It extends from the duodenum to the spleen. Pancreatic juice and exocrine secretion secreted by the pancreas passes through

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the pancreatic duct which joins with the bile duct to form the hepatopancreatic duct and amuplla which open into the duodenum.

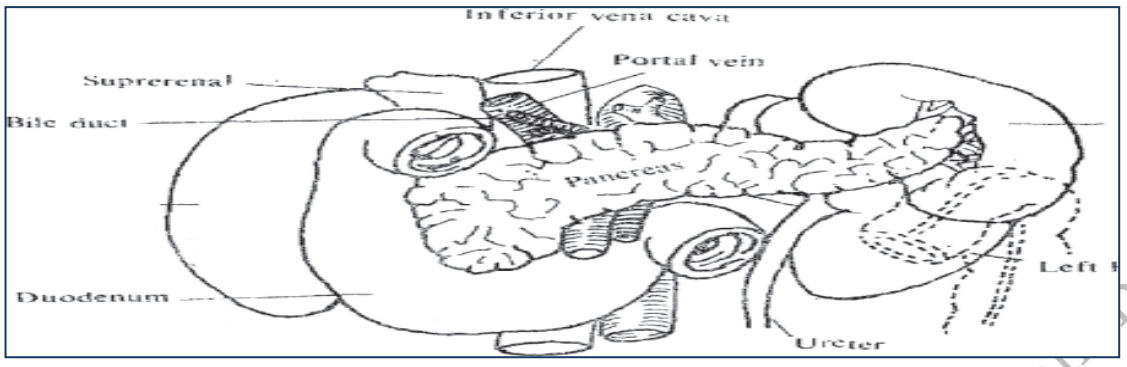

Fig. 1.17 Abdominal Viscera

Between the clusters of pancreatic alveoli there are irregular areas called Islets of Langerhans. The cells of the Islets secrete the insulin which directly pours into the adjacent enlarged blood capillaries. So this portion of the pancreas is the endocrine portion. This is mainly concerned with the secretion of insulin. Degeneration and dysfunction of Islet tissue leads to diabetes.

Spleen

Spleen lies in the left hypochondriac region of the abdomen, between stomach and the diaphragm. It is a blood forming organ, it consists of lymphocytes and red blood corpuscles. In the adult it mainly functions as storage organ of blood cells. It is not very essential for the life.

Heart

The heart is a hollow, muscular organ of a somewhat conical form. It lies in the thorax between the two lungs and pleurae, posterior to the body of the sternum and adjoining parts of the cartilages of the ribs. One third of the heart lies on the right of the median plane; 2/3 of the heart lies on the left of the median plane. (Fig.1.17). Size: In the adult, heart is about 280 grams.

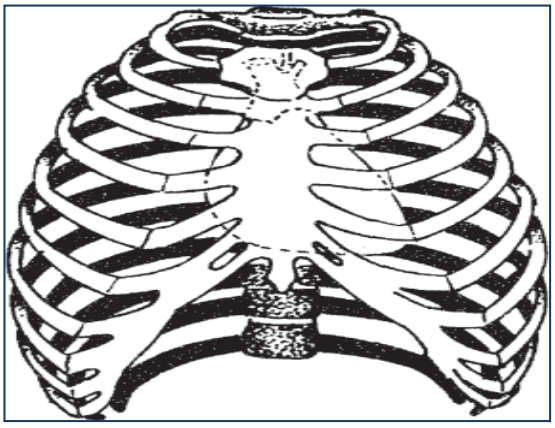

Fig. 1.18 The Position of the Heart in Relation to the Sternum, Ribs and Costal

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Base of the heart is directed backwards. Apex is directed downwards and forwards. In its interior it consists of 4 chambers. Two are receiving chambers called the atrium, other two are pumping chambers called ventricles. These chambers are separated by septa in the interior, the position of which is indicated on the surface of the heart grooves. These grooves contain the blood vessels supplying or draining the heart. Right portion of the heart that is right atrium and right ventricle contain the impure (Deoxygenated) blood. Left portion, that is, left atrium and ventricle contain the oxygenated blood. The right atrium receives the blood mainly from the head, neck and upper limbs through a large vein called the superior vena cava. It also receives deoxygenated blood from the lower limbs, major part of the trunk and abdominal organs, through the inferior vena cava. Venous blood from the walls of the heart is brought to the right atrium by a vein called coronary sinus shown in Fig. 1.18).

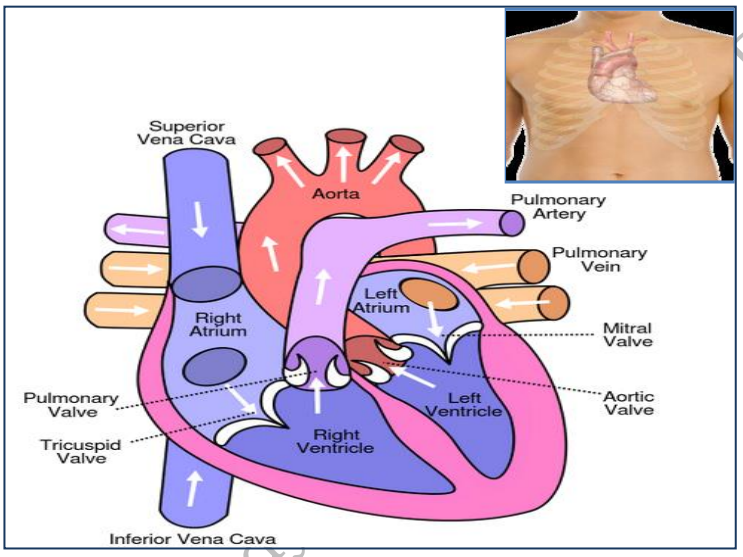

Fig. 1.19 The Interior of the Heart

The blood from the right atrium is pumped into the right ventricle through the right atrium ventricular opening. This communication between these two chambers is guarded by a valve which has three segments. So it is called tricuspid orifice. These segments or cusps of the valve prevent the back flow of blood from the right ventricle to the right atrium. From the right ventricle a large artery called pulmonary trunk arises but the junction between the two is called pulmonary orifice which is again guarded by pulmonary valve. This prevents the backflow of blood from the pulmonary trunk to the right ventricle. Pulmonary trunk divides into two pulmonary arteries, one for each lung.

Oxygenated blood from the lungs is returned to the left atrium by pulmonary veins. There are two such veins from each lung. Thus the 4 pulmonary veins open into the left atrium. Circulation of blood through the lungs constitutes the pulmonary circulation.

There are cusps which prevent the back flow of blood into left atrium. Left ventricle leads to the ascending aorta, the junction between the two is the aortic orifice guarded by aortic valve. Ascending aorta is the large artery which carries the blood from the heart to be distributed to various parts of the body, from where large veins

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bring the deoxygenated blood back to the right atrium. This constitutes the systemic circulation.

The blood vessels are the part of the systemic circulatory system that is transports blood in the whole body organs.

There are three major Kind blood vessels:

- **Arteries** - which carry the oxygenated blood away from the heart to other organs
- **Veins** – this is carry deoxygenated blood from the capillaries to the heart
- **Capillaries** (Thinnest, smallest, located between Arteries and Veins) - which enable the exchange of certain chemicals, water and nutrients between the blood and the tissue cell.

Pulmonary artery carry (CO_2) deoxygenated blood and pulmonary vein is carry (O_2) oxygenated blood. They are opposite artery and veins in circulatory system.

Lymphatic System

Lymphatic system consists of lymph capillaries which drain the tissue fluid. Lymph capillaries unite to form lymph vessels. These lymph vessels drain the lymph to the great veins, at the root of the neck through lymph nodes. Lymph vessel in the body is called thoracic duct which opens into a large vein called left bronchiole into phalic vein at the root of the neck.

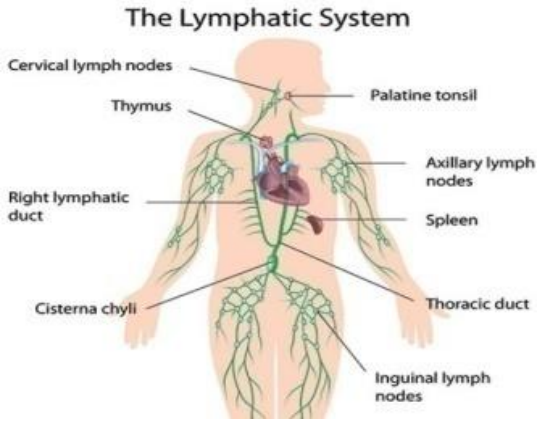

Fig. 1.20 Lymphatic Systems

Respiratory System

Respiratory system includes the parts concerned with air passage and the lungs where gaseous exchange takes place shown in Fig.1.21.

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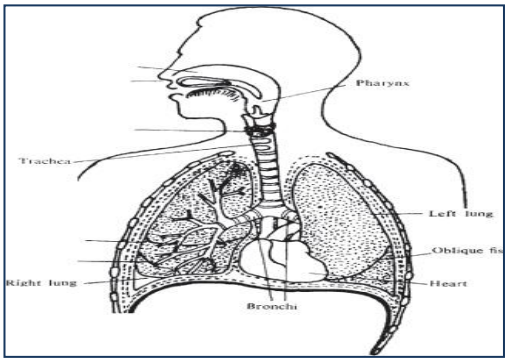

Fig. 1.21 Respiratory System

Nasal passage and pharynx

Air entering the nose through the anterior nasal aperture passes through the nasal cavity and enters the nasopharynx. Hairs present near the apertures act as sieve to remove the dust and other foreign particles in the air. Uppermost part of nasal cavity is lined by olfactory epithelium supplied by olfactory nerves. This part perceives the odour or smell of the inhaled air.

Air passes through the pharynx. Thus the lower part of the pharynx is the common passage for both food and air. From the lower part of the pharynx air enters the larynx through a slit like aperture called *inlet of the larynx.* This inlet is usually closed by epiglottis during the passage of food and thus prevents the food from entering into the larynx.

It is an organ of production of voice and air passage. Passage of air through this interval and vibration of vocal folds produces the voice. Lungs are the respiratory organs. They are situated one in each half of the thoracic cavity. They are conical in shape and each is enclosed in a serous sac called the pleura. Pleuras are serous sacs covering the lungs and lining the thoracic wall.

Right lung is broader and shorter where as left lung is longer and narrower. Inside the lungs consist of subdivisions of the bronchial tree, blood vessels, nerves and lymph vessels. Exchange of gases takes place between the air in the alveoli and blood in the capillary network. Pulmonary vessels supply the lungs for oxygenation. Nutrition to the lungs is provided by bronchial vessels.

Kidney and Associated Organs

Kidneys are bean shaped organs situated in the lumbar region of abdomen on each side of the vertebral column. They are concerned with the production of urine. On the medial border of the kidney there is a depression called ***hilus*** where blood vessels enter or leave the kidney and the Ureter emerges. Arterial supply is derived from renal artery. Renal vein draining the kidney empties into the inferior vena cava.

Near the upper Part of each kidney adrenal glands are present.

Interior of the kidney consists of two main parts-an outer ***cortex*** and an ***inner medulla.*** Functional unit of the kidney is called a Nephron. Each Nephron consists

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of a renal corpuscle and renal tubules. In the renal corpuscle there is a capillary bed called glomerulus within a double layered cup called Bowman's capsule.

Most of the fluid component of the blood of the glomerulus is filtered into the cavity of the Bowman's capsule which in turn is continuous with the renal tubule. As the fluid is passes through the tubules reabsorption of water and certain salts takes place. Remaining small portion of the fluid component enters into the larger ducts called collecting ducts as the urine. From the collecting ducts urine passes to the Ureter. Renal corpuscles and tubules are present in the cortex but a small segment of renal tubules is present in the medulla. Ureters are cylindrical thick walled tubes which carry the urine from the kidneys to the bladder. Ureters pass down in the abdomen and enter the urinary bladder. Urinary bladder is the reservoir for urine. In the empty condition it is tetrahedral in shape. Its average capacity is about 220 C.c. but it can be distended upto500 C.c. under will shown in Fig. 1.22.

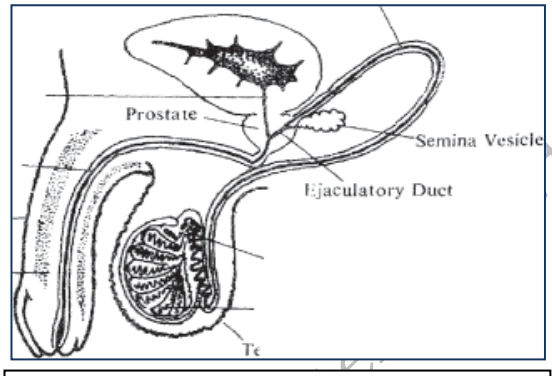

Fig. 1.22 Urinary system in male

Reproductive Organs

The reproductive organs include the gonads which are concerned with the production of germ cells or gametes and associated organs concerned with passage and maintenance of these gametes. In females the organ which shelters the prenatal development of its offspring and the copulatory organs in both sexes are also included in this system.

Male reproductive organs

Testes: These are the male gonads concerned with the production of gametes called sperms. They are situated one in each half of the scrotum which is a pouch of skin between the two thighs. Tail of the epididymis continues as the vas deferens which is a thick walled muscular tube. On the posterior surface of the urinary bladder there is a conical body called seminal vesicle. Beginning of urethra is surrounded by a gland called prostate. Secretions of prostate and seminal vesicle form the bulk of the semen. Penis acts as the male copulatory organ.

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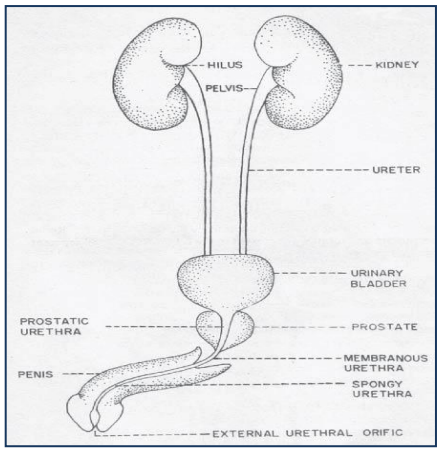

Fig.1.23Reproductive System In Male

Female Reproductive Organs

Female reproductive system consists of ovaries, uterine tubes, uterus and vagina.

Ovaries: Ovaries are two in number situated one on each side wall of the pelvis. They are the female gonads producing the gametes called ova. In each menstrual cycle only one ovum matures from any one of the ovaries. Within the ovary the ova are situated in structures called ovarian follicles. When a ovum matures within the ovarian the follicle enlarges to form mature Graafian follicle and ruptures. The ovum thus liberated from ovary comes into the peritoneal cavity. After the discharge of ovum the empty follicle develops into an endocrine organ called corpus luteum.

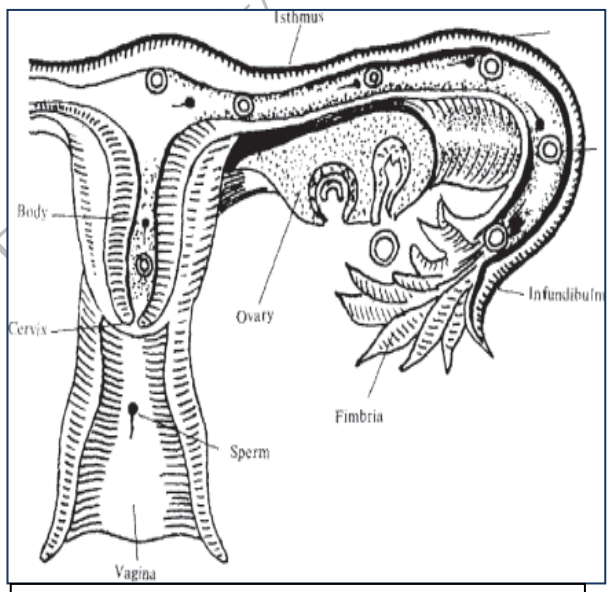

Fig. 1.24 Reproductive System In Female

Life span of corpus luteum depends only on fertilization of ovum. Uterine tubes are cylindrical muscular tubes one on each side of uterus. Each tube is 4 inches in length. Its medial end opens into uterus and lateral end opens into the peritoneal cavity.

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Uterus: It is a thick walled muscular organ situated in the pelvis in front of the rectum and behind the urinary bladder. It is about 3 inches in length, 2 inches in breadth and 1 inch in thickness. Its weight is about 60 grams. It has an upper portion called fundus, middle portion called body and a lower portion called cervix. Mucous membrane of the uterus is called endometrium, superficial portions of the endometrium are shed off in each menstrual flow and repaired subsequently under the influence of female sex hormones (Fig.1.25). Vagina is the female copulatory organ. It is a muscular organ lined by stratified squamous epithelium.

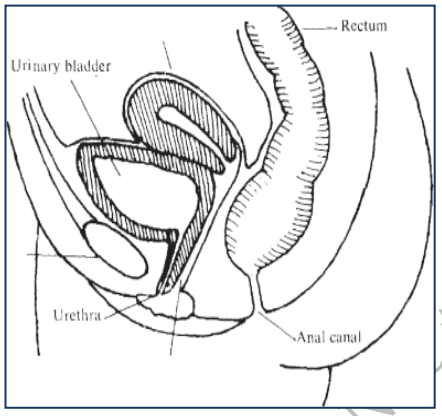

Fig. 1.25 Diagram uterus

Integumentary system

The skin forms a covering envelope for the entire surface of the body.

Structure

There are 2 main layers for the skin. The outer layer is called Epidermis, the inner layer is called Dermis.

The epidermis is divided into several layers:

Stratum corneum - horny layer,

Stratum Lucidum - transparent layer,

Stratum granulosum - granular layer,

Stratum Malphigian - prickle celled layer.

Dark pigment melanin is present in the deep layers of epidermis which gives the colour to the skin. The epidermis contains no blood vessels, but lymph circulates.

The dermis consists of the following:

Connective tissue

- Sweat glands - produce sweat & regulate body temperature.
- Sebaceous glands - secrete Sebum which helps to keep skin supple and the hair from becoming dry and brittle.

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- Nerve ending and receptors - are mainly sensory and responsible for general sensation.
- Hair follicles are present. The hair arises from these follicles. A tiny muscle Arrector pili is attached to the hair follicle. Contraction of this muscle causes the hair to become straight.
- Adipose tissue acts as an insulator.
- Bloodvessels.

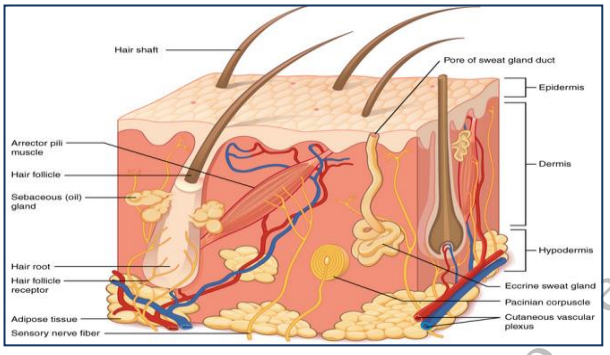

Fig. 1.26 Structure of the skin

Functions of the Skin

Protection: Skin protects the body from external injuries.

General sensation: It keeps us in contact with the external environment by informing us of touch, temperature, pain, pressure, vibration, sensation etc.

Temperature regulation: Normal body temperature is 37°C or 98.6°F. Temperature is regulated by increasing or decreasing the blood flow and sweat formation by the skin.

Absorption: It is capable of absorbing small amounts of oily substances.

Vitamin D Production: The skin contains dehydrocholesterol. This substance is converted into Vitamin D by the action of sunlight.

Activities

Activity 1: - Visit a Anatomy and Physiology science Lab and identify the following:

a) Gross and microscopic slides of various body organs

b) Study the gross and microscopic slides of various body parts

c) Identify the human body organs and their function.

d) Identify the anterior, posterior, superior and inferior parts of kidney and liver.

Activity 2: - Visit a nearby anatomy and physiology lab and observe various body tissues. Fill the table given below:

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Types	Tissue obtained from which body parts
Epithelial	
Connective	
Muscular	
Nervous	

Check Your Progress

A. Fill in the Blanks

1. The functional relation of different parts to each other is known as_____
2. The pepsinogen is converted to pepsin by the action of_____
3. The small intestine starts from_____of the stomach.
4. Peritoneum is the largest of the_____ in human body.
5. The liver is situated below the _____
6. Pancreatic juice and exocrine secretion secreted by the _____
7. The pulmonary vein carries_____ from lungs.
8. _____ is prevent the foods from entering in to the lungs.
9. Kidney is bean shaped organs situated_____ of abdomen.

B. Multiple Choice Questions

1. The following term are used to study the eye.
   a. Neurology
   b. Gynecology
   c. Ophthalmology
   d. Endocrinology
2. Choose the human teeth correct sequence from the center to the side
   a. Incisors- canine- premolars- molars
   b. Canine- incisors - premolars- molars
   c. Incisors- canine- molars- premolar
   d. Molars- Incisors- canine- premolars
3. Choose the correct meaning of the superior
   a. Nearer to the skin and surface
   b. Nearer to the head, also called skull
   c. Nearer to the foot
   d. Nearby to the median line.
4. The length of the small intestine is
   a. 16 feet
   b. 20 feet
   c. 18 feet
   d. 24 feet
5. The largest gland in human body
   a. spleen
   b. Liver
   c. Gall bladder
   d. Salivary gland

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6. Pancreas secretes.....
   a. Pancreatic juice
   b. pepsin
   c. HCL
   d. bile
7. The heart is a hollow muscular organ that is the weight of the heart in an adult
   a. 360 grams
   b. 250 grams
   c. 280 grams
   d. None of the above
8. The lungs are situated in human body
   a. Thoracic cavity
   b. Pelvic cavity
   c. Peritoneal cavity
   d. Nasal cavity
9. The functional unit of kidney is called
   a. Capillary
   b. Nephron
   c. Bowman's capsule
   d. Glomerulus
10. The dark pigment melanin is present in the deep layers of skin
    a. Hypodermis
    b. Dermis
    c. Epidermis
    d. All of the above

C. Match the following

Colum A	**Colum B**
Oral cavity organs	Male and female genital
Larynx	Sebaceous gland
Trachea	Kidney, urinary bladder
Large intestine	Heart, vessels, blood supply
Pancreas	Salivary glands
Spleen	Vocal Cord
Cardiovascular	Wind pipe
Urinary	Water absorption
Integumentary	Grayish pink gland
Reproductive system blood corpuscles	Lymphocytes and red

D. Fill in the Box following appropriate Words

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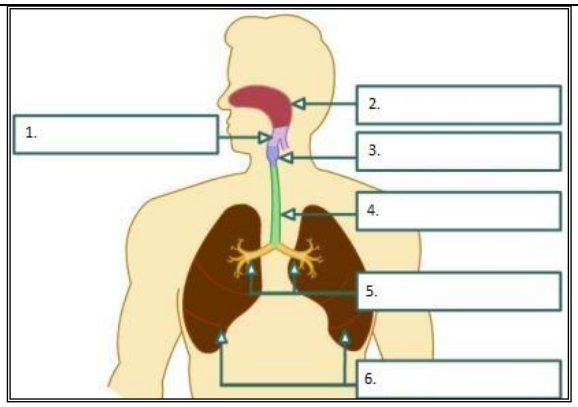
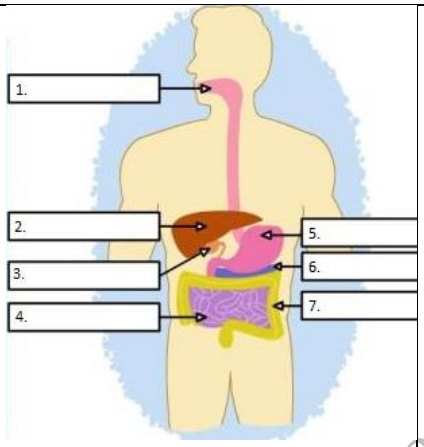


E. Write the Name of Human body Organs



a. Mouth
b. Stomach
c. Gall Bladder
d. Pancreas
e. Liver
f. Large Intestine
g. Small Intestine

F. Shorts Answer Questions

1. Define digestive system.
2. Write the anatomy of liver.
3. Write the functions of heart.
4. Write the exchange of gases in lungs.
5. Explain the filtration of urine.
6. Write short note on male and female reproductive system.

G. Draw the well Diagrams of the following Organs and Label

a. Heart
b. Kidney
c. Liver
d. Skin
e. Digestive system
f. Urinary system

Session 5: Healthcare Delivery System

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Healthcare is one of the major service sectors in India. Healthcare services include all the health and wellness related support provided to a person or population by various agencies and resources. The purpose of healthcare services is to effectively meet the total health needs of community in which hospitals play a key role in maintaining and restoring the health of person."Healthcare system" involves management of health sector and its organizational structure to provide healthcare services. The very essential part of any healthcare system is the good delivery system. Healthcare delivery system is the system of inter-related services provided to citizens or populations to maintain or restore or prevent health of an individual or population. Healthcare services delivered by medical and paramedical professionals working in various under public and private organization which offer different level of medical care ranging from primary to quaternary level of healthcare facilities.

Fig. 1.27: Healthcare services

Hospital provides comprehensive health facility under one roof with its well equipped technology and team of medical professional. The performance of all type of healthcare services is dependent on the cooperation and coordination of various components/departments within the system to provide clinical, non-clinical and support services to person. Hospital has many departments ranging from administrative, in-patient department, out-patient department, laboratories, house- keeping and other kitchen for complete care of the patient. Providing good nutrition for the faster recovery is one of the primary targets of Healthcare delivery services. Dietetic aide works in dietary department of the hospital. Department of dietetics has the responsibility of ensuring nutritional support and quality food service to the wide range patient according to their physiological conditions.

The student will be empowered with knowledge of healthcare delivery system in our country and role of Dietetic Aide in Healthcare sector after learning the sessions of this unit.

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Fig. 1.28 Telehealth services by health professional

LEVELS OF HEALTHCARE DELIVERY SYSTEM

According to World Health Organization (WHO)"A health system consists of all organizations, people and actions whose primary intent is to promote, restore or maintain health. Healthcare services include all the health and wellness related support provided to a person or population by various agencies and resources. This includes efforts to influence determinants of health through inter-sectorial action covering all health activities, programmes, institutions by health professional and other engaged personnel providing medical care to a population. The purpose of healthcare services is to effectively meet the total health needs of community in which hospitals play a key role in maintaining and restoring the health of person. A health system is therefore more than the pyramid of publicly owned facilities that deliver personal health services. "Healthcare system" involves management of health sector and its organizational structure to provide Healthcare services.

The very essential part of any healthcare system is the good delivery system. Healthcare service delivery has a principal role and act as basic input to community health status. Healthcare delivery system is the system of inter-related services provided to citizens or populations to maintain or restore or prevent health of an individual or population. Healthcare services delivered by medical and paramedical professionals working in various under public and private organization which offer different level of medical care ranging from primary to quaternary level of Healthcare facilities.

In India, provision of healthcare facility is a state subject. The healthcare system/models in India can be classified as public and private sector. The government and the private sector are working to make healthcare accessible in all areas of India; both rural and urban. However, Private sector owns majority of healthcare services in urban areas of India.

1. Public Healthcare Sector: This is run by government and its undertakings institutions across the country. Public Healthcare services are free or subsidize for the citizens especially belonging to below poverty line and low socio-economic

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status population. Healthcare services provided by Public institutions owned by central government, state government and local bodies. The central government is chiefly liable for monitoring and developing national standards and regulations. Centre government sponsors numerous schemes for the effective implementation and links the states with funding agencies. Union ministry of Health and family Welfare handle healthcare system at national level and it has department in every state which is responsible for the proper functioning of Healthcare services in state covering all rural and urban area for its citizen. Public health system is assembled structure of all government functioning that works to prevent disease and promote health and wellness among its people.

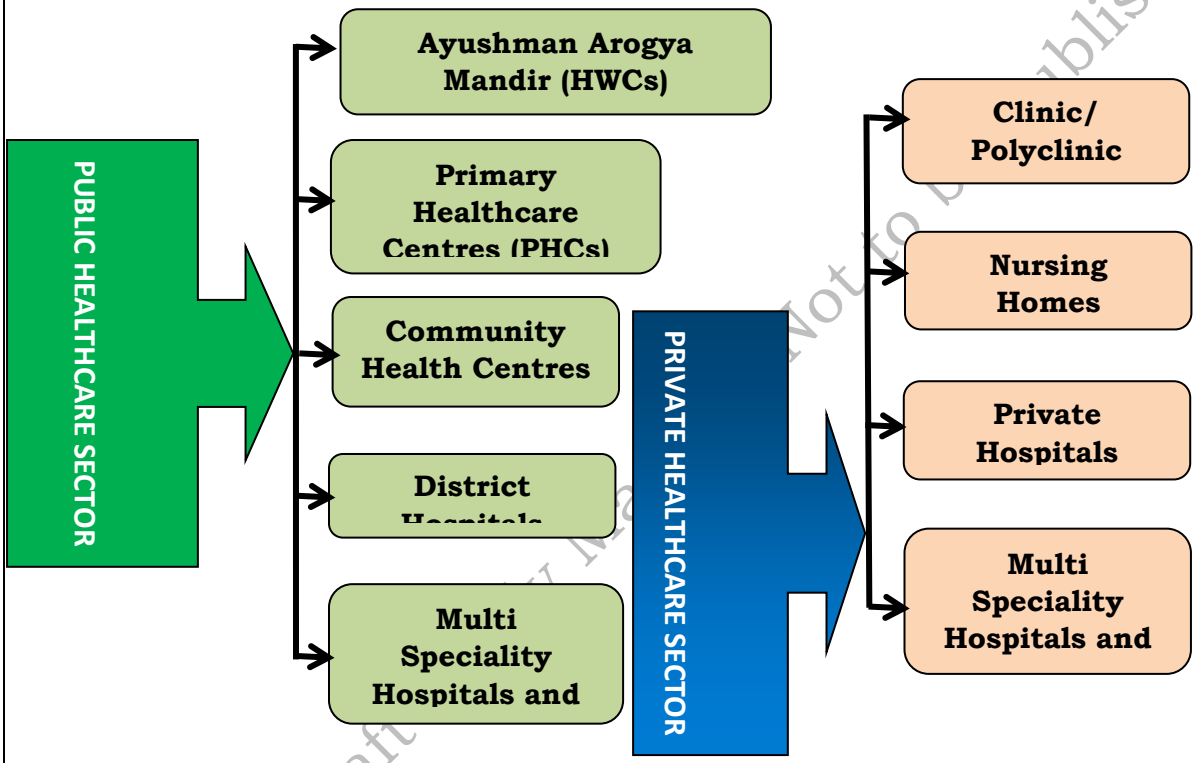

Fig. 1.29: Healthcare delivery system

Public Healthcare system has following structure to deliver health facility mainly in rural areas

Ayushman Bharat –Arogya Mandir(AAM-HWCs)–(MoHF)Sub Health Centre is being transformed into Ayushman Bharat – Health and Wellness Centre. The Central Government has renamed the existing Ayushman Bharat Health and Wellness Centers (AB-HWCs) as 'Ayushman Arogya Mandir' with the tag-line 'Arogyam Param Dhanam'. In 2017, based on the recommendations of the Task Force for Comprehensive Primary Health Care (CPHC), the National Health Policy was launched. Sub Health Centers (SHCs) covering populations of 3,000 – 5,000 are being converted into Health and Wellness Centers (AB-HWCs). Primary Health Centers (PHCs) in rural and urban areas are also being *converted* into AB-HWCs. These HWC centers offer basic facility for mother and child care, safe institutional delivery of child, vaccination, family welfare services to include palliative and

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rehabilitative care, Oral, Eye and ENT care, mental health and primary medical facility for emergencies and trauma, including free essential drugs and diagnostic services tele-consultation and health promotion services including yoga. The function of health and wellness-centers is to provide preventive and curative care to community. Each HWC has one community health officer, auxiliary nurse Midwife, ASHA and one health worker.

Fig. 1.30 Health and Wellness

"**Mohalla Clinic**" in Delhi, India. These are community health clinics established by the Delhi Government to provide basic health services to people especially in urban slum areas. These clinics aim to make health care more accessible to the local community by providing services such as consultation, basic diagnosis and medicines. They play a vital role in improving health care access and meeting the health needs of the population at the grassroots level.

e-Sanjeevani – India's national telemedicine service is a step towards digital health equity to achieve Universal Health Coverage (UHC). e-Sanjeevani facilitates quick and easy access to doctors and medical experts from your smartphone. You can access quality health services even remotely through eSanjeevani by visiting the nearest Ayushman Bharat Health and Wellness Centre.

Primary Healthcare Centres (PHCs) - Primary healthcare centers act as first interaction center between community and medical officer. Primary healthcare center has its importance in delivering Healthcare services as health promotive and welfare services in rural set-up including family planning, medical care, disease preventive services, health education, referral services, training and laboratory services. Primary healthcare centers are established and maintained under Minimum Need Programme (MNP) by the state government. Primary Healthcare centers manned with one medical officer and fourteen allied Healthcare staff including mid-wife, health worker, block extension educator, laboratory technician and other supportive staff. Provision of two additional contractual staff nurse has been made under National Rural Health Mission (NRHM).One primary Healthcare center cover 30,000 population in general areas and 20,000 populations in hilly or interior areas.

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Community Health Centers (CHCs) - *One* Community Health Center is established over four Primary Healthcare centers for every 80,000 to 120,000 population as referral units and maintained by state government. CommunityHealth Center has four medical officers with expertise in surgery, physician, gynecology and pediatrics with allied healthcare staff. A CommunityHealth Center has capacity of 30 beds, X-ray machine, laboratory and operation theatre. CommunityHealth Center provides the services of routine and emergency care, institutional delivery, diagnostic, blood bank, maternal and new born care and surgeries as well.

District Hospitals - District hospitals serve as secondary referral level for a district. Every district has a district hospital thus it caters urban as well as its rural population. Depending upon the population of the district, the bed capacity of a district hospital differs ranging from 75 to 500 beds. District hospitals are fundamental unit to implement health programmes and policies and it attached with all sub-centers, primary centers, and community centers. It offers comprehensive healthcare service to the population such as curative, preventive and promotive health facilities. To fulfill the objectives, district hospitals have equipped with all technical and administrative and medical staff with all diagnostic facilities.

Teaching cum Research Institution- These type of hospitals are teaching and training based. Their job profile is to advance knowledge, conduct the research activities and training the medicos. Example are like, All-India Medical Institute, New Delhi, Postgraduate Medical Education and Research Institute, Chandigarh, Postgraduate Medical Education and Research Institute, lucknow etc.

Healthcare workers under Public Healthcare sector: -Auxiliary Nurse Midwife (multipurpose health workers, Accredited Social Health Activist (ASHA) and anganwadi workers. They work in village level and are grass root health workers.

- *Auxiliary Nurse Midwife (ANM)*- Auxiliary Nurse Midwife is a village-level female health worker based in sub-centres. ANM act as first contact person between the community person and the health services at sub-centers. Auxiliary Nurse Midwife are given 18 months training to manage community health such as immunization, health education in village level by regular villages visits. Auxiliary Nurse Midwife is now known as Multi-purpose workers with new responsibilities of supporting ASHA and anganwadi workers.
- *Accredited Social Health Activist (ASHA)*- They are village level community health workers who received 23 days of training. Accredited Social Health Activist (ASHA) works to encourage for family welfare, institutional delivery, immunization and preventive care. Accredited Social Health Activist (ASHA) provides basic medical care and supplies such as first-aid, ORS, contraceptive pills, iron-folic acid tablets. They refer rural people to primary healthcare and community healthcare centres and are assisted by ANM.
- *Anganwadi Worker (AWW)* - Anganwadi worker employed by women and child development department works under Integrated child development schemes

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(ICDS). Anganwadi workers are chiefly engaged in maternal and child care such provision of supplementary food to young children, pregnant and lactating mothers. Adolescent girls receive health education iron and folic acid tablets. Anganwadi worker ensures immunization of children, good nutritional status of mother and children and institutional delivery. Early childhood care and education are also provided to young children in anganwadi.

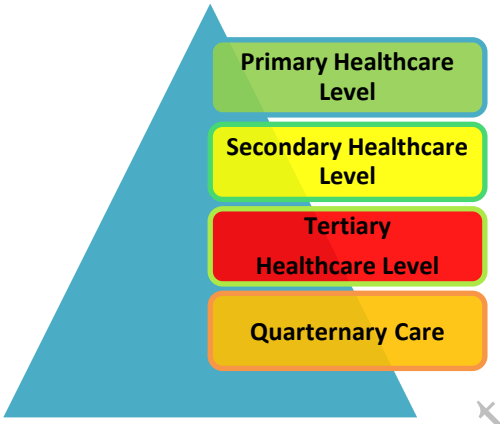

Fig. 1.31 Levels of Healthcare

2. Private Healthcare Sector: Any Healthcare organization or enterprises that are not owned or directly controlled by government are private healthcare providers. The healthcare organization can be profit earning or non-profit organization (NGO).Private Healthcare are mainly concentrated in urban areas and has important play in Healthcare delivery system in India. From the last few decades there has been extensive growth in private health sector in terms of facilities, quality and number of medical or allied Healthcare professionals. Private Healthcare sector includes clinics, specialty hospitals, nursing homes or medical hospital and research centers owned by any individual, private administration or agencies. The facility provided by private Healthcare organizations are chargeable and the fee varies from hospital to hospital.

Levels of Medical Care

It is customary to describe healthcare service at 4 levels, viz., primary, secondary, tertiary and quaternary care levels. These levels represent different types of care involving varying degree of specialization.

a) **Primary healthcare level**: primary healthcare level are the basic unit or back bone of healthcare delivery system and include services for day to day medical care needs of the community thus it is regularly used by person. This essential care is offered by the Primary Health Centres (PHCs) and their sub-centres which involves multipurpose health workers, village health guides and trained Dais. Primary care givers are doctors, nurses or physician assistants who provide whole care ranging from promotion of health, prevention of diseases, treatment and rehabilitation. Thus primary Healthcare address broader

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determinant of health as mental, social and physical health.

b) Secondary healthcare level: This is next higher level of care and served by subject specific experts to deal more complex problems. These includes specialist like cardiologist, nephrologists, endocrinologist. This type of Healthcare is mainly offered in district or multispecialty hospitals.

c) Tertiary healthcare level: The tertiary level is a further specialized level than secondary care level and serves specific facilities and attention of highly specialized health professionals. This facility is supplied by the regional or central level institutions. For example, to conduct coronary artery bypass surgery, distinguish equipment and expertise is needed. Tertiary Healthcare provider institute is generally well equipped with modern medical technology for intensive Healthcare and in emergency condition as well.

d) Quaternary Care: Quaternary care is an expansion of tertiary care and is more precise and highly unusual; therefore only particular every medical center offer quaternary care. It includes experimental medicine and procedures.

Activities

Activity 1:- Teacher will take students visit Telehealth care service sub centers, primary Healthcare and health and wellness centers near your locality observe the facilities available there and healthcare workers. Collect pictures.

Check Your Progress

A. Fill in the Blanks

1. The Healthcare services should be promotive, _____and rehabilitative.
2. In India, Healthcare services are generally provided by …… government.
3. A highly specialized Healthcare comes under …… level.
4. One sub – center is established for every ……in general area.
5. Ayushman Arogya Mandir' with the tag-line……

B. Write the short answer questions

1. Define the following:
   a. write Healthcare delivery system.
   b. write levels of Healthcare system

C. Write full form

a. AWW b. ANM c. ASHA d. ICDS e. MOHFW d. NGO

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Session 6: Hospital

According to World Health Organization (WHO), a hospital is defined as "an integral part of social and medical organization, the function of which is to provide complete healthcare, both preventive and curative for the population". The outpatient services of the hospital diagnose and treat the disease without admitting the patients. The hospital is also a centre for the training of health workers and bio-medical research. The main objectives of a hospital are to save lives, restore the health of person and maintain quality of life. Hospital also provides training to healthcare professionals and conduct bio-medical or bio-social research.

Hospital can be categorized on the of ownership, which can be private type, semi-government or government hospital type. Private hospitals are owned by voluntary agencies and have no financial interference of government. Semi-government hospital are collectively managed by private organization and by the government for internal matters. On the basis of range of specialties available, hospital can be of general type, single specialty or multi-specialty hospital. Single specialty hospital can be of any specialization ranging from children hospital, cancer hospitals, kidney or gastro-intestinal specialty. Multi-specialty hospital has all specialization under one institution providing tertiary level of Healthcare facilities. Multi-specialty hospital varies in bed capacity and other facilities available like teaching, training, research activities. For instance, All India Institute of Medical Sciences (AIIMS) of India and Post graduate Medical Education and Research Institute, Chandigarh serving as teaching cum research hospital under public Healthcare system.

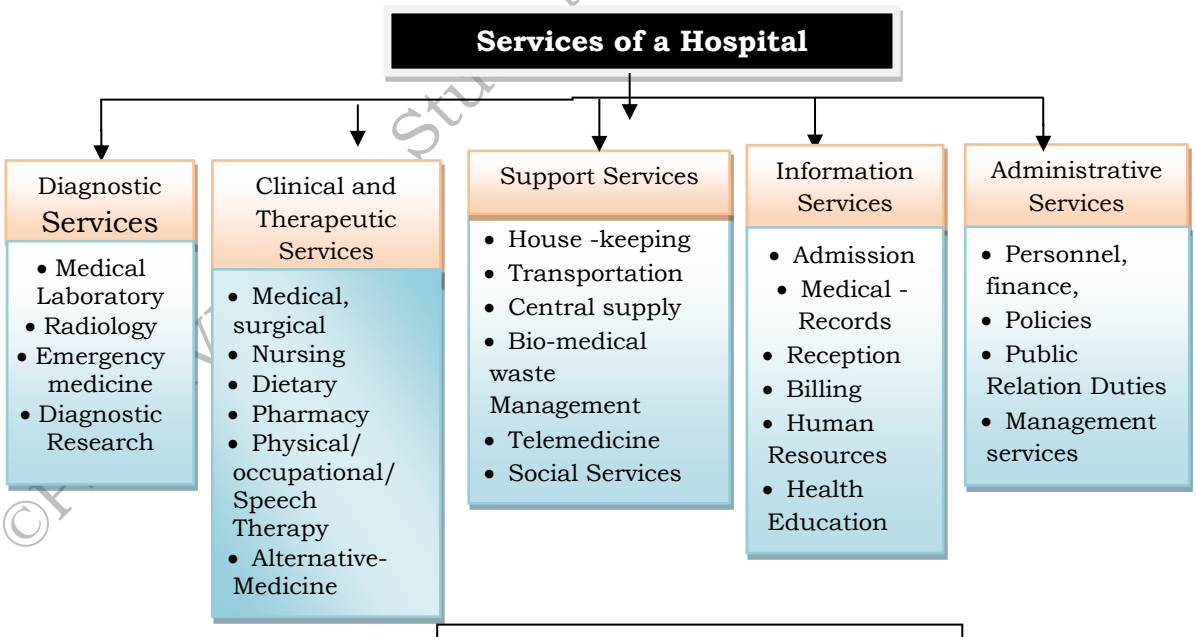

Fig. 1.32 Services of a hospital

A hospital is an important social institution which gives advantage to both population and society. In hospital a large number medical and allied healthcare professional along with technical staff apply their skill and expertise to work for

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healthcare of the person. Hospital organization offer proper care to sick and injured person in emergency without discrimination. Some private organizations are also working for the welfare of the weaker section of society as free and subsidized healthcare facilities.

Nowadays, there is rapid growth in the number of hospitals offering wide range of specialized healthcare facilities and quality service to gain recognition as good hospital and to facilitate patient satisfaction. The modern hospital structure and organization is a complex type which provides all facilities for 24 hours a day for whole year. These hospital works as industry and equipped with huge workforce, technologies, medical experts, allied health professional for 24 hours with effective coordination of its entire network like staff and service providers. Some hospitals have the facility of medical education and research bodies as a part of their services.

Services of a Hospital: Hospital is a complex organization which coordinates between its all components to deliver complete care to patient in various medical conditions. These services range from clinical, non-clinical, administrative, and information services.

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a) **Diagnostic Services:** Most of the hospitals have their own diagnostic facilities. Diagnosis is the process of determining cause of disease on the basis of blood testing, Radiation report of a person is suffering from. Diagnostic services are important for investigating the disease or illness in order to provide best therapy required as quickly. The reasons required for diagnosis is determined by history and physical examination of the person who is looking for Healthcare. Sometimes more than one diagnostic procedure is required to examine disorders in patient's body. Diagnosis can be done on biological samples of body such as blood, urine, sputum, stool, cerebro-spinal fluid (CSF) and other body fluids. Diagnostic services are the basic requirement in any Healthcare setting and it includes facilities of Pathology and laboratory, radiology and nuclear medicine to investigate fluctuation in bodily parameters. Health professional engaged in diagnostic services may be a laboratory technician, radiologist, phlebotomist, microbiologist, virologist, system analyst etc. Timely diagnosis is very essential to initial the treatment of diagnosed illness at the earliest possible.

b) **Clinical and Therapeutic Services:** These clinical services include medical and surgical facilities offered by medical health experts and surgeons to treat any type of mental or physical abnormalities and to handle causality or medical emergencies. The therapeutic services target to enhance health of person or population through direct or indirect intervention such as counselling, health awareness, care, treatment and various therapies for in-patients or out-patients within the hospitals. It involves Healthcare practitioners, occupational therapist, physiotherapist, recreational therapist, dieticians, counsellor, healer, psychologist, social workers etc.

c) **Support services:** Support services works to keep up every other service of hospitals and includes material supply, house-keeping services look after

maintenance, cleanliness of hospital building and laundry. Bio-medical waste management ensures the safe disposal of hospital waste while bio-medical technology is responsible for repair and maintenance of all equipments.

d) **Information services:** All people seek information to reach right medical expert in the hospital. Here information services works for both; for medical care seeker and medical service providers. At the time of admission, hospital needs information of the patients, all general data and medical history. Information services also deals admission procedures, billings, medical record keeping, clearance of insurance claims and maintenance. Benefits of employee as well as patients also taken care under information services.

e) **Administrative Services:** These include the persons who owns or run the hospital. They frame the policies and procedures of the hospital. They handle and supervise the functioning of hospitals, budget management, public relation responsibilities. Board of administration may comprise chairman, director, president, vice president, executives and departmental heads.

Functions of Hospital

The purpose of healthcare services is to effectively meet the total health needs of community. The hospitals play a key role in maintaining and restoring the health of the community. The main functions of the hospitals can be listed as follows:

Restorative Functions – Restorative care includes diagnostic, curative, rehabilitative and Emergency services activity. The aim of restorative care is to recover the patient from severe or acute illness. A team of medical and allied health professional works in comprehensive way to restore quality of life and brig the patient to normal life by all physical and mental mean. This comprises all diagnostic, medical or clinical and therapeutic services.

Preventive Functions – prevention of illness and communicable diseases, immunization, supervision of pregnancy, normal growth and development of children, health education services, health screening, check-ups included in preventive functions. Preventive function target to assist population or person to remain healthy and aware of early sign of any disease or health emergency so as to manage the illness at early stage with less complication.

Training and Research in health and medicine – training of medical, paramedical and other support staff to enhance the skills or knowledge of medical and health professionals. Research carried out in hospitals in the area of Physical, psychological, Clinical medicine, Hospital practices and administration and social aspects of health and diseases for better services and exploring newer medical technologies and knowledge of medical care.

Various Departments of Hospitals

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A hospital is an open system with various components that are integrated by common purpose of achieving a set of objectives. The performance of all these services is dependent on the cooperation and coordination of various components/departments within the system. It includes clinical, supportive and administrative departments. Departments like medicine, diagnostic, pathology, nursing and dietetics work with team of specialist in hospital as support service. Every department comprised of medical experts in their respective medical field and well-trained staff.

a) In-Patient Departments (IPD)

Every multi-specialty hospitals facility of specialized medical team of every multi-specialty hospital take care of every types of diseases and body parts like a cardiologist looks after heart diseases and nephrologists are expert of urinary system. Hospital usually have departments for every branch or department of medical sciences viz. as orthopaedic(bones), gynaecologist (female reproductive health), paediatrics (child specialist), neurologist (neurons specialist), ophthalmologist (eye specialist), dermatologist (Skin expert), gastroenterologist (gastro-intestinal), dentist, physiotherapist, Ear nose throat(ENT), psychiatry (mental health), Oncology (Cancer), emergency (causality) and dietetics departments.

Fig. 1.33 Department of a hospital

b) Out Patient Department (OPD)

The outpatient department is important component of a hospital organization in providing the medical care without admitting the person. Outpatient department managed by medical and health professionals of a hospital who runs inpatient department of their respective specialization. All diagnostic procedure and medical and therapeutic services offered to the out-patients. Usually all hospitals have out-patient departments in their ground floor in close proximity to parking and diagnostic facilities. Arrangement of transport of patient by wheelchairs or stretchers is available in outpatient department.

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The advantage of OPD is that much of the investigative and treatment work can be done there without admitting the patient, thus helping the patient in bring down the cost of treatment. OPD is located at the entrance area of the hospital.

The scope of OPD includes: -

- Consultation and investigation
- Preventive and promotive healthcare
- Rehabilitation services
- Health education
- Counseling

c) Laboratories

The following laboratories are usually found in a hospital:-

Bacteriology laboratory: It conducts tests related to bacteria and the toxins produced by them.

Clinical Biochemistry laboratory: It is involved in conducting tests and research in biochemical basis of diseases and clinical trials of new drugs.

Haematology laboratory: It is responsible for testing blood related investigations, haemoglobin determinations, coagulation time studies, red and white cell counts and special blood pathology studies for anaemia, leukaemia, etc.

Parasitology laboratory: It involves study of the presence of parasites and the cyst and ovas of the parasites that are found in the faeces.

Blood Bank: It has the role of collecting the blood and screening them for all blood related disease, and then put them into use for benefit of patient in the hospital through transfusions.

Laboratory services must be available day and night and the laboratories must be located on the ground floor. Laboratory services should be easily accessible to the outpatients.

Fig. 1.34 Laboratory in hospital

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d) Kitchen/ Dietary Department

The dietary department has the responsibility for ensuring quality food service to the client and according to their needs and doctor's prescription. This department is responsible for teaching the client with regard to proper diet after their discharge from the hospital. One dietary staff member is required for about 15 to 20 patients. Dietician, food storekeeper, cook, cook helpers and dish washer are engaged in this Department. One dietician can look after up to 200 beds. One cook, one cook helper, one bearer and one dishwasher are sufficient to prepare and serve meals for 20 patients and staff members. The food service department functions round the year.

Fig.1.35Kitchen/dietary department in hospital

e) Cleaning and Laundry Department

The cleaning and laundry department takes care of the entire linen of the hospital. It has the following functions:

1. Washing the dirty linen
2. Repairing the torn linen
3. Replacing the condemned linen

Fig.1.36 *Cleaning Department in*

One laundry operator can wash linen of 25 to 30 beds. One Laundry orderly can assist in washing the linen of 50 – 60 beds. The appointment of laundry supervisor, mechanic and clerk and the number employed depend upon the size of the hospital. One supervisor, one laundry mechanic and one laundry clerk are required in each shift. One washerman can take care of 150 to 200 kg linen per day. Each operation

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in Operation Theatre produces 7 to 8 kg of soiled linen. Each delivery in labour room produces 7 to 8 kg of soiled linen. Each ward patient produces about 5 to 6 kg of bed linen.

f) Housekeeping

The housekeeping department has the main function of keeping the hospital clean. Housekeeping in-charge should know the simple facts about bacteriology. Sanitation in-charge should also be able to train his employees in cleaning techniques that prevent the spread of disease, since all cleaning is meant to remove organic matter in which bacteria is harboured.

Fig.1.37House keeping in hospital

A sanitary attendant should be allocated a work-area of 1200 to 1500 square feet, keeping in view the policies of the hospital, the degree of cleanliness required, and the electrical cleaning equipment used such as scrubbing machine, vaccum cleaner, etc. For a nursing unit one sanitary attendant over 10 beds is recommended on the basis of round the clock service. In Intensive Care Unit (ICU) and Critical Care Unit (CCU) of higher degree of cleanliness is required, therefore more sanitary attendants are provided there. One supervisor to supervise 10 sanitary attendants is generally kept. For a 300 bed hospital, there should be 01 sanitation incharge, 04 supervisors and 40 sanitary attended (30 sanitary attendants for the daily requirement and 10 sanitary attendants as leave reserve).

g) Administration

The administration of the entire hospital cannot be vested on the administrator alone. It is the collective responsibility of the medical professionals and supporting staff. The

administrative staff, depending upon the size of the hospital, comprises the administrator, the assistant administrator, the business manager and the departmental heads.

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Purchasing Department: The purchasing department has the responsibility for purchasing all supplies and equipment for the hospital.

Finance and Accounts Department: The Finance and Accounts Department has the responsibility for collecting the money, paying for the supplies and equipment, handling all records pertaining to hospital finance, keeping records of assets and liabilities and assist in budget preparation. The business manager is responsible for the functions of the department and the accountants help the business manager.

Activities

Activity 1:-The teacher will take the student to the nearest hospital and collect all the picture of different various departments in the hospital.

Check Your Progress

A. Match the following

Colum A	**Colum B**
Diagnostic services	Medical and surgical
Therapeutic services	Housekeeping, Transport
Information services	Management services
Support services	Record and report
Administrative services	Madical Laboratory

B. Short Answer Questions

1. Define hospital according to WHO?
2. Write the components of hospital?
3. Write the functions of hospital?
4. Prepare a list of various departments of hospitals and their functions.
5. Classify the hospital on their ownership?

Session:7 Hospital Management Information System

Telemedicine is the use of telecommunication and information technologies in order to provide clinical health care at a distance. It helps eliminate distance barriers and can improve access to medical services that would often not be consistently available in distant rural communities. It is also used to save lives in critical care and emergency situations. Telemedicine, flourishing digital communication industry in India has the potential to dramatically change the way healthcare providers reach out to the underserved patients in the remote locations through the medium of telemedicine in health education, in screening and diagnosis, in the way patients have access to medical information and healthcare.

The Telemedicine Centre has been established by All India Institute of Medical Sciences, State Medical institute. Telemedicine incorporates direct clinical, preventive, diagnostic, and therapeutic services and treatment; consultative and

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follow-up services; remote monitoring of patients, rehabilitative services, and patient education.

Objective

1. Minimal patient's travel for quality treatment.

2. Cost effective method of health care delivery.

3. More efficient and effective use of medical and technological resource.

4. Enhanced diagnostic and therapeutic quality of care.

5. New possibilities for continuing education or training for isolated or rural health practitioners.

6. To develop and validate triage protocol for health care advice seekers

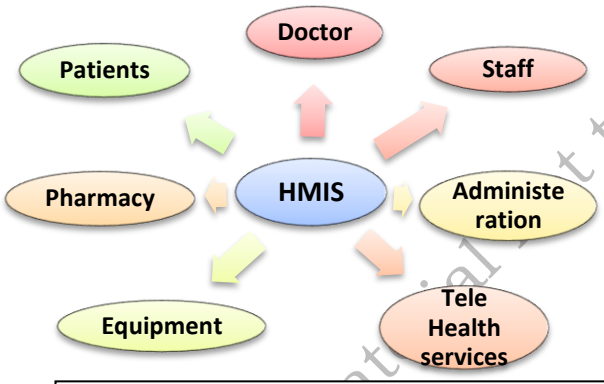

Fig.1.38 Hospital Management information system

Telehealth

The delivery and facilitation of health and medical -related services including medical care, patient education and counselling, health information services and self-care to remote people through tele communication and digital communication technologies.

Telemedicine

WHO adopted the following definition for telemedicine: "The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities"

Hospital management information system (HMIS)

HMIS is a comprehensive, integrated information system built for managing the operations in running health care facilities (Hospitals). HMIS as any other integrated system, needs time for developing, require special type of professional skills for development and software production but most importantly it costs money for development, installation, support and upgrade.

ADVANTAGES

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1. Hospital Management Information System helps in maintaining a totally secured database of Patients and business information. This information can be available at your fingertips.

2. Hospital Information System helps in improved healthcare delivery by providing medical personnel with better data access, faster data retrieval, higher quality data and more versatility in data display.

3. Hospital Information System helps in improving efficiency, both on the cost and the clinical care perspective. This is achieved by avoiding duplications, repetitions, delays, missing records and confusions.

4. Hospital Information System helps to force orderliness and standardization of the patient records and procedures in the clinic and increasing accuracy &completeness of medical records of Patient. delays, missing records and confusions.

5. Hospital Information System helps as a good managerial tool to provide total, cost-effective access to complete and more accurate patient care data to offer improved performance and enhanced functions.
6. Hospital Information System helps in gathering information to meet management challenges.
7. Hospital Information System helps to educate patients about their diseases of surgical procedures through pictures and animations.

Fig.1.39 Hospital information system

The major components of a hospital management information system:

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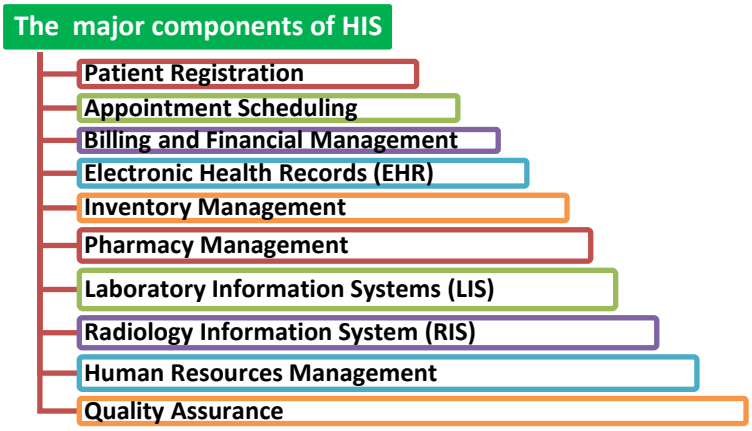

Structuring Medical Records to carry out functions like admissions, discharge, treatment history etc:

Patient Registration: This function of the hospital management information system is to register the new patient for OPD or IPD and give unique identification number to the patient. The ID is used for tracking a patient's medical records.

OPD / IPD Investigation Cases: This module of the hospital management system deals with all types of tests suggested by the doctors. This function enables entry of tests/procedures for a particular patient. The tests entered are done through the billing/cash office and once the patient makes the payment for the test, his entries go to the respective diagnostics centre.

IPD Admission and Ward Allocation: This function IPD Admission facilitates the process of patient admission and allocating a bed to the patient. The system identifies the patient as a new IPD patient or an inpatient referred from the hospital.

This function gives information about vacant and occupied beds in the hospital. Depending on the completion of the entry process, the patient category can be Company, Self, Government Schemes, Insurance and MLC. The patient's case report is printed from the system and sent to the concerned nursing station.

The system notifies the nursing station under them with audio visual alerts about the entry of the patient and preparing the room for the patient. In case of MLC, the system stores details of the police station, name of the officer informed about the medico legal case.

Patient Shifting: This function of the hospital management system facilitates transferring the patient from one room to another inside the hospital. With this facility, the actual status of the patient can be updated online so that internal operations like billing, investigation, surgery can be planned.

Financial Transactions: This function of the hospital management system facilitates all types of financial transactions such as deposits, advances, refunds, discounts and concessions from the patient. The task plays an important role in collecting timely payments from patients during their stay. Advances and deposits accepted by the billing/cash counter are posted directly to the accounts. Refund cases are considered for additional advance from the patient. Exemption categories

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are flexible and can be changed by the administrator. This makes it easier to keep track of discounts and concessions.

Fig.1.40 Digital Transaction

Following are the main reports and outputs generated by HMIS:

1. Patient List –This report provides information about patients admitted and discharged during a specified time period. This facilitates the management to know the admission and discharge ratio.

2. Bed occupancy Reports - This report gives information on Bed Occupancy at any given time room category wise.

3. Ward Allocation ReportsThis report gives allocated rooms report for tracking of patient.

4. Interim Bill v/s Advance Report. This report gives the ration of Interim Bill vs. Advances paid by the patient with the percentage of payment.

5. Admission and Discharge Register - This register is maintained by the system. This report gives details of patient Admission and discharges during specific period.

6. Consultant – This doctor wise report allows patients to know about the referring or in-charge doctor at any time.

7Appointment List – Appointments for consultants are maintained on the system. Performed operation list, Patient follow-up report, Diagnostic Centres

8. This module enables to get patient's investigation, procedure record from different locations i.e. IPD, OPD, Casualty.

Blood Bank Reports

- Blood Stock Register
- Donor register
- Investigation Report
- Blood Issue Register

Automated Clinical Laboratory Systems & Radiology Information System This function of HIS covers Laboratory System for Blood Bank Pathology, Radiology,

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Cardiology, Neurology, and Chest Medicine. The prescriptions given by the Physician are routed through billing system to respective Diagnostic Centre's.

Blood Bank

This module has been developed keeping in mind the legal and other requirements of functioning of blood banks. It gives details about blood transfusion centres and component laboratories and works like an online interactive system. It also prepares legal and internal operational records.

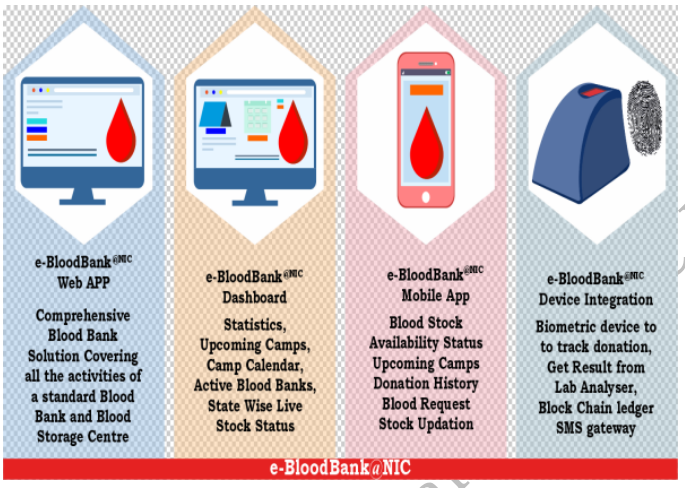

Fig.1.41 e-blood bank

Functions of Telehealth services coordinator

- Donor's data entry, Details of Donors such as Name, Address, Contact Numbers, and Blood group is maintained in the system through Donors data entry.
- The details can be printed as and when required. The mailing list from the available data of donors can be printed for Correspondence.
- Investigation Data Entry
- Various tests details are stored in the system for as per rules of Blood Bank.
- Maintains data of tests
- Tests data details required for Blood Bank records are stored into the system with specific results on HIV, HB details.
- Facilitates component level administration of the blood units
- Keeps track of distribution / disposal of the whole blood and the components
- Signals expiry dates and components characteristics

Pathology laboratory

Laboratory module starts with receiving the online request from doctors. Laboratory personnel can also generate requests. This facilitates investigations for referral patients. Tests are grouped under various sections and sample type (specimen). Based on the request the user can input the sample and generate the sample number. Results can be inputted based on the sample type. Results can be inputted either to one test or multiple tests. If the test result requires approval, the

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supervisor has to approve the result. Test results are available to concerned doctors. Test report can be made confidential. Tests can be performed only after the billing is done. This rule is exempted when the case is declared as Urgent.

Fig.1.42X-ray, scanning

- Integration of tests Ordered from Clinical Modules
- Comprehensive On-line Laboratory Reports
- Fast Entry of Results
- Enables Doctors to see the Results On-Line from any Location at any time
- Up-to-date status about request
- Provision for templates of Input of test Results

Radiology

Radiology module caters to services like X-ray, scanning, ultra sound etc. Scheduling of radiology resources is possible. The system stores all the result details of various tests and generates a report based on the test results. These tests are done for both inpatients and outpatients. The system stores all the details (e.g. patient number, test reports such as X-rays, scanning details) and for each scan the system generates a unique number for the image. This is helpful in easily identifying the patient's report.

- X-Rays: Direct Capturing of X-Ray images
- ECG Notes
- CT Scanning: Direct Capturing of CT Scanned images, Easy Reporting facility
- MRI: Easy reporting
- Sonography Reporting
- Prescriptions Discharge Card

Role of Tele Health Service Coordinator in Database in HMIS

Database is the heart of Hospital Management Information system. It consists of an orderly written document encompassing the patient's identification, health history, physical examination findings, laboratory reports, treatment, surgical procedure reports and hospital course. When complete, the record should contain the data to justify investigations, diagnosis, treatment, and length of stay, results of care and future course of action". Thus, it becomes a tool:

- To provide a means of communication among physicians, nurses and other allied health care professionals.
- To provide Continuity of patient care, help in medical education and research.

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- To provide information for the quality review of patient care
- To protect legally the physician, patient, hospital and helps in third party payment.
- Failure to maintain an accurate, timely and complete database spoils the usefulness of HMIS. Medical Records are valuable to patients, physicians, nurses, teachers, students, and health care institutions, and research teams, national and international organizations.

Need for networking in HMIS

Networking with new applications plays an important role in hospital management information systems that improve patient care and reduce rising health care costs. However, the rapid shift to next-generation wired and wireless healthcare applications means that networks are no longer an option, but a necessity. There is increasing pressure on HMIS providers to provide infrastructure that can be adapted to next generation applications.

Applications such as electronic medical record (EMR) and wireless monitoring The increasing use of handheld devices has given rise to a wide range of medical devices and applications, including EMR, PACS (picture archive and communication systems), collaboration, wireless patient monitoring, and more monitoring, and other services. As more and more wired and wireless services are used and networks must support patient care, an efficient network is no longer a luxury, it is a necessity.

HEALTH INSURANCE

Health insurance is insurance against the risk of medical expenses between individuals. By estimating the overall risk of health care expenses among a target group, an insurer can develop a regular finance structure, such as monthly premiums or payroll taxes, to ensure that funds are available to pay for the health care benefits specified in the insurance agreement. Must be collected is available. , benefits are managed by a central organization such as a government agency, private business, or non-profit organization.

HEALTH LEGISLATION

Health legislation encompasses the laws, ordinances, directives, regulations and other similar legislative instruments that deal with all aspects of health protection and promotion, disease prevention, and delivery of health care.

Health Legislation in India:

An Anthology Health is a state subject and state government laws apply in many areas. Given the enormity of the task of compiling all health-related laws, this compilation is limited to laws applicable at the central level and laws relating to health and health care issues. In this sector include Acts and Rules were collected from different sources from time to time, of which it is not possible to mention too many. Major health-related international guidelines are also included.

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The categorization of legislations has been adapted from the WHO classification. The broad areas covered include:

- Health Facilities and Services
- Disease Control and Medical Care
- Human Resources
- Ethics and Patient Rights
- Pharmaceuticals and Medical Devices
- Radiation Protection
- Hazardous Substances
- Occupational Health and Accident Prevention
- Elderly, Disabled, Rehabilitation and Mental Health
- Family, Women and Children
- Smoking, Alcoholism and Drug Abuse
- Social Security and Health Insurance
- Environmental Protection
- Nutrition and Food Safety
- Health Information and Statistics
- Intellectual Property Rights
- Custody, Civil and Human Rights

HEALTH FINANCING SYSTEM

Components

The field of application of ICT is always changing due to continuous technological progress and socio-economic context. The four primary e-health components are:

Fig.1.43E-Health System

1. Health informatics: The integration of health information networks and distributed systems of electronic medical history and records and related services to collect, analyze, and distribute health information. For example, in the case of electronic health records, they can sometimes be managed and shared by the patient. In this case, they are known as "personal health folders" or electronic patient records.

2. Telehealth and telemedicine: direct or indirect interaction with other health care providers (for a second or expert opinion), ill patients, or citizens. An example would be tele consultation and social media. Whereas the term telemedicine is restricted to direct health care, Telehealth has a broader definition.

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3. E-learning: Use of Information Communication Technology to provide learning and education opportunities to health providers and citizens.

4. Electronic commerce: Electronic commerce (related to business aspects of health care, for example, electronic reimbursement). For example, hospital information systems allow patients to control services provided and their associated costs, as well as other administrative information.

Activities

Activity 1:- Visit a hospital and prepare a report on health and medicine related services including medical care, patient education and counselling, health information services

Check Your Progress

A. Fill in the Blank

1.Telemedicine is the use of .....in order to provide clinical health care at a distance.
2. Hospital management information system is a .....information system.
3. Health insurance is insurance against the risk of .....between individuals.
4. Applications such as .....and wireless monitoring

B. Short Answer Questions

1. Define Telemedicine.
2. Define health insurance
3. What is Hospital Information System?
4. Write the major components of a hospital management information system.
5. Write the e-health components

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Module 2 — Promote the Telehealth Services as per Needs and Protocols

Introduction

Telemedicine was initially developed to bring health services closer to populations living in remote places with limited health resources, thus improving accessibility. Later, it became a means to improve the quality of medical care by facilitating training and decision making of health care professionals in remote areas. More recently, it has been proposed as a tool to improve the efficiency of health services since it allows sharing and coordinating resources that are geographically remote or redesigning health services to optimize resources. Telemedicine services are currently available for most specialties.

Learning Outcomes

After completing this module, you will be able to:

- Explain the various types Telehealth technologies.
- Discuss about the Pre-requisites for conducting the promotional/outreach activities.
- Explain to the patients about benefits and usage of primary home Telehealth technologies
- Identify the patients who are unable to visit the Telehealth facility like geriatric/ disable/ psychiatric/ paralytic patients, etc.

Module Structure

Session 1: Telemedicine services

Session 2: Telemedicine services and Applications

Session 1: Telemedicine services

Telemedicine services or programs are grouped into services based on stored images (store and forward) such as tele-radiology, tele-histopathology, tele-dermatology, etc.; home monitoring programs and systems (home-based services) and real-time specialized care (hospital-based services). However, other authors consider other

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categories, such as the type of service delivered, tele-consultation, tele-monitoring, and tele-radiology, for different specialties.

Principles telemedicine services are:

- **Remote assistance:** They can refer to both tele-consultations for remote follow-up of patients, diagnosis or treatment, and tele-monitoring services, usually for older patients. These services also include electronic communication between professionals to facilitate coordinated actions.

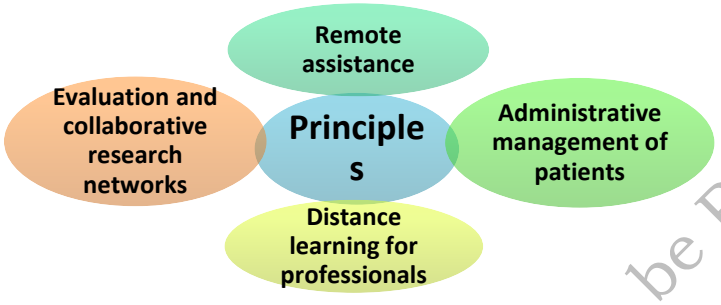

Fig.2.2PrinciplesTelemedicine services

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•**Administrative management of patients:** This service includes both laboratory test requirements and issues related to billing for service delivery.

•**Distance learning for professionals:** Provides health guidelines and evidence to facilitate continuing education of health professionals.

•**Evaluation and collaborative research networks:** The use of ICT to share and disseminate best practices and build knowledge through the actions and responses of its participants.

Telemedicine application areas

Major areas of telemedicine application are home-based patient health care, emergency services or information services. Teleconsultation refers to the use of telemedicine resources to obtain a second opinion from a health care professional through the exchange of clinical information.

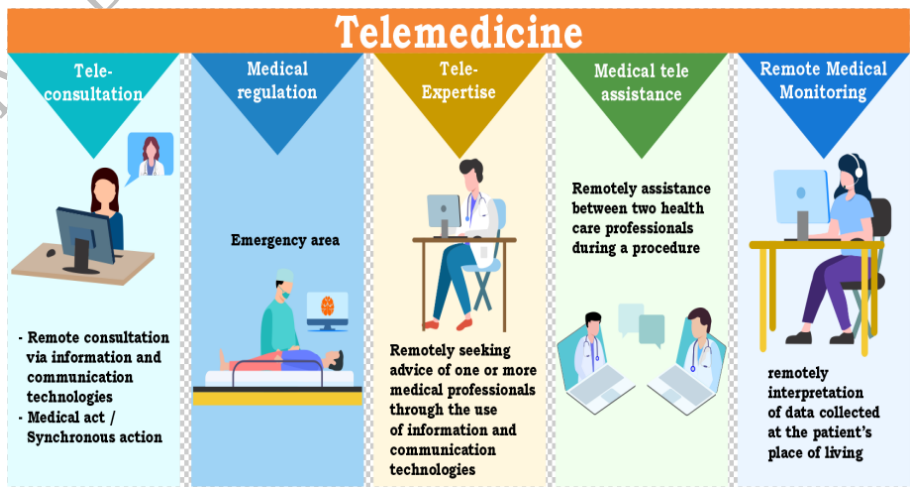

Fig.2.3 Telemedicine applications

Telemedicine applications are used in almost all medical specialties, telemedicine resources used for: diagnostic X-rays or other images (Tele-radiology), clinical laboratory and records and electronic clinical history (Tele-pathology), managing, helping, transmitting or exchanging information about psychiatric patients through videoconferencing. Treatment of cardiac disorders (tele-cardiology).

Telemedicine benefits

- Reduction in contact with infectious patients
- Improved time and transportation efficiency
- Enhanced privacy
- Easy patient follow-up
- Flexible working hours
- Better access to specialist medical opinion
- Possible disaster management solutions in short time
- Accurate analysis with the help of stored data

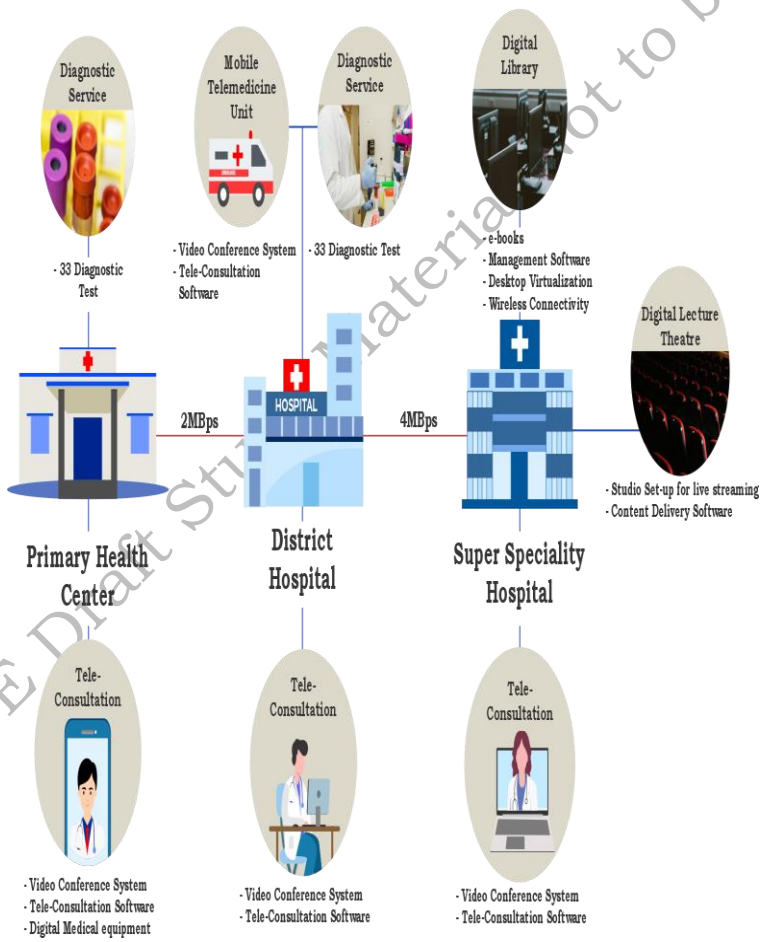

Fig.2.4 Telemedicine services Network

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Online Consultation - Tele-Medicine

Primarily for universal access to health services, MoHFW has aligned its initiatives with the Sustainable Development Goals to ensure healthy lives and well-being of

citizens. By incorporating ICT innovations, tele-health solutions are being promoted to provide basic and specialized health care services closest to the end user in inaccessible and rural areas. Major initiatives of the Department in this direction include National Medical College Network, National Telemedicine Network and use of space technology for telemedicine etc.

National Telemedicine Network (NTN): It is envisaged to provide telemedicine services in remote areas by upgrading the existing government health facilities in the states. Telemedicine nodes connecting PHCs, CHCs, district hospitals and medical colleges are being created in every state across India to provide citizen-centric services.

National Medical College (institute) Network (NMCN): Under this scheme, connectivity is provided to all government medical colleges for the purpose of tele-education, e-learning and online medical consultation. They are being linked together by using so that students will also get the benefit of National Knowledge Network.

Under this initiative, "Online Medical Consultation" is provided to patients through a web-portal by experts and super specialty doctors from medical colleges. This will help patients in rural, remote and urban areas to easily access doctors and specialists through government health institutions like Arogya Mandir HWC, PHC, CHC through their smart phones even from their home. Apart from this, e-class rooms are also being set up in these medical colleges to share and stream important lectures and seminars.

1. Use of tools to conduct educational sessions

Telemedicine facilities and equipment:

- **Video Conferencing Tools**
  - Webcams: High-quality webcams for clear video transmission.
  - Microphones: External microphones for improved audio quality.
  - Headphones: Clear audio output for both patients and healthcare providers.
- **Communication Devices**
  - Smartphones and Tablets: Portable devices for patients to connect with healthcare providers.
  - Laptops and Computers: Standard devices for video consultations.
- **Remote Monitoring Devices:**
  - Digital Thermometers: For temperature monitoring.
  - Blood Pressure Monitors: Measure blood pressure remotely.
  - Pulse Oximeter: Monitor oxygen levels in the blood.
  - Glucose Monitors: Essential for diabetic patients.
- **Telehealth Software:**
  - Telemedicine Platforms: Customized platforms for virtual consultations and data sharing.
  - Electronic Health Record Systems: To store and manage patient information.
- **Data Security Tools:**
  - Secure Messaging Apps: Ensuring secure communication between healthcare professionals and patients.

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- Encryption Tools: Protect patient data during transmission.

➢ **Diagnostic Tools:**
- Digital Stethoscopes: Transmit heart and lung sounds to healthcare providers.
- Dermatology Cameras: High-resolution cameras for skin examinations.

➢ **Wearable Devices:**
- Fitness Trackers: Monitor activity levels and basic health metrics.
- Smart-watches: Some models have health monitoring features heart rat, pulse rate and SPO2.

➢ **Collaborative Tools:**
- Screen Sharing Applications: Useful for sharing test results, images, or charts during consultations.
- Virtual Whiteboards: Facilitate discussions and explanations.

➢ **Internet Connectivity:**
- High-Speed Internet: Essential for smooth video and data transmission.
- Tele presence Robots: In certain cases, robots equipped with cameras and screens can provide a physical presence for healthcare professionals in remote locations.

HEALTH EDUCATION FOR COMMUNITY

Health education is the study and practice of communicating public health campaigns, health video materials, health education, and promotional health information between doctor and patient. The purpose of disseminating health related information is to make people aware of health. Because effective health communication must be tailored to the audience and situation, research in health communication is an effort to inform people about ways to enhance health or avoid specific risks.

Following are the methods of health communication:

1. Increase the audience's knowledge and awareness about a health issue.
2. Influencing behaviour and attitudes toward a health problem
3. Demonstrate the benefits of behaviour change on public health outcomes
4. Advocate a position on a health issue or policy
5. Increase demand or support for health services
6. Argue against health misconceptions
7. A patient's good communication with his or her health care team impacts his or her health outcome.
8. the most commonly used communication strategies by health professionals are YouTube, Twitter, television, providing health information to the public.

DOORASTH CHIKITSA KENDRA

In the medical field, getting medical advice from a doctor over telephone would be the easiest and most commonly used method by the patient. With the rapid increase in mobile phone users in urban and rural areas, such widespread networks are used to deliver medical care to patients' doorsteps. With this objective, All India Institute of Medical Sciences Bhopal has established its advanced tele health call centre

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"Doorasth Chikitsa Kendra" which provides a voice based tele consultation facility with toll free calling to the patient.

Telemedicine equipment

ISRO SATELLITE: ISRO satellites: Communications satellites are "space mirrors" that can help us bounce radio, TV, Internet data, video conferencing and other types of information from one side of the Earth to the other. Video transmission from one end of the earth to the other.

These elements are:

Video Conferencing Platform: A video conferencing unit is a platform used for conferences in multiple locations that allows simultaneous communication by audio and video transmission. In this, the user can share his thoughts with many people simultaneously. Video conferencing systems that enable the capture and transfer of video images and audio sounds. For example, Zoom, Microsoft Teams.

High-Speed Internet Connection: A stable and high-speed Internet connection is important for uninterrupted communication during health counselling and educational sessions. Using a high speed connection for better reliability. good quality webcam, microphone, headphones or speakers that will make it easier to counsel the patient.

Interactive tools: When consulting with patients on telemedicine platforms, use interactive tools such as chat, polls, and question and answer sessions, to actively engage.

Document sharing: Use platforms that allow easily sharing of patient's documents and other educational material. Google Drive or Microsoft One Drive are popular choices.

Screen Sharing Capability: Make sure the platform supports screen sharing so presenters can share slides, software demonstrations or other visual aids.

Whiteboard Software: For interactive teaching and health-related sessions, a digital whiteboard can be beneficial. You can use platforms like Microsoft Whiteboard or Zoom's.

Recording and Playback Features: Consider a platform that allows you to record sessions for future reference. This is valuable for participants who may want to review the material later.

Privacy and Security: Prefer platforms with strong security features to protect patient and sensitive information shared during educational sessions.

Training for participants: Provide training sessions to familiarize participants with the features of the telemedicine platform and ensure a seamless experience during educational sessions.

Backup power supply: A UPS is a smart addition to any telemedicine setup, ensuring that essential equipment remains powered during short-term power outages. It provides a seamless transition to a backup power source, preventing interruptions in patient consultations, educational sessions, or any critical healthcare activities.

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Remember to stay updated on the latest advancements in telemedicine technology and continual assess and improve your setup to enhance the overall educational experience.

1. Organize promotion and outreach activities for the Telehealth services

Rising health care costs and the need for better treatments are prompting more hospitals to investigate the benefits of telemedicine. They want better communication between physicians and remote patients and better access to health facilities. Here telemedicine also promotes better connectivity, which has resulted in reduced number of hospital readmissions. Doctors can use telemedicine to exchange their skills and create support networks to provide better healthcare services.

Capabilities and features of telemedicine when used in healthcare management system

- The concepts of telemedicine and associated services have now been well established and proven for citizen help.
- It provides chronic health management, prescription compliance, remote services, care-for-all under critical and severe cases, etc.
- Thus, for remote patient care, telemedicine uses a range of electronic communication media, ranging from teleconferencing to image-sharing to remote patient monitoring.
- Doctors can also use automation to provide quality treatment to their patients. For example, a virtual appointment encourages physicians about patient treatment. The examination report, history, medical findings, X-rays, or other images are sent to the specialist for examination by the doctor.
- These virtual consultations can eliminate the need for unnecessary in-person referrals to specialists, reduce wait times for specialist responses and eliminate the need for unnecessary travel.
- Telemedicine strategies are more useful where the doctor can see the patient, identify the illness, and chart the experience.
- An electronic personal health record system uses health records that can monitor and preserve. We can use a web-enabled device, such as a desktop or Smartphone, at any time.
- A personal health report will quickly provide essential details to emergency responders in an emergency, such as diagnoses, prescriptions and the doctor's contact information.
- The applications of this technology have been developed to assist customers with properly organising their medical records in one safe location.
- It allows patients to count calories, record vital signs, record exercise, and control prescription doses and schedules.

Tele health services and Facilities

- Technological advancements and health care creativity: Telehealth has experienced significant growth and applicability due to advances in technology and innovative health care practices.
- Inclusivity of healthcare professionals: Beyond physicians and doctors, Telehealth includes various healthcare stakeholders such as researchers, laboratory staff, and other medical professionals.

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- Integration into health care systems: Hospital systems, medical groups and suppliers are recognizing the need to integrate telemedicine into their medical services for comprehensive and accessible health care.
- Collaboration with telemedicine providers: Many organizations are seeking partnerships with telemedicine providers to streamline the process and deployment of Telehealth services within their health care framework.
- Telemedicine equipment: The implementation of Telehealth relies on specialized equipment, including computers and handheld medical devices, to facilitate remote medical consultations and services.
- High-resolution imaging: Physicians take advantage of high-resolution imaging cameras as part of telemedicine devices, enabling them to provide accurate clinical pictures for consultations with specialists.

Facilitate service to disabled patients

Telemedicine provides access to health services for patients with disabilities and other groups such as the elderly, the culturally isolated and the disadvantaged. And telemedicine can enhance consultations in the treatment of a variety of medical conditions. According to some reports, patients using telemedicine spend less time in the hospital, saving money. Additionally, shorter travel times may mean less secondary expenses such as petrol.

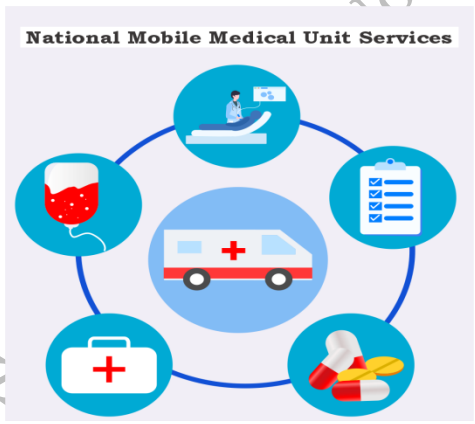

Fig.2.5 Mobile Medical Unit

Remote treatment

Remote treatment means providing health services to people without being present at the same place. This is a successful way to keep people away from the hospital. Telemedicine platforms are used to provide this type of service. allow physicians to communicate with the patient and each other through a remote link. With the help of patients can consult a doctor with highly specialized experience in a specific disease. This will save you from travelling long distances and wasting time.

MOBILE MEDICAL UNIT (MMU)

Support to Mobile Medical Units (MMUs) under NHM, which now includes both NRHM and NUHM, to facilitate access to public health care, especially for people living in remote, difficult, underserved and inaccessible areas. The strategy aims to take healthcare to the doorstep of the people, especially rural, vulnerable and underserved areas. Its purpose is not to move patients.

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MMU provides services in 12 thematic areas for Primary Health Center and these services are provided free of cost. *Maternal health, Neonatal and Infant Health, Child and Adolescent health, Reproductive Health and Contraceptive Services, Management of Chronic Communicable Diseases, Management of Common Communicable Diseases, management of Common Non-Communicable Diseases, Management of mental Illness, EYE care and ENT care, Dental care, Geriatric care, Emergency medicine.*

Typically there is one vehicle per MMU, however, in case of more than one vehicle

- A vehicle used to transport medical and paramedical personnel
- The second vehicle is used to transport equipment/accessories and basic laboratory facilities.
- The third vehicle carries diagnostic equipment such as X-ray, ultrasound, ECG machines and generators.

As per the norms, there is 1 MMU per 10 lakh population, where it provides health services to 60 patients in plain areas and 30 patients in hilly areas every day. The recommended staffs per MMU is one medical officer, one nurse, one lab technician, one pharmacist cum administrative assistant and one driver cum support staff.

Health surveys are systematic data collection tools used to collect information about the health status, behaviour, and characteristics of a population they are living in a geographical area. The purpose of these surveys is to provide a data of health issues within a community or a specific group of people. Health surveys can cover a wide variety of topics including demographic, health survey, health behaviour, environmental factor, mental health, health care facilities etc.

The campaign main objective

A health campaign is a coordinated series of activities, messages, and interventions aimed at promoting health behaviours, increasing awareness of health issues, or encouraging specific actions to improve public health. Health campaigns can target a variety of topics, including disease prevention, vaccinations, healthy lifestyle choices, mental health awareness, and more.

Online Conference

An online conference, also known as a virtual conference or web conference, is a meeting or event held over the Internet where participants can interact, collaborate, and share information in real time. These conferences leverage various online communication tools and platforms to facilitate discussions, presentations, and networking without the need for physical attendance.

Disadvantages of using teleconferencing

Like any technology, Telehealth conferencing also has some disadvantages. Here are some potential drawbacks:

Technical issues: Audio and video connectivity issues or platform issues can disrupt the flow of a Telehealth conference, affecting the quality of care and communication.

Privacy Concerns: Transmitting sensitive health information over digital networks raises privacy and security concerns. It is important to ensure a secure and compliant platform to protect patient privacy.

Limited physical examination: In some medical conditions, physical examination is important for accurate diagnosis and treatment. Telehealth may not allow for hands-on assessment.

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Digital Awareness: Not everyone has equal access to the technology needed for Telehealth. Socioeconomic factors and lack of digital literacy may contribute to disparities in health care access.

Emergency situations: In urgent or emergency medical situations, Telehealth may not be the most appropriate option because immediate practical care may be required.

Patient comfort and trust: Some patients may feel uncomfortable or less trusting in virtual interactions, which can impact the doctor-patient relationship.

IT system behind Telehealth conferencing

- Personal computer
- Telephone lines or satellite hook-up
- Monitor
- Microphone
- Webcam
- Speakers

Effect of Telehealth conferencing on health sector

a) Easy communication over long distance
b) Saves time, money, and energy
c) Face to face meeting reduces

Advantages of Telemedicine health care services

In India, providing personalized healthcare is challenging, especially given the large geographical distances and limited resources. One of the major benefits of telemedicine can be cost and effort savings, especially for rural patients, as they do not need to travel long distances to receive consultation and treatment.

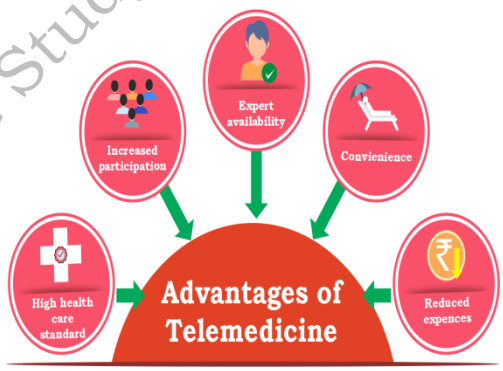

Fig.2.6 Mobile Medical Unit

- Telemedicine can play a particularly important role in cases where there is no need for the patient to physically see the doctor, for example. For routine, regular check-up or continuous monitoring.
- Telemedicine can reduce the burden on secondary hospitals.
- There is greater scope for maintenance of records and documentation, hence chances of missing consultations from doctors, other health care workers are reduced.

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- Telemedicine protects patient safety as well as frontline healthcare workers, especially in situations where there is a risk of infectious transmission.
- Tele Healthcare Service Coordinator can also enable availability of vital parameters of the patient available to the physician with the help of medical devices like blood pressure, blood glucose management etc.
- During pandemic outbreaks, telemedicine visits can be conducted without exposing employees to infection. This can provide quick access to medical practitioners who may not be immediately available in person.

Activities

Activity 1:-. Visit the telemedicine department of any nearby hospital and observe telehealth care services for patients.
Activity 2:- Visit a government hospital with your teacher and prepare assignments on the medical mobile unit

Check Your Progress

A. Multiple choice questions

1. Telemedicine services are
   a) Tele - radiology
   b) Tele - histopathology
   c) Tele - dermatology
   d) All of the above

2. Telemedicine application areas are...
   a) Home-based patient health care,
   b) Emergency services
   c) Information services
   d) All of the above

3. Benefits of telemedicine
   a) none of the following
   b) contact with infectious patients
   c) waste of time and transportation
   d) Difficulty in patient follow-up

4. Effect of Telehealth conferencing on health sector
   a) Easy communication over long distance
   b) Saves time, money, and energy
   c) Face to face meeting reduces

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d) All of the above

B. Fill the correct answer in the Blank

1. Health surveys are .....tools used to collect information.
2. Mobile Medical Unit especially for people living in ..... underserved and inaccessible areas.
3. Telemedicine protects patient safety as well as .....
4. Telemedicine can reduce the burden on.....

C. Short Answer Questions

1. Define Telemedicine services and principles.
2. Prepare a list of telemedicine application areas.
3. What is Doorasth Chikitsa Kendra?
4. What are the tele health services and facilities for the community people?
5. Write outreach activities for Telehealth services and explain a service.

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Session 2 - Telemedicine services and Applications

In general, telemedicine is used to denote a clinical service provided by a qualified medical practitioner, while Telehealth term for the use of technology for health and health-related services, including telemedicine.

Definition

A Qualified Medical Practitioner (QMP) For the purpose of this document a 'QMP' is defined as a person who is enrolled in the State Medical Register or the Indian Medical Register under the IMC Act 1956.

Definition of Telemedicine

Telemedicine refers to the remote provision of health services using telecommunication technology. This enables health care professionals to diagnose, treat and give medical advice to patients without the need for personal visits. This may include video consultations, phone calls, secure messaging and other forms of virtual communication. Telemedicine plays an important role in improving access to health care, especially in situations where physical presence may be challenging or unnecessary.

"Tele" is a Greek word meaning "distance "and "mederi" is a Latin word meaning "to heal".

TELEMEDICINE APPLICATIONS

Tools for Telemedicine

1.Qualified Medical Practitioner (QMP) can use any telemedicine tool suitable for technology-based patient consultation such as digital platforms telephone, internet, mobile, WhatsApp, mobile app, messenger, email etc.

2. Telemedicine applications can be classified into four basic types, according to the mode of communication, timing of the information transmitted, the purpose of the consultation and the interaction between the individuals.

Technology Used & Mode of Communications

There are 3 primary modes: Video, Audio, or Text, Each one of these technology systems has their respective merits and demerits, in which, they may be appropriate or inadequate to deliver a proper diagnosis. New technologies can improve these problems and provide best health care services.

According to the Mode of Communication

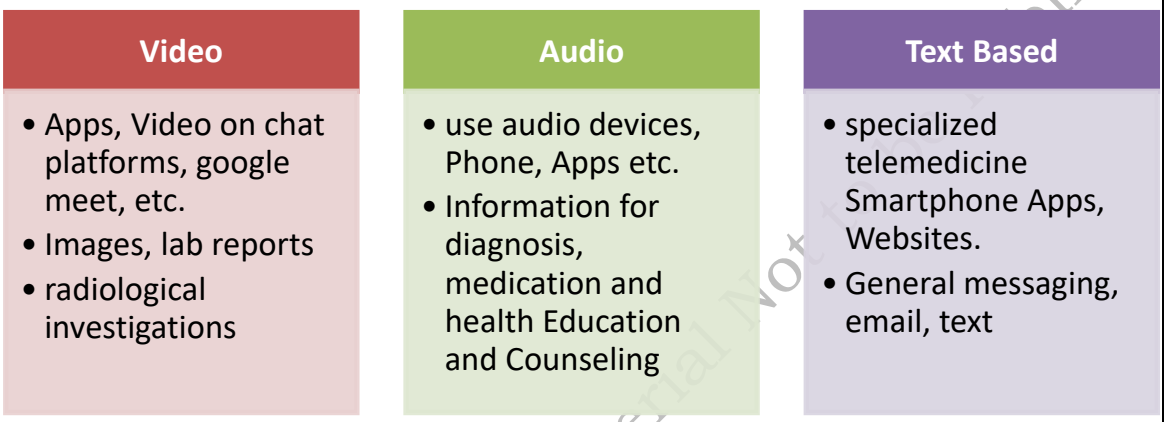

Fig.2.7 Mode of Communication

Telemedicine should be Appropriate and Adequate as Per Context

Qualified medical practitioners must use their professional judgment to decide whether a telemedicine consultation is appropriate in a given situation. They should consider the available modes and technologies for diagnosis and their adequacy before proceeding with any health education or counselling or medication. They should be comfortable that telemedicine is in the patient's best interest after taking a holistic view of the given situation.

Complexity of Patient's health condition

The medical condition of each patient may vary, for example, a new patient may present with a simple complaint such as headache, while a known diabetic patient may seek consultation for follow-up in case of an emergency. QMP will maintain the same standard of care as in-person consultation but within the intrinsic limitations of telemedicine.

Identification of the Qualified Medical Practitioner (QMP) and the Patient Is Required

- QMP should be registered by State Medical Council/MCI.

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- QMP should verify and confirm the identity of the patient by name, age, address, email ID, phone number, registered ID.
- The QMP should begin the consultation by telling the patient his or her name and qualifications.
- To issue a prescription, the QMP should clearly ask for the age of the patient, and if the patient is a minor, tele-consultation will be allowed only if the minor is accompanied by an adult.

PATIENT CONSENT

Patient consent is necessary for any telemedicine consultation. The consent can be Implied or explicit depending on the following situations:

- Patient consent is required for any telemedicine consultation.
- If, the patient initiates the telemedicine consultation, consent is implied.
- Patient consent is required if a health worker, QMP or caregiver initiates a telemedicine consultation.
- Patient can make appointment by sending email, text or audio, video message.
- The patient can communicate his/her intentions to the QMP over the phone or video.
- The QMP must record this in their patient's records.

Exchange of Information for Patient Evaluation

QMPs must make all efforts to gather sufficient medical information about the patient's condition before making any professional judgment.

Patient's Information

- Telemedicine has its own set of limitations for adequate examination.
- Can undergo examination and personal consultation by another doctor or health worker
- The information required for different medical conditions may differ on physiological parameters and standard treatments.
- QMP will properly maintain all patient records including case history, investigation reports, images etc.
- A QMP will use his or her professional judgment to patient information such as history, examination, test reports, past records, etc.
- This information can be Tele Health Services Coordinator and any information supported by technology-based tools.
- If the QMP feels that the information received is insufficient, it may request additional information from the patient. For example, the QMP may recommend certain laboratory or radiological tests to the patient.

TYPES OF CONSULTATION: FIRST CONSULT and FOLLOW-UP CONSULT

There are two types of patient consultations, namely, first consult and the follow-up consult. However, if the first consult happens to be via video, QMP can make

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a much better judgment and hence can provide much better advice including additional medicines, if indicated.

Meaning of first consultation

- The patient is consulting QMP for the first time.
- The patient has previously consulted a QMP, but more than 6 months have passed since the last consultation.
- The patient has previously consulted QMP, but for a different health problems.

Follow-Up Consult(s) means

- It is the time provided for the patients to come back to the treating healthcare provider for further information or reports, modification in treatment investigations, change in medicines, alternative medicines, proactive and preventive care etc.
- The patient has been consulting the same RMP for the last 6 months and it is for continuing care for the same health condition.
- Continuity of Care: Facilitates ongoing care for chronic conditions or follow-up appointments without the need for frequent in-person visits.

Prescribing Medicines

There are some limitations to prescription of medicines by the doctor on consultation through telemedicine. The categories of drugs that can be prescribed through tele-consultation will be notified from time to time in consultation with the Central Government.

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List O	List A	List B
• It will comprise those medicines which are safe to be prescribed through any mode of tele-consultation. • Medicines which are used for common conditions and are often available 'over the counter'. For instance, these medicines would include, paracetamol, ORS solutions, cough lozenges etc • Medicines that may be given health emergencies.	• These medicines are the ones that can be prescribed during the first video consultation. And in the follow-up situation. • This will be an inclusion list, which includes relatively safe drugs with low potential for abuse. • The doctor may prescribe refills as the patient undergoes follow-up consultation.	• Is a list of medication which QMP can prescribe in a patient who is undergoing follow-up consultation in addition to those which have been prescribed during in-person consult for the same medical condition.

Fig.2.8 categories of drugs prescribed through tele-consultation

Prohibited drugs:

Medicines listed in Schedule X because these medicines are narcotic drugs and psychotropic substances listed in the Drugs and Cosmetics Act 1985. Doctors cannot prescribe this type of medicine to a patient while providing consultation through telemedicine. Misuse of these drugs can harm the patient or society.

DUTIES AND RESPONSIBILITIES OF A Qualified Medical Practitioner

MEDICAL ETHICS, DATA PRIVACY & CONFIDENTIAILITY

The qualified medical practitioner must fully comply with the relevant provisions of the Indian Medical Council (Professional Conduct, Etiquette and Ethics) Regulations, 2002 and the IT Act, data protection and privacy laws or any applicable rules notified from time to time for security. with respect to patient privacy and confidentiality and the management and transfer of such personal information relating to the patient.

Role of Tele Health Services Coordinator To Maintain Digital Trail And Documentation Of Consultation

- Responsibility of the Tele Health Services Coordinator to maintain periodic records and documentation (e.g. phone logs, video interaction logs, email, text, etc.).
- Patient records, reports, documents, images, diagnoses, data etc. (digital or non-digital) used in telemedicine consultation should be maintained by the Telehealth service coordinator.
- The prescription records as required for personal consultations.

EMERGENCY SITUATIONS

According to the QMP decision, in all telemedicine consultations, if it is an emergency, health services should provide in-person care as soon as possible.

For example

- In cases involving trauma, proper advice and guidance about maintaining neck position can protect the spine in some cases.
- QMP may, at its professional discretion, recommend first aid, counselling, referral facilities.
- The patient should be advised to have a personal conversation with a registered medical practitioner as soon as possible.

Guidelines for Technology Platforms enabling Telemedicine

It specifically covers technology platforms that operate on a network of qualified medical practitioners and enable patients to consult QMPs through the platform.

- Technology platforms providing telemedicine services to the patient (e-Sanjeevani mobile app, website etc.)

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- The consulting physician should be registered with the National Medical Councils or the respective State Medical Council.
- Before the technology platform can register QMPs on its online portal, they have to provide their name, qualification and registration number, contact details.
- Technology platforms based on Artificial Intelligence are not allowed to counsel patients or prescribe any medicine to a patient. Only a QMP is entitled to give advice and must communicate directly with the patient in this regard.
- If a specific technology platform is found to be in violation, the government can designate the MCI technology platform as blacklisted, and no QMP can use that platform to provide telemedicine.

Activities

Activity 1: Visit the telemedicine department of any nearby hospital and observe the role and functions of qualified medical practitioner.
Activity 2: Prepare a list of medicines that can be prescribed by the doctor through tele-consultation.

Check Your Progress

A. Short Answer Questions

1. Define Qualified Medical Practitioner.
2. Role of the Qualified Medical Practitioner (QMP) using telemedicine applications.
3. Write down the limitations on prescribing medicines by the doctor on consultation through telemedicine.
4. Write the duties and responsibilities of a qualified medical practitioner.

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Module 3

Prepare and Manage the set-up for Tele Consultation

Introduction

First, physicians should ensure that their technology setup is secure and professional before any appointment. This includes maintaining a strong internet connection, clear video and smooth audio. While the verbal aspects of obtaining a patient history remain largely unaffected through a telemedicine visit, aspects of the physical examination are more difficult to accomplish.

Additionally, physicians' administrative staff should contact the patient at least a day before their appointment to provide adequate setup information.

This may involve distributing a clear, concise handout as shown in the picture. Such communication gives patients ample opportunity to gather materials and become familiar with specific expectations for the visit.

Finally, physicians may find it appropriate to add other counseling services, such as social workers or front line health workers, to video calls for patients struggling with complex issues.

In this way, telemedicine visits can act as a multidisciplinary tool for patients to interact with providers in a single, integrated setting.

Learning Outcomes

After completing this module, you will be able to:

- Discuss about the pre-requisites, design and set up of a Teleconsultation rooms and equipment.
- Describe common issues that may arise in the Telehealth set-up and the troubleshooting techniques to resolve them.
- Discuss the advantages of telemedicine through interactive videoconferencing.
- Describe the importance of availability of back-up coverage for phones, and network.
- Discuss the care of electrical equipment.

Module Structure

Session 1: Role of Tele Health Services Coordinator

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Session 1: Role of Tele Health Services Coordinator

Telehealth service coordinator before conducting a tele consult, the patient should be equipped with the necessary knowledge and resources and demonstrated how easy, convenient, and consistent virtual health care can be. Patients can receive the same quality care through telemedicine video consultations that they would receive in person without having to sit in a waiting room. Thereby you will improve patient satisfaction, which will impact the growth of your telemedicine practice.

Prepare Patient room for consultation

- We advise the patient to sit on a stable chair with good posture.
- Patients should sit in a properly lit room, avoiding light sources located behind their back as this may cause a silhouette effect.
- These preparations will ensure that physicians have a clear view of patients throughout the visit, which can be difficult to maintain in tight or dim conditions.
- Patients' video cameras should also be placed as close to eye level as possible.
- If patients use phones or I-Pads for their appointments, keep these devices in an appropriate place in the home. So that the doctor's can easily consult with patient.

Use of Telemedicine Equipment

Patients should be informed about any specific equipment they may need prior to telemedicine health care services. A laptop, phone, or tablet will be required to conduct telemedicine services. Patients should make sure that these devices work properly even before the session. This can be accomplished by video-calling a family member or friend to make sure the microphone and camera is working properly. If accessible, a blood pressure cuff, glucometer, or weighing scale may be helpful to record initial vital signs. Finally, patients should be prepared with an updated and comprehensive list of active medications to assist the physician during the history taking process.

There are several important steps involved in managing a telemedicine site before a Teleconsultation.

- First of all, you will want to ensure that your website is user-friendly and provides clear information about the counseling process.
- Consider implementing an easy-to-use booking system that allows patients to select an available time slot for their Teleconsultation.
- Make sure your site is secure to protect patient information and privacy.
- Provide comprehensive information about the health care professionals providing consultation, their expertise, and their status.
- Additionally, provide clear instructions on technical requirements for Teleconsultation, such as compatible devices, software, and Internet speed.

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- Regularly update your site with relevant content, such as blog posts, articles, or news related to the healthcare field.
- Collect feedback from patients to continuously improve your site and tele-consultation process.

Telehealth service coordinators must overcome a variety of challenges in setting up a Telehealth system.

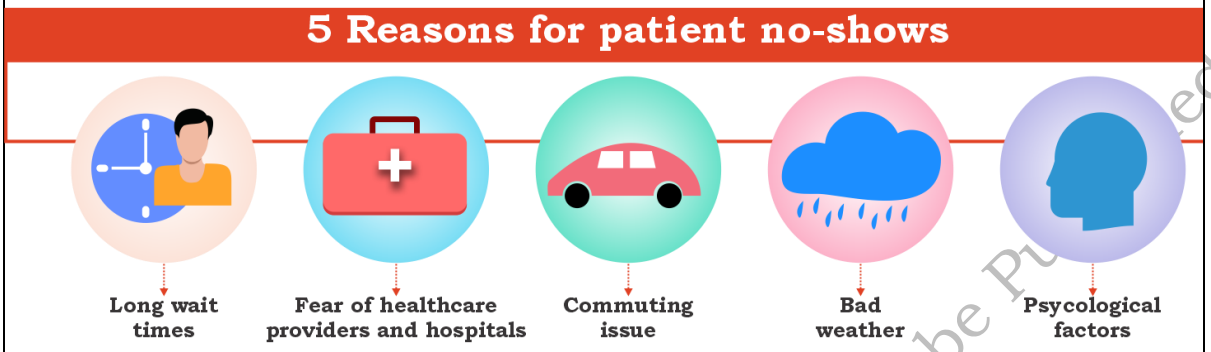

Fig.3.2 Barriers of communication

Telemedicine via videoconferencing many benefits, enhancing health care delivery in a variety of ways:

- Accessibility: Provides access to healthcare services for individuals in remote or underserved areas, overcoming geographical barriers.
- Convenience: Allows patients to consult with healthcare professionals from the comfort of their homes, reducing the need for travel and time spent in waiting rooms.
- Cost-Effectiveness: Reduces travel expenses for patients and may lower overall healthcare costs. It can also result in cost savings for healthcare providers.
- Time Efficiency: Streamlines the consultation process, saving both patient and provider time.
- Preventive Care: Encourages proactive healthcare by making it easier for patients to seek advice, follow-up on symptoms, and receive preventive care.
- Increased Patient Engagement: Promotes patient involvement in their healthcare by offering a convenient and accessible means to communicate with healthcare professionals.
- Flexibility for Healthcare Providers: Enables healthcare professionals to conduct virtual consultations at times that suit their schedules, increasing overall flexibility.
- Reduced Exposure to Infections: Minimizes the risk of infectious disease transmission, as patients can receive care without being physically present in crowded healthcare settings.

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- Enhanced Monitoring: Enables remote monitoring of patients with chronic conditions through video consultations and connected health devices, facilitating timely intervention.
- Collaboration and Second Opinions: Facilitates collaboration among healthcare professionals, allowing for easy sharing of medical information and enabling second opinions from experts worldwide.
- Patient Education: Offers an opportunity for healthcare providers to educate patients about their conditions, treatment plans, and preventive measures through visual aids and interactive sessions.
- Emergency Consultations: Enables quick access to medical advice in emergency situations, allowing for timely decision-making and potentially reducing emergency room visits.

Responsibility of Tele Health care services coordinator Care of equipment and electrical appliances

Taking care of equipment and electrical appliances in Telehealth care services is crucial to ensure smooth and reliable operations. Here are some tips to help you keep everything in top condition:

- **Regular Inspections:** Conduct routine inspections of all Telehealth equipment and electrical appliances. Check for any visible wear and tear, loose connections, or damaged cables.
- **Cleanliness Matters:** Keep the equipment clean and free from dust. Dust can affect performance and even cause overheating. Use appropriate cleaning materials to maintain hygiene standards, especially for devices that come in direct contact with patients.
- **Proper Storage:** Store equipment in a dry and cool environment to prevent moisture damage. Consider using protective cases for portable devices to prevent physical damage during transport or storage.
- **Update Software Regularly:** Ensure that all software and firmware are up-to-date. Manufacturers often release updates to improve performance and security.
- **Battery Maintenance:** If your equipment uses batteries, follow proper charging and discharging practices to prolong battery life. Replace batteries as needed, and don't leave devices plugged in unnecessarily.
- **Adhere to Manufacturer Guidelines:** Follow the manufacturer's guidelines for maintenance and care. This includes recommended cleaning agents, storage conditions, and any specific instructions they provide.
- **Emergency Protocols:** Establish clear protocols for handling equipment malfunctions or failures. Ensure that staff is trained on these procedures.
- **Regular Staff Training:** Train staff on proper usage and care of Telehealth equipment. This includes handling and connecting devices correctly to avoid unnecessary wear and tear.

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- **Surge Protection:** Use surge protectors to safeguard equipment from power fluctuations. Unstable power can damage sensitive electronic components.
- **Document and Track:** Keep a record of maintenance activities, inspections, and any issues encountered. This documentation can help identify patterns and anticipate potential problems.
- **Professional Support:** For complex equipment, rely on professional maintenance services as recommended by the manufacturer. Taking proactive measures to care for Telehealth equipment ensures a reliable and efficient Telehealth service, reducing the risk of interruptions in patient care.

Importance of network coverage and internet facilities

- The importance of network coverage and Internet facilities cannot be underestimated in the context of Telehealth care services.
- These technological elements form the backbone of remote health care, allowing patients to access medical services from the comfort of their home.
- Reliable network coverage ensures seamless communication between healthcare providers and patients, enabling virtual consultations, real-time monitoring and exchange of vital health data.
- This is especially important in situations where physical distancing or mobility issues may hinder traditional health care access.
- Internet facilities support the infrastructure for Telehealth platforms, facilitating the secure transfer of sensitive medical information and ensuring the efficiency of virtual health services.
- As Telehealth care is playing a vital role in improving access to health care, network coverage and robust Internet facilities become essential components in providing timely and effective medical care to individuals around the world.

National Teleconsultation Service:

National Teleconsultation Service of Ministry of Health and Family Welfare is first of its kind online OPD service offered by a country government to its citizens. National Teleconsultation Service aims to provide healthcare services to patients in their homes. Safe & structured video based clinical consultations between a doctor in a hospital and a patient in the confines of his home are being enabled.

What is eSanjeevani?

- It is a national doctor-to-doctor telemedicine service that attempts to provide an alternative to traditional physical consultation through a digital platform.
- e-Sanjeevani is an integral part of the Ayushman Bharat Digital Health Mission (ABDHM), and more than 45,000 Ayushman Bharat Health Account) IDs have been generated through the eSanjeevani application.

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- The ten states leading in the usage of this platform are: Andhra Pradesh, West Bengal, Karnataka, Tamil Nadu, Maharashtra, Uttar Pradesh, Madhya Pradesh, Bihar, Telangana and Gujarat.

Fig.3.3 eSanjeevani online Portal

eSanjeevani OPD

Government of India's flagship telemedicine technology developed by Centre for Development of Advanced Computing (Mohali). eSanjeevani - a doctor to doctor telemedicine system is being deployed nationally for the Ministry of Health & Family Welfare at 155,000 Health and Wellness Centres(ArogyaMandir) under Ayushman Bharat Scheme of Government of India. It caters to citizens in both rural and urban areas. It leverages technology via smart phones, tablets, laptops enabling doctor consultations to be accessible from the patient's residence regardless of location. eSanjeevani OPD has trained and on boarded all specialists, doctors and health workers. This platform has an impressive record of having served over 4. lakhs patients in one day.

Features of e Sanjeevani OPD

- Token Generation
- Queue Management
- Audio-Video Consultation with a Doctor
- e-Prescription
- SMS/Email Notifications
- Serviced by State's Doctors
- Free health care Service
- Daily Record – number of daily pt., Number of Dr., waiting slots, consultation time limit

Consultation process

- The consultation process with your doctor is mentioned below:-
- You can check the detailed consultation with your doctor.
- When you video call with the doctor, your doctor will have access to your past health records, if you have uploaded any.

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- The doctor will also generate an electronic prescription that is tailored to your disease.
- The doctor will send you the e-prescription and end the call when you finish your consultation
- After completing your consultation you can log out of the platform
- eSanjeevani OPD sends an SMS notification to the patient with a link to download the prescription.

Importance:

- These platforms could prove to be a game changer for people in rural and remote areas who do not have easy access to medical experts based in cities.
- Telemedicine saves time and cost. Moreover, these platforms are in line with the 'Digital India' vision of the government and are necessary to deal with situations like emergency.
- It endeavours to bridge rural-urban digital health divide by providing assisted Teleconsultation.
- It ensures that e-beneficiaries of Ayushman Bharat Scheme are able to avail of the benefits they are entitled to.

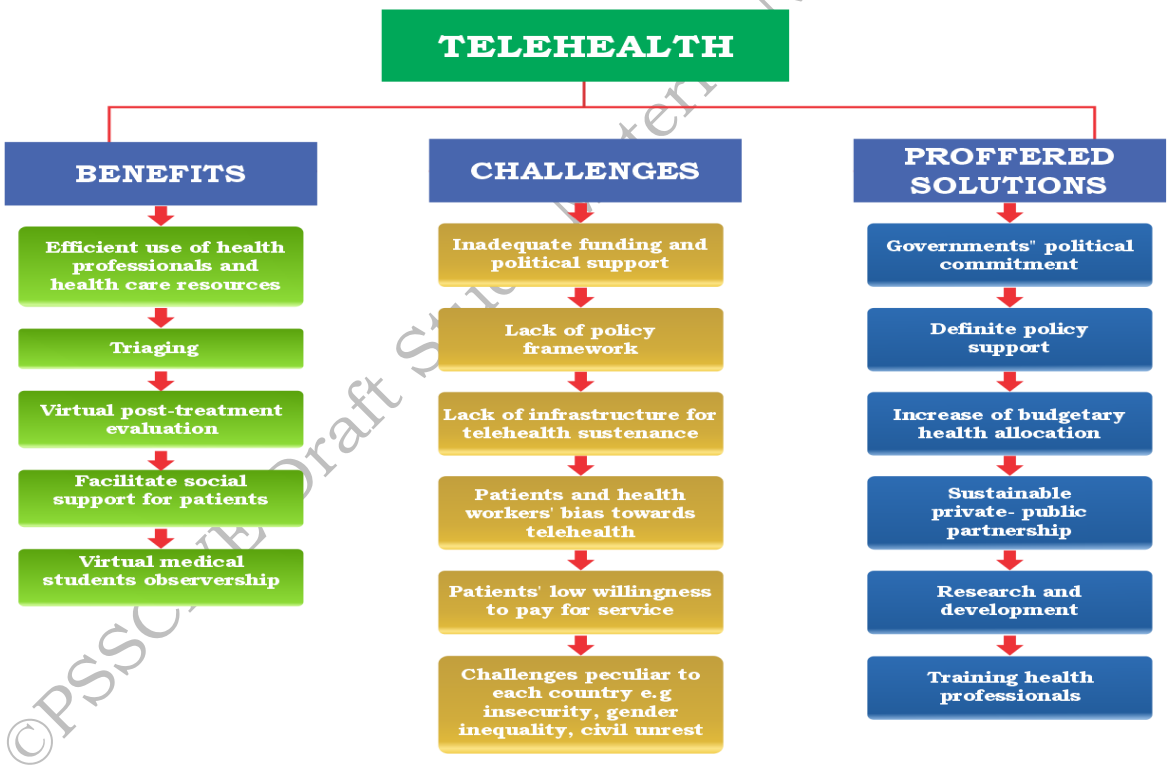

Fig.3.4 Telehealth functions

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Activities

Activity 1: Visit the nearby hospital and discuss the eSanjeevaniand Ayushman Bharat Digital Health Mission (ABDHM).

Check Your Progress

A. Match the column

	A		B
1	National Teleconsultation Service	a	A laptop, phone, or tablet
2	Telemedicine Equipment	b	doctor-to-doctor telemedicine service
3	eSanjeevani	c	Arogya Mandir
4	Health and Wellness Centres	d	Ministry of Health and Family Welfare

B. Short Answer Questions.

1. What is eSanjeevani?

2. Role of Telehealth services coordinator Prepare and Manage the Set-Up for Tele Consultation.

3. Write the benefits of videoconferencing enhancing health care delivery.

4. Explain the role and responsibility of Tele Health Care Service Coordinator in taking care of equipment and electrical equipment.

Module 4 Facilitate Bio-Medical Instrumentation Services for Tele Health Equipment

Introduction

Application of knowledge and technologies to solve problems related to living biological systems. Diagnosing, treating and preventing disease in the human body. The word "bio" refers to something related to life. When the basics of physics and chemistry are applied to living things, we call them biophysics and biochemistry. Therefore when the disciplines of engineering and medicine interact,

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it is called biomedical engineering. Measurement of biological signals such as Electro Cardio graph ECG or any electrical signal generated in the human body. Biomedical instrumentation helps physicians diagnose the problem and provide treatment.

Learning Outcomes

After completing this module, you will be able to:

- Identify Telehealth equipment and applications required to be set-up in Telehealth facility.
- Identify the supporting tools, resources and regulatory requirements for selected equipment and technology.
- Discuss about the operate tele health equipment safely and correctly.
- Explain laws, regulation and codes for technology and technical safety.

Module Structure

Session 1: Function and Operation of Equipment used in Tele Health Services

Session 2: Medical Equipment in Tele Health Care Services

Session 3: Biomedical Equipment and Management

Session 1: Function and Operation of Equipment used in Tele Health Services

Providing bio-medical instrumentation services for Telehealth equipment includes ensuring that the medical equipment used in Telehealth is working effectively and accurately. This includes activities such as maintenance, calibration, troubleshooting, and even training users on proper equipment use. Essentially, it's about keeping the technical side of Telehealth top notch, so that healthcare professionals can provide the best care possible. Designing biomedical devices and equipment.

DESIGN OF MEDICAL INSTRUMENTS

(1) Accuracy is the closeness with which an instrument reading approaches the true value of the variable being measured. The accuracy can be increased by proper calibration of the equipment and choosing the high precision equipment.

(2) Frequency response of an instrument is the response of the instrument for various frequency components present in a physiological signal. An instrument should display the original bio signal with higher fidelity.

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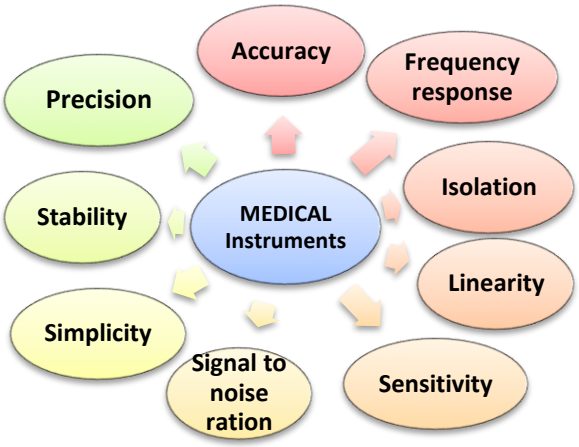

Fig.4.1 Design of Medical Instrument

(3) Isolation: between the subjects, on which the measurements are made and ground is necessary for reasons of electrical safety and to avoid any interference between different instruments used simultaneously. Using isolated circuits, the instrument does not produce a direct electrical connection between the patient and ground.

(4) Linearity: of an instrument is defined as the degree to which variations in the output of an instrument follow input variations.

(5) Sensitivity: of an instrument is the ability of that instrument to detect even a very small change that is taking place in the input. The sensitivity is also expressed in terms of resolution of the instrument which is the minimum variation that can be accurately measured.

(6) Signal to Noise Ratio: Since the magnitudes of the bio signals are very low, the Signal to Noise ratio should be very high to get reliable information about the input. Therefore the preamplifiers in the biomedical recorders are made up of differential amplifiers which have higher signal to noise ratio.

Telehealth equipment and applications

Telehealth equipment refers to a range of technologies designed to facilitate remote healthcare services. These technologies enable healthcare professionals to connect with patients and provide medical care from a distance. Here are some key components and applications of Telehealth equipment:

Video Conferencing Tools: Platforms like Zoom, Skype, or dedicated Telehealth software allow for real-time video consultations between healthcare providers and patients. This enables face-to-face communication, even when physically separated.

Remote Monitoring Devices: These include wearable devices that collect and transmit patient data in real-time, such as heart rate monitors, blood pressure

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cuffs, or glucose monitors. Healthcare providers can remotely monitor patients' vital signs and health metrics.

Digital Stethoscopes: Stethoscopes with digital capabilities allow healthcare providers to listen to a patient's heart and lung sounds remotely. The audio can be transmitted in real-time, enabling accurate diagnosis without physical presence.

Telemedicine Carts: Equipped with cameras, monitors, and other medical devices, these carts can be wheeled into a patient's location, allowing a remote healthcare provider to conduct a comprehensive examination with the help of an on-site healthcare professional.

Mobile Health (mHealth) Apps: Mobile applications enable patients to schedule virtual appointments, access medical information, and communicate with healthcare providers. Some apps also offer medication reminders and health tracking features.

Store-and-Forward Technology: This involves capturing patient information, such as images or videos, and sending it to a healthcare provider for later review. This asynchronous communication method is particularly useful for non-emergency cases.

Electronic Health Records (EHR) Systems: Integrated EHR systems ensure that patient records are accessible to healthcare providers regardless of their physical location. This contributes to seamless and efficient Telehealth services.

Tele-psychiatry Tools: Specialized equipment for mental health services includes video conferencing tools, secure messaging platforms, and online assessment tools. These help psychiatrists and therapists provide remote counseling and support.

Supporting tools, resources and regulatory requirement

When implementing and operating telemedicine services, various supporting tools, resources, and regulatory requirements come into play to ensure the effectiveness, security, and compliance of the Telehealth system. Let's analyze each aspect:

1. Supporting Tools:

- Telehealth Platforms and Software: Specialized Telehealth platforms and software are essential for conducting virtual consultations, managing appointments, and securely storing patient data.
- Health Information Exchange (HIE) Systems: These systems facilitate the sharing of patient information among healthcare providers, ensuring a seamless flow of data for comprehensive care.
- Electronic Health Record (EHR) Systems: Integration with EHR systems is crucial for maintaining accurate and up-to-date patient records, supporting continuity of care, and complying with regulatory standards.

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- Diagnostic Tools: Depending on the Telehealth services provided, integrating diagnostic tools such as digital stethoscopes, Otoscope, and high-resolution cameras enhances the diagnostic capabilities during virtual consultations.
- Secure Communication Platforms: Ensuring secure communication channels, including encrypted video conferencing tools and messaging platforms, is essential to protect patient confidentiality.

2. Resources:

- Training Programs: Healthcare providers and support staff need training on Telehealth technologies, protocols, and effective virtual communication to ensure smooth operations.
- Technical Support: Access to technical support services helps address any issues or challenges that may arise during Telehealth sessions, ensuring uninterrupted service delivery.
- Infrastructure: A robust and reliable internet infrastructure is crucial for seamless video conferencing and data transmission during Telehealth consultations.
- User Guides and Documentation: Clear documentation and user guides for both healthcare providers and patients contribute to the effective use of Telehealth tools.

3. Regulatory Requirements:

- HIPAA Compliance: Adherence to the Health Insurance Portability and Accountability Act (HIPAA) is essential to safeguard patient privacy and ensure the secure handling of health information.
- Telehealth Licensure and Credentialing: Healthcare providers must comply with state and national licensing requirements for Telehealth services. Credentialing processes ensure that providers meet specific qualifications.
- Reimbursement Policies: Understanding and complying with reimbursement policies from healthcare payers is crucial to ensure financial sustainability for Telehealth services.
- Data Security and Privacy Regulations: Beyond HIPAA, there may be additional local, state, or international regulations related to data security and patient privacy that must be followed.
- Telehealth Policies and Guidelines: Establishing internal policies and guidelines specific to Telehealth services helps healthcare organizations maintain consistency and quality in virtual care delivery.

Coordinating with authorities and agencies for technical

Coordinating with authorities and agencies for technical assistance is a crucial aspect of ensuring that Telehealth services comply with regulations, standards, and best practices. Here's a breakdown of the key elements involved:

Regulatory Compliance:

Understanding Regulations: Stay informed about local, state, and national regulations governing Telehealth services. Different regions may have varying

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requirements, so it's essential to be aware of the specific rules that apply to your Telehealth program.

Communication with Health Authorities: Establish communication channels with relevant health authorities to seek guidance on compliance issues, interpretation of regulations, and any changes in the regulatory landscape.

Technical Standards and Best Practices:

Industry Standards: Stay updated on technical standards and best practices in Telehealth. This includes standards for data security, interoperability, and the technical aspects of Telehealth infrastructure.

Collaboration with Technical Experts: Collaborate with technical experts within health agencies or relevant organizations to ensure that your Telehealth systems align with the latest technological standards and best practices.

Technical Assistance Programs:

Government Agencies: Explore technical assistance programs offered by government health agencies. These programs may provide resources, expertise, and support for the implementation and improvement of Telehealth technologies.

Industry Associations: Engage with industry associations related to Telehealth and healthcare IT. These associations often offer technical assistance, share insights, and provide networking opportunities with professionals in the field.

Data Security and Privacy:

Coordination with Data Protection Authorities: In regions where data protection authorities exist, coordinate with them to ensure compliance with data security and privacy regulations. This is especially crucial in maintaining the confidentiality and integrity of patient health information.

Security Audits and Assessments: Work with relevant agencies or experts to conduct security audits and assessments of your Telehealth systems. This proactive approach helps identify and address potential vulnerabilities.

Emergency Preparedness:

Collaboration with Emergency Services: Coordinate with emergency services and authorities to ensure that Telehealth systems are integrated into emergency response plans. This is important for providing Telehealth services during crises and natural disasters.

Training and Drills: Work with relevant agencies to conduct training sessions and emergency drills to prepare healthcare providers and technical staff for handling Telehealth services during emergencies.

Policy Advocacy:

Engagement with Policy Makers: Engage with policymakers to advocate for policies that support the growth and sustainability of Telehealth services. This

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includes addressing regulatory barriers, reimbursement policies, and licensing requirements.

Effective coordination with authorities and agencies involves proactive engagement, clear communication, and a commitment to continuous improvement based on feedback and evolving regulations. It ensures that Telehealth services not only meet technical standards but also align with the broader healthcare ecosystem and regulatory frameworks.

Organizational policies and government regulations

Organizational policies and government regulations play critical roles in shaping the landscape of various industries, including healthcare. In the context of Telehealth, these policies and regulations provide guidelines, standards, and frameworks to ensure the delivery of safe, effective, and ethical healthcare services. Let's explore the concepts of organizational policies and government regulations. Organizational Policies and Government regulations:

Organizational Policies	Government regulations
Internal Guidelines: Organizational policies are rules and guidelines developed and implemented by a specific healthcare institution or Telehealth provider. They outline the organization'sstandards, expectations, and procedures related to Telehealth services.	**External Standards:** Government regulations are laws and standards established by regulatory bodies at the local, state, or national levels. They provide a legal framework for the operation of Telehealth services and aim to protect public health and ensure quality care.
• Data Security and Privacy: Policies detail how patient health information is handled, stored in compliance with privacy laws, and protected from data breaches • Code of Conduct: Code of Conduct: Establishes ethical standards for healthcare providers during Telehealth consultations. • Emergency Protocols: Includes communication planning, patient prioritization, and collaboration for Telehealth services during emergencies. • Collaboration: Policies are often developed collaboratively with input from various stakeholders, including healthcare providers, legal experts, and IT professionals.	• Licensing and registration: Regulations often mandate that healthcare providers providing Telehealth services hold appropriate licenses. • Reimbursement Policies: Explain the reimbursement of Telehealth services by public and private payers, which impact the financial sustainability of Telehealth programs. • Emergency preparedness: Regulations allow Telehealth providers to integrate their services into emergency response plans.

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• Training and education: Staff members are educated on these policies, and regular training sessions may be held to reinforce compliance. • Enforcement: Violations of organizational policies may result in disciplinary action.	• Monitoring and audits: Regulatory bodies can monitor Telehealth providers to ensure compliance with established standards. Conduct audits or inspections as required. • Penalties for noncompliance: Noncompliance with government regulations may result in fines, legal action, or suspension of Telehealth services. It is necessary to follow the rules.

Laws for technology and technical safety:

In the area of technology and technical security for Telehealth care services, several laws and standards are important to ensure the safe and effective delivery of health care remotely. It is essential for Telehealth providers to remain aware of these laws and standards to navigate the legal landscape, protect patient privacy, and provide high-quality, safe healthcare services remotely. Always consult legal professionals familiar with health care and technology regulations in your specific jurisdiction.

- **General Data Protection Regulation (GDPR):**In the European Union, GDPR outlines rules for the protection of personal data. Telehealth services operating in EU member states must comply with GDPR to safeguard patient privacy.
- **Telemedicine Practice Guidelines:** Many jurisdictions have established specific guidelines for the practice of telemedicine, outlining the standards for technology use, communication, and patient care.
- **Medical Device Regulation:** Regulations governing medical devices may apply to certain Telehealth technologies. Ensuring compliance with relevant medical device regulations is crucial for the safety and effectiveness of Telehealth tools.
- **Telecommunications Laws:** Telehealth heavily relies on telecommunications infrastructure. Providers need to comply with regulations governing communication services to ensure reliable and secure connectivity.
- **National and Regional Healthcare Laws:** Countries and regions may have specific healthcare laws that address the use of technology in healthcare delivery. These laws may cover licensing, reimbursement, and other aspects of Telehealth.
- **Emergency Medical Treatment and Labor Act (EMTALA):** In the U.S., EMTALA requires that emergency services be provided without discrimination. Telehealth services must ensure they can handle emergency situations appropriately.

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- **Fraud and Abuse Laws:** Providers must be aware of fraud and abuse laws to prevent improper billing practices and ensure compliance with regulations like the False Claims Act.

Regulation and codes for technology and technical safety

Regulation and codes for technology and technical security for Telehealth care services involve compliance with various regulations and codes in ensuring the safety and efficacy of Telehealth care services. Staying informed about updates to these regulations and standards is essential for Telehealth care providers to maintain compliance and provide safe and effective services.

Telemedicine practice guidelines: Many jurisdictions have established specific guidelines for the practice of telemedicine, which outline standards for technology use, communication, and patient care.

Technical Standards: Compliance with technical standards is important for the development and use of Telehealth technologies. Organizations such as the International Electro technical Commission (IEC) and the Institute of Electrical and Electronics Engineers (IEEE) provide standards for medical electrical equipment and health informatics.

Telecommunication Standards: Compliance with telecommunication standards is essential to ensure the reliability and security of communication channels in Telehealth services. Standards organizations such as the International Telecommunication Union (ITU) provide guidelines for telecommunications equipment and networks.

Medical Device Regulations: Telehealth devices may be subject to medical device regulations in different jurisdictions. Compliance with standards such as ISO 13485 is important for quality management systems for medical devices.

Interoperability Standards: To facilitate seamless information exchange, it is important for Telehealth systems to adhere to interoperability standards such as Fast Healthcare Interoperability Resources (FHIR).

Clinical Practice Guidelines: Incorporating established clinical practice guidelines into Telehealth services ensures that health care professionals follow evidence-based practices, promoting patient safety and quality of care.

Emergency Protocols and Disaster Recovery: Telehealth providers should have protocols in place to handle emergencies and disaster recovery to ensure continuity of care during unexpected events.

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Activities

Activity 1: Visit the telemedicine health centre of any nearby hospital and prepare a list of equipment used in Telehealth services during patient consultation.

Check Your Progress

A. Choose the correct answer

1. The word "bio" refers to something related to.....
   a) Life
   b) Life science
   c) Bio science
   d) Living science

2. When the basics of physics and chemistry are applied to living things, we call them.....
   a) Biophysics and Bioscience
   b) Biophysics and Biochemistry
   c) Biotech and Biochemistry
   d) Biochemistry and Bioscience

3.The disciplines of engineering and medicine interact, it is called.....
   a) Biochemical engineering
   b) Biotechnical engineering
   c) Biomechanical engineering
   d) Biomedical engineering

4.Full form of HIPAA.....
   a) Health Insurance Portability and Accountability Act
   b) Health Insurance Accountability and Portability Act
   c) Health Policy Portability and Accountability Act
   d) Health Insurance Portability Act

B. Short Answer Questions

1. Define Telehealth equipment and applications.
2. What are the Laws for technology and technical safety?
3. Write the Regulation and codes for technology and technical safety.

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Session 2: Medical Equipment's in Telehealth care services

Uses of equipment's in Telehealth care services

Automated measurement

Thermometers are most widely used because of their convenience. Also, they are often much more sensitive than primary ones. For secondary thermometers knowledge of the measured property is not sufficient to allow direct calculation of temperature. They have to be calibrated against a primary thermometer at least at one temperature or at a number of fixed temperatures. Such fixed points, for

example, triple points and superconducting transitions, occur reproducibly at the same temperature.

Fig.4.1 Measuring Body Temperature

Automated electronic BP devices - Electronic sphygmomanometer – this battery-powered device replaces the mercury manometer with a pressure sensor and electronic display. The display may be numerical, or a circular or linear bar graph. No stethoscope is needed. Most automated BP measurement devices in current clinical practice use the oscillometric method.

Fig.4.2 Measuring Blood Pressure

Blood Sugar Test

Blood sugar level :-

- 99 mg/dl or lower: This is a normal fasting blood sugar level.
- 100–125 mg/dl: Fasting blood sugar in this range typically indicates pre-diabetes. This means your blood sugar levels are higher than normal but not high enough to be classified as diabetes.
- 126 mg/dL or above: This indicates high blood sugar, the main sign of diabetes.

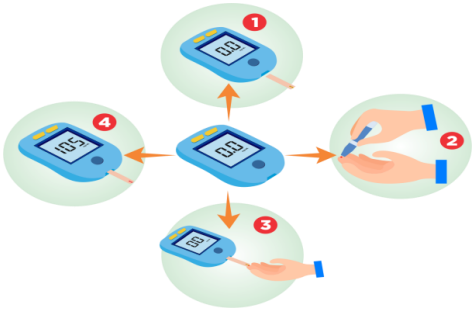

Fig.4.3 Sugar Test Digital Equipment

Procedure: In some cases, your healthcare provider may be able to test your blood sugar use glucometer test machine. Insert a test strip into your meter. clean finger

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tip use antiseptic lotion and Prick the side of your fingertip with the needle (lancet) provided with your test kit. Touch and hold the edge of the test strip to the drop of blood. The meter will display your blood sugar level on a screen after a few seconds.

Finger-tip oximeter

A fingertip oximeter is a small, portable medical device used to measure the oxygen saturation level in a person's blood. It is a non-invasive device that is usually attached to the fingers, although it can also be used on other body parts such as the earlobe or toe. The oximeter works by emitting light into the capillaries of the finger, and a sensor on the opposite side detects the amount of light passing through.

Fig.4.4 Digital Pulse Oximeter

The protein in red blood cells that carries oxygen, absorbs light differently depending on whether it is carrying oxygen or not. The oximeter calculates oxygen saturation by analyzing light absorption, and the result is displayed as a percentage. Normal oxygen saturation level is usually between 95% and 100%.Fingertip Oximeter are commonly used in health care settings, such as hospitals and clinics, as well as by individuals at home, particularly people with respiratory conditions such as asthma or chronic obstructive pulmonary disease (COPD). They provide a quick monitor oxygen level.

SpirometerA spirometer is a medical device used to measure the amount of air a person takes in or out. It is commonly used to assess lung function and diagnose respiratory conditions. The basic idea is that the person breathes into the spirometer, and the device measures various respiratory parameters, such as tidal volume, vital capacity, and forced expiratory volume.

It is an electronic and small hand-held instrument with a tube and a chamber to collect and measure air. By analyzing the patterns and volume of air movement, health care professionals can gain information about lung function.

Fig.4.5 Spirometer

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Electrocardiogram(ECG)

- ECG stands for electrocardiogram, which is a medical test that records the electrical activity of the heart over a period of time. It is commonly used to assess the heart rhythm and detect any abnormalities or irregularities in the electrical impulses that coordinate the heartbeats.
- During an ECG, electrodes are attached to the skin of various parts of the body, especially on the chest, arms, and legs. These electrodes are connected to a machine that amplifies and records the electrical signals produced by the heart. The resulting graph, known as an electrocardiograph, displays the heart's electrical activity as waves.
- Doctors use ECG to diagnose and monitor a variety of heart conditions, including arrhythmias, myocardial infarction (heart attack), and other cardiac abnormalities. It is a valuable tool in assessing overall heart health and function.

Fig.4.6 Electrocardiogram

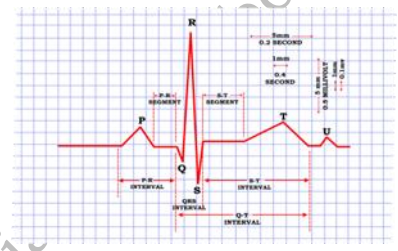

Fig.4.7 Electrocardiograph

X-rays, basis of diagnostic radiology

X-ray, or radiography, is a medical imaging technique that uses electromagnetic radiation to create images of the inside of the body. In a basic X-ray procedure, a small amount of ionizing radiation is directed through the body, and a detector on the other side catches the radiation passing through the tissues. Dense structures, such as bones, absorb more radiation and appear white on an X-ray image, while soft tissues allow more radiation to pass through and appear darker.

X-rays are commonly used to view the skeletal system, detect fractures, assess joint conditions, and identify certain medical conditions or abnormalities in organs and tissues. Chest X-ray, dental X-ray, are examples of typical applications.

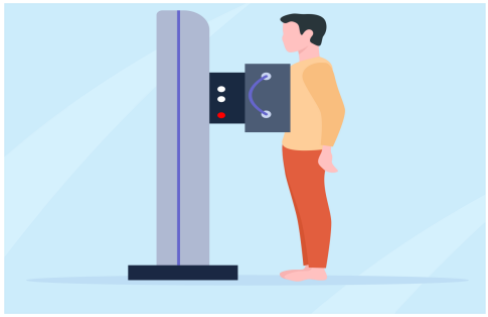

Fig.4.8 X-ray Radiography

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Endoscopy

Endoscopy is a medical procedure that involves the use of an endoscope, a flexible tube with a light and a camera at the end, to examine the interior of a hollow organ or cavity within the body. It is a minimally invasive diagnostic and therapeutic technique used to screen, diagnose, and treat various medical conditions. such as when child has swallowed something that needs to be removed and common problems like stopping bleeding, draining abscesses, removing growths, opening narrowed passages, inserting medical devices for treatment.

Fig.4.9 Endoscopy Procedure

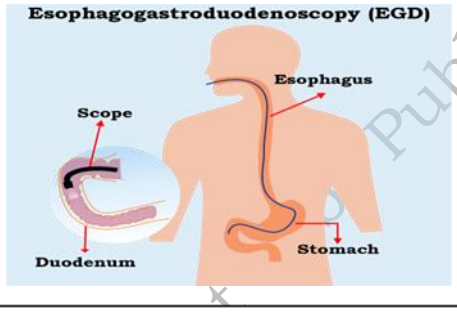

Fig.4.10 Upper GI Duodenum Scopy

During an endoscopy, the endoscope is typically inserted into the body through a natural opening, or a small incision. The camera sends images to a computer screen showing your internal organs The camera mounted on the endoscope allows health care professionals to view internal structures in real time on a monitor.

There are different types of endoscopy procedures For example:

Endoscopy	Examine Specific Areas
Esophagogastroduodenoscopy or EGD	Oesophagus, stomach, duodenu
Colonoscopy	colon and rectum
Bronchoscopy	Airway and Lungs
Cystoscopy	Bladder and Urethra

Responsibilities of Telehealth care services coordinator

- First of all, the patient who is to undergo endoscopy should be registered.
- All information about the patient should be collect and inform to the doctor.
- Make the patient sit comfortably and then check his vital signs.
- The patient should be informed about the endoscopy procedure.
- After completion of the endoscopy procedure, the report should be given to the doctor.

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- The all information of the patient should be kept safe in the computer as a record.

Ultrasound Sonography Ultrasound, or ultrasonography, is a medical imaging technique that uses high-frequency sound waves to create real-time images of the inside of the body. It is a non-invasive and safe diagnostic tool that is commonly used for various medical purposes.

During an ultrasound examination, a small handheld device called a transducer is moved over the skin or placed inside a body cavity. The transducer emits sound waves, and as these waves travel through the body they bounce back when they encounter different tissues. The returning echoes are then converted into images by a computer, creating a visual representation of the internal structures.

Fig.4.11 USG Abdominal Examination

Ultrasound is versatile and can be used to view organs, blood vessels, and tissues in real time. It is often employed in obstetrics to monitor fetal development and detect any abnormalities during pregnancy. Additionally, it is used to assess the liver, kidneys, heart, and other internal organs. It is a valuable tool to guide certain medical procedures such as biopsies or injections.

An important advantage of ultrasound is that it does not involve ionizing radiation, making it safe for routine use, including during pregnancy. Sonographers are trained medical technicians who perform ultrasounds, create images of your body, and provide images to doctors.

USG Procedure:

- You'll lie on your side or back on a comfortable table.
- The ultrasound technician will apply a small amount of water-soluble gel on your skin over the area to be examined. This gel doesn't harm your skin or stain your clothes.
- The technician will move a handheld transducer or probe over the gel to get images inside your body.
- The technician may ask you to be very still or to hold your breath for a few seconds to create clearer pictures.
- Once the technician has gotten enough images, they'll wipe off any remaining gel on your skin and you'll be done.
- An ultrasound test usually takes 30 minutes to an hour.

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Computed tomography

Computed tomography is commonly known as CT scan. this is A medical imaging technique that uses X-rays and computer processing to create detailed cross-sectional images of the body. Is Unlike traditional X-rays that produce 2D images, CT scans produce 3D images that provide a more comprehensive view of internal structures. During a CT scan, the patient lies on a motorized table that moves through a donut-shaped machine called a CT scanner. CT scans are used to view a variety of structures, including the brain, chest, abdomen, and pelvis. They are valuable for the diagnosis and evaluation of a wide range of conditions such as tumors, fractures, infections, and vascular diseases. CT scanning provides detailed information about the size, shape, and density of organs and tissues.

Fig.4.12 CT Scan Examination

MRI (magnetic resonance imaging)

Magnetic Resonance Imaging (MRI) is a medical imaging technique that uses a strong magnetic field and radio waves to generate detailed images of the internal structures of the body. During an MRI scan, the patient lies on a table that is moved into the cylindrical MRI machine. The machine generates a powerful magnetic field.MRI is particularly adept at providing images of soft tissues, such as the brain, spinal cord, muscles and organs. A radiologist is a registered physician who performs and interprets imaging tests to diagnose conditions. A radiology technician is a healthcare provider who's specially trained and certified to perform an MRI scan.

Fig.4.13 MRI Examination

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Advantages:

- The information from these signals is processed by a computer to create detailed, high-resolution images of the internal structures.
- It is often used to diagnose and assess conditions such as tumors, injuries, infections, and neurological disorders.
- It is especially valuable in situations where detailed visualization of soft tissues and structures is crucial.
- Unlike X-rays or CT scans, MRI does not use ionizing radiation, making it a non-invasive and safer imaging modality.

Disadvantages: MRI may not be suitable for individuals with certain metal implants or devices due to the strong magnetic field.

Responsibilities of the Telehealth service coordinator during an MRI scan

- Check the patient's medical documents and explain all the procedures of MRI scanning to the family member and the patient.
- To provide psychological support to the patient to reduce his anxiety.
- Before the MRI scan, the entire patient's jewellery should be removed and the patient should be given a gown to wear.
- The patient should lie down comfortably.
- After MRI scan, the report will have to be immediately sent to the radiologist through e-device mail, message.
- The Telehealth service coordinatorshould keep the patient's report safely in the hospital records so that in case of any problem in future, he can do online tele-consultation from home.

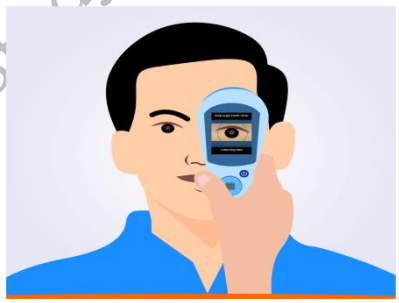

Fig.4.14 Electroretinography

Electroretinography (ERG)

Electroretinography (ERG) is a diagnostic test that measures the electrical responses of the retina to light stimulation. It involves placing electrodes on or around the eyes to record the retina's electrical activity in response to flashes of light. ERG is used to assess the health and function of the retinal cells, aiding in the diagnosis of various eye conditions, including retinal disorders and genetic eye diseases.

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It is a non-invasive and relatively quick procedure that contributes to the understanding of retinal function and aids in the management of various eye conditions.

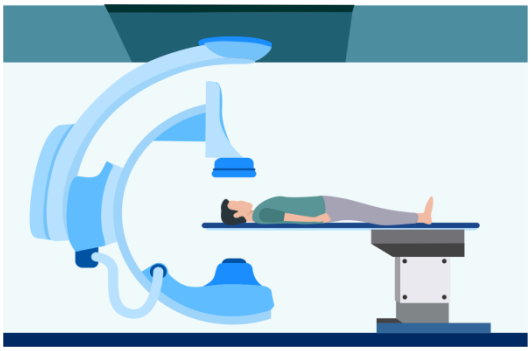

Fig.4.16 Electroretinography

Fluoroscopy

Fluoroscopy is a medical imaging technique that uses continuous X-rays to create real-time moving images of the internal structures of the body. It involves a fluoroscope, which is a specialized X-ray machine. The patient is exposed to a continuous X-ray beam, and the images are viewed on a monitor, allowing healthcare professionals to observe the dynamic function of organs, blood vessels, and other structures.

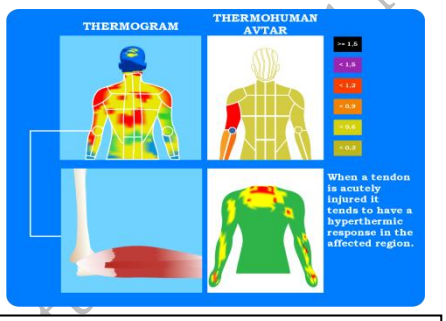

Fig.4.15 Fluoroscopy Machine

Fluoroscopic Equipment

- High Voltage Generator
- X-Ray Tube (XRT)
- X-Ray Image Intensifier
- Video Camera

Fluoroscopy uses:

- Orthopaedic surgery: Surgery concerned with musculoskeletal system conditions.
- Catheter insertion: Inserting a tube into the body.
- Blood flow studies: Visualizing the flow of blood to the organs.
- Enemas: Inserting a rubber tip into the rectum.
- Angiography: x-rays of lymph or blood vessels, including heart, leg and cerebral vessels.
- Urological surgery: Surgery of the urinary tract and sex organs.
- Pacemaker implantation: Implanting a small electronic device in the chest.

Disadvantages

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There are some minor risks associated with fluoroscopy. Because it uses x-ray technology, you have some radiation exposure. The amount you absorb varies depending on the procedure length and your size. Some individuals could experience radiation-induced injury to their skin that results in “burns” of their skin tissue.

Fig.4.17 Electrical Equipment Installation

Medical Thermography

Non-Invasive Imaging: Thermography is non-invasive and does not involve radiation exposure. It captures the infrared radiation emitted by the body and converts it into thermal images.

Heat patterns: images generated by medical Thermography display variations in temperature as different colours or shades. These patterns may indicate areas of inflammation, blood flow, or abnormalities.

Applications: Medical Thermography is used in various medical fields, including breast health (breast Thermography), neurology, rheumatology, and sports medicine.

Electrical safety in a medical environment

Electrical safety in a medical environment is crucial to ensure the well-being of both patients and healthcare professionals. Here are some key considerations for maintaining electrical safety in medical settings.

Equipment Inspection and Maintenance:

- Regularly inspect and maintain all electrical equipment to ensure it meets safety standards.
- Check power cords, plugs, and outlets for any signs of damage or wear.
- Follow manufacturer guidelines for equipment maintenance and calibration.

Grounding:

- Ensure that all electrical equipment is properly grounded to prevent electrical shocks.
- Ground fault circuit interrupters should be installed in areas where electrical equipment is used.

Isolation and Segregation:

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- Segregate electrical circuits to prevent interference and minimize the risk of electrical accidents.
- Use isolation transformers to protect sensitive equipment and reduce the risk of electrical noise.

Proper Wiring and Installation:

- Ensure that wiring installations comply with electrical codes and standards.
- Use qualified electricians for installations and repairs.
- Minimize the use of extension cords, and avoid running them under carpets or across walkways.

Emergency Power Systems:

- Implement reliable emergency power systems, such as backup generators or uninterruptible power supplies (UPS), to ensure critical medical equipment remains operational during power outages.

Education and Training:

- Provide training to healthcare staff on electrical safety protocols and procedures.
- Ensure that personnel are aware of the location of emergency shut-off switches and procedures.

Patient Safety:

- Inspect electrical equipment used for patient care regularly.
- Implement safety measures to prevent accidental contact between patients and electrical devices.
- Educate patients about the safe use of electrical equipment within healthcare facilities.

Compliance with Standards:

- Adhere to national and international electrical safety standards relevant to healthcare settings.
- Regularly assess and update safety protocols in accordance with evolving standards.

Risk Assessment:

- Conduct regular risk assessments to identify potential electrical hazards and take preventive measures.
- Develop and implement a comprehensive electrical safety plan for the healthcare facility.

Fig.4.17 Electrical Hazards

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By prioritizing electrical safety measures, medical environments can significantly reduce the risk of electrical accidents, protecting patients and health care professionals and ensuring reliable operation of critical medical equipment.

Effects of Electric Current on the human body

- Threshold of Perception
- Physical Injury and Pain
- Ventricular Fibrillation
- Sustained Myocardial Contraction
- Burns and Physical Injury

Precautions to Minimize Electric Hazards

- In the vicinity of the patient, use only apparatus or appliances with three-wire power cords.
- Provide isolated input circuits on monitoring equipment.
- Have periodic checks of ground wire continuity of all equipment.
- No other apparatus should be put where the patient monitoring equipment is connected.
- Staff should be trained to recognize potentially hazardous conditions.
- Connectors for probes and leads should be standardized so that currents intended for powering transducers are not given to the leads applied to pick up physiologic electric impulses.

Benefits of Telemedicine

Reduce exposure to pathogens: No face-to-face interaction between HCPs and patients. So the chance of catching a disease through pathogens is also reduced.

Middle-of-the-night Care: Telemedicine instantly offers medical service from far-off places and is also accessible at any time to patients.

Improves doctor safety: online conversation between a patient and physician works well during recent unwanted events such as the pandemic and lockdown period.

Support for Patients with Chronic Diseases: Telemedicine turns out to be a convenient option for chronic disease patients as it enables them to avoid paying a physical visit to hospitals. Online Psychiatric Support: Psychiatric patients receive many benefits from physicians.

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Activities

Activity 1: Visit hospital nearby your area and enlist of equipment facilities available there.

Activity 2: Discuss in classroom about the functions of using equipment in a hospital.

Activity 3: Visit hospital with your teacher and collect photographs of Telehealth care services equipment.

Check Your Progress

A. Match the column A and B.

	A		B
1	Body Temperature		Eye
2	Blood Pressure		Thermometer
3	Sugar test		sphygmomanometer
4	oximeters		Spirometer
5	Respiratory		oxygen saturation
6	Electroretinography		glucometer

B. Short Answer Questions

1. Define digital clinical thermometer.
2. Write the advantages of ultra sound Sonography.
3. Explain the advantages and dis advantages of
4. Write the use of MRI in examining which diseases?
5. Write electrical safety measures while using medical equipment.

C. Write the name of medical equipment

a.....

b.....

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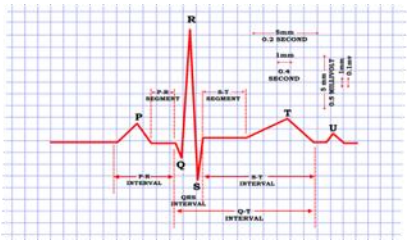

c..... **d.....**

Session 3: Biomedical Equipment and Management

Managing biomedical equipment is a crucial aspect of healthcare infrastructure. Biomedical equipment includes a wide range of devices used in the diagnosis, monitoring, and treatment of patients.

Effective management involves several key components

Medical device: An article, instrument, apparatus or machine that is used in the prevention, diagnosis or treatment of illness or disease, or for detecting, measuring, restoring, correcting or modifying the structure or function of the body for some health purpose.

Procurement and Acquisition: This involves the careful selection and purchase of biomedical equipment based on the needs of the healthcare facility. Considerations include the functionality, reliability, and compatibility of the equipment.

Installation: Proper installation of biomedical equipment is essential for its optimal functioning. Integration with existing healthcare systems, such as electronic health records, is also important for seamless operation and data management.

Maintenance and Calibration: Regular maintenance and calibration are critical to ensure the accuracy and reliability of biomedical equipment. This includes preventive maintenance schedules and prompt repairs when issues arise.

Risk Management: Identifying and mitigating risks associated with biomedical equipment is crucial for patient safety. This involves assessing potential hazards, implementing safety protocols, and having contingency plans.

Training and Education: Staff members need to be trained on the proper use and maintenance of biomedical equipment. This helps in preventing misuse, ensures patient safety, and maximizes the lifespan of the equipment.

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Inventory Management: Keeping track of all biomedical equipment, including their location, usage, and maintenance history, is vital. This facilitates efficient resource allocation and prevents equipment from being lost or misplaced.

Fig.4.18 Electrical Equipment Management

Compliance and Regulations: Healthcare facilities must adhere to regulatory standards and compliance requirements for biomedical equipment. This includes certifications, safety standards, and quality control measures.

Lifecycle Management: Biomedical equipment has a lifecycle, and planning for replacement or upgrades is essential. This involves assessing the performance, technological advancements, and budget considerations for timely replacement.

Budgeting and Financial Management: Managing the financial aspects of biomedical equipment includes budgeting for acquisitions, maintenance costs, and potential upgrades. It also involves optimizing resource allocation for maximum efficiency.

Data Security: With the integration of technology in biomedical equipment, ensuring the security of patient data is paramount. Implementing robust cyber security measures helps protect sensitive information and maintain patient privacy.

Role and responsibility of Telehealth services coordinator Diagnosing and repairing faults

Diagnosing and repairing faults in Telehealth equipment typically involves a systematic approach, and the complexity of the process can vary depending on the specific equipment and issues at hand. Here's a general guide for diagnosing and repairing major and minor faults in Telehealth equipment.

Diagnosing and repairing faults in Telehealth equipment

- Gather Information: Obtain a detailed description of the issue from users or staff members. Identify when the problem started and if there were any recent changes or incidents.

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- Visual Inspection: Check for any visible damage, loose connections, or unusual indicators on the equipment.
- Functional Testing: Test each component of the Telehealth system to identify specific malfunctioning parts. Verify that peripherals such as cameras, microphones, and speakers are functioning correctly.
- Software Diagnosis: Check for software-related issues such as outdated software, compatibility problems, or configuration errors. Review error logs or diagnostic tools provided by the Telehealth software.
- Network Connectivity: Verify the stability of the network connection. Check for issues related to bandwidth, latency, or firewall settings.
- User Feedback: Gather feedback from users to understand their experiences and any error messages they may have encountered.

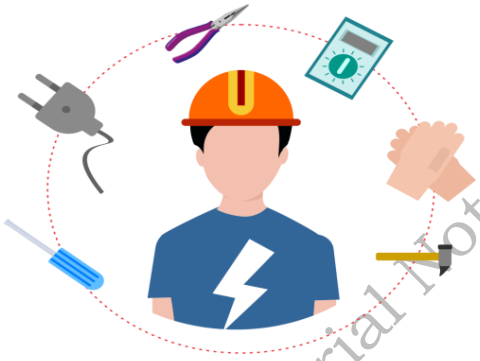

Fig.4.19 Electrical Instrument

Repair of malfunctions in Telehealth equipment

- Basic Troubleshooting: Restart the Telehealth equipment and software to see if the issue resolves. Ensure that all cables and connections are secure.
- Software Updates: Update the Telehealth software to the latest version. Apply patches and security updates.
- Hardware Replacement: Replace faulty hardware components such as cameras, microphones, or any malfunctioning peripherals.
- Network Configuration: Adjust network settings if there are connectivity issues. Ensure that the Telehealth equipment is configured to work within the network environment.
- User Training: Provide additional training to users if the issue is related to user error or misunderstanding.
- Collaborate with Technical Support: Contact the manufacturer or vendor's technical support for assistance.
- Documentation and Reporting: Document the troubleshooting and repair process for future reference. Report major issues and resolutions to relevant stakeholders.
- Preventive Maintenance: Implement a preventive maintenance schedule to catch potential issues before they become major faults.

Operate the Telehealth equipment safely and correctly

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Operating Telehealth equipment safely and correctly is essential to ensuring effective communication and patient care. There are a few key steps involved in operating Telehealth equipment safely and effectively.

Fig.4.21 Electrician on duty

- Start by thoroughly reading the appliance's user manual to understand its features and safety guidelines.
- Before the use, inspect the appliance for damage and make sure all connections are secure.
- Choose a quiet, well-light location for the sessions, placing the camera and microphone in appropriate positions.
- Prioritize patient privacy and confidentiality, implementing secure login procedures.
- Update the software regularly, and do a quick test before each session to spot any problems quickly.
- Provide training to users, follow established privacy rules and document sessions appropriately.
- In case of technical problems, seek assistance from IT support or technical support of the device manufacturer.
- Maintaining professionalism and a positive user experience contributes to safe and successful Telehealth operations.

Fig.4.20 Electrical Equipment

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On call and onsite technical assistance

On-call and on-site technical assistance are two types of support services provided to address technical issues and ensure the smooth operation of systems, equipment, or services.

On-Call Technical Assistance: On-call technical assistance involves remote support provided by technical experts. Professionals are available via phone, email, or online platforms to troubleshoot issues, answer queries, and guide users through problem-solving steps. This form of assistance is often immediate, allowing users to access help without the need for physical presence.

On-Site Technical Assistance: On-site technical support, on the other hand, requires a technician or support personnel to travel to the location where the problem is occurring. This is especially useful when problems cannot be solved remotely or when hands-on troubleshooting and repairs are necessary. On-site support is valuable for complex issues, installations, or maintenance tasks that require physical presence.

Coordination and Integration: Both on-call and on-site technical assistance play complementary roles. On-call support provides quick responses and resolutions for common issues, while on-site support is essential for more intricate problems or tasks that demand physical intervention. The choice between on-call and on-site assistance often depends on the nature of the problem, its complexity, and the urgency of resolution.

Tele health equipment Records and report

Telehealth equipment refers to the technology and devices used to facilitate remote healthcare services, allowing patients and healthcare professionals to connect virtually. This can include video conferencing tools, medical cameras, remote monitoring devices, and other technology that supports Telehealth consultations.

Fig.4.23 Telehealth Services

Documents and Service Record Book

User Manuals: Comprehensive guides provided by equipment manufacturers outlining proper usage, troubleshooting steps, and safety guidelines.

Service Record Book: A record-keeping document that tracks the history of service, maintenance, and repairs performed on Telehealth equipment. It includes

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dates, details of interventions, and the signatures of technicians or personnel involved.

Role of Telehealth care service coordinator during reporting Malfunctioning:

Internal Reporting: Immediately report any malfunction or issue with Telehealth equipment to internal technical support or IT departments.

Use of Service Record Book: Refer to the service record book to document the details of the malfunction, any attempted fixes, and the date and time of the report.

Fig.4.22 Service Record Book

Communication Channels: utilize established communication channels within the healthcare facility to report malfunctions, ensuring that the information reaches the relevant personnel.

Manufacturer or Vendor Reporting: If the issue persists, contact the equipment manufacturer or vendor for technical support. They may provide remote assistance or recommend on-site service if necessary.

Follow Protocols: Adhere to established protocols for reporting malfunctions, ensuring that all necessary information is communicated to the appropriate parties.

Activities

Activity 1: Group discussion with technician on identifying and diagnosing technical faults in the machine

Check Your Progress

A Fill in the blank

1. Biomedical equipment includes a wide range of devices used in the diagnosis, monitoring, and .....of patients.
2. On-call technical assistance involves remote support provided by.....
3. Telehealth equipment refers to the technology and devices used to facilitate remote.....

B. Fill in the one word

1. Maintenance and.....
2. Risk .....
3. Training and .....

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4. Data .....
5. Service .....
6. Communication .....

C. Short Answer Questions.

1. Define On Call and Onsite Technical Support Services?
2. Write the major components of effective management.
3. Role and responsibility of Telehealth services coordinator Diagnosing and repairing faults.

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Answers

Module 1: Tele Diagnostic Service

Session 1: Tele Health Services

A. Fill in the Blanks

1. Electronic information and telecommunication technologies,
2. distance-learning and
3. telecommunication

Session 2: Tele Medicine

A. True or False

1. False
2. False
3. False
4. True
5. False
6. True

Session 3: Human Body Structure and Functions

Session 4: Human Anatomy and Physiology

Session 5: Healthcare Delivery System

Session 6: Hospital

Session:7 Hospital Management Information System

A. Fill in the Blanks

1. Telecommunication and information technologies
2. Comprehensive, integrated
3. Medical expenses
4. Electronic medical record (EMR)

Module 2: Promote the Telehealth Services as per Needs and Protocols

Session 1 - Telemedicine services

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A. Multiple Choice Question

1-d
2-d
3-a
1-d

B. Fill in the Blanks.

1.Systematic data collection
2.Remote and difficult
3. Frontline healthcare workers
4. Secondary hospitals

Module 3: Prepare and Manage the Set-Up for Tele Consultation

Session 1: Role of Telehealth services coordinator

A. Match the column

1-b
2- a
3-d
4-c

Module 4: Facilitate Bio-Medical Instrumentation Services for Telehealth Equipment

Session: 1 Function and operation of equipment used in Telehealth services

A. Choose the correct answer

1-a
2-a
3-d
4-a

Session: 2 Medical Equipments in Telehealth care services

A. Match the column A and B

1-b
2-c
3-f
4-e
5-d
6-a

B. Write the name of medical equipment.

a. Fluoroscopy
b. Electroretinography
c. Electrocardiography
d. Endoscopy

Session–3 Biomedical Equipment and Management

A. Fill in the blank

1. Treatment,

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2. Technical experts,

3. healthcare services

B. Fill in the one word

1. Calibration

2.Management

3. Education

4.Security

5. Record Book

6.Channels

Glossary

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