Medical Technologies

Foundations of Technology, Montgomery County Public Schools

Outcomes

In this lesson you will learn:

- Medical technologies include prevention and rehabilitation, vaccines and pharmaceuticals, medical and surgical procedures, genetic engineering, and the systems within which health is protected and maintained. (ITEA 14-K)

- Telemedicine reflects the convergence of technological advances in a number of fields, including medicine, telecommunications, virtual presence, computer engineering, informatics, artificial intelligence, robotics, materials science, and perceptual psychology (ITEA 14-L)

Medical Technologies

Medical technology is the study of medicine through the use of and advances of technology, such as medical instruments and apparatus, imaging systems in medicine, and mammography.

Medical technologies include prevention and rehabilitation, vaccines and pharmaceuticals, medical and surgical procedures, genetic engineering, and the systems within which health is protected and maintained.
For example, the development of vaccines and drugs, such as the polio vaccine, penicillin, and chemotherapy, has helped to eradicate or cause remission of many serious illnesses.

Computers in Medicine

Computers play a significant role in the healthcare system keeping track of patients' diagnostic information, medicines, results of procedures, and in analyzing data in order to help clinicians do their work more efficiently and effectively.

The development of diagnostic tools, such as the x-ray machine, computerized tomography (CT) scan, ultrasound, MRI, and lasers, allows for less invasive interior views of the body than surgery.

Medical Technologies

Specific Medical Technologies Include:

- **Prevention**
- **Rehabilitation**
- **Vaccines**
- **Pharmaceuticals**
- **Medical procedures**
- **Surgical procedures**
- **Genetic engineering**

Prevention

In medicine prevention is any activity which reduces the burden of mortality or morbidity from disease. This takes place at primary, secondary and tertiary prevention levels.

Prevention uses knowledge, technological devices, and other means to help people maintain healthy bodies. Prevention focuses on such health aspects as proper nutrition, exercise, immunizations against diseases, and proper actions at work and recreation.

Primary prevention avoids the development of a disease. Most population-based health promotion activities are primary preventive measures.

Secondary prevention activities are aimed at early disease detection, thereby increasing opportunities for interventions to prevent progression of the disease and emergence of symptoms.

Tertiary prevention reduces the negative impact of an already established disease by restoring function and reducing disease-related complications.

Rehabilitation

Drug Rehabilitation, for dependency on psychoactive substances such as alcohol, prescription drugs, and illicit drugs such as cocaine, heroin or amphetamines.

Physical Therapy, treatment aimed at the recovery of musculoskeletal function, particularly recovery from joint, tendon, or ligament repair.

Physical Medicine and Rehabilitation, a branch of medicine dealing with restoration of function despite physical disability.

Vaccines

A vaccine is an antigenic preparation used to establish immunity to a disease. The term derives from Edward Jenner’s use of cowpox ("vacca" means cow in Latin), which, when administered to humans, provided them protection against smallpox, which Pasteur and others perpetuated. Jenner realized that milkmaids who had contact with cowpox did not get smallpox.

The process of distributing and administrating vaccines is referred to as vaccination.

Vaccines can be prophylactic (e.g. to prevent or ameliorate the effects of a future infection by any natural or "wild" pathogen), or therapeutic (e.g. vaccines against cancer are also being investigated; see cancer vaccine).

Pharmaceuticals

Pharmacology (in Greek: *pharmacon (φάρμακον)* meaning drug, and *logos (λόγος)* meaning science) is the study of how substances interact with living organisms to produce a change in function.

If substances have medicinal properties, they are considered pharmaceuticals.

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Pharmacology as a chemical science is practiced by pharmacologists. Sub-disciplines include *clinical pharmacology* (the medical field of medication effects on humans), *neuro-* and *psychopharmacology* (effects of medication on behavior and nervous system functioning), *toxicology* and *theoretical pharmacology*.

Pharmacokinetic Properties

When describing the pharmacokinetic properties of a chemical, pharmacologists are often interested in ***ADME***:

Absorption - How is the medication absorbed (through the skin, the intestine, the oral mucosa)?

Distribution - How does it spread through the organism?

Metabolism - Is the medication converted chemically inside the body, and into which substances. Are these active? Could they be toxic?

Excretion - How is the medication eliminated (through the bile, urine, breath, skin)?

Medical Procedures

A medical procedure with the intention of determining, measuring or diagnosing a patient condition or parameter is also called a medical test. Other common kinds of procedures are therapeutic (i.e., with the intention or treating, curing or restoring function or structure), including the large group or surgical procedures. Rehabilitation procedures are included in this group.

Surgical Procedures

Surgery (from the Greek *χειρουργική* meaning "hand work") is the medical specialty that treats diseases or injuries by operative manual and instrumental treatment.

A surgery can also refer to the place where surgery is performed, or simply the office of a physician, dentist, or veterinarian. Surgeons may be physicians, dentists, or veterinarians who specialize in surgery.

Wellness

Technology in medicine involves both wellness and illness. Wellness programs are designed to help people maintain their health. Illness treatment involves diagnosing, treating, and preventing disease and injuries. Diagnosis determines what is wrong with a person.

Treatment

Treatment attempts to restore the person's health. Prevention deals with promoting wellness programs and immunizations. In wellness programs and illness treatment, technology plays a vital role. Both technological equipment and technological knowledge aid health care professionals in maintaining and restoring people's health.

Telemedicine

Telemedicine is about delivering medical services from a distance.

Telemedicine can be defined as the investigation, monitoring and management of patients, using systems which allow ready access to expert advice and to patient information, no matter where the patient or relevant information is located.

Telemedicine is not a new concept. It has existed for a number of years in the form of the telephone and fax machines. In recent years, with the improvements made in access, technology, and communications systems, telemedicine has expanded and, in a time of limited resources, has become a feasible alternative for smaller and rural medical facilities to provide routine and specialized services.

Primary Applications

The primary applications of telemedicine are clinical, educational, administrative, and research. Clinical applications include initial patient evaluations, diagnosis (telediagnosis), and consultation (teleconsultation). Physician supervision of non- physicians and monitoring of patient status are possible.

Telecommunications in Medicine

Continuing education for professionals is available, as is patient and community education (tele-education). Administrative uses, such as conferences, scheduling, and utilization and quality review may be provided. Research is enhanced by aggregation of data from multiple sources and coordination.

Telemedicine allows access to the wealth of information available on the Internet. This allows information to be at the touch of a finger. The availability of e-mail allows an efficient mechanism of communication between consulting and primary physicians. Communication between facilities is enhanced.

Telemedicine may be as simple as two health professionals discussing a case over the telephone, or as complex as using satellite technology and video-conferencing equipment to conduct a real-time consultation between medical specialists in two different countries.

Telemedicine

Telemedicine reflects the convergence of technological advances in a number of fields, including medicine, telecommunications, virtual presence, computer engineering, informatics, artificial intelligence, robotics, materials science, and perceptual psychology.

Telemedicine represents a significant change in the delivery of medical care by increasing the number of doctors who can diagnose illness and offer treatment in unsafe and remote areas via computer or videoconference.

Telemedicine is most beneficial for populations living in isolated communities and remote regions and is currently being applied in virtually all medical domains. Specialties that use telemedicine often use a "tele-" prefix; for example, telemedicine as applied by radiologists is called teleradiology. Similarly telemedicine as applied by cardiologists is termed as telecardiology, etc.

Telemedicine

The focus of telemedicine has mainly been consultative, meaning a general practitioner consulting a specialist or a specialist consulting another specialist. Monitoring a patient at home using known devices like blood pressure monitors and transferring the information to a caregiver is a fast growing emerging service.

In developing countries a new way of practicing telemedicine is known as Primary Remote Diagnostic Visits (PRDV). A patient is examined by a doctor or medical professional residing in another location and virtually examines the patient and treats them.

When a scientist in Antarctica discovered a potentially cancerous lump and could not fly out for medical care, equipment was airlifted to the location, and doctors, located in the United States, were able to use the medical equipment and communication devices in the determination of a treatment.

Telemedicine

Telemedicine is used in a variety of medical fields; for example, cardiology, radiology, psychiatry, and oncology. Diagnoses, treatments which include telesurgery, physician and patient education, and medical administration video conferencing between healthcare providers are all possible with telemedicine.

Telemedicine

The use of telemedicine is generally considered positive for both patients and the economy. Through remote health monitoring, telemedicine may allow countless numbers of people to avoid nursing homes and hospitals, allowing them to remain productive, stay home longer, and consequently incur less health care costs. The economy also benefits from the diminished need to transport patients to other facilities when a health care specialist is needed.

In short, Telemedicine improves the mobility of patient care, and assists the access to all kinds of medical information. The patient gets improved treatment, and scarce resources are used more efficiently.

Summary

- Rehabilitation is the combined and coordinated use of medical, social, educational, and vocational measures used for training or re-training individuals disabled by disease or injury to the highest possible level of functional ability
- Pharmacology is the study of how substances interact with living organisms to produce a change in function
- If substances have medicinal properties, they are considered pharmaceuticals
- A medical procedure with the intention of determining, measuring or diagnosing a patient condition or parameter is also called a medical test
- Prevention is using knowledge, technological devices, and other means to help people maintain healthy bodies
- Diagnosis is using knowledge, technological devices, and other means to determine the causes of abnormal body conditions
- Treatment is using knowledge, technological devices, and other means to fight diseases, correct body malfunctions, or reduce the impact of a body condition
- Medical technologies include prevention and rehabilitation, vaccines and pharmaceuticals, medical and surgical procedures, genetic engineering, and the systems within which health is protected and maintained
- Prevention is any activity which reduces the burden of mortality or morbidity from disease
- A vaccine is an antigenic preparation used to establish immunity to a disease

Summary

- Surgery is the medical specialty that treats diseases or injuries by operative manual and instrumental treatment
- In medicine prevention is any activity which reduces the burden of mortality or morbidity from disease
- Medical technology refers to the diagnostic or therapeutic application of science and technology to improve the management of health conditions
- Technologies may encompass any means of identifying the nature of conditions and intervening with devices, pharmacological, biological or other methods to increase life span and/or improve the quality of life
- Telemedicine improves the mobility of patient care, and assists the access to all kinds of medical information through the use of telecommunications technologies
- The patient gets improved treatment, and scarce resources are used more efficiently
- The use of telemedicine is generally considered positive for both patients and the economy
- Through remote health monitoring, telemedicine may allow countless numbers of people to avoid nursing homes and hospitals, allowing them to remain productive, stay home longer, and consequently incur less health care costs
- The economy benefits from the diminished need to transport patients to other facilities when a health care specialist is needed