

UNIT 3

TECHNOLOGY IN HEALTHCARE



UNIT SUMMARY

by Abd Alrahman Basim

SECTION 1: THE ROLE OF TECHNOLOGY IN HEALTHCARE

SECTION 2: SMART MEDICAL DEVICES AND WEARABLES

SECTION 3: MOBILE APPLICATIONS AND E-SERVICES

SECTION 4: AUGMENTED REALITY (AR) AND
VIRTUAL REALITY (VR)

SECTION 5: ARTIFICIAL INTELLIGENCE (AI)

SECTION 6: TELEMEDICINE

SECTION 7: 5G



This file is provided by [InLibrary](#).



THE ROLE OF TECHNOLOGY IN HEALTHCARE

Medical Technology

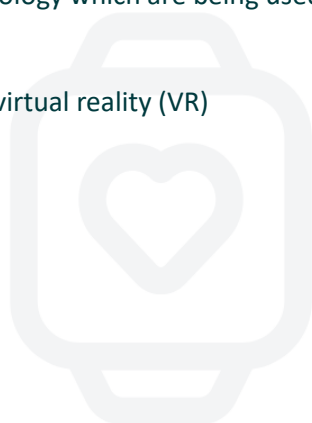
Every day new technologies are used by healthcare professionals. These aim to:

- increase care for patients,
- increase productivity of staff,
- reduce the chance of mistakes
- and reduce the overall cost of providing healthcare.

Technology can be used to diagnose illnesses before symptoms show and it can even prevent illnesses from happening. It is used in medicine and vaccine production; it is also used in the treatment and recovery of patients.

Some of the latest advances in technology which are being used today in healthcare:

- Artificial intelligence (AI)
- Augmented reality (AR) and virtual reality (VR)
- 3-D printing
- 5G
- Robotic surgery
- Artificial organs
- Medical wearables
- Telemedicine services



Developments in Healthcare

Improvements in technology have resulted in major developments in healthcare. Some of these improvements are:

- Patients are **diagnosed quicker**
- Patients have **quicker recovery** times
- People are **living longer**
- Better healthcare facilities
- Modernised hospitals and equipment

SMART MEDICAL DEVICES AND WEARABLES

The Use of Smart Medical Devices and Wearables

Smart devices and wearable technology in healthcare includes electronic devices that people can wear. Simple examples include **smart watches** and **activity trackers** such as Fitbits.

They are designed to collect data about the user's health and fitness. There are wearable devices for more serious conditions such as **diabetes** and **heart disease**.

Devices work by **collecting** the user's health data. Then it creates a personalised database of the user's health information. The user can **track** their information, challenge their wellbeing goals, or have their data collected to be shared with friends, family or a healthcare professional.

Examples of Smart Medical Devices and Wearables

- **Fitness Trackers and Smart Watches**

These are currently the **most used** medical wearable. **Fitness trackers are usually wristbands that have sensors to keep track of physical activity and heart rate.**

They can **sync** to mobile applications and provide fitness guidance for users. Smart watches have many advanced features including:

- tracking workouts in different exercise modes.
- stress monitoring.
- mental health tracking.
- movement reminders.
- sleep tracking.
- measuring step-count.
- measuring heart rate.
- measuring blood oxygen level.
- taking an electrocardiogram (ECG) anywhere at any time and notifying the user if something is wrong.

Electrocardiogram: **a recording of the heart's electrical activity.**

Smart watches can perform tasks that people do on their phones such as read notifications, send simple messages, make phone calls and play music while offering the health-related benefits of fitness trackers.



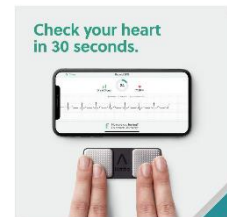
SMART MEDICAL DEVICES AND WEARABLES

- **Smart Hearing Aids**

Smart hearing aids are fitted with sensor technology which uses **AI** and an algorithm to **filter out** background noise such as wind, and focus on specific sound sources such as speech.

- **Wearable ECG Monitors**

Electrocardiograms (ECG) track heart rhythm and rate. Wearable ECG monitors can help users to track their heart health, some can even measure other vital signs such as blood pressure. They can also detect and alert the user when their heartrate is abnormal.



One type of wearable ECG monitor gets users to place their fingers on top of two electrodes and attach the bottom electrode to their left ankle. Results are received within thirty seconds.

- **Wearable Biosensors**

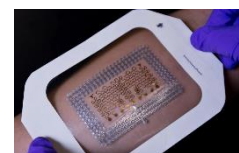
Wearable biosensors are still very **new**, but they have the potential to greatly improve the way remote healthcare and telemedicine works.

Telemedicine: when the healthcare provider and the patient are not physically present with each other but communicate via phone or videocall.

Biosensor devices are portable sensors that come in the form of patches and bandages. They create two-way communication between the user and their doctor. The doctor can monitor health and give diagnoses based on physical motion and biofluids.

Biosensors can measure:

- heart rate
- respiratory rate
- skin temperature
- body temperature
- posture
- falls
- step count



- **Sleep Monitors**

These come in the form of a soft headband. They help people to learn their sleep needs and they can provide clinical solutions.



SMART MEDICAL DEVICES AND WEARABLES

Sleep monitors track **sleep cycles** and help users who do not get enough sleep, or those who wake up too late or too early. These devices can play music which can help increase sleep length. The headband monitor is connected to a mobile application.



MOBILE APPLICATIONS AND E-SERVICES

Mobile Applications

Health-related mobile applications vary in what they do; some provide advice for users with specific problems such as diabetes, while others might allow users to book appointments or find their nearest healthcare provider.

E-services

E-services are electronic services that are provided using the internet. Medical e-services therefore are health-related online services which range from booking appointments to accessing medical records and paying medical bills.

Applications and E-services used in UAE

Alhosn

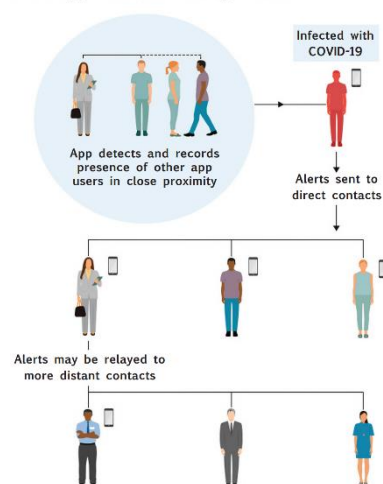
The UAE's **most popular** health-related app of 2021 is Alhosn. The app was created by the **Ministry of Health and Prevention (MoHAP)** along with Dubai Health Authority and the Department of Health Abu Dhabi.

Alhosn is the UAE's **official** app for COVID-19 testing results, vaccine certification and contact tracing. The app was created using artificial intelligence (AI) technology similar to that used by lots of other countries around the world.

What is contact tracing?

Contact tracing is the process of identifying people who have been in contact with an infected person. During the pandemic, contact tracing has been important in stopping the spread of COVID-19. Thanks to technology and the use of GPS and Bluetooth on apps like Alhosn, contact tracing is faster and more secure than before.

How app contact tracing works



DHA

Dubai Health Authority (DHA) have their own app called DHA. This app provides all DHA services in one application. Using this app, Dubai residents can access DHA's Smart Services such as:

- Manage appointments
- Lab results
- Medical fitness applications
- Register and volunteer for blood donation services.



MOBILE APPLICATIONS AND E-SERVICES

COVID-19 UAE

The COVID-19 UAE app was created by **MoHAP** to manage COVID-19 within the UAE. The app provides numerous features which are available to all UAE residents. The features of the app include:

- Daily COVID-19 cases in UAE
- Self-assessment survey
- Digital channels for mental health support
- Live video calls with healthcare professionals for high-risk cases
- Hotlines and locations of MoHAP's testing centres
- COVID-19 vaccine information

Shefaa

MoHAP launched a smart patient portal known as Shefaa. This e-service platform is the digital communication between patients and healthcare providers. The services available on the Shefaa portal include the following:

- Access to medical records
- Health education
- Questionnaires
- Opinion polls
- E-payment options
- Vital signs records
- Home-based healthcare
- Lab results and reports



MoHAP E-services

There are many e-services available on the MoHAP website. These are for patients, healthcare professionals, businesses and governments. Some of the services on this site will direct users to the Shefaa portal. Examples of the available services:

- UAE citizens can access copies of their birth certificate.
- Patients can request screening for certain types of cancers.
- Residents can request vaccinations for travel.
- Nurses and midwives can register to practice their profession.
- Doctors can obtain their licence to practice.

MOBILE APPLICATIONS AND E-SERVICES

The Benefits of Health-Related Apps and E-services

Some benefits are:

- **Easy to access:** apps and e-services can be accessed using the mobile phone at any time during the day.
- **Saves you money and time:** apps and e-services can save you time and money as you don't have to drive anywhere to book an appointment, check results of tests and other services. Everything can be done through your mobile phone.
- **Organisation:** apps and e-services can help you organize your medical records, including appointments, results of tests, medication and other services.
- **Empowerment:** apps and e-services encourage you to make good decisions related to your health.



AUGMENTED REALITY (AR) AND VIRTUAL REALITY (VR)

What are Augmented Reality and Virtual Reality?

Augmented reality (AR) is the technology that allows laying some information, videos and graphics on smart devices over reality (what you can see without technology). Therefore, this technology augments (changes) the real world by adding additional data to it.

Virtual reality (VR) is a simulated reality created by computer technology when a person completely enters into a digital environment and cannot see the real environment around them. There is a large selection of VR games available today, as well as car test driving experiences.

How are AR and VR Used in Healthcare?

Medical Training

Medical students, doctors or surgeons can learn how to treat patients better or perform difficult operations without the risk of making real-life surgery mistakes that could have life threatening results.

Robotic Surgery

When robotic devices perform high-precision operations they are usually controlled by a human surgeon using **VR** technology. This reduces the time and risk of complications. The robotic device is **accurate**, meaning:

- smaller incisions are made,
- the amount of blood lost is reduced
- and recovery can be faster.

Physiotherapy

VR helps patients to overcome high levels of pain and have faster recovery through active therapy.

Mental Health Treatment

Anxiety, stress, depression and **post-traumatic stress disorder (PTSD)** can be treated using AR and VR by placing the patient in a safe and calm environment where they can do meditations and other relaxation activities.

AUGMENTED REALITY (AR) AND VIRTUAL REALITY (VR)

Emergency Treatment

AR can be used on maps to help people to find healthcare facilities, medical equipment, such as public AEDs, and pharmacies at speed.

Personalised Treatment

VR and AR can help doctors to explain medical treatments to their colleagues and patients in a clear and visual way. Doctors may demonstrate how operations will be performed and which steps a patient should take for more effective recovery.

How AR and VR Improves the Patient Experience

AR and VR improve the patient's experience in healthcare by making them **more aware** of what exactly is happening to their bodies before, during and after treatment. Doctors can show patients what their surgery will look like and what the results should be once the procedure is completed.

Self-guided treatments such as meditation and physiotherapy can make the recovery process more enjoyable for patients. This is because patients can experience their rehabilitation in the form of an AR or VR game.

When patients enjoy their rehabilitation, they are more likely to complete their exercises regularly and recover faster. VR can be used as a **distraction** tool for patients who are in pain. Some women have used VR while in labour (giving birth) to help distract them from any pain and discomfort.

ARTIFICIAL INTELLIGENCE (AI)

What is AI?

Artificial intelligence (AI) is a computer's ability to think, behave and learn like a human. Scientists have developed AI by studying how the brain works in different situations, such as how humans think when trying to solve a problem, how they detect patterns or how they understand pictures.

How is AI Used in Healthcare?

Keeping Well

AI can help people to stay healthy so that they do not need to visit a doctor as often as they do now.

AI is used to develop apps that encourage healthy behaviours and help people to manage a healthy lifestyle. AI also allows healthcare professionals to understand the day-to-day patterns of the people they care for. This means healthcare professionals can give better guidance and support to patients.

Early Detection of Disease

AI is being used to detect diseases, such as cancer, more accurately and in the early stages. AI is used to review and read **mammograms** 30 times faster than humans, with 99% accuracy. This level of accuracy reduces the need for unnecessary follow-up examinations or second opinions.

The rise of medical wearables and other devices with AI technology can be used to detect heart disease in the early stages. These devices help healthcare professionals to monitor and detect a potential heart attack at an earlier, more treatable stage.

Decision Making

AI can recognise **patterns** which are **consistent** among patients with a certain disease. It can use this data to recognise the risk of other people developing a condition based on lifestyle, environmental, genetics or other factors. AI can predict what diseases a person is likely to develop based on these factors.

Treatment

AI helps doctors to manage patients with chronic diseases based on their individual needs, as compared to all patients with the same disease. AI can help to create individual care plans and help patients with long-term treatment programmes.

AI robots have been used for more than **30 years** in healthcare. They range from simple to highly complex surgical robots that can either help a human surgeon or complete operations alone. In addition to surgery, they are used in hospitals and labs for repetitive tasks, in rehabilitation, physiotherapy and in support of those with long-term conditions.

ARTIFICIAL INTELLIGENCE (AI)

End of Life Care

People are living much longer than previous generations and are dying in a different and slower way. They have conditions like heart disease, Alzheimer's and osteoporosis.

The later years of life can be quite a lonely time for people. Robots can help people to be independent for longer, reducing the need for hospitalisation.

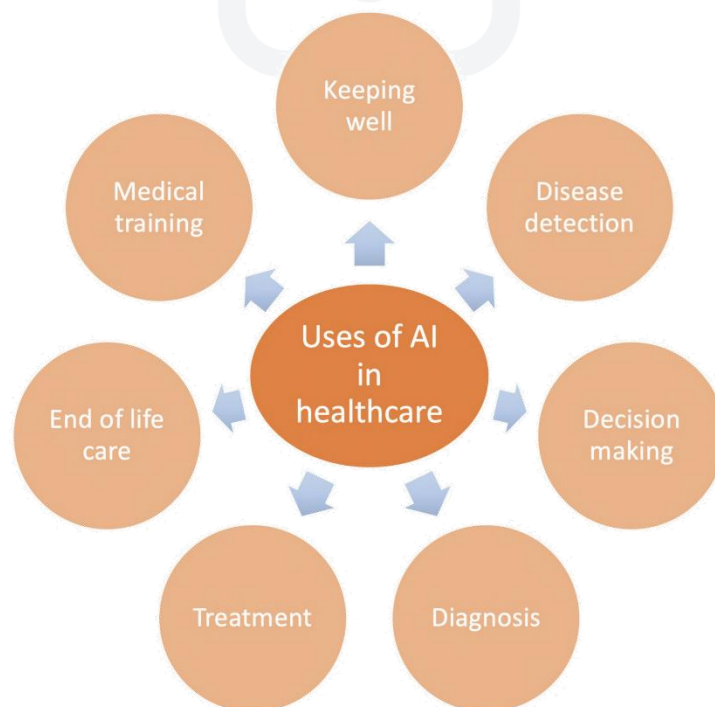
AI combined with newer technology means robots can have **conversations** and carry out other social interactions with people to keep aging minds sharp and to **reduce loneliness**.

Medical Training

AI allows those in training to experience realistic simulations in a way that simple computers cannot. An AI computer can instantly provide learners with a scenario from a large database.

Robots can use natural speech to explain their problems as if they are a human. The learner's responses and decisions can be challenged by the robot.

Training can be done anywhere at any time. With the power of AI on a smartphone, training is possible if the healthcare professional wants to refresh their skills in case they are faced with a challenging scenario in a clinic.



TELEMEDICINE

What is Telemedicine?

Telemedicine is defined by the WHO as, “healing from a distance.” It uses technology to improve patient health and improve the level of access that people have to a doctor and medical information.

Telemedicine services can be delivered in most **non-emergency** cases, doctors can treat the following conditions via telemedicine:

- Coughs and colds
- Asthma
- Allergies
- Headache and fever
- Muscle pain
- Joint and back pain
- Skin problems
- Minor burns
- Obesity
- Mental illness

Reasons Why Telemedicine is Used

Sometimes there are barriers to physical treatment, such as:

- the increased risk of spreading or contracting an infectious disease, such as COVID-19.
- a patient lives far away from a medical facility, such as a hospital.
- a patient cannot get transport to a medical facility.

Benefits of Telemedicine

There is a lot of evidence showing that telemedicine works well for both the patient and healthcare professionals. It works best when a patient provides clear details about their signs and symptoms. Other benefits include:

- **Convenience** – people who use telemedicine spend less time and money getting to and from hospital and waiting for their doctor.
- **Improved access to care** – it is easy for people who have disabilities, are very old, or not near to a healthcare facility to call a doctor and speak from their own home.
- **Reduced risk of spreading infections** – going to the hospital involves being around people who are sick. Some diseases can spread easily. Telemedicine reduces the chance of getting an infection at the hospital or clinic.

TELEMEDICINE

How the UAE Have Enhanced Telemedicine

Virtual Clinics

In 2020, due to the precautionary measures from the COVID-19 pandemic, the MoHAP decided to strengthen the telemedicine services by opening virtual clinics using smart technology and digital communication. The clinics provide consultation services similar to traditional medical services, but without the visit to a hospital. The clinics also provide a home delivery service for medicines across the UAE.

Virtual Visits

The hospitals launched virtual visits to allow patients to keep in touch with their families. These are done through video call. These calls help to boost the patient's mood and improves their mental health which impacts the other dimensions of health in a positive way.



5G

What is the Link Between 5G and Healthcare?

5G is the fifth generation of cellular wireless technology. It has been widely available in the UAE since 2019. 5G can offer strong connection power and fast speeds that have the ability to transform how healthcare is delivered.

Sometimes doctors need to make extremely fast decisions, or they need access to up-to-date information, they can benefit greatly from 5G. Providing diagnoses could be faster, transfer of large files, images and records would also be much quicker using 5G.

How 5G Can Improve Technology in Healthcare

Telemedicine

Good telemedicine needs a strong network, with high quality video. A 5G network can support video-based consultations and improve the quality of care given. Patients can get treated sooner and gain access to specialists who may not be available in their nearest hospital or clinic.

Monitoring Patients

With the use of medical wearables, healthcare professionals can monitor patients outside of the hospital facility. This allows more personal care for each patient.

Slow network speeds and poor connections mean that doctors usually do not receive data from wearables in real-time. This can be a problem if they need to make a quick decision about a patient who is having a heart attack, for example.

With 5G technology, healthcare professionals can monitor patients closely and they can be confident that the data they receive is up to date. This means that care and advice can be provided quickly, if needed.

Artificial Intelligence (AI)

AI can help to predict which patients are more likely to have post-surgical complications. This allows healthcare professionals to provide early care when necessary.

By using 5G networks, healthcare professionals can use the AI tools they need to provide the best care possible wherever they are in the hospital or clinic using any device.

Augmented Reality (AR) and Virtual Reality (VR)

5G can be used to simulate difficult medical scenarios and allow alternative treatments for the critically ill. Also it can be used to improve patient's mood and to distract patients who are in a lot of pain. It is important that the connection quality is strong and speed is fast for this to work.

UNIT 3

TECHNOLOGY IN HEALTHCARE

UNIT SUMMARY

Resources

- G12 – Term 1 – Unit 3: Technology in Healthcare

THIS FILE IS FOR EDUCATIONAL PURPOSES ONLY.

This file is under Fair Use:

Copyright Disclaimer under section 107 of the Copyright Act of 1976, allowance is made for "fair use" for purposes such as criticism, comment, news reporting, teaching, scholarship, education and research. Fair use is a use permitted by copyright statute that might otherwise be infringing.

All rights and credit go directly to its rightful owners. No copyright infringement Intended.

Related Files:

Health Science Unit 2 Summary 2022-2023

[<https://t.me/InLibrary/1325>]

Chemistry Student Book EN Term 1 2022-2023

[<https://t.me/InLibrary/1045>]

Chemistry Teacher Guide EN Term 1 2022-2023

[<https://t.me/InLibrary/1113>]

Chemistry Student Book AR Term 1 2022-2023

[<https://t.me/InLibrary/1041>]

Chemistry Teacher Guide AR Term 1 2022-2023

[<https://t.me/InLibrary/1100>]

Copyright © 2022 InLibrary. All rights reserved.