2224 – 5508M

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Markscheme

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Digital Society

Higher level

Paper 3

14 pages

1. (a) Identify **two** characteristics of a wearable technology device used for digital healthcare. **[2]**

Answers may include:

- Small device that can be attached to the body such as a watch or strapped on (excludes device that is implanted such as a heart pace-maker).
- The device uses a sensor to makes measurements of the body such as temperature, heart rate, blood pressure.
- The device can be used to measure activity e.g. sleep, steps.
- The device can have a display e.g. touchscreen/LED display.
- The device can be connected to the Internet.
- The device stores the measurements that are made.
- The measurements can be transmitted to another device like a smartphone using Bluetooth or other connections.
- The device could send readings to the doctor.
- The device could detect abnormal readings.
- The device can send health alerts to the wearer and/or doctor.

*Award **[1]** for each characteristic identified up to **[2]**.*

(b) Identify **two** differences between a cell phone/smart phone and a satellite phone. **[2]**

Answers may include:

- Cell phones/smart phones use terrestrial towers/cell repeaters to connect to the phone network whereas satellite phones use satellites to connect to the phone network.
- Cell/smart phones operate within a limited transmission range (within cell) whereas satellite phones have a longer range not limited by location.
- Satellite phones have a higher signal strength output than cell/smart phone as need to connect to a distant satellite including more features.
- Unlike some satellite phones, cell phones are often smart phones.
- Cell phones/smart phones are used within a structured environment (transmission towers) whereas satellite phones do not have a structured environment as connected to a satellite.
- Data Services – Satellite phones often have limited data services with slower speeds, compared to cell phones, which have faster speeds and internet access e.g. 5G.
- Battery Life – Satellite phones generally have longer battery life and can last longer on standby, but when being used, drains the battery quicker; compared to cell phones which need daily charging due to regular use.
- Latency – Satellite phones typically experience high latency, due to the long distances, compared to cell phones which only need to connect to the nearest cell tower.
- Physical size – Satellite phones are bulkier/heavier than cell/mobile phones.

*Award **[1]** for each difference between a cell/smart phone and a satellite phone identified up to **[2]**.*

2. (a) Explain **one** way in which residents of Ren Valley could be trained in the use of medical equipment without having to leave the valley. **[3]**

Answers may include:

- Reading training materials e.g. written manuals
- which are sent to Ren Valley with the medical equipment or is accessed by a link to the online documentation
- and development or example; e.g. the packaging of the EpiPen includes a QR code which when scanned gives instructions on how to administer the insulin.

- Watching instructional videos
- which are available online e.g. the Ren Valley Medical Portal (RVMP) or manufacturers website
- and development or example; e.g. the resident can search for the name of the equipment on the RVMP and find a video which explains how to operate the wheelchair; medical professionals in Sao Luis hospital are tasked with the job of producing the videos.

- Live demonstration by medical personnel on how to use the equipment
- this could be delivered via video conferencing on the RVMP, via a phone call, or face to face in the village hall, or in the resident's home
- and development or example; E.g. Residents could book Cecilia to come to their home where she can demonstrate the use of the equipment.

- Training course which is completed by the resident
- which are made available on the RVMP
- and development or example; development could include details of the training materials e.g. a variety of formats (text/pdf/video) and a quiz; once completed, the equipment will be delivered.

- Engaging in AR/VR activities on equipment
- provided to the resident through an app downloaded to the resident's phone
- and development or example; e.g. once the resident opens the app and points it at the equipment, labels and explanations will appear on how to use the equipment.

*Award **[1]** for identifying the method of training used by the residents, and **[1]** for providing a supporting example or development specific to the scenario, and **[1]** for explaining how this could be done without having to leave Ren Valley, up to **[3]**.*

(b) Explain **one** benefit of using store-and-forward (asynchronous) telehealth. **[3]**

Answers may include:
Benefits that can arise:

- the patient, GP and specialist do not have to be available at the same time
- which allows each of the stakeholders to carry out the task at their own convenience / making the process more convenient than real time consultations
- e.g. of store and forward telehealth technology – the doctor can email the patient the results of the blood test which the patient can then check when they are available.

- patients do not need to travel
- participants can be located anywhere / making the process more convenient than consultations.in person
- e.g. of store and forward telehealth technology e.g. the hospital can upload the results of a blood test to the RVMP portal, which the patient can access without having to drive to the hospital in Sao Luis to collect the results.

- waiting times to receive reports or information from the doctor or patients are reduced
- doctor's reports and patient information are often received within a few hours of the request, making the process more efficient than traditional approaches of having to wait to communicate directly between the patient and the doctor
- e.g. of store and forward telehealth technology e.g. the health wearable can send the data collected routinely and when the doctor starts their shift, the data is already there for them to analyse.

- Patients, GP, specialists don't need to reliable Internet to communicate
- being disconnected or having poor signal will not impact the ability to share the data
- e.g. of store and forward telehealth technology – Doctors could record a short video or audio call and send it to the patient, who can then listen/watch when they are in a better internet connected area; the video/audio can be download and listening/watching will have no buffering.

Note:
Information/data stored and forwarded:
Store-and-forward telemedicine is collecting clinical information and sending it electronically to another site for evaluation and use. Information typically includes demographic data, medical history, documents such as laboratory reports, and image, video and/or sound files.

*Award **[1]** for identifying the benefits, and **[1]** for development of the benefit and **[1]** for relevant example of store and forward telehealth technology used **[3]**.*

3. To improve access to healthcare information in Ren Valley, both interventions will include the use of electronic health records. These will be accessed through the Ren Valley Medical Portal (RVMP).

Discuss whether providing access to electronic health records through the RVMP outweighs the privacy concerns for the residents of Ren Valley. **[8]**

Answers may include:

Stakeholders who have access to the portal and health records
- Residents (of the remote and rural areas).
- Medical practitioners in remote and rural areas.
- Companies that develop and maintain electronic medical records.
- Doctors and specialist medical practitioners in the regional city.

Benefits of having access to health records:
- Allows medical professional such as locum doctors/nurse or rostered medical staff at the hospital base to access patient files, especially in an emergency.
- Company staff, medical practitioners in the remote and rural areas, doctors and specialists and residents will have access rights to medical files as needed to improve regular medical care for residents of Ren Valley.
- In emergency situations access by medical practitioners and other residents to EHRs provides patient history, especially when a patient may not be able to speak for themselves or when the condition is beyond the capability of an untrained person.
- The convenience of 24/7 access can be significant if there are medical issues where local medical help may not be available – especially for residents in Ren Valley, as they are isolated and may be away from the nurse or other help.
- Store and forward telehealth will be available – see Q2b for list of benefits.

Privacy concerns, and security concerns that impact privacy:
- Members of the sick resident's household may be able to get access to the medical records without the permission of the sick resident, especially if the resident is incapacitated or shares the login details
- If the access levels of the resident are not set appropriately then the medical information of other residents may be accessible to another resident, or other unauthorised stakeholders, such as DMS company staff or hospital staff in Sao Luis.
- The approval process (vetting) of the various stakeholders who have access to the portal may not be as rigorous as needed, so they may be able to gain access to private medical information than they should not be able to.
- The activity on the portal and the access to and use of the medical information may **not** be tracked and checked regularly allowing private medical information to become public without a resident's knowledge or permission.
- The portal may be hacked if security of the website and database are not good enough, and the private health records published, sold or held to ransom.
- What responsibility and/or accountability does the software developer have if there is a breach of security and residents' private health information is exposed?
- The EHRs will be stored in a cloud-based service – privacy concerns if the data is not secured. Who is responsible and/or accountable?

Cs	Guide, pre-release or keywords	Suggestions of what we are looking for in the response
Context	Health	How are Electronic Health Records (EHR) being used related to the sources (contextualised): • positive and negative impacts/implications of electronic medical records on stakeholders, provided by Digital Medical Services (DMS) and accessed through the Ren Valley Medical Portal.
Content	Accountability authentication electronic health record, EHR, synchronous, real-time, asynchronous, Privacy, security, trust, Types of networks - cloud	**The technology that underpins EHR includes:** Data – what personal & health data is being collected? Electronic Health Records – What health and personal data is being stored? How is it being accessed? Where is the data being stored? Synchronous / real time - electronic health records are updated in real time Asynchronous – patients and medical professionals can access health records at different times **The Data Dilemmas:** Privacy - Who has access to the data? Is it being shared? Is it being stored securely? Is it being used for the purpose it was collected for? Trust – How much trust can residents, doctors have on the EHR system? Security – how are residents, medical professionals accessing the EHR? What security measures are being put in place? What authentication is being used? What access do users have?
Concepts	change, power, systems, values, ethics	**Change:** new approaches to healthcare record keeping **Power**: The use of EHR can empower residents and the medical professionals; Residents may have the control over their data, to download and keep track of medical information, update their personal data or information from the wearables. control, access, update/change/edit/delete, reliability, integrity, regulation. How might the integrity of medical data impact the power of the user and reliability of the data? Will regulation of the use of EHR impact the power of the users & control how it used? **Systems**: Electronic Health records need to work with other systems such as the RVMP portal and are dependent on Internet access via 5G, Internet or Satellite connections. ownership, control, individual rights, collective rights, government authority, reliability, accuracy, integrity **Value and ethics**: privacy & security concerns from the access to, use of and sharing of personal and medical data,

		How appropriate is it that residents have access to complex medical data? How will this data be interpreted by non-medical specialists that might cause harm e.g. causing more stress. appropriateness, freedom of information, perspective. Keywords that may be used - ownership, control, individual rights, collective rights, government authority, reliability, accuracy, integrity, appropriateness, freedom of information, perspective

Keywords: Privacy, healthcare, electronic health record, EHR, synchronous, real-time, asynchronous, security, authentication, stakeholder, trust, accountability, change, power, systems, values, ethics.

Please use the markband on page 9.

The following markband should be used with responses to question 3.

HL Paper 3, question 3	
Marks	**Level descriptor**
0	The work does not reach a standard described by the descriptors below.
1–2	• The response shows a limited understanding of the demands of the question. • The response is of limited relevance. The response is descriptive and consists mostly of unsupported generalizations. • The response has limited organization.
3–4	• The response shows some understanding of the demands of the question. • The response is primarily descriptive with some evaluation demonstrated but this is not sustained or fully supported. • The response is partially organized.
5–6	• The response shows adequate understanding of the demands of the question. • The response demonstrates adequate evaluation that is relevant and supported. • The response is adequately organized.
7–8	• The response is focused and shows an in-depth understanding of the demands of the question. • The response demonstrates sustained evaluation that is relevant and well-supported throughout. • The response is well-structured and effectively organized.

4. Recommend which of the interventions, a digitally supported community health hub **or** digital home care, should be adopted to improve the access to health care services for the residents of Ren Valley. **[12]**

The response should make reference to the pre-release, the sources and independent research (IR) into these two interventions.

Answers may include:
For 'a digitally supported community health hub':

From pre-release and intervention inquiries:
- There is already a permanent centre to hold equipment and for patients to be treated (feasibility) (cost).
- Holds more equipment than 'digital home care' in patient's homes.
- There is a permanent trained medical practitioner who would be more skilled and know more than a patient or their carer/s.
- Permanent digital communications technologies with higher quality than available in a patient's home (innovation).
- Medical and emergency supplies can be stored in the hub for residents rather than getting from the main local city.

From sources:
Source 1:
- Immediate implementation as Cecilia is available (feasibility).
- There is a small hall that can be quickly developed as a medical hub (feasibility) (cost).
- Basic telephone connection so satellite connection will be needed which is not hard to implement (cost).

Source 2:
- RVMP can be set up quickly and easily as DMS are experienced (feasibility) (innovation).
- RVMP is capable of many functions – link to medical records, video conferencing, linking residents in Ren Valley to each other (innovation).

Source 3:
- Andre and others like him will feel more comfortable that good medical care is readily available. Due to his age, he may be more confident with a community hub than digital care at home. (acceptability).

Source 4:
- Cecilia can provide better care as she is medically trained and already known by residents (acceptability).

Against 'a digitally supported community health hub':
From pre-release and intervention inquiries:

- Finding a trained medical practitioner would be difficult for a remote and rural location (feasibility).
- Funding of the health hub and the practitioner would be more costly than digital home care (cost).
- There often would not be a requirement for a trained medical practitioner with such a small population (cost).
- The issue of distance for a patient to travel from home to the hub could be too long for an emergency (feasibility).
- The issue of travelling to the nearest city would not be helped by the medical practitioner unless in the case of care being required along the way, but he would be in a better position to send information electronically to a specialist.
- Many of the basic emergency and medical skills could be learnt by the residents at less cost than a hub and practitioner (cost).
- Regular monitoring of patients would not be easy considering the distances between farms (feasibility).

From sources:
Source 1:

- One person like Cecilia will be not enough to manage 200 people across large distances in the valley (feasibility).
- Cost of setting up Cecilia and the local hall as a medical hub (cost).
- Cecilia may not stay or might not be available all the time (feasibility).

Source 2:

- DMS is not local, and reliability of the company could be a concern as services may not be tailored to Ren Valley's particular problems (innovation).
- Privacy of medical records may be compromised (ethics).

Source 3:

- Andre will still need to take an active role in his health, and so will his family, as Cecilia is not close to him.

Source 4:

- There are a lot of accidents on farms as shown by the statistics and causes of medical issues which means that a simple medical hub may not be capable of providing proper care, and the hub should be made bigger. Maybe by having visiting doctors to supplement Cecilia and having regular access by plane to react quickly to medical situations unsuited to digital access (feasibility, equity).

For ‘digital home care’:
From pre-release and intervention inquiries:

- Patients and carers would be skilled enough for basic emergency and medical care (feasibility).
- All residents could access medical supplies, information, and equipment from home quickly and easily (feasibility).
- Communications equipment would be supplied to a common and useful standard.
- Medical records would be readily available and can be used easily.

From sources:
Source 1:

- The hub, with one nurse, Cecilia, and the large distances means medical help will be difficult in an emergency which means digital homecare needs to be the primary source of care (feasibility).
- They will need satellite connections and phones made available (cost).

Source 2:

- The RVMP will be a great resource for all residents, and they will not need to rely on a hub or person (innovation).

Source 3:

- Andre and others like him can take control of their health, with the aid of their families. The technology could be a challenge for some people, but training could overcome this (equity).

Source 4:

- With so much potential for accidents training and equipment for individual farms and residents will make the residents more self-reliant.

Against 'digital home care':
From pre-release and intervention inquiries:

- Issue of time for individual farms to obtain medical supplies and equipment could be significant from the regional city or the hub (feasibility).
- Quality and quantity of medical supplies and equipment would be limited to that residents could use easily, hence not suitable for more than basic medical issues (feasibility).
- Training would be required, and the expertise would not be consistent across the residents due to the capabilities of the residents and their backgrounds (equity).
- Quality training would be hard to put in place for all residents as it takes time to develop good skills and knowledge. Everyone would need to be trained – just in case (cost).

From sources:
Source 1:

- The size of Ren Valley means that special facilities need to be considered rather than residents relying on themselves (feasibility).

Source 2:

- Privacy of residents when all have access to medical records can be an issue – responses may include parts of Q 3 response but should not be penalised if they are used to support the recommendation (ethics).
- Operating the RVMP may not be within the capabilities of a lot of residents (equity).

Source 3:

- As Andre says, his condition may get worse and require specialised care that others cannot provide, and a specialise nurse would be better at providing.

Source 4:

- With so many types of accidents and medical issues basic training of residents will not be good enough (feasibility).

Keywords: Privacy, healthcare, electronic health record, EHR, synchronous, real-time, asynchronous, security, authentication, stakeholder, trust, accountability, change, power, systems, values, ethics, transparency, equity, cost, feasibility, innovation

Notes for examiners:

Please pay attention to responses that appear to be pre-rehearsed or generic.

Please refer to the markband on page 14.

The following markband should be used with responses to question 4.

HL Paper 3, question 4	
Marks	**Level descriptor**
0	• The work does not reach a standard described by the descriptors below.
1–3	• The response shows a limited understanding of the demands of the question. • The response consists mostly of unsupported generalizations with limited relevant knowledge. • No recommendations are presented or those that are presented have only limited support. • The response has limited organization.
4–6	• The response shows some understanding of the demands of the question. • The response demonstrates some knowledge, but this is not always relevant or accurate and may not be used appropriately or effectively. • Recommendations are presented with some support although this is not sustained and only partially effective. • The response is partially organized.
7–9	• The response shows adequate understanding of the demands of the question. • The response is adequately supported with relevant and accurate knowledge. • Recommendations are presented and effectively supported. • The response is adequately organized.
10–12	• The response is focused and shows an in-depth understanding of the demands of the question. • The response is well-supported throughout with relevant and accurate knowledge. • Recommendations are presented and well-supported with a clear consideration of possible trade-offs and implications. • The response is well-structured and effectively organized.