**Health Care Management and Technology Adoption**

The field of health care information technology has grown rapidly around the world in recent years. **Hospitals and clinics** have increasingly been using mobile devices, such as smartphones and tablets, to improve patient care and streamline healthcare workflows. Here are some examples of how mobile devices are being used in hospital and clinic settings:

Clinical communication: Healthcare providers can use mobile devices to communicate with each other about patient care. This can include sending secure text messages, sharing images and videos, and conducting video conferencing.

Electronic health records: Mobile devices can be used to access electronic health records (EHRs) in real-time, allowing healthcare providers to review patient information and update records at the point of care.

Patient monitoring: Mobile devices can be used to remotely monitor patients, such as tracking vital signs, medication adherence, and patient activity.

Medication management: Healthcare providers can use mobile devices to check medication orders, scan barcodes to confirm the right medication and dose, and receive alerts about potential drug interactions or allergies.

Patient education: Mobile devices can be used to provide patient education materials, such as videos, animations, and interactive tools.

It's important to note that the use of mobile devices in healthcare must comply with regulatory requirements such as HIPAA in the United States, which ensures the privacy and security of patient information.

medical information databases are collections of electronic health records (EHRs), which contain medical information about patients such as their medical history, diagnoses, treatments, and laboratory results. These databases are used by healthcare providers, researchers, and public health officials to improve patient care, conduct medical research, and monitor and respond to disease outbreaks.

**Medical information databases** can be hosted by healthcare organizations, research institutions, or government agencies. Some examples of medical information databases include the National Electronic Health Records Database (NEHR) in Singapore, the National Health Information Network (NHIN) in the United States, and the National Health Service (NHS) Digital in the United Kingdom. These databases are often subject to strict privacy regulations to protect patient confidentiality and ensure the security of medical information.**Remote medicine** also known as telemedicine or telehealth, refers to the delivery of healthcare services using telecommunications technologies such as videoconferencing, remote monitoring, and mobile health apps. Remote medicine allows patients to receive medical care from a distance, often without having to travel to a healthcare facility.

Here are some examples of how remote medicine is being used:

Virtual consultations: Patients can consult with healthcare providers remotely via videoconferencing, allowing for medical advice and prescriptions to be provided from afar.

Remote monitoring: Patients with chronic conditions can use wearable devices to monitor their vital signs and symptoms from home, with healthcare providers receiving the data remotely and providing necessary interventions.

Mobile health apps: Patients can use mobile apps to track their health status, access medical information, and receive medication reminders.

Second opinions: Patients can obtain second opinions from remote medical specialists, providing access to expert care without having to travel long distances.

Mental health services: Remote medicine is increasingly being used to deliver mental health services, such as therapy sessions conducted via videoconferencing. **computerized provider order entry (CPOE)** is a digital system that allows healthcare providers to electronically order and manage patient care, such as medications, diagnostic tests, and procedures. CPOE replaces traditional paper-based order entry systems and helps to reduce errors, improve efficiency, and enhance patient safety.

CPOE systems can be integrated with electronic health record (EHR) systems, allowing healthcare providers to view patient data, including medication history, allergies, and lab results, while placing orders. Providers can also use decision support tools to check for drug interactions, dosage errors, and other potential issues before orders are submitted.

Benefits of CPOE include:

Reduced errors: Electronic orders can eliminate errors related to handwriting, transcribing, or miscommunication.

Improved efficiency: Providers can easily access and manage patient care orders, saving time and reducing delays.

Enhanced patient safety: CPOE can help to prevent medication errors and other adverse events, improving patient outcomes.

Increased accuracy: Providers can view patient data and decision support tools to ensure that orders are accurate and appropriate.There are each a different management-oriented topic selected by Master's in Health Informatics students. Theses which use surveys (e.g Surveys of HIT can provide valuable insights into the use and impact of these tools in healthcare settings, allowing for ongoing improvement and optimization of HIT systems. However, it's important to use validated survey instruments and to ensure that survey samples are representative of the population being studied in order to obtain reliable and accurate results.) of provider adoption and study measures of healthcare information technology effectiveness in management can encompass many different settings healthcare systems like Healthcare information technology (HIT) systems are used in a variety of healthcare settings to improve patient care, increase efficiency, and enhance communication among healthcare providers and types of provider such as there are various types of healthcare information technology (HIT) providers who offer different products and services. Here are some common provider types of HIT:

Electronic Health Record (EHR) Vendors: These vendors provide software solutions for managing patient records electronically, including patient demographics, medical history, clinical notes, test results, and medication orders.

Health Information Exchange (HIE) Providers: These providers enable the secure exchange of patient information among healthcare providers and organizations, allowing for coordinated care and improved patient outcomes.

Telemedicine Providers: These providers offer technology solutions for remote patient care, including virtual consultations, remote monitoring, and mobile health apps.

Medical Device Manufacturers: These manufacturers develop and produce medical devices, including monitoring devices, diagnostic tools, and imaging equipment, that are often connected to HIT systems for data sharing and analysis .

It is true that many healthcare information technology (HIT) networks lack interconnectivity, which can limit the exchange of patient health information between healthcare providers and organizations. This lack of interconnectivity can result in a variety of challenges for healthcare providers, including:

Incomplete patient records: Without interconnectivity, patient health information may be fragmented across multiple HIT systems, making it difficult for providers to access complete patient records and make informed clinical decisions.

Duplicated tests and procedures: In the absence of interconnectivity, healthcare providers may need to repeat tests or procedures that have already been performed because they cannot access the patient's previous test results or medical history.

Reduced efficiency: Lack of interconnectivity can lead to inefficiencies in healthcare delivery, such as increased wait times, longer hospital stays, and delays in patient care.

Increased costs: Duplicated tests and procedures and reduced efficiency can result in increased healthcare costs for patients and healthcare organizations.which means that many don't have the ability to communicate with one another. Sometimes, this lack of communication can put patients' health in danger for example.There are also potential risks associated with the use of HIT that can threaten patient safety and health. Here are some examples of how HIT can pose a risk to patient health:

Medication errors: HIT systems, such as computerized provider order entry (CPOE) systems, can increase the risk of medication errors if they are not properly designed, implemented, or used. For example, if the wrong medication or dose is selected in a CPOE system, it can result in serious harm to the patient.Moreover, there are many more cyber security risk in that such as:

\***Breach of Protected Health Information.**

It opens up the potential risk for data to be accessed by third parties. Whether intentionally breached by malicious actors or accidentally exposed, cases abound of patient data making its way into the wrong hands.

And by relying on external cloud service providers to manage their data infrastructure, those without advanced expertise in cybersecurity may be opening up the patients who use their systems to risk.

\***Altered Data may Inadvertently Lead to Incorrect Healthcare Decisions**

Cybersecurity risk doesn’t just pertain to the exposure of private data or the ransoms that are sometimes associated with data breaches. The risks related to altered data can have serious consequences.

Patients and healthcare professionals that are relying on data to make treatment decisions depend on correct and accurate datasets. If data is deleted or altered it can lead to a wrong diagnosis or treatment plan, or other adverse events.

**\*Altered Device Functionality may Result in Adverse Results**

The above highlights one of the key disadvantages of IoT in healthcare. Moreover, without the correct security protocols, patients’ connected medical devices may be accessed with the intention of altering functionality. In the worst-case scenario resulting in serious device malfunction in life-and-death situations.

Whether or not cybersecurity contributes to the disadvantages of technology in healthcare is yet to be seen, as thankfully, there are no documented cases of medical devices being hacked for such a purpose. That said, the risk needs to remain at the forefront.

**\*Patients Interact with Technology Instead of a Live Care Provider**

Dealing with dashboards on connected medical devices and computers removes the human touch of treatment, resulting in a lack of empathy toward patient care.

**\*Risk of Miscommunication**

Especially for the elderly and the most vulnerable patients, relying on technology as the interface of care can cause confusion and frustration; and can result in confusion, treatment plans not being understood properly, or patient non-compliance.

**\*More Struggling, Less Caring**

Healthcare professionals and clinicians that spend more time struggling with technology as opposed to patient care are likely to disregard the use of technology and future iterations altogether.

But even for healthcare professionals that are in favor of using and implementing technology, ensuring that the technology-assisted outcomes are more accurate, or better at diagnosing is crucia

HRSTO: Persons employed in science and technology

Those people who are employed in an S&T occupation.

Occupations are classified according to the International Standard Classification of Occupation

(ISCO), developed by the International Labour Organisation (ILO) and adapted for the EU to

implement ISCO for census and several survey coding purposes.

Recommendations in the Canberra Manual identify certain occupation groups as HRSTO, namely:

 ISCO major group 2 (Professionals) - occupations whose main tasks require a high level of

professional knowledge and experience in the fields of physical and life sciences, or social

sciences and humanities.

 ISCO major group 3 (Technicians and associate professionals) - occupations whose main

tasks require technical knowledge and experience in one or more fields of physical and life

sciences, or social sciences and humanities.

These types of occupations typically require a formal education qualification equivalent to the one

defined above. However, whether the person actually has this formal education qualification or not

is irrelevant as people with those occupations are automatically considered as belonging to

HRST(O).

Due to an increasing demand for internationally comparable indicators on occupations, the original

standard developed in 1988 was revised and updated in 2008.

As a result, HRST data in Eurobase domain up to and including 2010 are built up based on the

original classification - ISCO-88. From 2011, ISCO-08 is employed.

The International Standard Classification of Occupation (ISCO-88)

Professionals are sub-divided into four sub-major groups — physical, mathematical and

engineering science professionals; life science and health professionals; teaching professionals;

and other professionals — the first two making up the sub-set of scientists and engineers (S&E).

Technicians and associate professionals are sub-divided in four sub-major groups – physical and

engineering science associate professionals; life science and health associate professionals;

teaching associate professionals; and other associate professionals

The user should note that this definition constitutes a certain deviation from the recommendations

laid down in the Canberra Manual. In addition to ISCO major groups 2 and 3, the Canberra Manual

proposes to also consider the following groups as HRST: production and operations managers,

other specialist managers, managers of small enterprises (ISCO 122, 123 and 131). These groups

may work in the field of S&T but are not included in HRST as used here (but they are included in

HRSTE if they have successfully completed third level education). The limitation applied here is,

however, justified as a pilot survey conducted in 1995 tested the validity of the original definitions

for HRST and the results indicated that, for the EU, including these certain managerial occupations

distorted the results significantly due to variations between countries in the treatment and

classification of managers.

The International Standard Classification of Occupation (ISCO-08)

Professionals are sub-divided into six sub-major groups – science and engineering professionals;

health professionals; teaching professionals; business and administration professionals;

information and communications technology professionals; and legal, social and cultural

professionals.

Technicians and associate professionals are sub-divided in five sub-major groups – science and

engineering associate professionals; health associate professionals; business and administration

associate professionals; legal, social, cultural and related associate professionals; and information

and communications technicians.

The ISCO changeover

In general, 1-to-1 correspondence does not exist between ISCO-08 and ISCO-88. Consequently,

the overall comparison between the two versions is difficult. The revision of the ISCO has an

impact on the HRSTO populations, even if the precise magnitude is complicated to be measured.

As the data are only available at 3-digits, this impact is not quantifiable, except for the transfer of

one category in ISCO-88 to one single category in ISCO-08, at the level of 3 digits. This is case for

the HRST population which could impact as much as 10% of the population in the Czech Republic,

for example. For the other countries, the distribution of reallocation from ISCO-88 to ISCO-08

between the other categories is not known and this makes the estimation of the impact on HRST

not possible. Consequently, for all the HRST categories using the ISCO classification, there was a

break in series in 2011.

Other terminology related to HRST

HRSTC: Persons with tertiary education (ISCED) and employed in science and technology

— Core

Those people :

 who have successfully completed education at the third level (HRSTE) – ISCED1997 levels 5

and 6

and

 are employed in a S&T occupation (HRSTO) – ISCO major groups: 2 (professionals) and 3

(technicians)

S&E — Scientists and Engineers

Prior to 2011, Scientists and Engineers are those people who work in:

 21 physical, mathematical and engineering occupations;

 22 life science and health occupations.

With the new ISCO-08 classification, S&E are those people who work in:

 21 science and engineering professionals;

 22 health professionals;

 25 information and communications technology professionals.

HRSTU: Unemployed persons with tertiary education

Those people who have successfully completed education at the third level and are unemployed.

NON\_HRSTU: Unemployed persons with non-tertiary education

Those people who have not fulfilled the HRST requirements and are unemployed (unemployed

non tertiary educated).

HRST labour force

The HRST labour force comprises persons who fulfil the requirements of HRST and are either

employed or unemployed, but not inactive. The definitions for employed, unemployed and inactive

are provided in the website of EU-LFS. (EU labour force survey)

Employed HRST

The employed HRST comprises persons who fulfil the requirements of HRST and are employed

The definitions for employed, unemployed and inactive are provided in the website of EU-LFS. (EU

labour force survey)

Non-HRST Labour Force

The non-HRST labour force comprises persons who do not fulfil the requirements of HRST and are

either employed or unemployed, but not inactive. The definitions for employed, unemployed and

inactive are provided in the website of EU-LFS. (EU labour force survey)

HRST / population ratios

HRST / population ratios correspond to HRST as a proportion of the total population of the age

group considered. Note that for total HRST as a proportion of the population, anyone below the

age of 15 is excluded from the figure for population. This is because no one below the age of 15

can fulfil either of the requirements for being classified as HRST and so the denominator is

adjusted accordingly.

HRST / labour force ratios

HRST / labour force ratios correspond to HRST as a proportion of the total labour force of the age

group considered. Only active (employed and unemployed) HRST categories are taken into

account and divided by the total labour force.

HRST/ employment ratios

HRST employment ratios correspond to the number of HRSTO which by definition are employed

divided by the total employed population of the age group considered.

HRST rate of unemployment

The HRST unemployment rate corresponds to the number of unemployed HRST divided by the

total active HRST population. Unemployed HRST restricts to the tertiary educated unemployed

population.

Non-HRST rate of unemployment

The non-HRST unemployment rate corresponds to the number of unemployed non-HRST divided

by the total active non-HRST population.. Unemployed non-HRST correspond to non-tertiary

educated unemployed persons.

**Micro-project**:

Technical resources in hospital

There are several technical resources that are commonly used in hospitals to support patient care and management. Some examples include:

Picture Archiving and Communication Systems (PACS): PACS are used to store and manage medical images such as X-rays, CT scans, and MRIs. They allow healthcare providers to access and analyze images quickly and easily, improving the speed and accuracy of diagnoses.

Clinical Decision Support Systems (CDSS): CDSS are computer programs that help healthcare providers make decisions about patient care. They use patient data and medical knowledge to provide recommendations for diagnosis, treatment, and follow-up care.

Telemedicine: Telemedicine uses communication technology to provide remote medical care and consultation. It allows healthcare providers to connect with patients and other providers in different locations, improving access to care and reducing the need for travel.

Wearable Devices: Wearable devices such as smartwatches and fitness trackers can be used to monitor patients' vital signs and activity levels. They provide a continuous stream of data that can be used to inform treatment decisions and track patient progress.

Patient Portals: Patient portals are web-based platforms that allow patients to access their medical records, communicate with healthcare providers, and manage their care. They improve patient engagement and can help patients take an active role in their own healthcare.

These are just a few examples of the many technical resources that are used in hospitals to support patient care and management.

Electronic Health Records (EHRs): EHRs are digital records of patients' medical information, including diagnoses, medications, and treatment plans. They provide a centralized source of information that can be accessed by healthcare providers across different departments and facilities.

Assessing the Impact of Electronic Health Records (EHRs) on Healthcare Management in a Small Clinic

Objective: The objective of this study is to evaluate the impact of Electronic Health Records (EHRs) on healthcare management in a small clinic, including changes in workflow, efficiency, and patient outcomes.

Methodology: The study will use a mixed-methods approach, including both quantitative and qualitative data collection and analysis. The study will take place at a small clinic that has recently implemented EHRs. Data will be collected through surveys and interviews with healthcare providers, patients, and administrative staff, as well as through an analysis of clinic records and EHR usage data. Data analysis will include both descriptive statistics and thematic analysis.

Expected Results: The study is expected to demonstrate the impact of EHRs on healthcare management in a small clinic, including changes in workflow, efficiency, and patient outcomes. The study may also uncover challenges associated with EHR implementation and management, as well as opportunities for improving EHR use in small healthcare settings.

Conclusion: The results of this study will provide valuable insights into the impact of EHRs on healthcare management in a small clinic. The findings may inform future EHR implementation and management strategies, as well as contribute to the broader literature on healthcare technology adaptation.

Can we predict the likelihood of patient readmissions within 30 days of discharge using patient demographic and clinical data?

Data: Electronic health record (EHR) data for patients who were discharged from a hospital in the past year, including demographic information (age, gender, race), clinical information (diagnoses, medications, procedures), and readmission status (yes or no).

Model: A logistic regression model, which can predict the probability of a binary outcome (in this case, readmission within 30 days) based on a set of predictor variables (in this case, patient demographic and clinical data).

Interpretation: The model's results can be interpreted in terms of the magnitude and direction of the coefficients for each predictor variable. For example, if the coefficient for a particular diagnosis code is positive and statistically significant, it suggests that patients with that diagnosis are more likely to be readmitted within 30 days. If the coefficient for a particular medication is negative and statistically significant, it suggests that patients who take that medication are less likely to be readmitted within 30 days. The model's overall performance can be evaluated using metrics such as accuracy, precision, recall, and F1 score.

Rules: Based on the model's results, rules could be developed to help identify patients who are at high risk of readmission within 30 days. For example, a rule could be created that flags patients who have a certain combination of diagnoses and medications as being at high risk, or a rule could be created that assigns patients a risk score based on their demographic and clinical data. These rules could then be used to guide interventions aimed at reducing the risk of readmission, such as increased follow-up care or medication management.

**Aim # 1**

Deriving an aggregated and optimized index-value for country-health: the higher the index-value is, the LESS the number of health problems in a country\_year\_object is

To derive an aggregated and optimized index-value for country-health, you can follow these steps:

Step 1: Determine the health problems that you want to include in your index. This could include factors such as infant mortality rate, life expectancy, incidence of specific diseases, and access to healthcare.

Step 2: Collect data on these health problems for each country and year that you are interested in. You can obtain this data from sources such as the World Health Organization, the World Bank, and national health statistics agencies.

Step 3: Normalize the data for each health problem by converting it to a standardized score between 0 and 1. For example, you can divide each data point by the maximum value of that variable across all countries and years to obtain a score that reflects the relative performance of each country.

Step 4: Assign weights to each health problem based on its importance in determining overall health outcomes. For example, you may assign a higher weight to life expectancy than to access to healthcare.

Step 5: Calculate the weighted average of the standardized scores for each country and year. This will give you an aggregated index-value for country-health that reflects the relative performance of each country across all the health problems that you included in your index.

Step 6: Invert the index-value so that a higher value indicates better health outcomes. You can do this by subtracting the index-value from 1, or by multiplying it by -1.

By following these steps, you can derive an aggregated and optimized index-value for country-health that reflects the relative performance of each country across a range of health problems. The higher the index-value, the better the health outcomes in that country.**question**

The main **question** is Which countries seems to have the lowest and the highest index-value?

Countries that may have high or low index-values based on the factors that are typically included in health indices.

Countries with high index-values are likely to have better health outcomes and lower rates of health problems. This may include countries with high life expectancies, low infant mortality rates, low incidence of diseases, and high levels of access to healthcare. Some examples of countries that are often ranked highly on health indices include Japan, Switzerland, Sweden, Australia, and Canada.

Conversely, countries with low index-values may have worse health outcomes and higher rates of health problems. This may include countries with low life expectancies, high infant mortality rates, high incidence of diseases, and low levels of access to healthcare. Some examples of countries that are often ranked poorly on health indices include Afghanistan, Chad, Nigeria, and Haiti.

However, it is important to note that health outcomes can be influenced by many complex factors, such as socio-economic status, education, environment, and cultural practices. Therefore, health indices should be interpreted with caution and should not be used to make definitive judgments about the overall health of a country or population.

Object: Countries

Attributes: Index-value, number of health problems

Matrix: Index-value Number of health problems

Country 1 0.8 3

Country 2 0.6 5

Country 3 0.9 2

Country 4 0.4 7

Country 5 0.7 4

Note: This is just a hypothetical example of an OAM for a set of countries with their corresponding index-values and the number of health problems they have. The actual OAM would depend on the specific data being analyzed and the research question being addressed.

Result

As we can see in the OAM table that given information in ture such as counteries with higher index value have lower number of health problem.

**Aim # 2**

Describe and compare the countries human Human resources in science and technology .

Question:

Which countries have the highest number of Human resources in science and technology in europe.

hypothesis:The countries with higher number in tertiary education has the highest number of human resources in science and technology.

Answer:After comparing the four european countrires we can see our hypothesis is right.

These rankings are based on the number of people who have attained tertiary education (i.e. post-secondary education) in science, technology, engineering, and mathematics (STEM) fields, as well as the number of people who are employed in STEM occupations. It's important to note that these rankings may change over time and that different organizations may use slightly different criteria to define "human resources with education in science and technology".

Result:

Object-Attribute-Matrix (OAM) analysis of human resources with education in science and technology across different countries or regions. However, such an analysis could provide valuable insights into the strengths and weaknesses of the science and technology workforce in each country or region, as well as the factors that contribute to their success or challenges. By identifying these factors, policymakers, educators, and employers can work together to address the gaps and ensure that human resources with education in science and technology have the necessary skills, resources, and opportunities to drive innovation and progress in their respective fields.