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Cooperation and training on innovation and entrepreneurship in the eHealth community (CONNECT)

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IO1 - eHealth Interdisciplinary Curriculum: Telemedicine

[Partner: Asociatia INIT]

Cluj-Napoca, September 17, 2021

eHealth Interdisciplinary Curriculum Template – Purpose of this tool

Babeș-Bolyai University has developed this tool as a guide and generic template for creating the eHealth Interdisciplinary Curriculum. We have tried to make it user-friendly by providing explanations and examples under each heading.

The eHealth Interdisciplinary Curriculum will be developed under *"Objective 1: Develop an innovative multidisciplinary curriculum for students from the computer and information, healthcare and social professional background, with the main focus on cooperation between sectors for improving the existing knowledge, skills, and accessibility to new opportunities"*. The indicators of this objectives are represented by 1 curriculum developed in the first 10 months of the project, with at least 1 member of each partner institution involved in the curricula development.

The eHealth Interdisciplinary Curriculum is centered around theoretical and practical subjects within the eHealth domain. It will have the form of an online book, adapted as an interactive online resource, and uploaded on the online platform for managing eHealth eLearning. It will be addressed to health sciences and IT students, from participant countries and disseminated to students from other European universities. This Curriculum will focus on undergraduate students, but other beneficiaries can be included. Although there is a requirement that readers and learners need to have a background in health care/ medicine/ information technology, information systems or business.

The eHealth Interdisciplinary Curriculum will include foundational knowledge (formal), key perspectives in eHealth (examples of new technologies, applications, instruments – non-formal), application abilities (increasing qualifications, competencies, and critical thinking – non-formal) to provide eHealth remedial education. Consultation of formal and informal educational providers will be necessary in developing the curriculum.

The eHealth Interdisciplinary Curriculum is organized to emphasize relationships between different fields (health, IT, management). It will be structured on the recommendations of the International Medical Informatics Association (IMIA).

The primary learning goals of the curriculum will be integrated to create a coherent methodology: (a) foundational knowledge (concepts, principles, facts, terms), (b) key perspectives in eHealth, that will be the starting base of practical abilities, (c) application abilities - to have a standard of working competencies for the future workplace, (d) to engage students to increase interest and have access to information.

The eHealth Interdisciplinary Curriculum will be developed by an international, inter-professional teaching team (members) with different expertise in the eHealth domain, from partner institutions. Two educational providers, from each partner institution, will be involved in the process. For each chapter, at least two external contributors will be invited to co-author the chapters and give feedback on the developed intellectual output.

The eHealth Interdisciplinary Curriculum will be purposefully designed (flexible, modular format, user guidance) so that they can be easily used and transferred in academic activities and within the university curriculum. The eHealth Interdisciplinary Curriculum is comprised of 8 individual modules. The number of pages of the entire Curriculum will be between 200-300, A4 format– around 30-40 pages/module. The course material for the entire Curriculum requires 40 hours of the hands-on, active reading experience. For each module a maximum of 5 lessons plans of 1 hour each are recommended (5 hours/module). Extra 20 hours must be added (for necessary time to access references and areas of inquiries) for the entire Curriculum, meaning 30 minutes for each lesson plan (2.5 hours for each module).

The following steps will be taken for the development of the eHealth Interdisciplinary Curriculum:

1. Desk Research
2. First draft developed by each institution for their module
3. Expert review and input
4. Second draft developed by each institution for their module based on the expert input
5. BBU complies final version of the curriculum
6. Experts validate the final curriculum

The research team from Babeș-Bolyai University is available to support any efforts to compile each curriculum component (module) and is responsible for overseeing the compilation of the final eHealth Interdisciplinary Curriculum. The contact info for the coordination team for this task is provided here: madalina.coman@publichealth.ro and alina.forray@publichealth.ro. Please name the final document using the following strategy "CONNECT Project_IO1_Curriculum_Module name_Institution Acronym" (e.g. CONNECT Project_IO1_Curriculum_mHealth_BBU)

Some tips for developing the Curriculum for the assigned modules:

- Review the Desk Research documents available for all the modules and extract the appropriate information to be used for the development of the module;
- A total of 5 hours for the lesson plans and 2.5 hours for individual work are assigned to each module
- Plan for maximum 5 lesson plans, each with the duration of 1 hour + 30 additional minutes for further references and inquires that will be done individually by students;
- Describe in detail each lesson plan following the suggested headings from section *3. Lesson plans;*
- Consult the key expert points from the Expert Network Centralizer in the development of the curriculum for the assigned module.

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1. Learning objectives of the Telemedicine module

[The objective of this section is to describe the module's brief statements that describe what students will be expected to learn by the end of the module. The learning objectives can reflect the educational standards used by your institution (if the case) or they can be drawn from international Common Core Standards. The learning objectives need to be closely connected with the lesson plans. Some examples of developing learning objectives can be found here]

Learning objectives of the module:

1. Students will be introduced to the concept of telemedicine and healthcare challenges in relation to telemedicine.
2. Students will learn about current technological challenges and opportunities in the field of telemedicine.
3. Students will learn how to communicate effectively (including nonverbal) with patients in a virtual space. (Patient communication guides)
4. Students will discuss the development of telemedicine apps and startups as a solution to healthcare challenges. (GDPR & HIPAA COMPLIANT)
5. Students will discuss and analyze relevant use cases in the field of telemedicine.
6. Students with a technical background will be exposed to several major health issues as well as the privacy, security, and confidentiality concerns that are present in healthcare today.
7. Students with a healthcare background will become familiar with the technical aspects of privacy and information security concerns regarding the storing and sharing of private health information. (MALPRAXIS)
8. Students will explore issues associated with telemedicine use including forces driving to adoption of telemedicine, liability and insurance, reimbursement and career opportunities.
9. Students will be provided a forum for critical discussion of current developments, research topics, and impact within the field of telemedicine.

10. Students will be provided a forum for interdisciplinary collaboration focused on future directions for telemedicine (e.g., communication, research, development).
11. Practical activities
12. Data protection & regulation

2. Foundational knowledge of the Telemedicine module

[The objective of this section is to briefly describe the foundational knowledge of the module. It refers to main concepts, theories, models, terminology, principles, and methods being currently used related to the module that are going to be further studied in the lesson plans]

[This part should ideally not exceed two pages. However, if needed, it can go up to four pages]

Definition of Telemedicine

Telemedicine is a subset of telehealth, and it refers to the use of communication networks to deliver healthcare services at a distance. The communication and networking technologies also vary, such as satellite communications, the internet, Global System for Mobile Communications (GSM). The COVID-19 pandemics led to such a need for socially distanced health care that telemedicine visits increased 683% at the height of the pandemic. It seems that telemedicine will permeate pervasively into healthcare delivery over time (CHIRON, n.d.).

World Health Organization (WHO) defines telemedicine as “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 the 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”. What we recognize as telemedicine today started in the 1950’s when a few hospital systems and university medical centers started to try to find ways to share information and images via telephone. In one of the first successes, two health centers in Pennsylvania were able to transmit radiologic images over the phone (WHO, n.d.).

When it comes to patients, the main benefits of telemedicine are less time away from work, no travel expenses, less interference with a child or eldercare responsibilities, privacy, and no exposure to other potentially contagious patients. On the other hand, in the case of providers, their benefits are an increase in revenue, improvement in office efficiency, better patients follow through and improved health outcomes, fewer missed appointments and cancellations, and private payer reimbursement.

There are few limitations to how telemedicine can be applied. Some examples of how it is being used today are follow-up visits, remote chronic disease management, remote post-hospitalization care, preventive care support, school-based telehealth, and assisted living center support (WHO, n.d.).

According to an economic forecast organization, the size of the telemedicine market was around $45 billion in 2019, and it is projected to reach $175 billion by 2026. The reasons for this growth are the increasing healthcare cost, geriatric population, government funding and grants for telemedicine, medical tourism, the prevalence of chronic and lifestyle-associated diseases, the medical requirement in remote areas, and the need for remote patient monitoring services in developing countries. In the European Union, five projects related to telemedicine are carried out. The scope of these projects is teleradiology, teledermatology, teleneurology, telemonitoring for diabetes and chronic heart failure, but there is no topic on education(Isights, n.d.).

Key components of *Telemedicine*

Teleconsultation

Teleconsultation is defined as synchronous or asynchronous consultation using information and communication technology to omit geographical and functional distance (Deldar et al., 2016).

Examples:

1. Both sides are health providers [e.g., who may need a second expert opinion]
2. Physician–physician consultation
3. Physician–primary care provider (PCP) communication, like nurses
4. One side is health provider and another side is the patients [e.g., for tele-monitoring or tele-visiting]
5. Physician – patient relationship
6. PCP–patient relationship
7. Tripartite communication among physician – PCP – patient

Telementoring

Telementoring is mentoring that is carried out at a distance (usually online), when face-to-face mentoring is not possible (*Telementor Guide*, n.d.).

Telemonitoring

Telemonitoring is the remote monitoring of patients, including “the use of audio, video, and other telecommunications and electronic information processing technologies to monitor patient status at a distance”(Meystre, 2005).

Examples:

1. Cardiovascular: Heart rate, Fetal Heart rate, Blood pressure, ECG, Pacemaker parameters
2. Hematologic: Coagulation (INR)
3. Respiratory: Pulse oximetry, Spirometry, Respiratory rate, CO2 production, O2 consumption

4. Neurologic: EEG, EMG, Intracranial pressure
5. Metabolic: Body weight, Basal metabolic rate, Blood glucose, Blood lactate, Blood ethanol, Diet, Physical activity, Temperature

Teleassistance

Teleassistance represents the act of a doctor to assist other health professionals at a distance in the performance of some medical act(IGI Global, n.d.).

Telemedicine applications can be classified into two basic types, according to the timing of the information transmitted and the interaction between the individuals involved—be it health professional-to-health professional or health professional-to-patient. Store-and-forward, or asynchronous, telemedicine involves the exchange of pre-recorded data between two or more individuals at different times. For example, the patient or referring health professional sends an e-mail description of a medical case to an expert who later sends back an opinion regarding diagnosis and optimal management. In contrast, real time, or synchronous, telemedicine requires the involved individuals to be simultaneously present for immediate exchange of information, as in the case of videoconferencing. In both synchronous and asynchronous telemedicine, relevant information may be transmitted in a variety of media, such as text, audio, video, or still images. These two basic approaches to telemedicine are applied to a wide array of services in diverse settings, including teledermatology, telepathology, and teleradiology. The majority of telemedicine services, most of which focus on diagnosis and clinical management, are routinely offered in industrialized regions including, but not limited to the United Kingdom of Great Britain and Northern Ireland, Scandinavia, North America, and Australia . In addition, biometric measuring devices such as equipment monitoring heart rate, blood pressure and blood glucose levels are increasingly used to remotely monitor and manage patients with acute and chronic illnesses. Some predict that telemedicine will profoundly transform the delivery of health services in the industrialized world by migrating health care delivery away from hospitals and clinics into homes(WHO, n.d.).

3. Lesson plans for the Telemedicine module

[The objective of this section is to provide the foundational knowledge for each concept studied in a lesion plan and offer real-life, practical examples of all the concepts studied in the module. This will be done with the help of lessons plans, during which each concept is explained and exemplified with analogies of real-life examples. Lesson plans will include examples, analogies, application of the concepts, and areas for further enquiries for participants. Each lesson plan should have the format from below. There are 10 weeks of intensive study program with a total of 40 hours for the entire curriculum, so a maximum of 5 lesson plans, each with the duration of one hour should, be developed for every module since we have 5 hours allocated for every module]

[This part should ideally not exceed 30 pages]

Lesson 1: Introduction to Telemedicine: Opportunities and Barriers

L1: Foundational knowledge

[For each lesson plan please include a detailed explanation of the concepts, theories, models, terminology, principles, and methods being currently used related to the concept explained in this lesion plan. In doing so please create synergies withing the two domains (IT and health and social science) to create mutual understanding among students]

1. **What is 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" - World Health Organization(WHO, n.d.).

2. Key components of Telemedicine

Teleconsultation

Telementoring

Telemonitoring

Teleassistance

3. Current telemedicine use

Telemedicine, or the electronic transmission of medical information via digital communications, has become an essential tool. It has led to a significant increase in the utilization of remote telemedicine and telehealth interventions, with many physicians in some regions using these technologies to manage patients remotely. Expanded use of telemedicine in medical care and teleradiology occurred in tandem with the increased need for social distancing. Telemedicine tools are more commonly used for remote treatment, particularly in the United States, where 63% of health care practitioners have used it. Among physicians currently using telemedicine for consultation, nearly half (48%) are using it for the first time. When the outbreak ends, one-fifth of physicians using telemedicine tools expect to use them significantly more than before the pandemic. The COVID-19 pandemic has shone a spotlight on the innovative degree to which eHealth can empower health systems to avoid cross-infection of COVID-19 patients and ensure continuity of essential health services (Abdel-Wahab et al., 2020).

4. Telemedicine within different specialties:

- **Teleradiology** (ultrasounds, MRIs and x-rays) (eVisit, n.d.-b)
- **Telepathology** (static image-based systems, virtual slide systems, real-time systems) (TechTarget, n.d.)
- **Teleophthalmology** (Synchronous teleophthalmology, Asynchronous teleophthalmology) (Wikipedia, n.d.)
- **Teledermatology** (skin mapping, diagnosis, and archiving system) (DermNet, n.d.)
- **Telecardiology** (coronary heart disease, both chronic and acute, as well as arrhythmias, congestive cardiac failure, and sudden cardiac arrest) (News Medical, n.d.)
- Teleobstetrics /prenatal telemedicine service

- Telecare in geriatrics
- Teleoncology
- Teleneurology
- Telediabetes
- Telepsychiatry and telemental health
- Telesurgery
- Teleotorhinolaryngology
- Teledentistry
- Teleemergency service
- Tele-ICU (Intensive care unit)
- Teledialysis
- Telerehabilitation

5. Advantages of telemedicine

- increases access to specialized and timely urgent care,
- increases the capacity and efficiency of specialists,
- reduces wait times for appointments and follow-up visits,
- reduces emergency department visits and the time patients spend in hospitals,
- reduces the discomfort and anxiety associated with patients traveling to receive services,
- reduces the costs and carbon emissions associated with patient travel,
- connects care teams to provide greater continuity of care,
- connects remote family members with long-stay patients,
- connects healthcare professionals for knowledge sharing,
- integrates with conventional care delivery models,
- keeps patients in their homes and communities longer.
- redaction of healthcare costs in the public and private sectors
- easy access to specialist for the rural area patients
- prevention and medical education (*Telemedicine Benefits: 17 Advantages for Patients and Doctors*, n.d.)

6. Barriers to development of telemedicine

- **Unfamiliarity with the technology**

  Telemedicine is a hybrid system, which involves the medical as well as ICT domain for complete understanding of the telemedicine solutions and its delivery. There is a serious lack of such technical persons, who can run day-to-day business of telemedicine. To run any telemedicine system properly, trained technical manpower is required (*Barriers to Development of Telemedicine in Developing Contries*, n.d.; "E-Health and telemedicine: Concepts, methodologies, tools, and applications," 2015).

- **Lack of informed consent before teleconsultation**

  Healthcare providers need to have a clear understanding of what their legal and ethical responsibilities are. Similarly, patients must receive the protection of adequate standards of care and know that the person to whom they are entrusting their health has the proper qualifications. The lack of clear-cut legal guidelines, rules, and regulations hinders the telemedicine to improve healthcare access and healthcare quality through information and communication technology (*Barriers to Development of Telemedicine in Developing Contries*, n.d.).

- **Initial upfront cost for equipment and connectivity**

  Although telemedicine can be leveraged to increase access to care and reduce the cost of care but that is mainly true for the user's point of view. Story is different if we look from the side of providers or healthcare organizations. For establishing a telemedicine unit, it needs lots of financial investment. It becomes more difficult for the developing countries to allocate a huge budget for the investment in telemedicine (*Barriers to Development of Telemedicine in Developing Contries*, n.d.).

- **Reimbursement and insurance barriers**

  Reimbursement of telemedicine services has been reported as one of the important barriers in developed countries. When patient avails healthcare services through telemedicine system, insurance claim may not cover the cost of care as it is not delivered through traditional healthcare system. Such discrimination seldom occurs in developing countries, where health insurance is still a rare commodity (*Barriers to Development of Telemedicine in Developing Contries*, n.d.).

- **Licensure issues**

  Highly sophisticated, safe, secure, and speedy teleconsultations have reduced the distance barrier in healthcare seeking and have improved the healthcare access. In order to avoid malpractice in telemedicine, healthcare professionals should be specifically trained for telemedicine as they do for traditional medicine. Poor availability of experts and trained professions raises legal implications and warrants licensing of telemedicine providers (*Barriers to Development of Telemedicine in Developing Contries*, n.d.).

- **Patient acceptance/satisfaction**

  There is lack of confidence in patients about the outcome of telemedicine. It is difficult for them to believe that machine can provide healthcare demands without visiting physician face to face. This cultural perception and attitude toward newer technology also possess threat to the development of telemedicine. Even many physicians also think that patient consultation and treatment are incomplete without touching the patient and prefer face-to-face consultation than remote consultation through ICT platform. Some medical practitioners do not want to opt telemedicine practice due to the fear of medical indemnity (*Barriers to Development of Telemedicine in Developing Contries*, n.d.; "E-Health and telemedicine: Concepts, methodologies, tools, and applications," 2015).

- **Lack of legal regulation in telemedicine**

  Telemedicine practices has eliminated many physical and emotional barriers to healthcare seeking but have raised many legal and ethical issues, which are normally not encountered during traditional healthcare delivery. Legal considerations are a major obstacle to telemedicine uptake (*Barriers to Development of Telemedicine in Developing Contries*, n.d.; "E-Health and telemedicine: Concepts, methodologies, tools, and applications," 2015).

7. Issues linked to Telemedicine use

	Type	Problem	Explanation	Possible solution	Serious?
1	Clinical	Care provision with less than ideal information or misinformation	Examination and procedures not possible	Knowing the limits and stating them upfront. Clinical decision support using adaptive learning methods; ICT should not override the clinicians	Yes
2	Administrative	Cross-border care (multijurisdictional)	Licensing rules may restrict care provision across borders of various countries and, sometimes, states	Governance and cooperation	No
3	Administrative	Care provision by relatively less or untrained persons	It is always difficult to know whether the supposed care provider is a fraud or hack Sometimes, family members are asked to answer a query	Ensuring guidelines ("Map of Med" for telehealth)	Yes
4	Technical	Lack of emergency support and retrieval care	Inadequate connectivity or broken links to the requisite support team	High bandwidth connectivity; systems interoperability	Yes
5	Administrative	Diversion of funding from more deserving immediate problems (and lack of funding through conventional mechanisms)	Telehealth systems have been promoted as a technology answer to each and every problem (a major reason for failures)	Health economics and cost-benefit analyses; public-private funding models	No
6	Administrative/ technical	Bias toward "best-connected" demographic (including developing world)	Telehealth was supposed to decrease the rich-poor gap allowing developing countries to leap frog. It has not happened	Scalable solutions; platform independence of services; better penetration of connectivity	Maybe
7	Clinical	Unusability of patient remote monitoring information (including adverse events) especially on software upgrade	High-end systems do fail. A system for local maintenance and availability of trained persons is a constant need	Automated customized personal surveillance systems; enthusiasts and promoters; help and support on version change	Yes
8	Technical	Noninteroperability of monitoring devices/sensors	As above	Standards and open systems	No
9	Technical	User acceptability of new telehealth technology (games, avatars, and immersion). Intrusive—asking for too many passwords	The best of systems fail because of human factors. An unused technology or system is literally useless	Participatory design; interventions targeting youth; training; proper reimbursements	No
10	Clinical	Services established outside ordinary protocols; weak links to EHRs	Occurs whenever change management principles are ignored	Include the service into the traditional healthcare system and EHRs (if available)	No
11	Personnel	Loss of interpersonal relationships due to wrong words and misinterpretation	Miscommunication and misinformation are common, for example, autotyping leading to wrong words	Rechecks; a general slowdown; Guidelines	Yes
12	Personnel	Loss of respect for timelines	Calls for help on a 24/7 basis—sometimes the care seeker is in a different time zone	Strict appointment system; guidelines	Yes
13	General	No clear method of reimbursement. Care access through unconventional means competing with regular channels	Insurance companies do not reimburse the travel and time cost. In India, telehealth has had higher success rate as healthcare expenses are out of pocket	Creation of telehealth-related care and reimbursement protocols; engagement of insurance companies	Yes

Adapted from Gogia SB, Maeder A, Mars M, Hartvigsen G, Basu A, Abbott P. Unintended consequences of tele health, and their possible solutions. Contribution of the IMIA Working Group on telehealth. Yearb Med Inform. 2016;(1):41–46. doi:10.15265/IY-2016-012.

(Gogia, n.d.)

L1: Examples and analogies

[For each lesson plan please provide examples and analogies that show how the concept can be applied in real life, focusing on standards for quality and qualification withing the two domains (IT and health and social science)]

1. **Example of startups that are using Telemedicine:**

- Telios

  Telios brings your business immediate and direct access to experienced doctors and other healthcare professionals. Employees save time by avoiding the issues prevalent with accessing traditional medical care, some of which are, synchronizing appointments with their schedules, wasting time in traffic and waiting room delays.

- Atlas

  Atlas.app is the largest therapy, parenting and personal development platform in Romania. They have over 200 specialists in one safe place and the customers can meet them online at Atlas, or directly at their office.

- Docbook

  Docbook is the sole online medical appointment booking service app in Romania integrated with clinics software. It address the problem of patients that are in need of rapid medical appointments, by allowing free of charge doctors search & booking within seconds.

- MEDICAI

  MedicAi is a collaborative online imaging platform that enables better sharing and communication between patients, doctors & clinics.

2. Departments which can benefit from Telemedicine

Service	Important components	Role
Wound care	Unless very serious, wounds should be managed at the subprimary level. Requires transfer of images mostly. Sometimes telementoring and VC	Very high
Radiology	Images and video. Preexisting digitization and PACS make it easy. DICOM a specific standard	Very high
Dermatology	Images. Most problems are chronic, so decrease in frequency of visits is important	Very high
Cardiology	Tele-ECG, telestethoscope, and emergency support for MI	High
Ophthalmology	Images, which used to be taken through a slit lamp, an ophthalmoscope, and a fundoscope, can now be replaced by smart mobiles with special attachments	High
Psychiatry	Video conference and face-to-face contact for counseling	High
Pathology	Images and opinion. Special microscopes allow remote manipulation of the slide	Moderately high
Intensive care	Monitoring devices and emergency support	Moderately high
Emergency care	Allows care to begin as soon as a 911 call is made	Moderately high
Rehabilitation	Immobility of patients is a constant concern	Moderately low
Pediatrics	Emergency support and telemonitoring home-based care. A comfortable environment and access to parents is helpful for child development	Moderately low
Orthopedics	X-ray films. Home monitoring of splints and dressings. Emergency support	Low
Neurology	Tele-ICUs with robotic assistants and home care	Low
Plastic surgery	For preop assessment, planning, and also follow-up care (See example in Box 4)	Low

(Gogia, n.d.)

L1: Application and integration

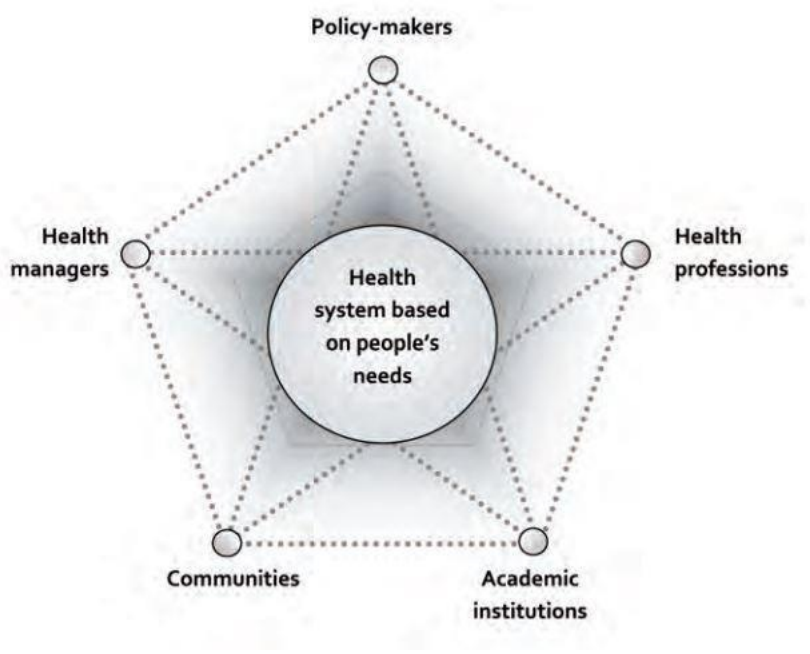
[For each lesson plan please provide exercises and practical activities that will help students apply what they have learned about this concept. For this section non-formal activities are strongly advised to be used]

A practical exercise in which for several different patient journeys students need to identify the segment of care that can be performed through telemedicine, and the specific benefits for each stakeholder.

A practical exercise in which one of the available resources in the hospital could be performed through telemedicine and how would the different stakeholders's needs would be impacted.

A practical exercise in which to define the main factors/stakeholders that are directly involved in the telemedicine process. (With the help of the resources below)

Health system transformation requires the involvement of all stakeholders. Partnerships usually facilitate change, and the telemedicine sector is no different. Community leaders, health professionals, academic institutions and educators, health administrators, and policymakers represent the best alliance to make changes necessary to reflect and react to societal needs.



(WHO, n.d.)

L1: References for further information and areas on inquiries

[For each lesson plan please provide references and connected areas for students to further inquiry and read more about. There are 20hrs of individual work for the entire curriculum, which means 2.5 hours for each module, so 30 minutes for each lesson plan (if you decide to have 5 lesson plans). Books, scientific publications, and other activities connected with the topic of the modules can be offered as references in this section]

https://www.who.int/goe/publications/goe_telemedicine_2010.pdf

https://www.intechopen.com/chapters/64650

Fundamentals of Telemedicine and Telehealth

https://www.youtube.com/watch?v=FAW1JjnCpdQ

Lesson 2 and 3: Teleconsultation (Telediagnosis and Telemonitoring)

L2,3: Foundational knowledge

[For each lesson plan please include a detailed explanation of the concepts, theories, models, terminology, principles, and methods being currently used related to the concept explained in this lesion plan. In doing so please create synergies withing the two domains (IT and health and social science) to create mutual understanding among students]

1. What is Teleconsultation?

Teleconsultation is defined as synchronous or asynchronous consultation using information and communication technology to omit geographical and functional distance. Its goals are for diagnostics or treatment between two or more geographically separated health providers (for example physicians or nurses) or between health providers and patients. "Remote consultation" is the superior term of teleconsultation in MeSH (Medical Subject Headings) and is defined as "Consultation by remote telecommunications, generally for the purpose of diagnosis or treatment of a patient at a site remote from the patient or primary physician"(Deldar et al., 2016).

2. The advantages of Teleconsultation

- The teleconsultation system does not replace medicine but allows easy access to care and provides good added value thanks to videoconferencing and the electronic sending of documents.
- It is essential in the current infectious disease emergency situation, because it limits travel and contact, and therefore the risk of contamination.
- It protects patients, healthcare professionals and citizens (CNS, n.d.).

3. Types of Teleconsultations

3.1 Telediagnosis

3.2 Telemonitoring

3.1 Telediagnosis

3.1.1. What is Telediagnosis?

Telediagnosis refers to remote diagnosis (“tele” means remote, prefixed to diagnosis). These platforms are designed to enable transmission of physical examination records and medical reports remotely or concurrently to a specialist at a different or the same geographical location. The examining specialist doctor may be in the same geographical region at the same time of the examination, or the specialist may be remotely located: the transmission platform is designed to work identically. Telediagnosis platforms ensure that records of images and videos preserve the diagnostic quality even after being subjected to compression procedures for transmission. The use of the Digital Imaging and Communications in Medicine (DICOM) standard is a recommended requirement to allow heavy file traffic without impairing efficiency in use. A limitation might be low connection speed for data transmission or restrictions with bandwidth. Therefore, balancing image quality, efficiency in use, and available bandwidth pose significant challenges to telediagnosis platforms (Basu, 2019).

3.1.2. Implications of Telediagnosis for Diagnostic Quality and Safety?

Diagnostic Process	Prospects	Pitfalls and Challenges
Supportive Infrastructure	• The tools (phones, video chats, others) are familiar to many and generally available. • The general approach is similar enough to in-person care. • Widely used videoconferencing tools may provide opportunities to engage disadvantaged patients.	• Disadvantaged patients may lack internet access or video-chat tools. • Infrastructure is immature compared with in-person care. • Standardized language and protocols have yet to emerge. • Providers may need specific training to perform telediagnosis well. • Some platforms are not HIPAA compliant (Note: During the COVID-19 pandemic, the Office for Civil Rights has waived civil monetary penalties for noncompliance, however, it remains a legal requirement to use HIPAA-compliant software [U.S. Department of Health and Human Services; Office for Civil Rights, 2020 #7516]).[25]
Access to the Health System	• E-visits can provide enhanced access to healthcare professionals. • Multiple platforms are potentially usable. • Video visits may offer enhanced "presence" vs. telephone (e.g., more eye contact, deeper listening). • Tips on how to strengthen "presence" are emerging.	• Creating relationships and presence via phone and video may be challenging. Telehealth experts suggest that it can be difficult to replace the value of "touch" when establishing trust in the therapeutic relationship. • Some platforms are not HIPAA compliant.
Patient History	• History should be comparable to the office-based history. • It may be better than an office-based history to the extent that other family members can be involved and the clinician can get a sense of the home environment.	• Getting the patient history may be problematic with non-English speakers although this issue may be mitigated through improved access to translation services and family members. • Telehealth programs may not be set up to allow patients to pre-enter health information before the visit.
Physical Examination	• With full knowledge of the limitations, virtually all aspects of the in-person visit can be conducted effectively. • At-home devices can augment the ability to collect physical findings (ECG, others).	• Clinicians cannot visualize the tympanic membrane or the retina or listen to heart or lung sounds. • Incidental findings that might have been detected in an office-based visit may be missed.
Clinical Reasoning	• For challenging diagnostic scenarios, telediagnosis could enable timely convening of multiple clinicians (peers, consultants from other specialties, or other health professionals) to be involved in the clinical reasoning process.	• The impact of telediagnosis on the clinical reasoning process is hard to predict and will require focused study.

Diagnostic Process	Prospects	Pitfalls and Challenges
Diagnostic Testing	• At-home testing tools could enhance testing for some conditions (diabetes, asthma, chronic obstructive pulmonary disease, others).	• Most laboratory tests and imaging require a separate visit. • If lab testing or imaging requires a separate in-person visit, it may discourage their completion and followup.
Referral, Consultation, Interfaces	• Virtual conferences with patient, family, and different members of clinical team may be facilitated by technology. • Consults are easily ordered. • In-person evaluation can be arranged for those who need it.	• Virtual visits may not allow a patient's full engagement or the engagement of the full diagnostic team. For example, the patient may be less likely to stop by and chat with the dietitian or social worker and fewer opportunities arise for exposure to patient education materials or health screening.
Communication of Diagnoses	• Communication may be enhanced if family members participate and facilitate communication and understanding.	• Communication is probably reduced if the diagnostic team (for example, the nurse, pharmacist, therapist) is not engaging to the same extent as they would in person.
Monitoring of Health Outcomes	• Monitoring simplifies followup possibilities for patients and providers. • Followup reminders can be set.	• Most telehealth programs as yet do not have systems in place to monitor quality and safety.
Diagnostic Safety	• Safety may be enhanced by improved access, a better sense of the patient's home environment, and participation of family members.	• Safety may be reduced by missed physical findings, lack of presence, and decreased participation of onsite team members (nurses, pharmacists, others).
Family Involvement	• Video visits provide an opportunity to engage patients and families. • Video visits provide a glimpse into the patient's living environment.	• It can be difficult to discuss issues of violence or abuse if the patient cannot complete the visit in a private location.

(Smith et al., 2020)

3.2 Telemonitoring

3.2.1 What is Telemonitoring?

Telemonitoring refers to the transmission of symptom scores, physiological data including heart rate, blood pressure, oxygen saturation, and weight directly to care providers either via automated electronic means or by web-based or phone-based data entry. Over time these interventions have evolved from automated phone response systems to web, to interactive television-based systems, to mobile phone or PDA-based systems to complex systems, which wirelessly transmit recorded physiological data.

As an illustrative example of a telemonitoring platform, think of an application that assists a patient to control weight. The telemonitoring platform monitors the patient's physical activity and the individual's records of meals and calories consumed in a day and transmits the data for analysis by professionals. The professionals can then act on the basis of received data to help the patient reduce weight. Here the telemonitoring platform is used with active participation of the patient. In other situations, users may have their data collected through connected devices, for example, blood glucose for diabetics or blood pressure measurements for a hypertensive patient. Such monitoring may lead to prevention or in the postdischarge planning and treatment in patients with heart attack or stroke. In yet another scenario, telemonitoring platforms can be integrated in home care equipment to enable continuous monitoring and generate emergency alerts or for elderly patients, who can be continuously monitored with sensors that transmit an alert when the patient suffers a fall at home (Gogia, n.d.).

3.2.3. The advantages of Telemonitoring

- Telemonitoring allows patients to remain in their homes. Better follow-up of patients reduces the complications of chronic diseases such as diabetes, hypertension, or chronic heart failure.
- Telemonitoring may reduce patient travel, time off from work, and overall costs.
- Several systems have proved to be cost effective, such as home monitoring of high-risk pregnancies, infants, pediatric pacemaker patients, and patients suffering from chronic diseases.

- The cost of simple telemonitoring was evaluated to be approximately $70 per month. A standard emergency room charge is $260.
- Telemonitoring provides accurate and reliable data, which results in stabilization and often improvement of chronic diseases and avoids unnecessary treatments because of the "white-coat" effect.
- Real-time telemonitoring of patients transported in ambulances reduces the time for initiating treatment and allows the emergency crew to be better prepared (Meystre, 2005).

L2: Examples and analogies

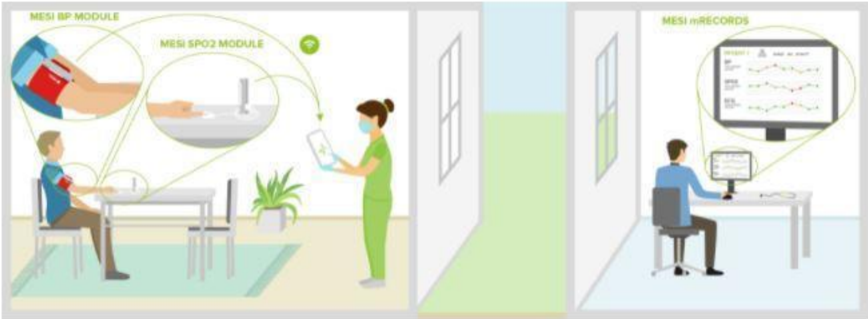
[For each lesson plan please provide examples and analogies that show how the concept can be applied in real life, focusing on standards for quality and qualification withing the two domains (IT and health and social science)]

Telediagnosis and telemonitoring tools

1. **MESI mTABLET: a professional quality tele-diagnostic tool**

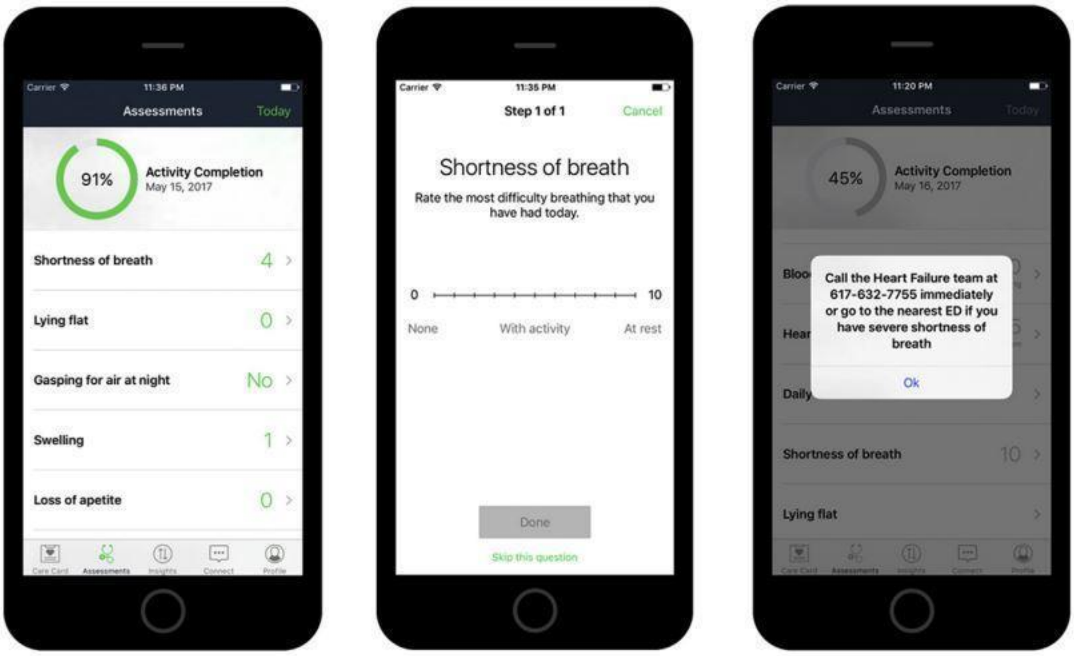
MESI mTABLET system is ideal for telecare. Equipped with different wireless diagnostic modules, MESI mTABLET system can be taken anywhere by the healthcare professional. MESI mTABLET system was developed in cooperation with nurses and doctors to meet their specific needs. The result is a simple and optimized interface for everyday use in teleconsultation and tele-diagnostic.

The healthcare professional in contact with the patient can thus perform tests such as resting ECG, blood pressure, oxygen, saturation, ankle-brachial index measurement for PAD or wound-care assessment. The physician, based in a remote location, has access to quality measurements which he can base his diagnosis on and determine the best medical care (MESI, n.d.).



2. **BIDMC@Home**

BIDMC@Home provides personalized home monitoring in many different conditions. HealthKit allows the app to collect data from various sensors and 3rd party apps to gain a holistic picture of health and help prevent hospital readmissions. Together with HealthKit-enabled wireless devices such as scales and blood pressure cuffs, patients with congestive heart failure can use BIDMC@Home to monitor vital signs and symptoms. Daily fluid, sodium intake and important predictors of fluid retention, can also be imported via HealthKit. Connected thermometers allow patients with autoimmune diseases such as lupus and rheumatoid arthritis to better predict infections and monitor inflammation. Outpatient chemotherapy is associated with varied symptoms and side effects. The app allows these patients to better monitor their health during treatment. BIDMC@Home simplifies complicated post-operative instructions given to patients after orthopedic surgery by utilizing the dynamic care card and allowing them to track their recovery. Major bowel surgery can place patients at risk for severe dehydration. Connected scales and electronic patient reported outcomes will help prevent complications in these patients in between visits to the doctor's office. An essential part of staying healthy is the plan and thought process laid out in the health care providers' notes. All too often these are hidden in the silos of individual electronic health record systems. BIDMC@Home harnesses the capabilities of the Health app in iOS 10 to serve as a secure, patient controlled, shareable database of medical records (Cerrato & Halamka, 2019).



L2&3: Application and integration

[For each lesson plan please provide exercises and practical activities that will help students apply what they have learned about this concept. For this section non-formal activities are strongly advised to be used]

Imagine a scenario in which Telemedicine is introduced in a medical specialty/ field. Using your smartphones or computers, try to roleplay with your colleagues in which each of you is playing a specific character (doctor, nurse, patient, relative, etc.). Try to be as imaginative as you can, imagine the environment, the case, the attitude, the emotions, etc

L2,3: References for further information and areas on inquiries

[For each lesson plan please provide references and connected areas for students to further inquiry and read more about. There are 20hrs of individual work for the entire curriculum, which means 2.5 hours for each module, so 30 minutes for each lesson plan (if you decide to have 5 lesson plans). Books, scientific publications, and other activities connected with the topic of the modules can be offered as references in this section]

https://www.sciencedirect.com/science/article/pii/B9780128149232000027

https://www.ahrq.gov/sites/default/files/wysiwyg/patient-safety/reports/issue-briefs/Telediagnosis-brief2.pdf

Lesson 4&5: Tele Imaging and Telepathology

L4&5: Foundational knowledge

[For each lesson plan please include a detailed explanation of the concepts, theories, models, terminology, principles, and methods being currently used related to the concept explained in this lesion plan. In doing so please create synergies withing the two domains (IT and health and social science) to create mutual understanding among students]

Tele Imaging involves transmitting a patient's X-rays, CT scans, and MRIs from one site to another, usually to a radiologist based at a different location. Before the internet age, teleradiology mostly involved consulting individual radiologists over the phone for emergent cases. With the advent of the internet, everything changed. Sending CT scans or MRIs digitally and securely became simple. Now, with the visual data and patient health record in front of them, the radiologist can provide an analysis, record it, and send it right back to the patient's physician(*[Medical tele-imaging: a good chance for the future] - PubMed*, n.d.).

Types of Imaging Modalities

There are several methods of medical imaging in modern medicine. Each has different potential advantages and disadvantages including exposure to radiation with some types of imaging.

The commonly used imaging techniques are:

1. **X-rays**

- X-rays are the oldest and most frequently used form of medical imaging.
- The images are taken by passing x-rays through a part of the body under investigation and recording the amount of x-radiation not received in the body.
- It is a non-invasive medical test that helps physicians diagnose and treat medical conditions.

- From a diagnostic and imaging point of view, the resolution of x-ray as 4K x 4K is required to capture the necessary details (OrthoInfo, n.d.).

2. Computed Tomography (CT)

- Computed tomography is another imaging system which also makes use of x-rays.
- CT images are generated by making the patient lie on a table, which passes through a donut-shaped scanning machine. The x-rays that pass through the patient are digitized and pulsed signals are detected by detectors on the opposite side of the x-ray source.
- An image of the tissue density is computed by the CT scanner and represented as a slice of the patient's body.
- In modern CT scanners, three-dimensional (3D) images can be computed from multiple scans. A CT scan may consist of 10 to 12 individual cross-sectional images.
- These can be laser printed on to high quality transparency film. Each image is a 512x512 data matrix containing 256 shades of gray (OrthoInfo, n.d.).

3. Magnetic Resonance Imaging (MRI)

- MRI is a non-invasive imaging technology based on excitation and detection of the change in the direction of the rotational axis of protons found in the water that makes up living tissues.
- The patient is surrounded by extremely powerful electro magnets which act to align the atomic nuclei in the body.
- When a radiofrequency current in the pulsed form is externally applied to the patient, the protons are disturbed, and spin out of equilibrium. When the radiofrequency field is turned off, the nuclei return to their initial orientation, emitting radiation which is picked up by a receiver coil. The analysis of this radiation forms the basis of identifying the concentration of certain atoms within the body and helps in generating an image based on this concentration.
- Image resolution in MRI conforms to 128x128 or 256x128 matrix size (OrthoInfo, n.d.).

4. Ultrasound Imaging Systems

- Ultrasound imaging systems involve passing a high- frequency sound wave (2-4 MHz) into the patient's body.
- In an ultrasound examination, a transducer (probe) is placed directly on the skin of the patient's body or a body opening. A thin layer of gel is applied to the skin so that the ultrasound waves are transmitted from the transducer through the gel into the body. The ultrasound waves get reflected off from various internal body structures of the patient.

- The received ultrasound waves are then amplified, processed and a two-dimensional image of the scanned area is constructed.
- Unlike x-ray imaging, ultrasound imaging does not involve exposure to ionisation radiation. The advantage of ultrasound lies in their ability to detect soft tissue, such as tumors and lesions.
- Ultrasound today is the preferred non-invasive diagnostic imaging modality practiced in most of the medical specialties, which include cardiology, internal medicine, obstetrics and gynecology (OrthoInfo, n.d.).

5. **Nuclear Medicine Imaging Systems**

- Nuclear medicine uses certain properties of isotopes and the energy particles emitted from radioactive material to diagnose or treat various pathological conditions.
- Based on the principle of injecting the patient with a radioactive substance and detecting the gamma rays that are emitted (OrthoInfo, n.d.).

Types of Tele Imagistics Systems

In practice, there are three types of tele Imagistics systems:

1. **On-call:** Typical "on-call" tele imaging systems are most frequently used for after-hour, "on-call" applications.
2. **Off-site:** "Off-site" systems are set up mostly by radiology specialists and hospitals to establish a central database with a view to expand the interpretation network.
3. **In-hospital:** In-hospital systems are meant to be used to transfer images within the same facility over a LAN..

Telepathology refers to practicing pathology from a distance. Telecommunications technology is used for facilitating the transmission of pathology image-rich data between two distant locations for diagnosis, research, and education purposes. To perform telepathology, a pathologist must choose the video images that need to be analyzed and then render a diagnosis. Using television microscopy, which preceded telepathology, didn't require a pathologist to have a virtual or physical hands-on involvement in choosing the microscopic fields-of-view to analyze and diagnose (Farahani & Pantanowitz, 2015).

Telepathology has been used successfully for many different applications, including histopathology tissue diagnoses being rendered from a distance. In developed countries, digital pathology imaging, which includes virtual microscopy, is preferred. However, in some developing countries, analogy telepathology imaging still is used in patient services (eVisit, n.d.-a).

Telepathology System Types

1. Virtual slide systems

The virtual slide pathology system digitizes slides. It completely removes glass slides from the practice of pathology.

With virtual slide pathology, scanners copy glass slides and turn them into digital slides for remote pathologists to use. These images are high-resolution, which means that they are highly detailed.

When scanning these slides, there are no alterations to the image. The specimen on the slide appears precisely the same as if someone were viewing it under a microscope with a glass slide.

In fact, virtual slides may help pathologists be even more accurate because of the hugely detailed images. These are much more useful than past kinds of pathology procedures.

Virtual slides are also better at preserving slides. With regular glass slides, specimens can age and become discolored. This is a severe problem if the pathologist doesn’t view the slide before any alterations take place.

With virtual slides, pathologists can look at the original images at any time. Because of this, these professionals can go back and look at any sample they want or need to. They can also use these older samples for research and education purposes if the care is particularly interesting (Direct, n.d.).

2. Real-time systems

Real-time pathology systems are arguably the best kind of pathology system for pathologists to use. With real-time pathology systems, the remote pathologist can use a remote to move a microscope that is viewing the specimen in real-time.

Once the slide is placed under the electronic microscope, the pathologist can use their technological systems to move the microscope around and view the specimen to diagnose any potential problems.

Real-time pathology systems give remote pathologists access to fresh slides that they can view as if they are in the medical facility where the sample was taken. The robotic microscope allows the pathologist to adjust the positioning, magnification, illumination, and focus as needed.

The pathologist views the microscope's point of view from a screen at their remote location. From this, they can view the specimen with a high-resolution image.

One of the most significant benefits of the real-time pathology system is that the pathologist can manipulate the image in any way that they want. The photos aren't pre-shot and sent to the pathologist. Instead, they can manipulate the quality and scope of the image to be the way they want it to be(Direct, n.d.).

3. Image-based systems

Image-based pathology systems are the cheapest of all three of these kinds. This is also the easiest form of pathology to use.

Image-based pathology simply uses pictures of those specimens on the slide. In this way, it is the system that is most in-line with in-person pathology work.

Pathologists that are working with image-based pathology systems simply look at the images that are sent to them. Typically, these images aren't on a large, detailed scale like those from virtual pathology systems.

These images are usually a collection of small, up-close pictures of whatever samples the pathologist is looking to study. With virtual pathology systems, there is one high-resolution image that the pathologist can zoom in on and move around with. Image-based systems simply give smaller, slightly lower quality images for the pathologist to study.

However, image-based pathology systems are still beneficial for pathologists and the medical staff that they're working with. They just aren't quite as advanced as virtual pathology systems.

Image-based pathology systems also work by taking pictures of glass slides. Usually, there is no digitization of the slide except for the images themselves.

Because these images are taken when the specimen is fresh, it also prevents discoloration of the images. They are stand-still and cannot age over time as the standard slide would (Direct, n.d.).

L4&5: Examples and analogies

[For each lesson plan please provide examples and analogies that show how the concept can be applied in real life, focusing on standards for quality and qualification withing the two domains (IT and health and social science)]

1. Micro Telepathology Solutions

1.1. SPOTMeeting: Interactive Real Time Telepathology

SPOTMeeting™ is an easy to use, fully interactive software environment for sharing high definition images and collaborating with remote specialists in real time. Audio, cursor, annotations, files and software controls are also shared, and presenters can be swapped, making communication simple. SPOTMeeting is the ideal choice for remote pathology consultations (*SPOTMeeting Collaborative Imaging System - SPOT Imaging*, n.d.).

1.2. SPOTBroadcast: Real Time Telepathology Broadcasting

SPOTBroadcast captures video in high definition and provides cost effective, one-way streaming of images over the internet without a computer or software(*Pathology Imaging Systems | SPOT Imaging*, n.d.).

2. Micro Telepathology Solutions

PathStation 2: Macro Imaging System with Real Time Interactive Telepathology

The PathStation 2 macro digital imaging system makes it easy to capture, annotate, measure, and save high quality images of gross specimens in the frozen section room, and to share the images with specialists in other locations. Its fully enclosed HD camera and touch screen monitor take up minimal workspace, and can be mounted in a grossing hood, configured as a freestanding unit with lighting, or mounted on a wall in the laboratory per your needs(*Pathology Imaging Systems | SPOT Imaging*, n.d.).

L4&5: Application and integration

[For each lesson plan please provide exercises and practical activities that will help students apply what they have learned about this concept. For this section non-formal activities are strongly advised to be used]

https://www.youtube.com/watch?v=LPUkb8i06CU

Tele Imagistics can be considered as a mature field, however there are opportunities that could appear due to increased technology present in the patient-s hand (home echo machine after the home thermometer eg.)

Telepathology could provide faster access and additional relevant information to services that usually tend to take significant time and provide limited information.

Students should study current procedures and guidelines in this field and think about how these could be improved by implementing telepathology (teams of 3,4 members). They should imagine a scenario in which an existing guideline is changed by using telepathology and they should discuss it with another team.

L4&5: References for further information and areas on inquiries

[For each lesson plan please provide references and connected areas for students to further inquiry and read more about. There are 20hrs of individual work for the entire curriculum, which means 2.5 hours for each module, so 30 minutes for each lesson plan (if you decide to have 5 lesson plans). Books, scientific publications, and other activities connected with the topic of the modules can be offered as references in this section]

https://specialistdirectinc.com/telepathology-en/the-3-major-types-of-telepathology-systems/

https://healthcare-in-europe.com/en/news/telepathology-a-prime-application-of-digital-pathology.html

https://www.researchgate.net/publication/274461111_Overview_of_Telepathology

Lesson 6 and 7: Tele-Expertise and Teleassistance

L6&7: Foundational knowledge

[For each lesson plan please include a detailed explanation of the concepts, theories, models, terminology, principles, and methods being currently used related to the concept explained in this lesion plan. In doing so please create synergies withing the two domains (IT and health and social science) to create mutual understanding among students]

1. What is Tele-Expertise?

A doctor seeking the opinion of one or more colleagues, at a distance, based on medical data related to the care of a patient (Morquin et al., 2018).

Tele-expertise system is designed to improve the availability of information needed for understanding of the clinical situation and consequently for medical decision, and to improve the traceability of the information provided by the doctors to prescribers facilitating the monitoring and the re-assessment of patients (Morquin et al., 2018).

Given the current and future pandemic context it might be preferable to have the patient information be evaluated instead of sending the patient to different specialties. The interspeciality collaborations are improving the patient outcomes, as seen in now highly recommended and used "tumor boards" (Morquin et al., 2018).

2. What is Tele-Assistance?

A doctor assists other health professionals at a distance in the performance of some medical act.

Given the scarcity of certain specialties and the increased specialization of doctors the teleassistance might provide significant value to patient care in specific cases. Also, in some situations the patient might benefit from guidance from a healthcare professional, beyond teleconsultation (IGI Global, n.d.).

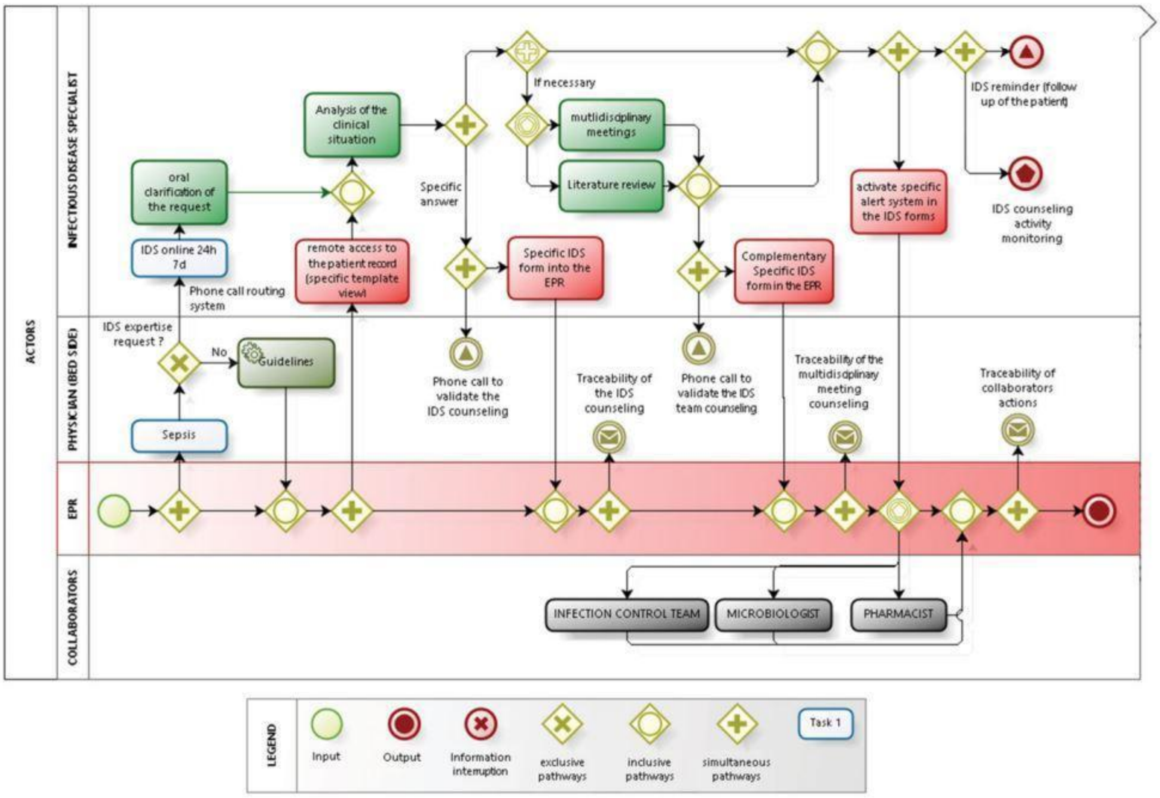
L6&7: Examples and analogies

[For each lesson plan please provide examples and analogies that show how the concept can be applied in real life, focusing on standards for quality and qualification within the two domains (IT and health and social science)]

1. The design of the tele-expertise system in a French university hospital

In 2012, the University Hospital of Montpellier (France) shifted its method of clinical documentation (e.g., patient charts and flowsheets, medication order) from a paper-based system to an EPR (electronic patient record). The hospital center is in the south of France and features approximately 2,000 beds in seventy-four different departments. Overall, the hospital staff consisting of 6,000 caregivers, 1,400 doctors (physicians, anesthetists, and surgeons), and 500 residents provides treatment to more than 235,000 inpatients and 540,000 outpatients annually. The new EPR system, which is an information technology (IT)-based enterprise wide healthcare solution was designed to support all aspects of patient care, covering medical and paramedical notes and reports, physician order entry and treatment plans, laboratory management system, operating room management system, billing, and follow-up procedures. This "off-the-shelf" EPR was implemented in 9 months with a task force of one physician, one pharmacist, three manager nurses, and 100 fulltime technicians recruited for the customization during 1 year. The EPR allows customization and configuration of patients' records through setting of new forms, queries, and personalized views.

Aware of these opportunities, an IDS (infectious diseases specialist) decided to formalize the counseling activity and customize the EPR for his team. His aim is to facilitate the IDS' daily practice of providing counsel to clinicians from every department and to increase the traceability of the activity of the IDD (infectious disease department). For this, in collaboration with the other IDS, a form was designed and deployed for the IDS initial assessment, for the re-assessment and for the decisions made during the team consultation meeting of all the IDS, the pharmacist, the microbiologist, and the infection control team. The global process is described in Figure 1. When a clinician needs more specific information than provided by standard recommendations embedded into the EPR, he or she may contact the IDS on a unique telephone number 24 hours a day, 7 days a week. A Web-based telephone call routing system is used to switch the telephone line to the IDS on call, which may change daily according to availability schedule. The requesting clinician briefly explains the medical situation and the degree of emergency and the IDS may ask for additional clarifications on the request. The call is then followed by a remote access by the IDS to the full patient's record (including laboratory results, radiology, medical and nurses' notes), with a specific template view (inflammation biomarkers graphs, table of microbiological results, past antimicrobial use). The information recorded includes the IDS' previous advices, allowing follow-up care. These advices focus mainly on the diagnosis of infectious diseases or on the therapeutic use of the appropriate antimicrobial strategy, but they may also be related to the infection control issues, unexplained fever, accidental exposure to biological fluid or rabies exposure. The IDS may choose to respond make an answer alone and may justify his or her response by providing hypertext links to scientific articles. For complex cases, the clinician may decide that the response require a decision made by the team consultation meeting of the all IDS, the pharmacist, the microbiologist, and infection control team. The IDS's response is recorded in a specific IDS form into the EPR and available in real time for all the clinicians. To enable clinicians to make medical decisions, IDS do not make any prescription, they only provide and record argued counsels. Originally, the specific IDS form was designed to record the medical reasoning and the diagnosis or therapeutic proposal, the identification details of the IDS and of the patient with a timestamp. Later, the users' remarks and all input errors were taken into account. Consequently, all unused or ambiguous fields were removed. The information framing is based on: (a) ergonomics choices, as tabs that designate the steps of the counseling, combo boxes, checkbox, under form for the use of the typical instructions associated with dosages and monitoring of each suggested drug; (b) standardized requirements and mandatory elements, as remote or bedside assessment, allergies related to anti-infective drug, and monitoring decisions; (c) indexing of each situation by combining the clinical category of infection, the pathogens classes (bacteria, viruses, etc.), and the disease context (i.e., immunosuppression, cancer, pregnancy, etc.). The most important elements, as the analysis of the clinical situation, its history and therapeutic proposal, are described in narrative text. The size has been defined to fit the work practices of each IDS. An input help has been added. Requests have been computerized to allow monitoring of use. Furthermore, media fields have been inserted to associate an image in the form (e.g., biological result curves or patient photos) or scientific papers concerning the clinical situation. Additionally, binary radio buttons were set up linked with the automated mailing at defined time intervals (e.g., the IDS may ask for a specific pharmaceutical monitoring). The form evolved iteratively during the first year of use of the system. After, the rate of change of the form has slowed considerably with updates on the new instructions associated with treatment proposals and new ways to alert collaborators (Infection Control [IC] staff, microbiologists, pharmacists) for specific queries and to provide automatic instructions associated with the proposed antibiotic treatment. Especially, in the summer of 2015 a new feature was designed: every time the IDS completed the checkbox “alert the IC team,” a secured mail with essential clinical data is sent to the IC department. This applies to all major health-care associated infections and community-acquired infections with an epidemic potential (e.g., measles or tuberculosis). Regular automatic queries provide real-time anonymous data from IDS activity, as the number of telephone calls, the regimental number, the prescriber’s department, the infection class, the time passed since the first evaluation, and the antimicrobial suggestion. In this context, an observational prospective study was conducted to assess the diffusion of the tele-expertise system and the perceived utility for the medical managers of most demanding departments (Morquin et al., 2018).



Tele-expertise process

(Morquin et al., 2018)

L6&7: Application and integration

[For each lesson plan please provide exercises and practical activities that will help students apply what they have learned about this concept. For this section non-formal activities are strongly advised to be used]

There is any tele-expertise process in your country? If not, imagine a tele-expertise process in a hospital department.

Analyzing the patient journey of a chronic patient identifies situations where tele expertise might be of value and identify the current limitations.

Tele assistance might increase the value/efficacy of certain therapeutic solutions (especially the ones requiring patient involvement). Can you identify and explain the pros and cons?

L6&7: References for further information and areas on inquiries

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https://sci-hub.se/https://pubmed.ncbi.nlm.nih.gov/29490710/

4. Appendices

[In the appendix, it can be useful to share your sources and list the documents used as in a bibliography. Please cite any information sources using the APA citation style]

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