Università degli Studi di Trieste

Corso di Laurea Magistrale in
INGEGNERIA CLINICA

CENNI DI TELEMEDICINA

Corso di Informatica Medica

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Telemedicine origins

- 1960s → NASA experiments on humans in the space
  - Need of remote monitoring of astronauts health
  - Need of remote diagnosis and consultation

- 1974 → NASA study to define the minimum requirements for remote diagnosis

- 1977 → Canada uses the satellite network for tele-education

- Since then → many programs exploring the possibility to provide care at a distance were financed
  - Many medical specialties are interested in remote communication
  - Many environments are in need of remote communication

- Internet era and mobile era → prompted the development of systems and services

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Definitions (1/2)

- **"Telemedicine consists in the**
- **integration, monitoring and management of patients, as well as**
- **education of patients and healthcare professionals**
- **using systems and technologies allowing**
- **a prompt communication with experts and**
- **an effective access to patient's information,**
- **independent from where the patient is or the information are stored"**
- *(EC commission, 1990)*

Definitions (2/2)

USING A FORMAL NOTATION

Exchange of: audio, video, data, annotations $\cap$ Real time $\cap$ Medicine, Healthcare

Telemedicine and Telehealth

TELEMEDICINE

- Defined as the use of medical information exchanged from one site to another (American Telemedicine Association, ATA)
- Healthcare services involving patients
- The practice of medicine using ICTs

TELEHEALTH

- The use of ICTs to provide access to health assessment, diagnosis, intervention, consultation, supervision, and information across distance
- Broader than TeleMedicine → Includes non-clinical services, education, and training provided at a distance

The modalities of telehealth

Syncronous telemedicine	Asyncronous telemedicine	Telemonitoring
Real-Time Provider and patient communicate via live video-conferencing. Used often in telepsychiatry, telehomecare, telecardiology and remote consults (teleconsults) with specialists, primary care physicians, counselors, social workers and other health care professionals.	**Store & Forward** Digital images, video, audio, clinical data are captured and stored on a patient's computer or mobile device and then trans-mitted securely to a provider for later study or analysis. Used often in teledermatology and telepathology.	**Remote Monitoring** Patient uses a system that feeds data from sensors and monitoring equipment to an external monitoring center so that health care profes-sionals can monitor a patient remotely. Used to monitor chronic conditions such as heart disease, diabetes and asthma.

Delivery methods:

- **ICTs**
- **mHealth**

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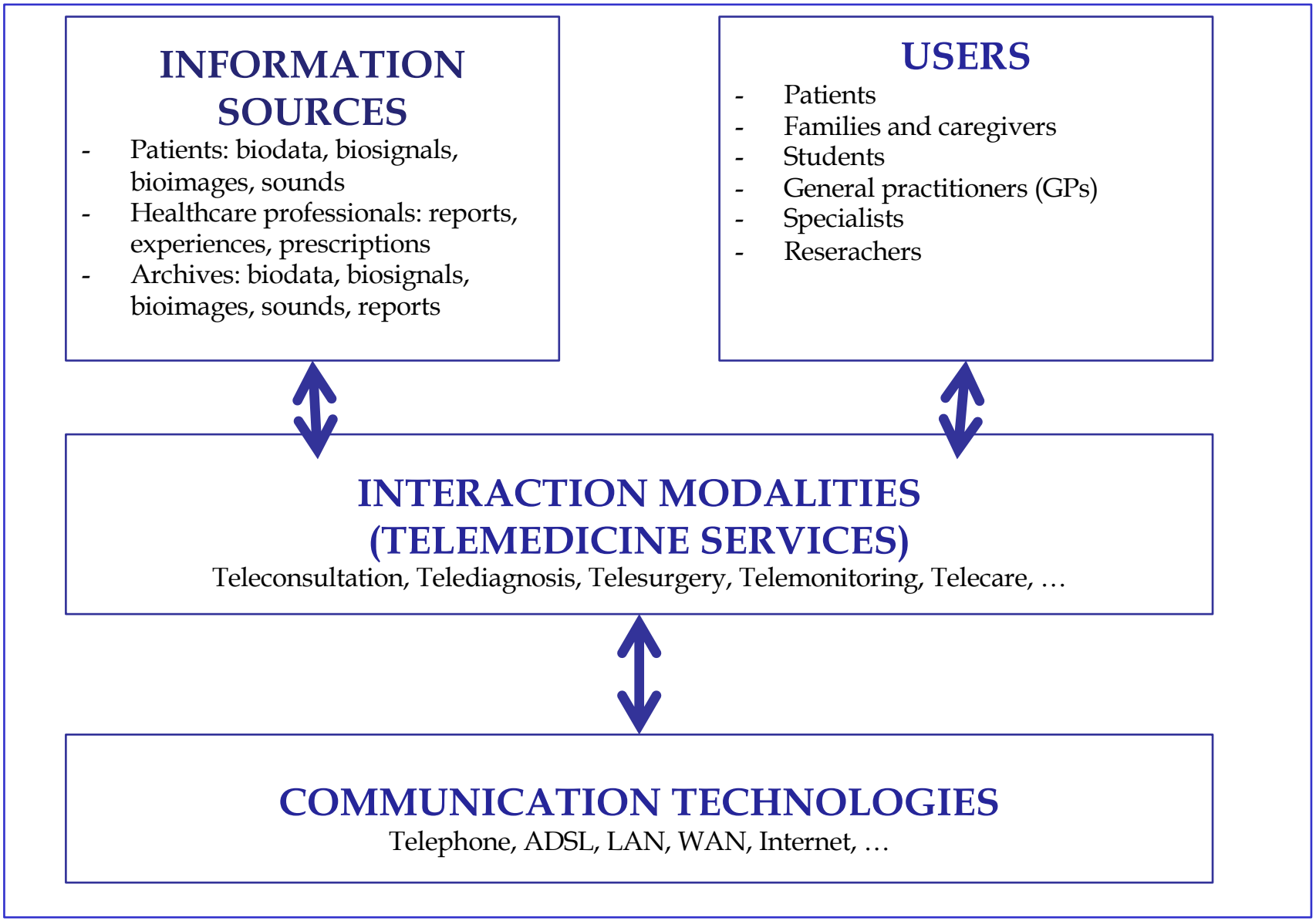
A general model for telemedicine



Telemedicine systems: resources

- Medical devices for users
- Connection network
- Users →
  - Patients
  - Healthcare professional team
  - Consultants
- System managers →
  - Service providers
  - Communication providers
- Administration manager
- Legal consultants

Telemedicine systems: constraints

EDUCATIONAL CONSTRAINTS

- All users need specific training to use the system
- Resources have to be allocated for education and training

CERTIFICATION

- Healthcare services need to be accredited
- Quality measurements have to be defined also for telemedicine services

PRIVACY AND SAFETY

- Security related to data transmission and data storage have to be guaranteed
- Strong and shared access policies have to be defined to protect privacy

COSTS

- Technical equipment
- Medical personnel

Telemedicine systems: system management procedures

- System test procedures (quality of the devices and the infrastructure; system functioning)
- Activation procedures (user definition, documentation, contracts and terms of use)
- Service provision procedure (detailed description of the service, data acquisition, specialist intervention, …)
- Access policies procedures
- Identification procedure
- Healthcare team shifts
- Storage and backup procedures
- Maintenance (ordinary) procedures
- Emergency procedures
- Operators training procedure
- Users training procedure
- Procedure for starting new services
- Assistance procedure

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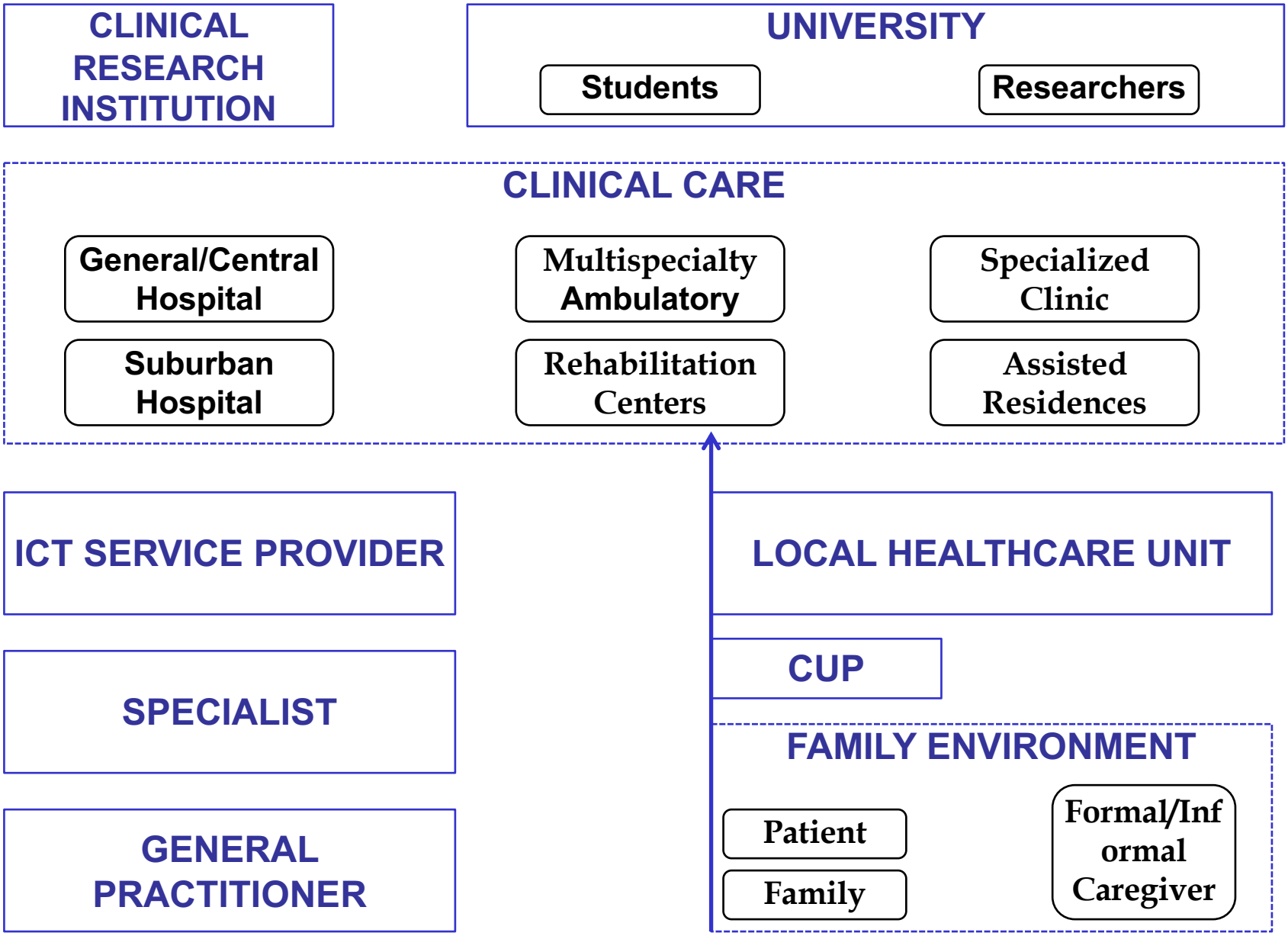
Actors involved



Actors involved: users

- The users request the service→
  - Patients
  - Families
  - Formal/Informal caregivers
  - Institutions
  - Healthcare professionals
- The user is responsible to transmit and/or receive medical data/signals/images
- The user is responsible of satisfying the technical/behavioural constraints that are indicated by the service provider in order to ensure data quality and reliability
- To do so, the users need specific training

Actors involved: service providers

- Legally responsible for the provision of the service
- It is usually the healthcare service provider (institution, hospital, …)
- Should receive payments/reimbursements
- The service provider can use a third party for the technological infrastructures and services
- It is responsible for the correct integration of the telemedicine in →
  - The technological infrastructure of the institution
  - The clinical and administrative workflows and processes
  - The available budget and financial plan

Actors involved: technological providers

- The role of the technological provider is crucial because it ensures the communication infrastructure

- The responsibility of the technological provider depends on its contract with the service provider:
  - Connection timing
  - Maximum time without connection
  - Data quality requirements
  - Data storage requirements
  - Emergency intervention time frame
  - Security and privacy requirements

Telemedicine systems: classifications

By medical specialty	By healthcare path phase	By healthcare service
• Telecardiology • Telepathology • Teleradiology • Teleoncology • Telesurgery • …	• Teleprevention • Telediagnosis • Telerehabilitation • …	• Telereport • Teleconsultation • Telemonitoring • …

Telemedicine classification by service

Tele-reporting

- → the reports are created and visualized remotely

Tele-consultation

- → a second opinion is asked remotely

Tele-explanation

- → from a specialized to a non-specialized physician

Tele-psychology

- → to provide comfort to the patient/family

Tele-monitoring

- → remote monitoring of patient's clinical condition

Tele-prescription

- → remote prescribing (drug, therapies, rehabilitation, activities, exercises,..)

Tele-control

- → possibility to remotely change what is monitored

Tele-booking

- → remote booking of visits, exams, …

Tele-administration

- → remote control of administrative procedures

Tele-education

- → training, support, and even examination in a remote fashion

Telemedicine efficacy

- At present, the **efficacy of telemedicine intervention is still under debate**
- One of the main problems is the lack of appropriate and systematized **research methodologies**:
  - Economic analysis of telemedicine has not yet met accepted standards
  - Lack of exploration of the socio-economic impact of telemedicine
  - Lack of evidence on factors promoting uptake of telemedicine is lacking
  - Qualitative methods face an undeveloped use
- Evaluation is still dependent on the **implementation place**:
  - No cross-border collaboration
  - No common language to establish benefits and drawbacks

Elements to evaluate the efficacy of the service/system (PICO)

Population/participants

- Clear identification of the target users
- Definition of the key stakeholders: patients, families, caregivers, healthcare professionals

Interventions

- ICT tool used
- Phase
- Health vs Social

Comparisons

- With standard care
- With other systems

Outcomes

- Health related outcomes (morbidity, mortality, quality of life, patient' satisfaction)
- Process outcomes (quality of care, professional practice, adherence to recommended practice, professional satisfaction)
- Costs or resource use.

Is telemedicine effective? YES

Types of interventions that were found to be therapeutically effective include:

- online psychological intervention, telepsychiatry, and cognitive behavioural therapy
- programmes for chronic heart failure with remote monitoring
- home telemonitoring of respiratory conditions
- web and computer-based smoking cessation programmes
- telehealth approaches to secondary prevention of coronary heart disease
- Virtual reality exposure therapy (VRET) for anxiety disorders
- robot-aided therapy of the proximal upper limb
- home telehealth for diabetes, heart disease and chronic obstructive pulmonary disease
- internet based physical activity interventions

Is telemedicine effective? PROMISING

- Areas in which telemedicine showed therapeutic promise, but still requires further research include:
  - Virtual reality in stroke rehabilitation
  - Symptoms and behaviour associated with and knowledge about specific mental disorders and related conditions
  - Diabetes
  - Weight loss interventions and possibly weight loss maintenance
  - alcohol abus
- Telemedicine seems also promising in terms of:
  - Health service utilisation (e.g., asynchronous telehealth developments could result in shorter waiting times, fewer unnecessary referrals)
  - High levels of patient and provider satisfaction with equivalent (or better) diagnostic accuracy.
  - Positive patient experiences and empowerment especially for patients with chronic conditions and in rural areas

Is telemedicine effective? NOT ENOUGH EVIDENCE

- The improvements introduced by telemedicine services and systems is only partial (e.g., in diabetes it improves glycemic control but not other aspects of management)

- There is a lack of Randomized Controlled Trials (RCTs)

- There remain certain topics that require further research, → technical, ethical, legal, clinical, economical and organisational implications and challenges

- Telemedicine is a dynamic field, and new studies and new systematic reviews are rapidly being published also on new areas of intervention (e.g., smart homes, spiritual care)

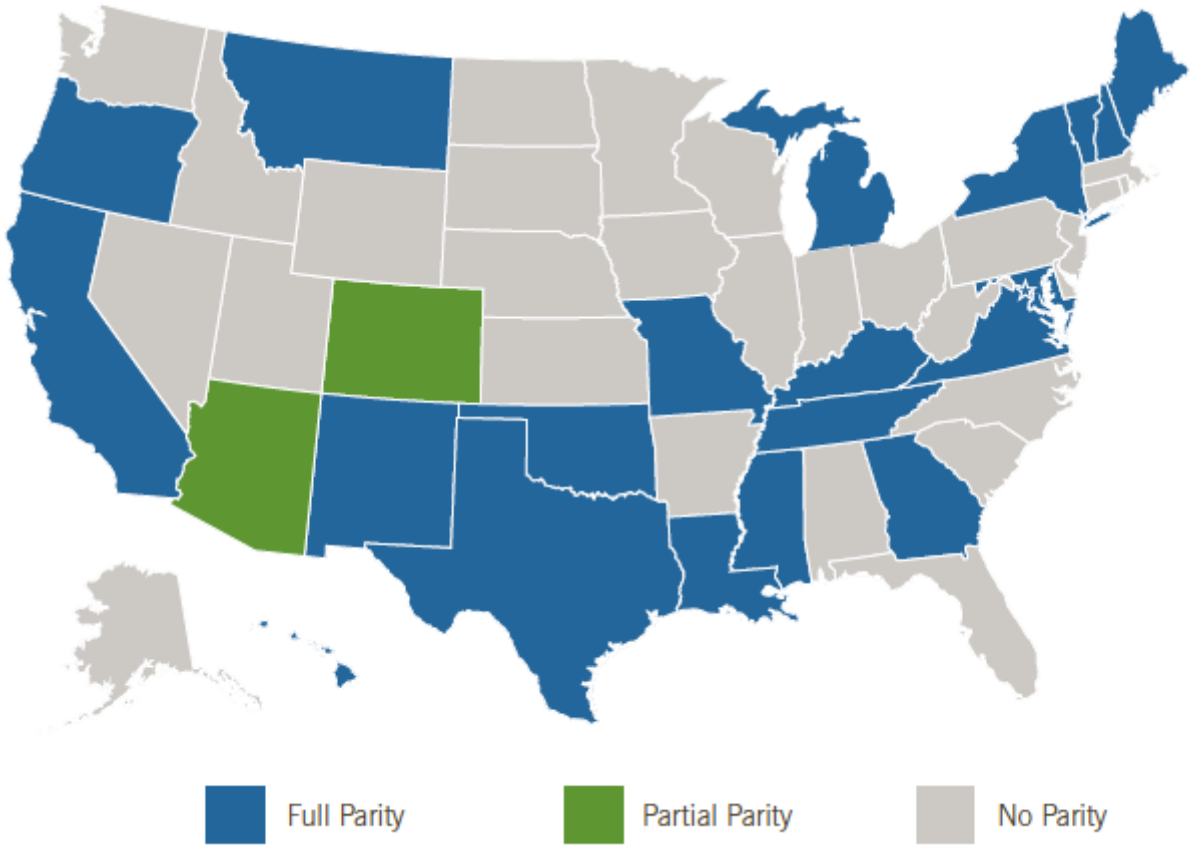
Other aspects of efficacy

- The knowledge and understanding on the costs of telemedicine is still lacking:
  - Cost-effectiveness is usually related to the decrease in the use of hospitals, improved patient compliance and satisfaction
  - However, social and organizational costs have to be quantified
- Telemedicine may further alter the patient/healthcare professional relationship → education and empowerment
- The telemedicine service/system can be not suitable for everybody→
  - More user-centered design
  - Consider gender and age issues
- Present lack of guidelines

Who pays for telemedicine services?

Twenty states and the District of Columbia have enacted parity laws requiring insurers to cover telehealth services.

Chart 4: Private Payer Coverage and Reimbursement for Telehealth Services



- Do public and private payers cover telehealth services and adequately reimburse hospitals?
- Payment is a complex and evolving issue and a possible barrier to adopting such services.
- Providers that also have their own health plans may find it easier to deploy telehealth because they control their coverage guidelines and can benefit from the cost savings.

Present use

Teladoc's membership hits 17.5M in Q4 2016

"So we look at the remote monitoring space quite a bit. I would say our first step into that is not exactly remote monitoring, but we did a partnership with CareCentrix around the home care space, where a home care nurse can bring one of our physicians into the home virtually to help assess a patient," he said. "Remote monitoring gets to the next level of clinical integration. And so we are starting to talk to some hospital systems primarily about what they are doing and how we could be helpful to them. But it's not I wouldn't call it immediate on our product roadmap. It's a little further out relative to the next, let's say, 9 months to 12 months."

"During the year, we completed our company's 2 millionth telehealth visit, representing savings through our clients in the U.S. healthcare system of over $900 million," Gorevic said on the call. "As context, it took us about 12 years to reach our first million visits, while only 14 months for our second million. This clearly signals the inflection point in overall telehealth adoption."

Present use

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Why the utilization conversation in telemedicine is bigger than dollars and cents

By **Jonah Comstock** | March 09, 2017

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A study **published in Health Affairs** and conducted by the RAND Corporation made a big splash this week with a bold claim: That telemedicine doesn't actually reduce healthcare costs because the increased convenience leads to increased utilization, which ultimately costs more than in-person care would have.

The study looked at claims data from a cohort of 300,000 employees with access to Teladoc through their employer. Researchers compared a cohort of telemedicine users to a cohort of non-telemedicine users and found that in the telemedicine users, visits to primary care doctors barely decreased, meaning that the Teladoc visits were mostly additive (visits that otherwise would not have occurred), rather than substitutive (visits that otherwise would have occurred in person). They found that 88 percent of visits were additive, and only 12 percent replaced in-person visits. The result: telemedicine cost the payer $45 per patient more than a plan without telemedicine would have.

Present use

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UPMC Health Plan launches app-based video visits to all Pennsylvania residents

By **Heather Mack** | March 24, 2017

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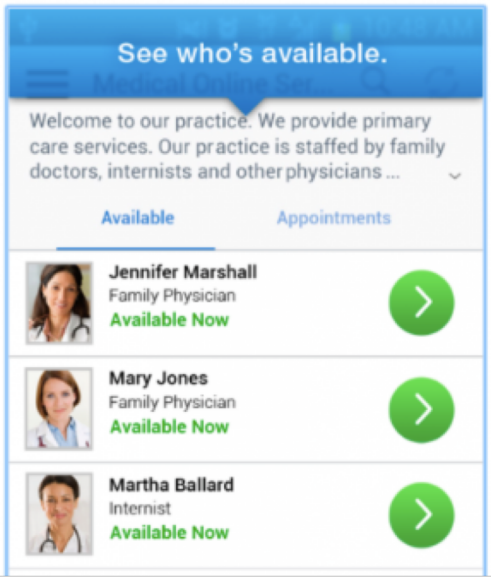
The University of Pittsburgh Medical Center (UPMC) Health Plan has launched an app-based, 24/7 telemedicine service to offer patients across Pennsylvania video visits from UPMC emergency room nurses and clinicians. Initially launched on desktop in November 2016 to UPMC Health Plan employees, the app version of AnywhereCare is now available to all patients within the state.

Even though emergency room professionals are providing the service, the AnywhereCare app is actually intended for non-emergency ailments that nonetheless require urgent care, such as sore throats and respiratory illnesses. Powered by American Well and whitelabeled under UPMC, the video visit app is available for free on smartphones, tablets or desktop computers, and users can expect to wait a little over six minutes, on average, to see a clinician.



PRACTICAL PROBLEMS: ePRESCRIBING

eazyScripts gets $2M to help telemedicine providers e-prescribe

By Jeff Lagasse

The company's e-prescribing solution was built to address the specific needs of telemedicine providers, aiming for a user experience that's fast and efficient. EazyScripts said its clients are saving time, increasing patient volume and improving patient and provider satisfaction.

Its user interface, striving for modernity, enables providers to begin using it without any training, and it's adaptable to a provider's preferences, running on desktops, laptops, tablets, and smartphones.

Providers can send an electronic prescription in a matter of seconds, the idea being that they can put a greater focus on patients' health outcomes. EazyScripts also offers secure electronic prior authorization and medication adherence options