НОВ БЪЛГАРСКИ УНИВЕРСИТЕТ
NEW BULGARIAN UNIVERSITY

The role of softwares and telemedical solutions in assessment, rehabilitation and therapy in developmental disorder

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Definitions

- Telemedicine is composed of the Greek word τελε (tele) meaning 'far', and medicine. Telemedicine usually means transmission of information followed immediately by medical care.
- Telemedicine is defined by the *Telemedicine Information Exchange* (1997) as *"the use of electronic signals to transfer medical data from one site to another via the Internet, Intranets, PCs, satellites, or videoconferencing telephone equipment in order to improve access to health care"*.
- In 1996 Jim Reid defined telemedicine in his book *"A Telemedicine Primer: Understanding the Issues"* as *"the use of advanced telecommunication technologies to health information exchange and health services delivery across geographical, time, social and cultural boundaries"*.
- According to the Telemedicine Report to Congress (1997), *"telemedicine can mean access to health care where little had been available before. In emergency cases, this access can mean the difference between life and death. In particular, in those cases where fast medical response time and specialty care are needed, telemedicine availability can be critical. For example, a specialist at a North Carolina University Hospital was able to diagnose a rural patient's hairline spinal fracture at a distance, using telemedicine video imaging. The patient's life was saved because treatment was done on-site without physically transporting the patient to the specialist who was located a great distance away"*.
- The report added, *"Telemedicine also has the potential to improve the delivery of health care in America by bringing a wider range of services such as radiology, mental health services, and dermatology to underserved communities and individuals in both urban and rural areas"*.

What is the aim of Telemedicine

A Telemedicine project is successful, when it achieves to

Save time 

Save money 

Improve the quality of healthcare 

HOW TELEMEDICINE WORKS

LOS ANGELES

SAN FRANCISCO

1. WEBCAM

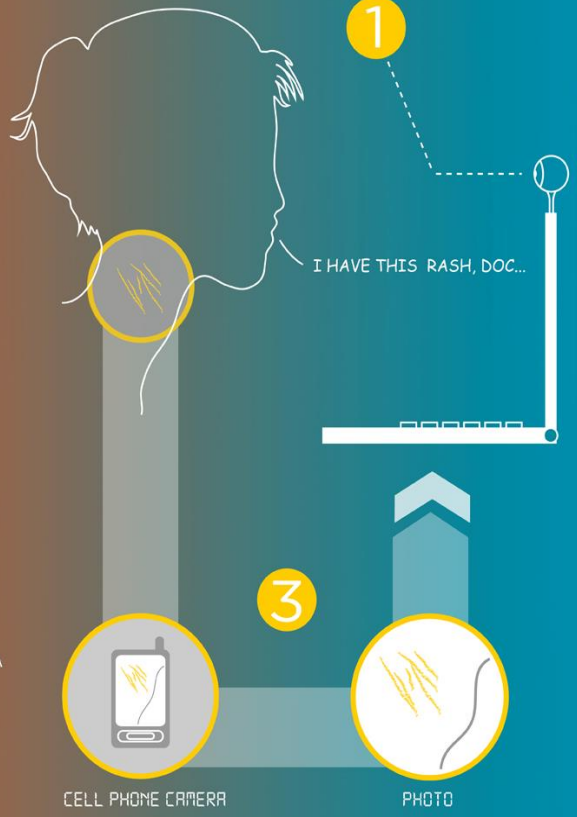
A WEBCAM AND MICROPHONE CONNECTED TO THE COMPUTER ALLOWS YOUR DOCTOR TO SEE YOU ON THE OTHER SIDE. YOUR SESSION WORKS JUST LIKE A NORMAL DOCTOR VISIT.

2. INTERNET

A HIGH-SPEED INTERNET CONNECTION ALLOWS THE VIDEO SESSION TO OCCUR IN REAL TIME FROM YOUR COMPUTER.

3. FEATURES

TELEMEDICINE GIVES YOU THE ABILITY TO SECURELY UPLOAD A PICTURE OF YOUR PROBLEM AREA TO YOUR ONLINE PATIENT FILE. ONCE UPLOADED, THE DOCTOR CAN VIEW THE IMAGE FROM A COMPUTER.



4. EMR

A SECURE THIRD-PARTY ELECTRONIC MEDICAL RECORDS SYSTEM STORES YOUR INFORMATION AND ALL RELEVANT DATA COLLECTED FROM YOUR TELEMEDICINE SESSION. ALL APPOINTMENT SCHEDULING, PATIENT FILES AND BILLING ARE CONTROLLED HERE.

5. PRESCRIPTIONS

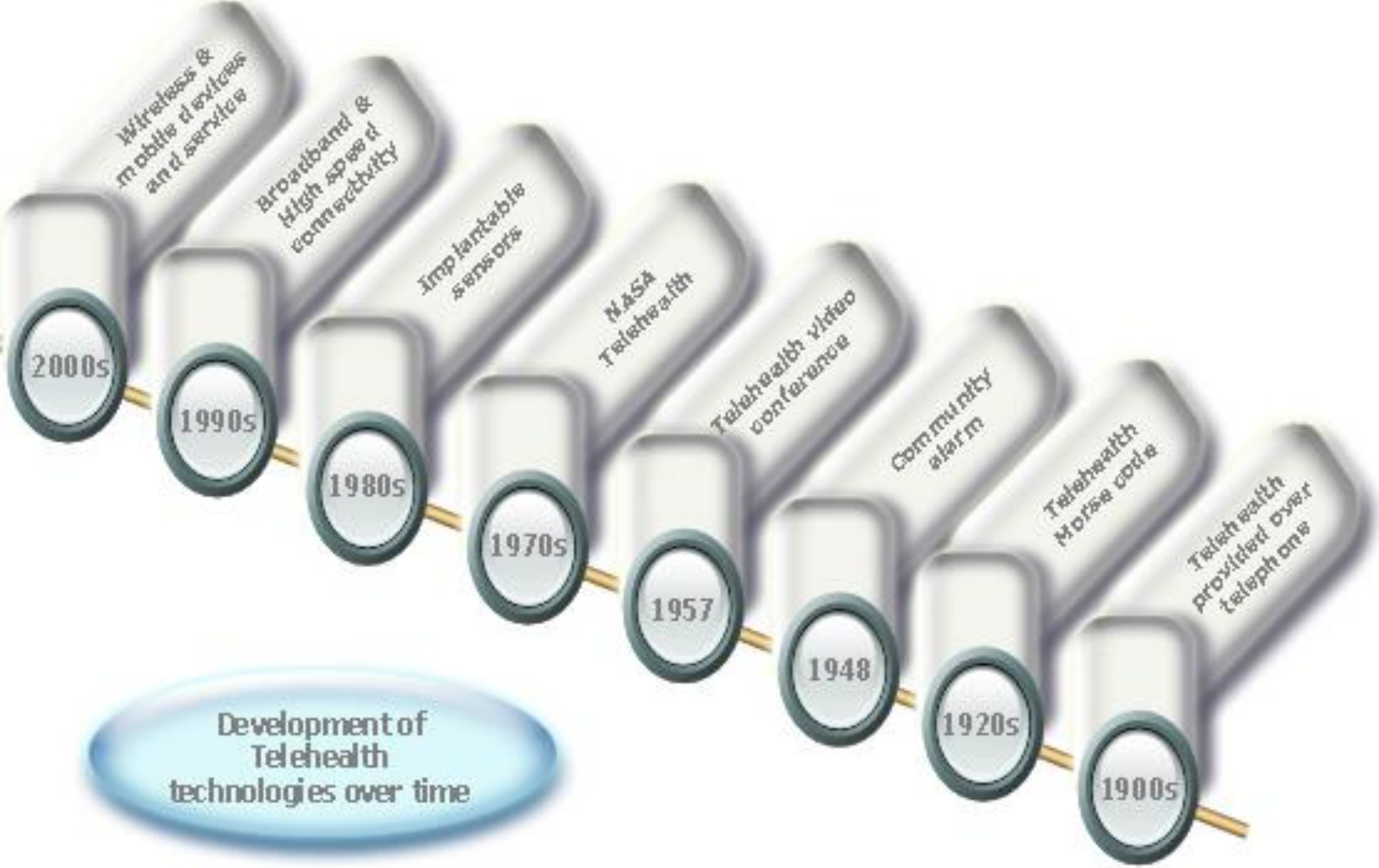
AFTER THE DOCTOR HAS EVALUATED YOU AND PROVIDED TREATMENT RECOMMENDATIONS, A PRESCRIPTION CAN BE ELECTRONICALLY SUBMITTED TO THE PHARMACY FOR ANY NECESSARY MEDICATION.

yuru

Timeline - since 1844

- Primitive forms of telemedicine have already been used hundreds of years ago. One example is the use of clocks by lepers, to warn others to stay away from them. In the Middle Ages information about the bubonic plague was sent throughout Europe by bonfires. During those days some wealthy families even sent urine samples to their doctor for a diagnosis.
- First telemedicine message is sent in 1844 using the electric telegraph invented by Samuel Morse (1791-1872).

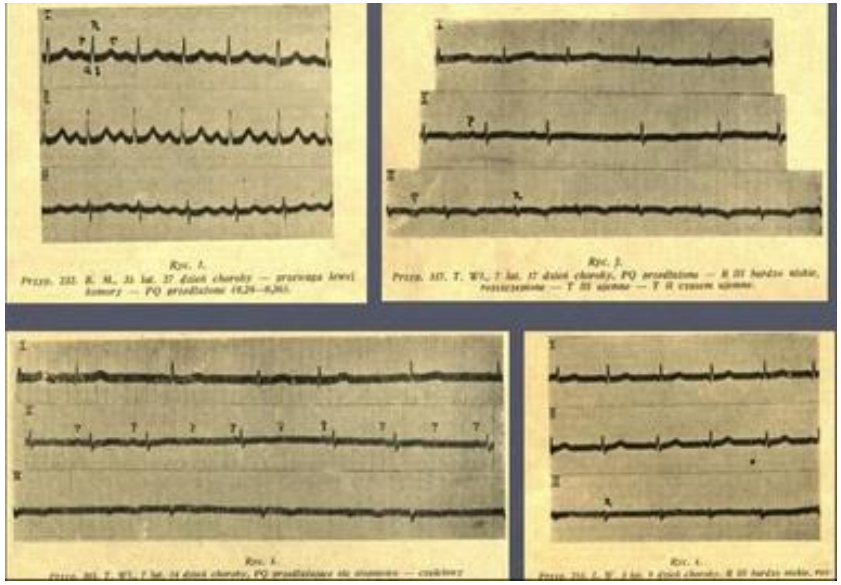
For details – see the paper Version of the Lecture "**The role of telemedicine in assessment and therapy in developmental disorder"**



Source: Frost & Sullivan

History

- Гениални прогнози за телемедицина от Hugo Gernsback през 1920
- Телемедицина и телекардиология – 1905г. (First TELE-ECG session worldwide – Netherlands 1905)
- Първото клинично приложение на TELE-ECG – Украйна, 1935г.



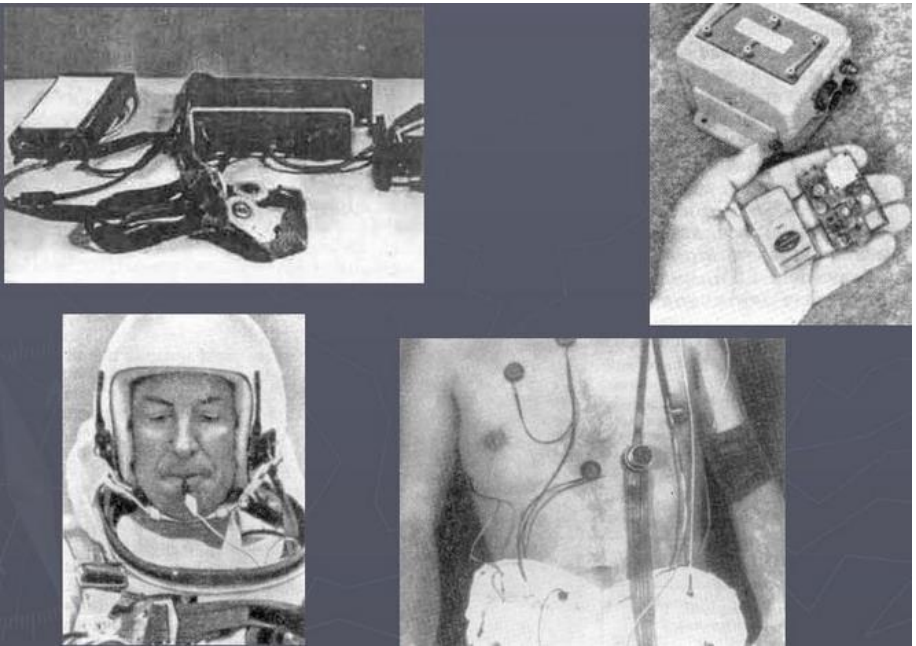
History

1935г. Италия - International Center of Radiocommunication Medicine

31 May 1949г. (USA) - First medical videoconference worldwide

History

First videoconference in telecardiology by prof. Michael DeBakey 1965 (link USA-Swiss by satellite “EarliBird”)

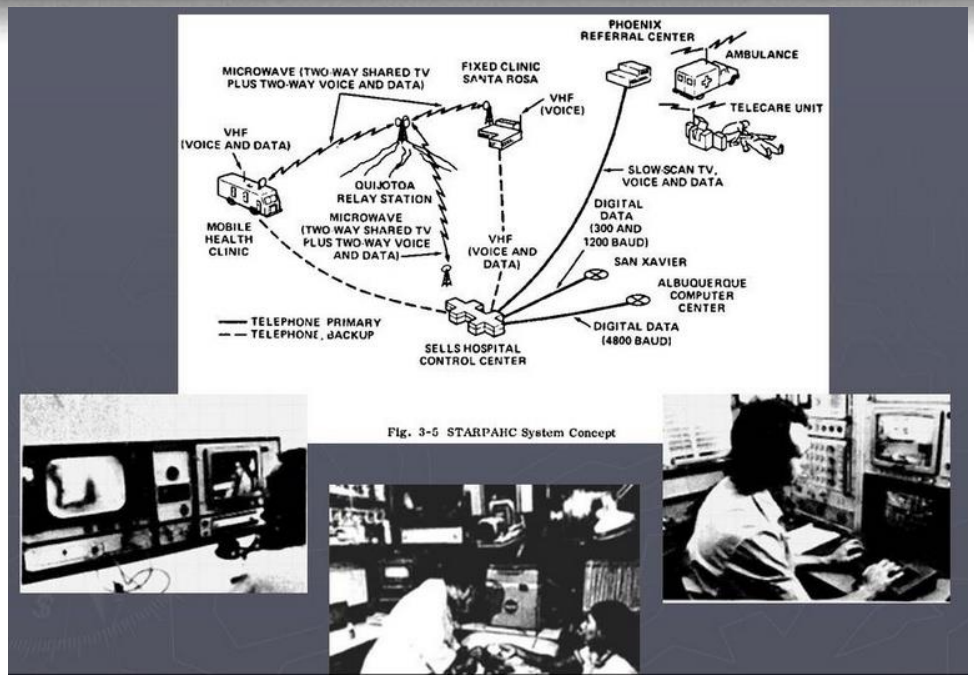


1950-1960- space telemetry

History

1970 – First mobile (wireless) telemedicine

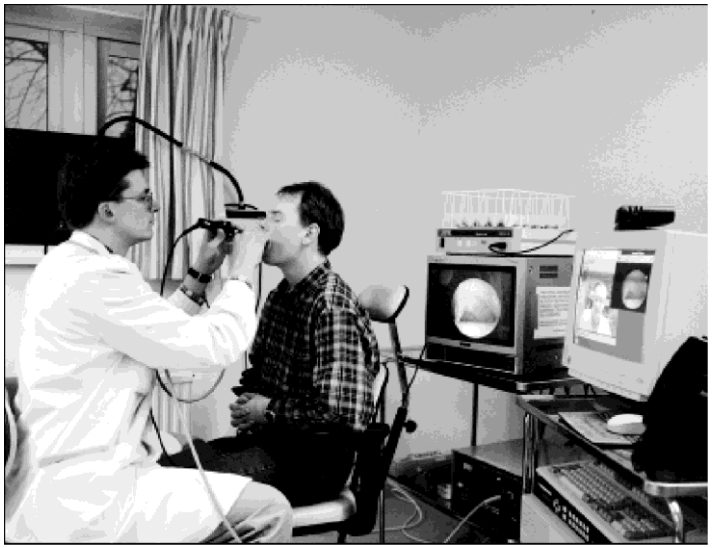
STARPAHC-NASA Telemedicine project

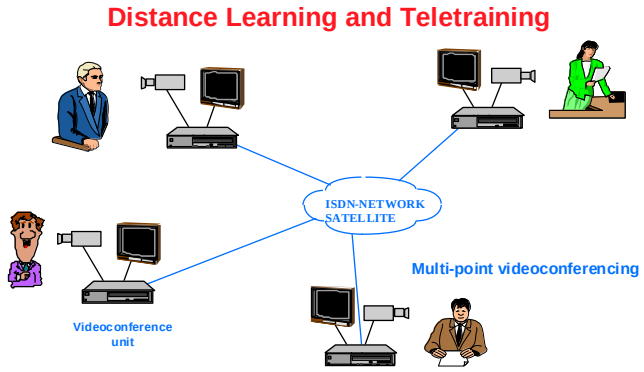


First trans-atlantic telesurgery (France-USA) september 2001

Telemedical systems, according their application in healthcare

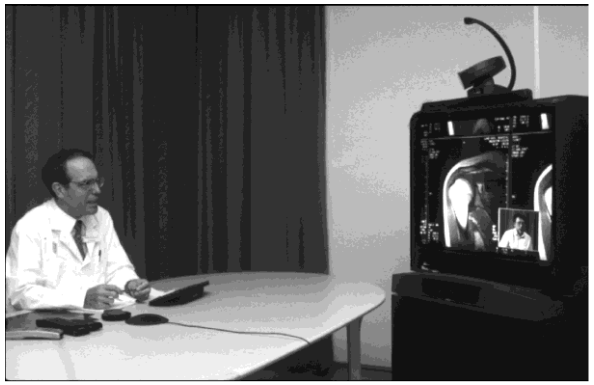
- Teleconsultation
- Telediagnosis
- Tele-education
- Medical emergencies and distant relief
- Telesurgery and virtual reality

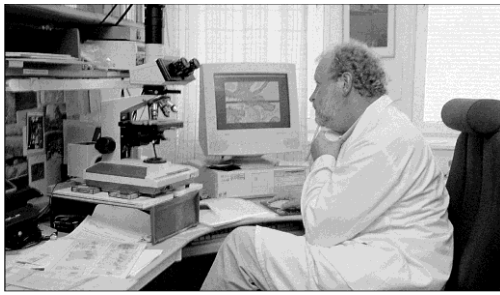




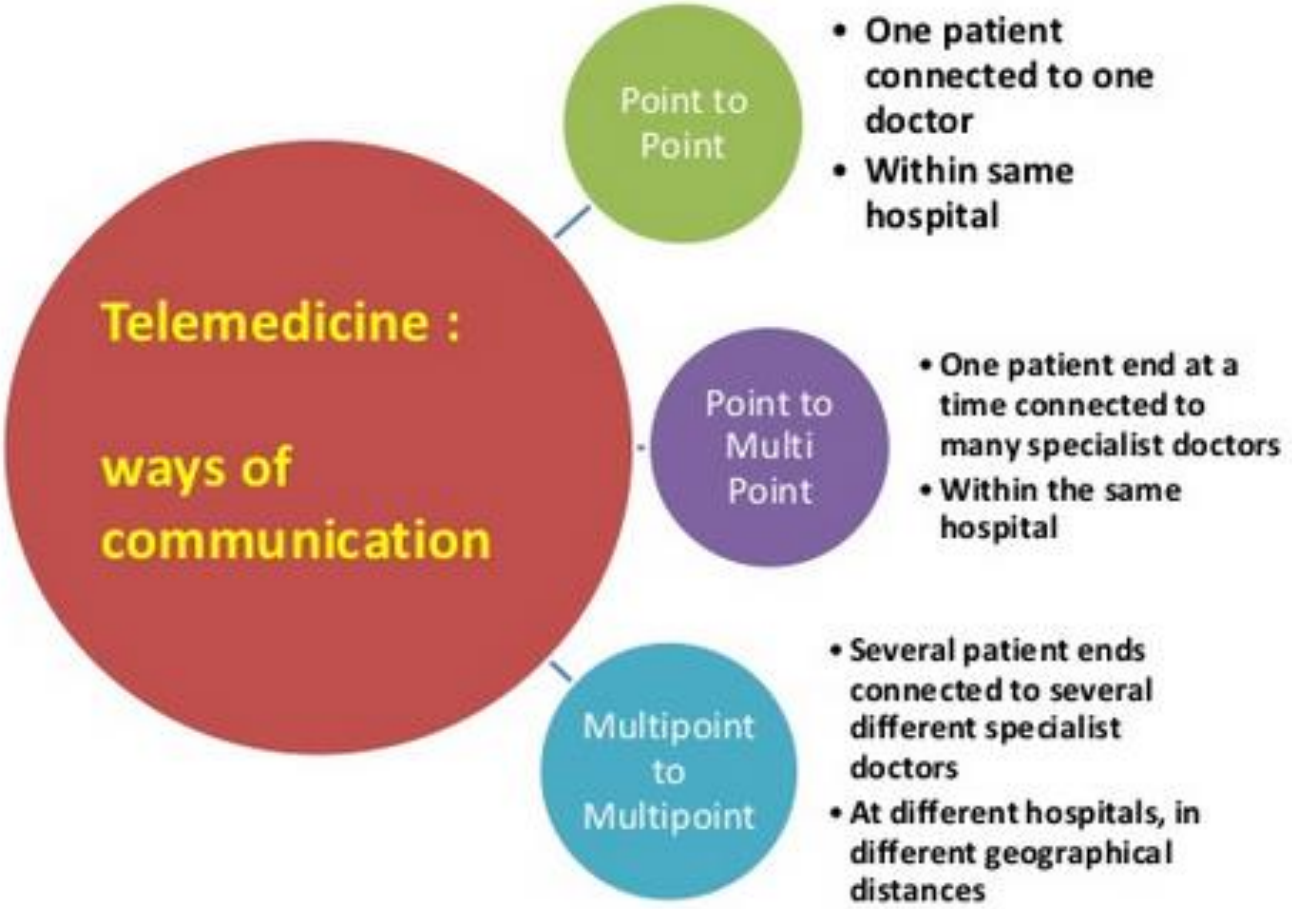
Telemedical systems, according their application in healthcare

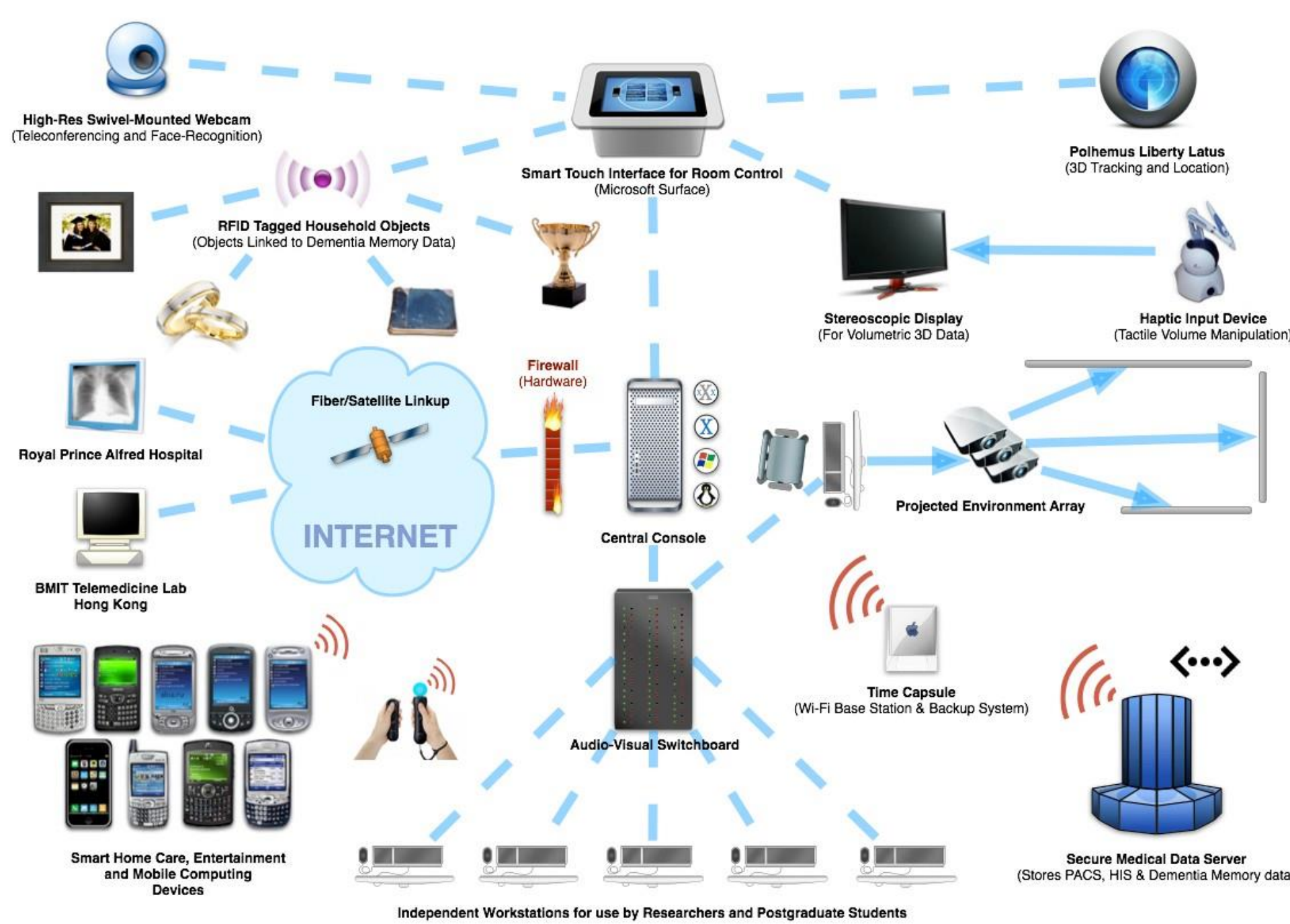
- **Телерадиология**
  - *X-Ray*
  - *CT*
  - *MRI*
  - *NM (Nuclear Medicine)*
  - *Fluoroscopy*
  - *Angiography*
  - *Ultrasound*
  - *Thermography*
- **Телепатология**
- **Теледерматология**
- **Телекардиология**
- **Телеметрия**
- **Телефармация**
- **Телепсихиатрия**
- **Теле-ендоскопия**

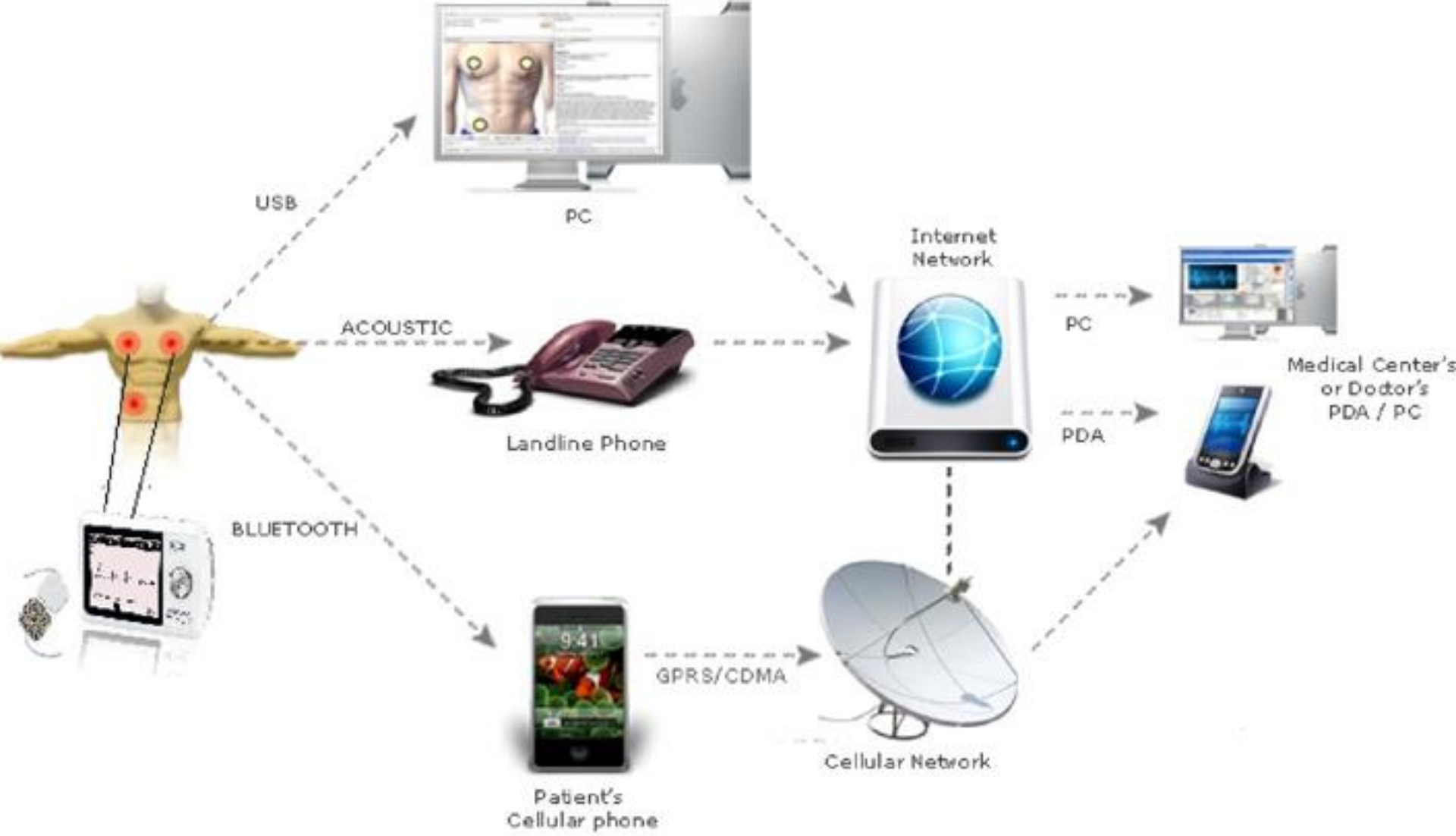




Communication “roads”



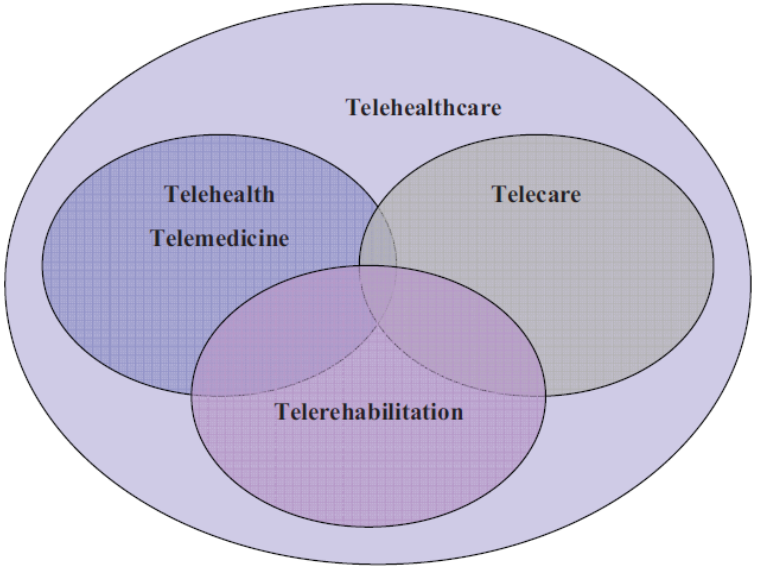

High-Res Swivel-Mounted Webcam
(Teleconferencing and Face-Recognition)
Smart Touch Interface for Room Control
(Microsoft Surface)
Polhemus Liberty Latus
(3D Tracking and Location)
RFID Tagged Household Objects
(Objects Linked to Dementia Memory Data)
Stereoscopic Display
(For Volumetric 3D Data)
Haptic Input Device
(Tactile Volume Manipulation)
Fiber/Satellite Linkup
Firewall
(Hardware)
Royal Prince Alfred Hospital
INTERNET
Central Console
Projected Environment Array
BMIT Telemedicine Lab
Hong Kong
Time Capsule
(Wi-Fi Base Station & Backup System)
Audio-Visual Switchboard
Smart Home Care, Entertainment
and Mobile Computing
Devices
Secure Medical Data Server
(Stores PACS, HIS & Dementia Memory data
Independent Workstations for use by Researchers and Postgraduate Students



Source: BioScience[1]

Telemedicine and children` s health

- Telemedicine is used to screen, diagnose, treat, and monitor a wide range of pediatric health conditions from common childhood illnesses, such as strep throat and asthma, to conditions requiring specialty care in such fields as dermatology, endocrinology, emergency and critical care, neurology, gastroenterology, obesity, radiology, pathology, oral health, and psychiatry.
- Telemedicine and telehealth applications help providers and patients manage the patient’s health, reducing the need for more complex and costly hospital visits and health treatments later.



- For example, UC Davis Children's Hospital in Sacramento, California has used telemedicine to facilitate the availability of emergency and critical care consultations to a rural hospital in Northern California 24 hours a day, 7 days a week by installing telemedicine equipment at UC Davis' pediatric intensive care unit and in the homes of its pediatric critical care physicians.

Telemedical solution for children with disorders

Mother finds a problem with her child

She visits a specialists for a consultation

The diagnosis

Personal assistant contacts remote site and requires consult

Local physician's assistant schedules time & date for consult

Inform consultant site about new patient

Consultant reviews patient record

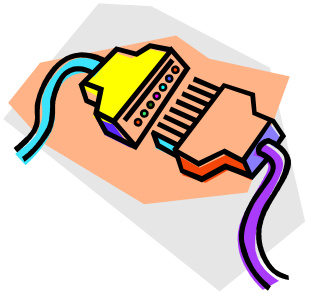
Consultant notifies mother and assists child

Videoconferencing

Introduction with patient

- Clarifies details of record with physician

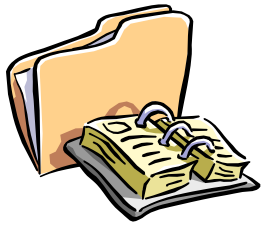
Consultant gives orders immediately



Diagnosis & Treatment plan

Consultation ends

Consultant reviews patient's electronic record and sends orders later

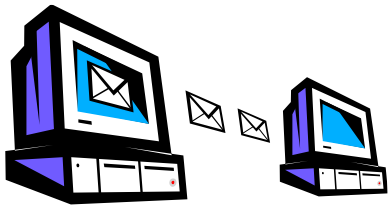


a. Home monitoring

3 times daily :
exercises

Once a day :
fill in form with difficulties and complaints

If necessary:
Type in questions or request teleconference with consultant



Send data through the internet

Consultant's assistant reviews new data on a daily basis

Urgent → Notify Consultant immediately

Not certain → Notify consultant the same day

Normal → Consultant reviews data once a week

Consultant reviews new data

Normal

Assistant sends email once a week for reassurement

Pathological

Urgent

Call patient, give order for hospitalization

Adjustments needed

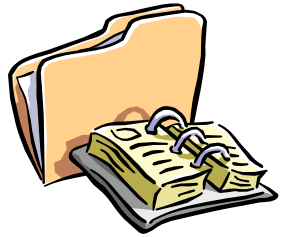
Send instructions over internet

Notify local physician

Notify patient

Physician's assistant schedules appointment with patient and notifies consultant's assistant

Answers patient's questions, if asked for, schedules teleconference appointment



c. Visit to Local practice

Patient arrives at remote site

- Every 3 weeks
- On Consultant's request

Assistant

Notifies consultant site

Turns on videoconferencing equipment

Sets up linkage

Physician

Reviews patient record

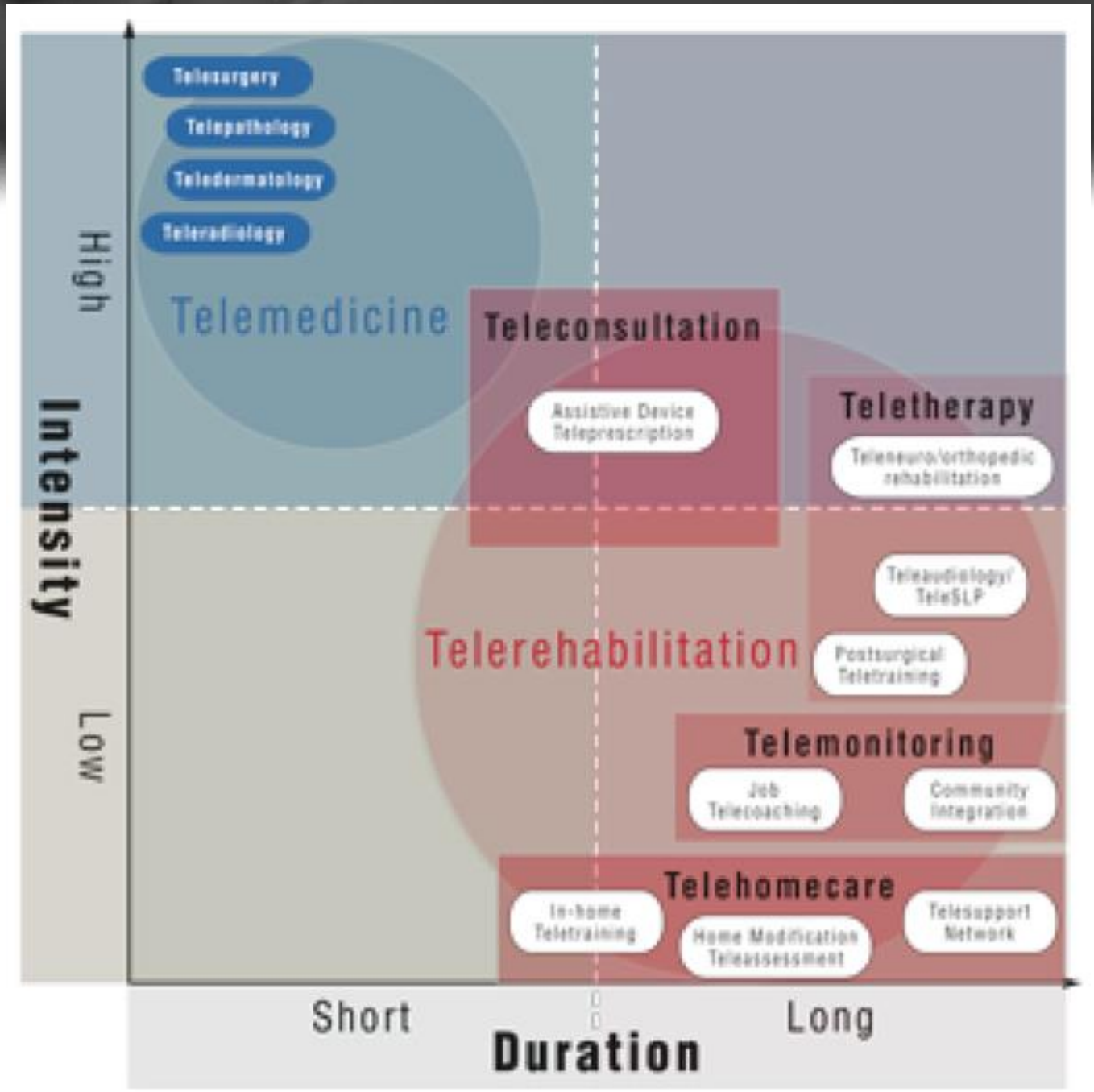
Examines patient

Enters new data into record

When ready, assistant notifies consultant site

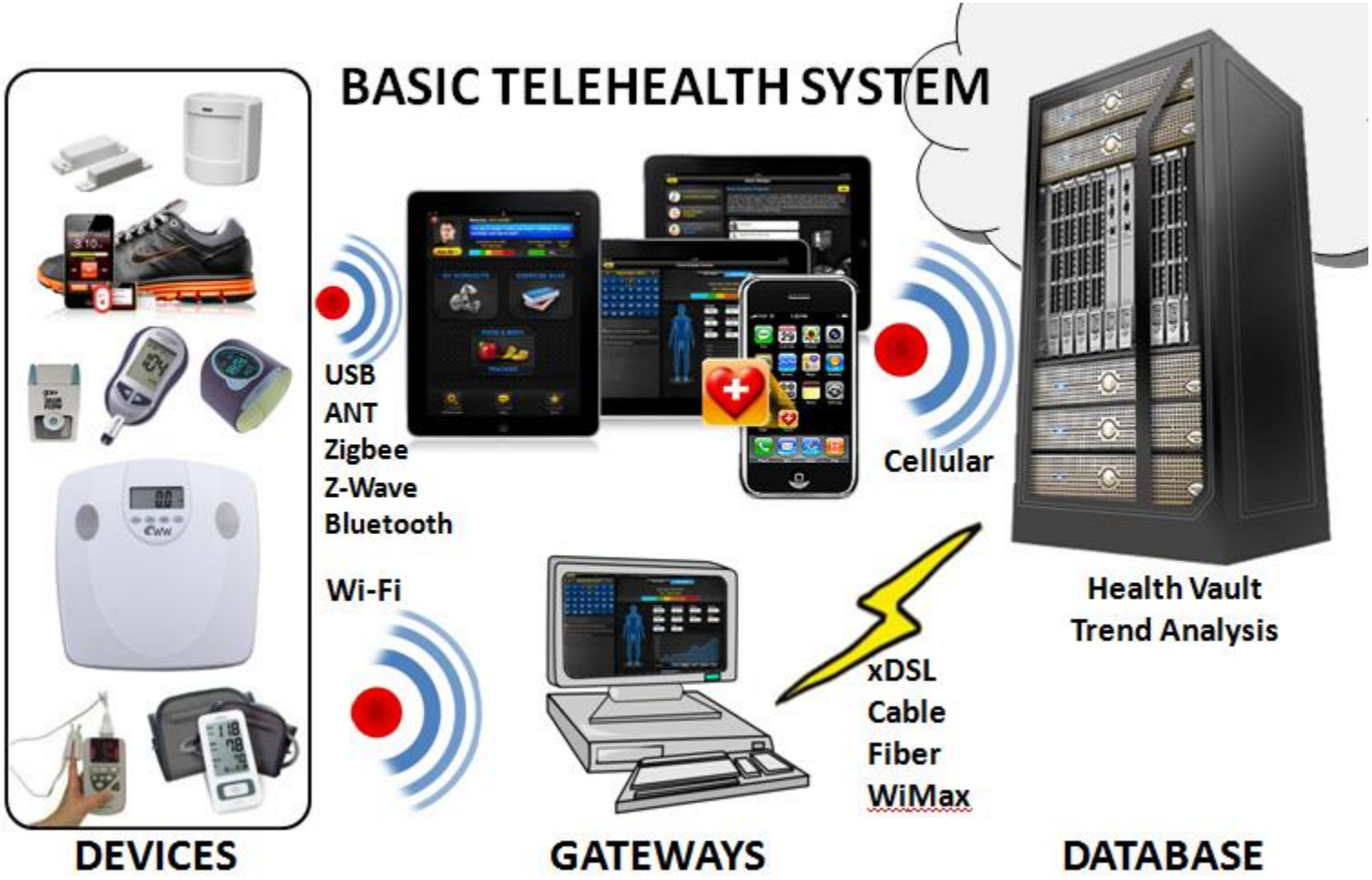
Good practice example

- Kern Regional Center uses telemedicine to connect children with developmental disabilities in Kern, Inyo and Mono Counties—very remote areas in California—to pediatric psychiatrists, neurologists, and other sub specialists at major medical centers throughout the state.
- Through approximately 2,000 telemedicine consults a year, Kern Regional Center has helped children get the care they need while reducing their absences from school and their parents' absences from work.
- Kern Regional Center has also used telemedicine to coordinate children's care by simultaneously connecting the members of a child's care management team, such as the pediatrician, teacher, sub specialist, and the regional center staff.

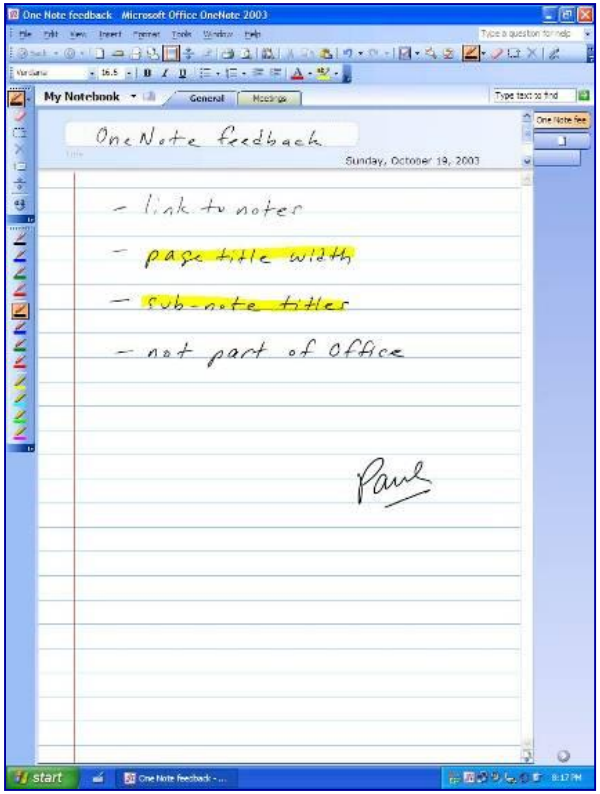


http://www.rerctr.pitt.edu/sos/index.html
http://www.rerctr.pitt.edu/Resources/Presentations.html

One basic telehealth system



The new technologies and mHealth



- **There are identified 101 uses of cell phones in healthcare - categories of functions and services**

AUTISM APPS

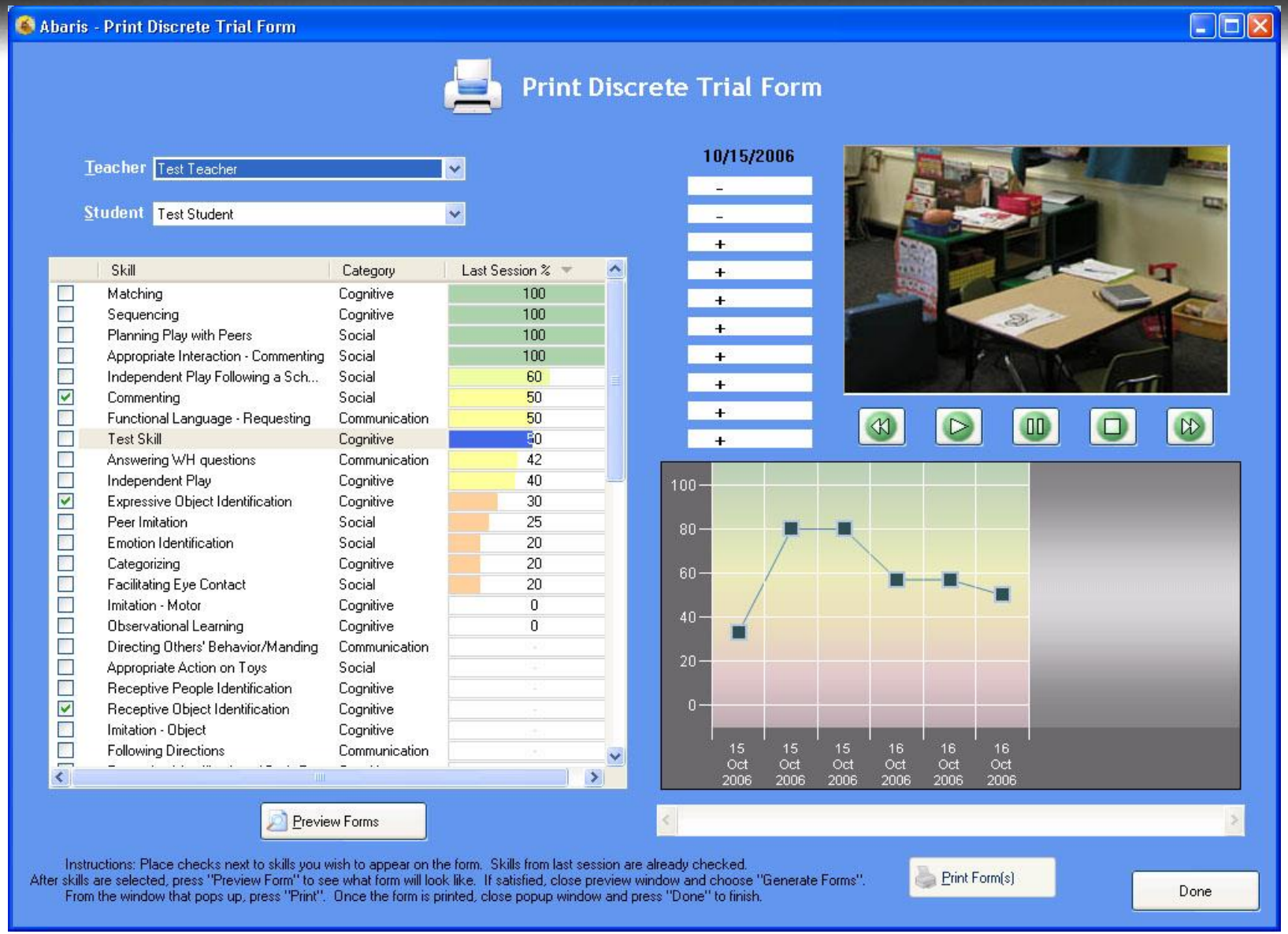
Identified Prevalence of Autism Spectrum Disorders

ADDM Network 2000-2008

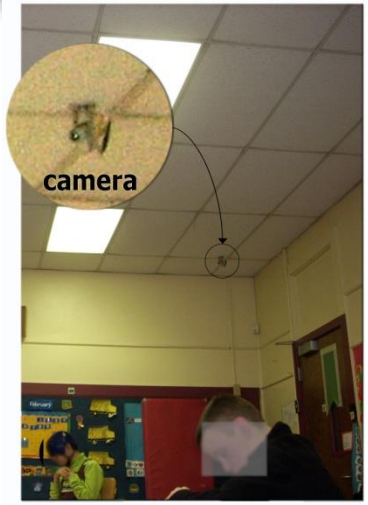
Combining Data from All Sites

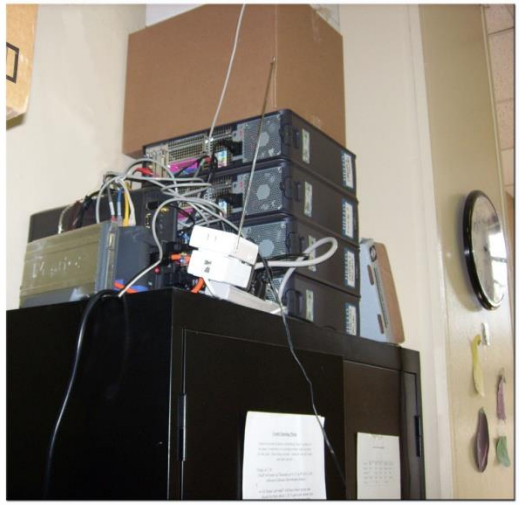
Surveillance Year	Birth Year	Number of ADDM Sites Reporting	Prevalence per 1,000 Children (Range)	This is about 1 in X children...
2000	1992	6	6.7 (4.5-9.9)	1 in 150
2002	1994	14	6.6 (3.3-10.6)	1 in 150
2004	1996	8	8.0 (4.6-9.8)	1 in 125
2006	1998	11	9.0 (4.2-12.1)	1 in 110
2008	2000	14	11.3 (4.8-21.2)	1 in 88

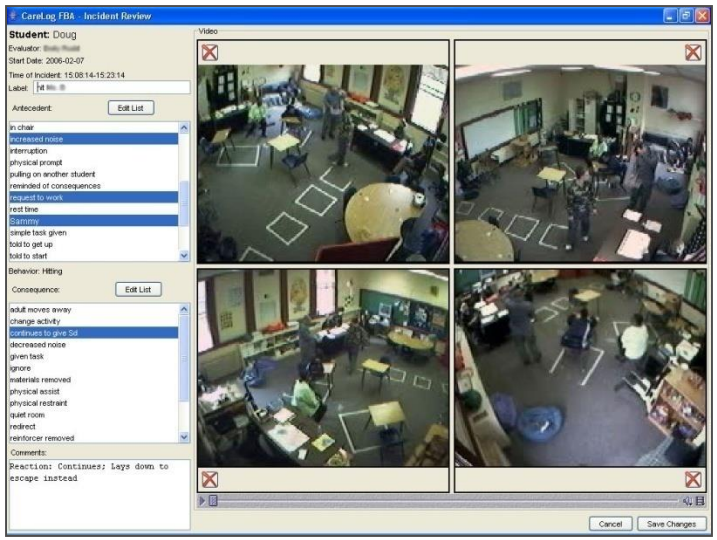
Abaris for Schools

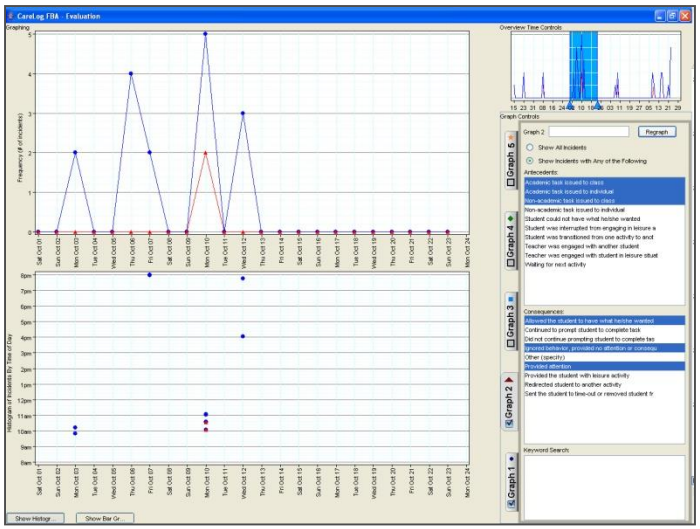


CareLog


camera




CareLog FBA - Incident Review
Student: Doug
Start Date: 2006-02-07
Time of Incident: 15:08:14-15:23:14
Antecedent:
Edit List
in chair
increased noise
interruption
physical prompt
pulling on another student
reminded of consequences
request to work
rest time
Sammy
simple task given
told to get up
told to start
Behavior: Hitting
Consequence:
Edit List
adult moves away
change activity
continues to give Sd
decreased noise
given task
ignore
materials removed
physical assist
physical restraint
quiet room
redirect
reinforcer removed
Comments:
Reaction: Continues; Lays down to escape instead
Video
Cancel
Save Changes


CareLog FBA - Evaluation
Graph 5
Graph 4
Graph 3
Graph 2
Graph 1

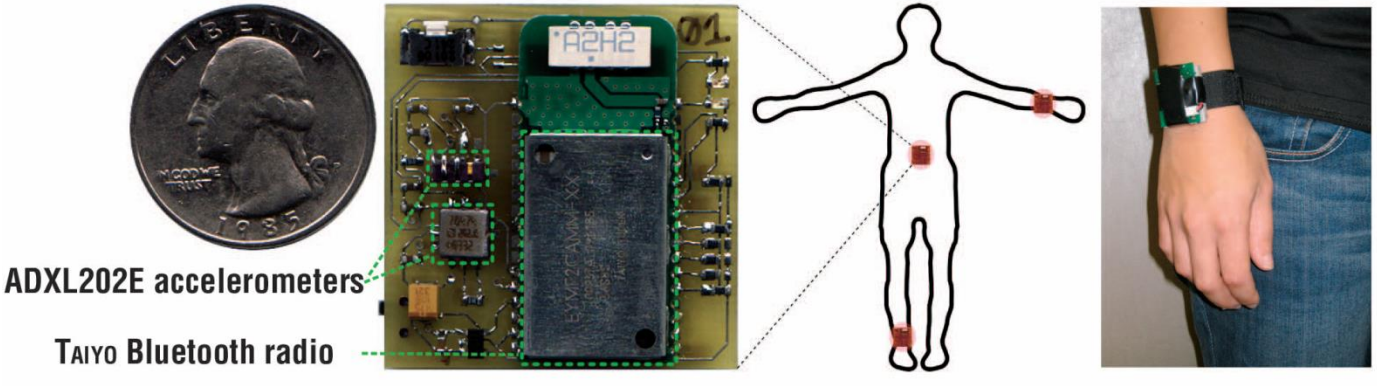
Recognizing Autistic Behaviors

- Машинните техники, представляващи ненатрапчиви безжични сензори могат да предоставят автоматична справка за дейност, за да докладва ежедневно поведенческите промени на хора с когнитивни увреждания

Westeyn, *et al*. ISWC 2005

Подход

- Use wearable sensors to determine when self-stimulatory behaviors occur
  - **Communicate findings to caregiver**
    - Can correlate self-stimming behaviors with different needs
- Drawbacks
  - **Children may not be comfortable wearing**



Други технологии за Аутизъм

- Accelerometers for Stimming
  - **Albinali, Goodwin, & Intille (Ubicomp 2009)**

- Virtual peer for storytelling
  - **Tartaro, ASSETS ‘06**

- Emotion prosthetic for recognizing facial expressions
  - **Kaliouby & Robinson, Universal Access in the Information Soc ‘05**

Други технологии за Аутизъм

- Mobile picture schedules for children with au
  - **Hayes et al., UC Ir**

- Biometric Sensors for A
  - **LifeShirt**
    - Goodwin, et al., Groc
  - **Wearable GSR**
    - MIT Media Lab

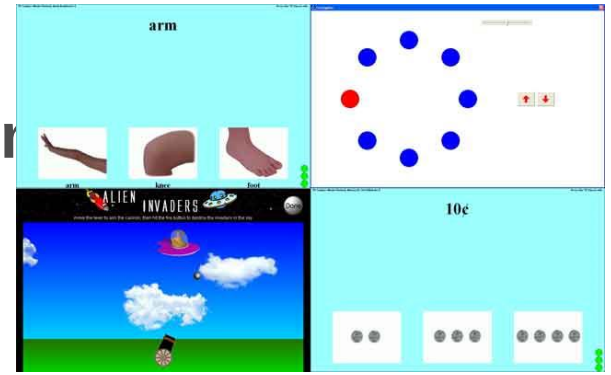
Други технологии за Аутизъм

- Touch table games to teach turn-taking skills
  - **Piper, et al. CSCW**
  - **Gal et al., Intetain**

- Virtual Worlds for Ind with Autism
  - **Second Life**

Други технологии за Аутизъм

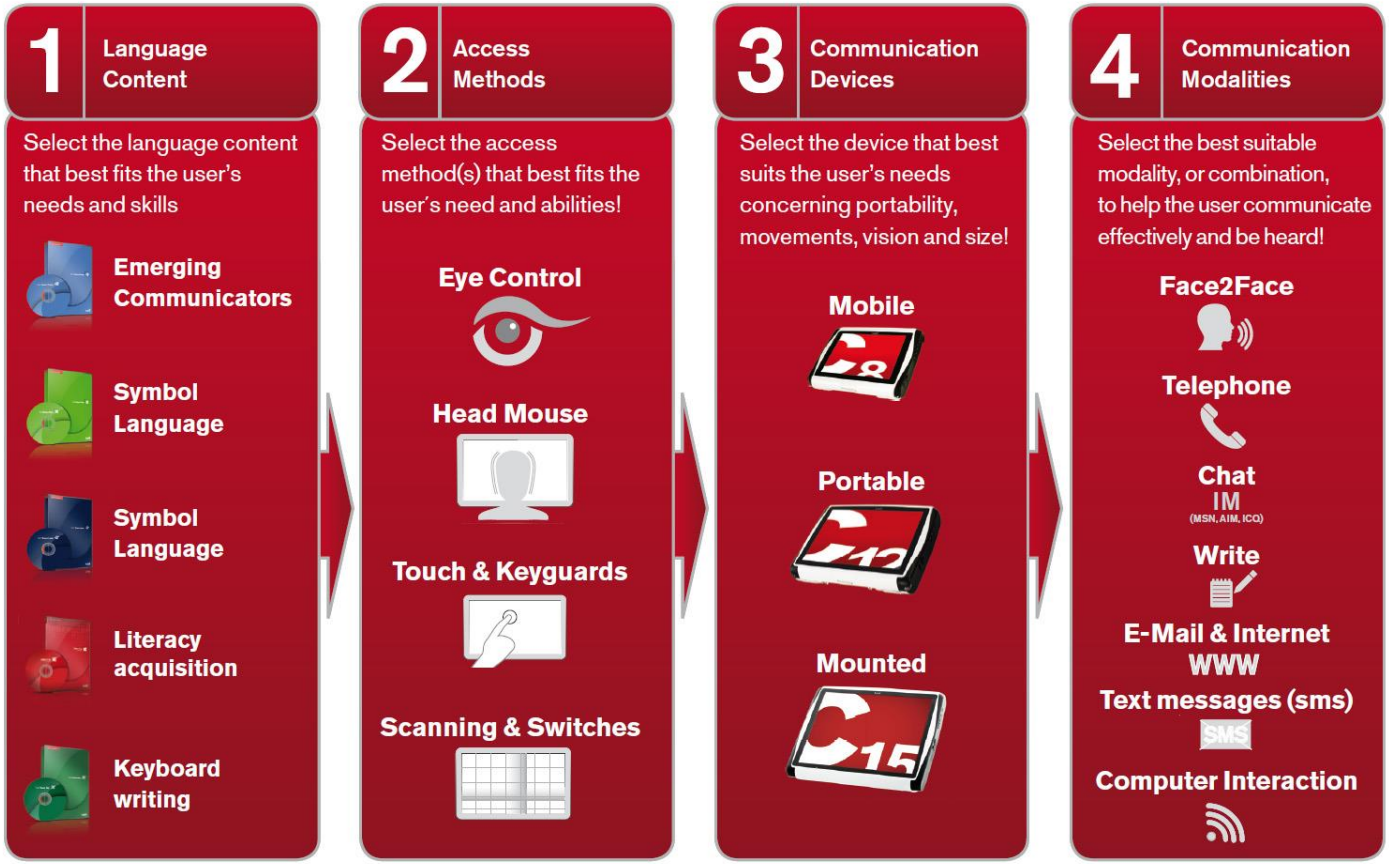
- Discrete Trial Trainer
  - **http://www.dttrainer.cor**



- Virtual reality as training for dealing with difficult e or dangerous situations
  - **Strickland, D. Virtual reality in Neuro-Psycho -Physiology. 1997**

Други технологии за Аутизъм

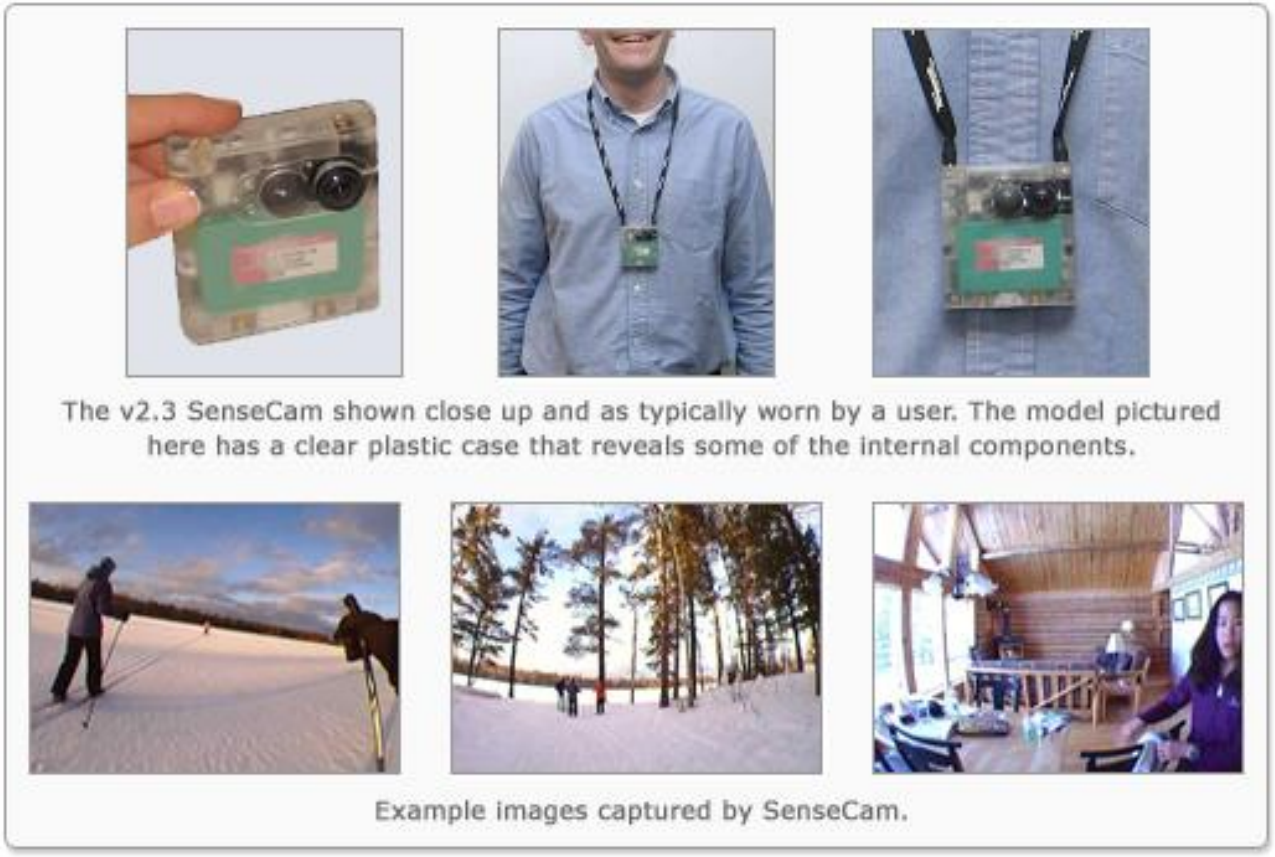
- Augmentative Communication Devices
  - **GoTalk**
    - http://www.thespeciallife.com/communication-device.html
  - **Dynavox** http://www.dynavoxtech.com
  - http://www.tobii.com/Global/Assistive/Product_Documents/SL40%20Slick%20707439_HW-10.pdf?enslanguage=



http://www.tobii.com/assistive-technology/global/hidden-pages/tobii-c-series-family/

Други технологии

- SenseCam
  - **Запомнящо асистиращо средство за хора с дименция**
  - **Mic**

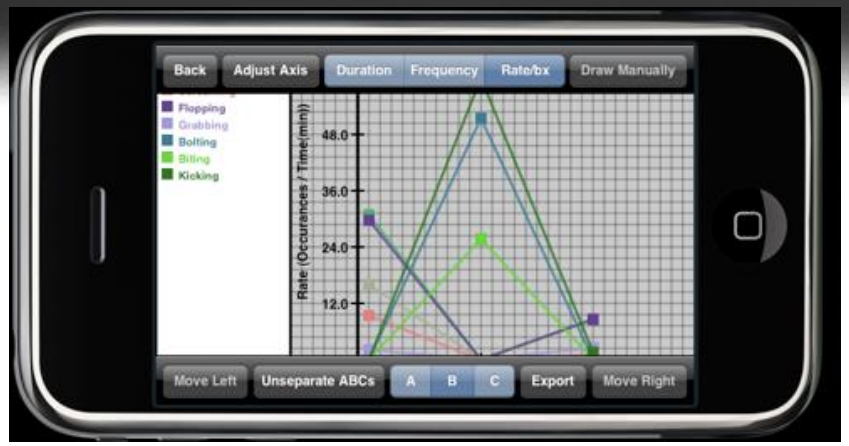


The v2.3 SenseCam shown close up and as typically worn by a user. The model pictured here has a clear plastic case that reveals some of the internal components.

Example images captured by SenseCam.

iPhone Applications

- Behavior Tracker Pro
  - **Collects similar information to CareLog**



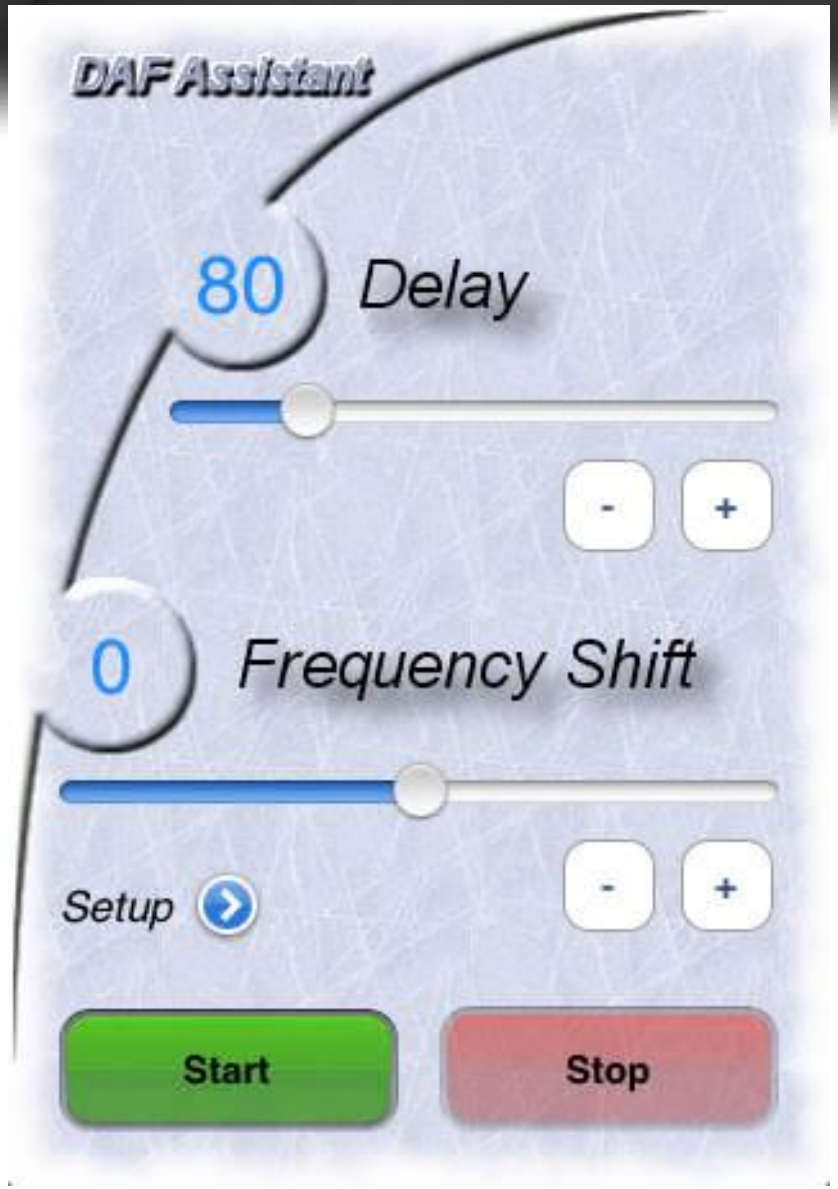
- Proloquo2go
  - **Picture communication on the iPhone**
    - $150 app

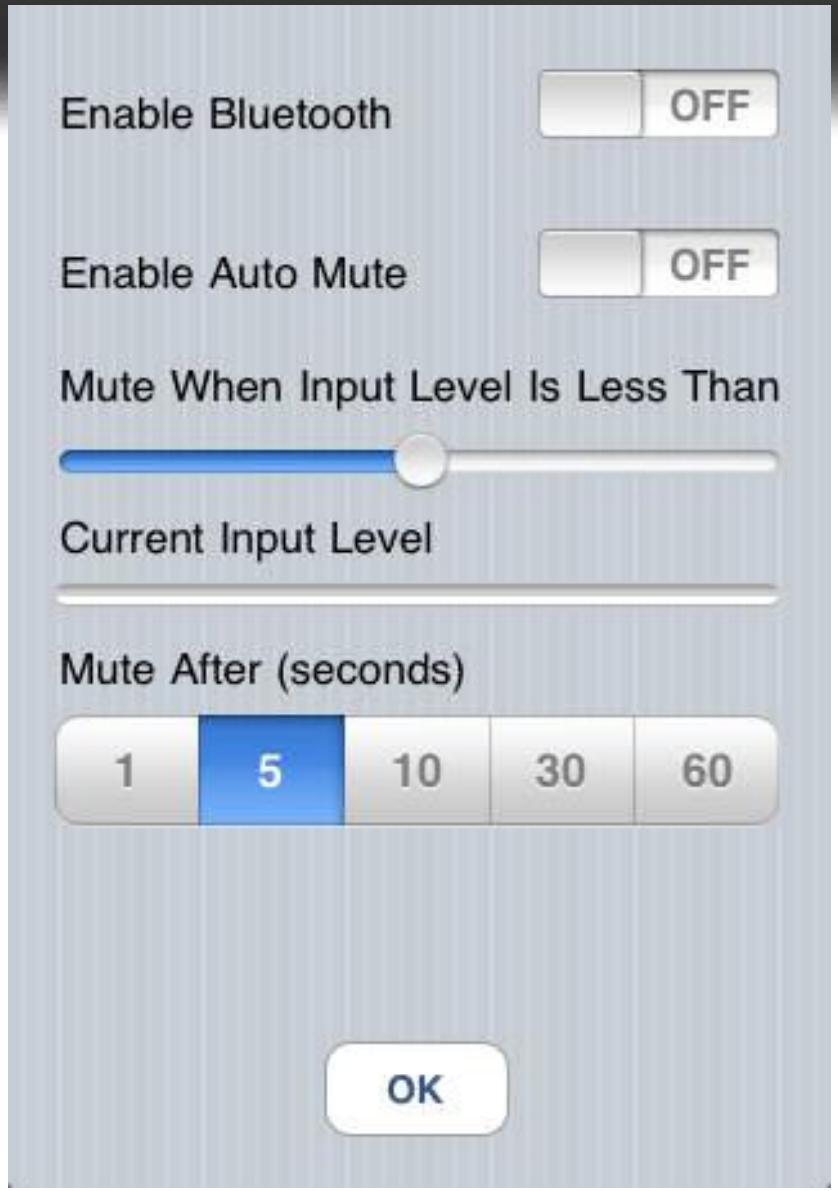
- **Apps for Communication/AAC**
  Apps that are going to be used for AAC on the iPad need to be adapted and customized for each child. Therefore, as stated above, it is essential that a skilled professional determine whether an iPad app will meet a child's communication needs and then provide ongoing programming and training. Here are just a few of the apps available for AAC/Communication needs:
- LAMP Words for Life (By Prenke Romich Company (PRC))
- TouchChat (By Saltillo)
- TouchChat with WordPower (By Saltillo, Word Power by Nancy Inman)
- SonoFlex (By Tobii)
- Proloquo2Go
- Grace
- MyTalk
- iCommunicate
- Tap to Talk
- Yes/No
- - See more at: http://www.autismconsortium.org/blog/detail/technology-and-autism-whats-available-and-what-works#sthash.It9DJsEi.dpuf

- Proloquo2Go-AAC in Your Pocket
- TalkRocket Go
- SpeechHero
- Expressive
- First Then Visual Schedule
- Visual Schedule Planner
- ConversationBuilder
- Predictable
- Doceri
- Evernote
- Springpad
- Popplet
- Kurzweil firefly
- iCommunicate
- Stories2Learn
- Pictello

Assistive Technology	Description	Used To Address
Portable Word Processor	Keyboard with small LED screen	Poor fine motor or motor planning skills for writing
Talking Word Processor	Writing software programs that provide speech feedback	Poor fine motor, motor planning, cognitive, or combination
Text To Speech Software	Program used to convert text from print to audio formats	Poor reading comprehension, decoding, fluency, etc.
Visual Assistants Electronic/Non-Electronic Organizers	Graphic symbols sequentially laying out events/activities (may also have auditory cues)	Behavior issues and develop task completion/focus and language/ communication skills
Headphones	Earphones that cancel extraneous environmental noise	Auditory overstimulation issues
Assistive Listening Systems	Speaker worn transmitter and listener worn receiver or near placed speakers	Deficits in attention and listening comprehension and auditory overstimulation issues

SPEECH disorders APPS


DAF Assistant
80
Delay
-
+
0
Frequency Shift
-
+
Setup
Start
Stop


Enable Bluetooth
OFF
Enable Auto Mute
OFF
Mute When Input Level Is Less Than
Current Input Level
Mute After (seconds)
1
5
10
30
60
OK

- **Fluency SIS**
- **DAF Professional**
- **Easy AAF**
- **http://smartyearsapps.com/apps/** (Fluency Tracker and Disfluency Index Counter) - преглед
- **DAF Assistant**
- **MPiStutter**
- **The Stammurai**, a game created by teens who stutter
- http://www.voiceamp.net/va601download.php

Soft`s

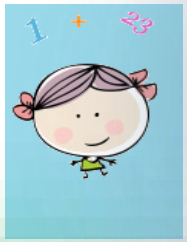
- **Speech Monitor** (free)
- **Fluency Coach**
- **http://www.speechgym.com/windows.html**
- **ArtefactSoft**

Софтуер, подпомагащ деца със специални образователни потребности.

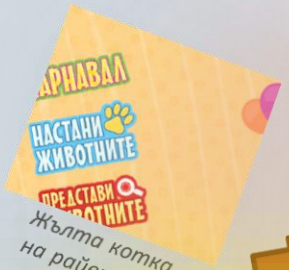
ОПИСАНИЕ НА СОФТУЕРА

Образователният софтуерен е продукт за обучение на деца и ученици със специални образователни потребности. Образователният софтуер е специално разработен така, че да е подходящ за повишаване на знанията и подпомагане на обучението на децата и учениците с дислексия, дискалкулия и ХАДВ /хиперактивен синдром и дефицит на вниманието/, като може да бъде използван и при деца и ученици с: аутизъм, различна степен на интелектуална недостатъчност, деца с остатъчен слух и с практическа глухота.

Игри за усвояване на умножение и деление, събиране и изваждане, за подпомагане на слуховата и зрителната памет за цифри. Специално внимание е обърнато на практическата насоченост за боравене с монети и банкноти, работа върху количество, цена, пазаруване в магазина.



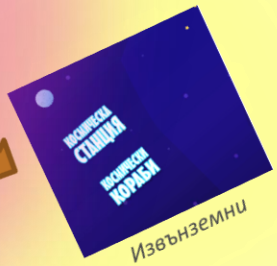
Модул „Математика“



Жълта котка на райета

Мобилен телефон

Виртуален магазин



Извънземни

Решение в три модула

Да сверим часа

Дари отива на училище

Между лятото и зимата

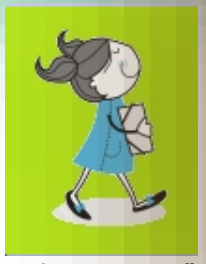
Къщата на Дари

Модул „Логика“

Подмодул Пространство - насочен към соци-алната интеракция, пространствените отношения по собственото тяло, по отразен образ и практическата роля на математиката.

Подмодул Време - подпомага опознаването на сезоните, месеците, дните; на часовника. Откриване на грешки по зададена вербална инструкция и коригиране.

Върху какво въздейства образователният софтуер:
- -Краткосрочна оперативна памет
- -Дългосрочна памет
- -Внимание
- -Зрително възприятие
- -Слухово възприятие
- -Скорост на обработка на информацията
- -Роля на езика
- -Математически познавателен стил



Модул „Четене “

Стъпала към четенето

Модул „Четене” съдържа образователна програма, разработена да подобри разбирането при четене и слушане на комплексни текстове за деца от **7** до **14** годишна възраст. Програмата осигурява учебна среда, в която децата четат (или слушат) интерактивни текстове с различно ниво на трудност. Организирана в седем нива с увеличаваща се сложност. Включва **49** интерактивни текста (съдържащи между **50** и **300** думи). Програмата работи и за разширяване на речниковия фонд на децата. Всеки текст е последван от въпроси, чиито брой се увеличава за всяка възраст с цел подобряване на нивото на разбиране.

*Изготвен от: Милена Димова, **F73181***

DISLEXIA APPS

Here, existing techniques to deal with dyslexia and like conditions are considered; this includes teaching methods, learning methods, and technology-specific learning methods. Techniques to create an effective e-learning system are also outlined, and media combinations are discussed.

Existing techniques which deal with dyslexia are not generally technology-based, although technology is sometimes used. Teaching methods include conveying information through [2]:

- Videos
- Colour
- Stories
- Handouts
- Worksheets
- Multiple-choice questions
- Mind maps (where ideas are noted and linked with lines)
- Cloze procedures (students supply missing words from a passage)

Dyslexic methods for learning and recording information include [28]:

- 'Box and underline' technique to understand essay questions
- Physical space (placing paper in different areas of a room according to the information represented)
- Colour (highlighting, or differentiating between notes, sources, prose to check and final prose)
- Bullet points
- Asking friends to check work

Systematic control of the work is essential [28], and frameworks can help: students are sometimes encouraged to use one A3 sheet to record whole essay plans. The sheet is a framework for the essay, encouraging student focus on an overall view.

Dyslexic methods which make use of technology include use of [28]:

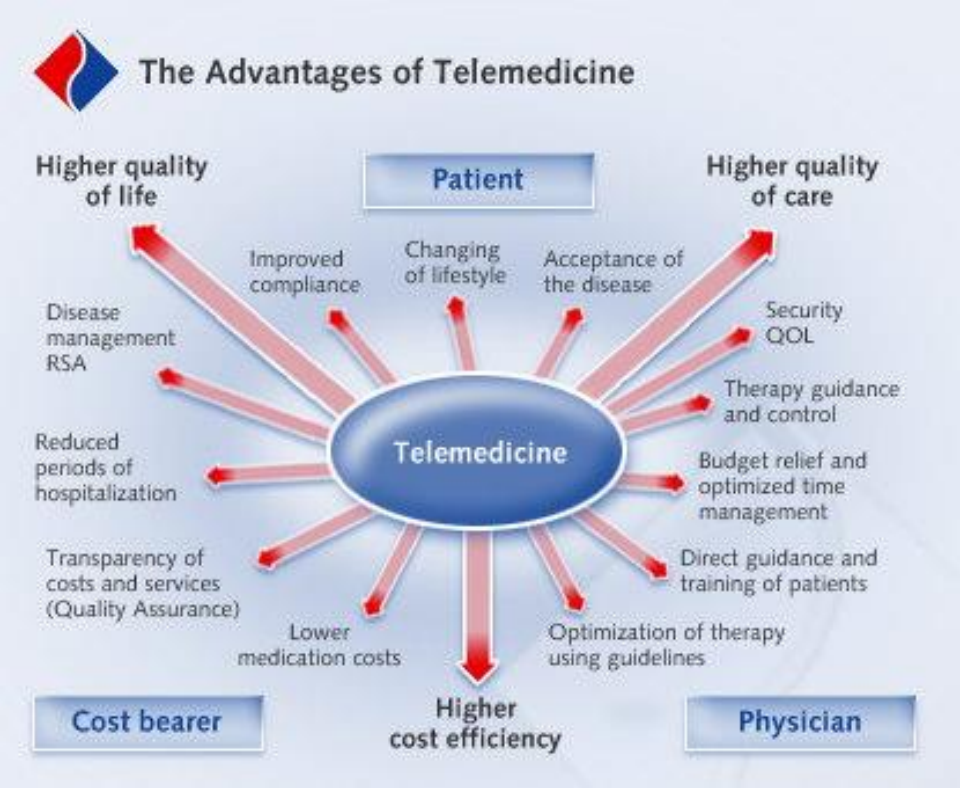
- Text-to-speech
- Talking spell checkers/thesauruses
- A split screen for notes and prose
- Notes to self and audio triggers in Microsoft Word
- Cut and paste
- Speech recognition

It has been noted that e-learning can lack a vital ingredient of the learning process – fun [8]. Only a few of the techniques and artefacts discussed in this paper constitute e-learning, yet this is an important point. Suggestions for improving e-learning include:

- Allow the sharing of ideas
- Require regular fixed deliverables
- Support a healthy group dynamic
- Provide feedback
- Keep records
- Appoint a 'cheerleader' (a member of the core community who brings interesting questions, topical issues and other new material)

The benefits of telemedicine

- Improved access to healthcare, e.g., obtaining second opinions;
- Improved continuity of care;
- Improved patient education, and timely treatment;
- Continuous monitoring of chronically ill patients;
- Reduced travel time for physicians, other healthcare providers, and patients;
- Better access for patients in underserved areas;
- Improved access to medical records and information,
- Promoting self-help by increasing the online availability of medical information;
- Knowledge-based self-diagnosis programs;
- Distance learning programs; and medical research data/information;
- Improved continuing medical education.



Telemedical potential risks

- collected and transmitted information may not be sufficient to allow appropriate medical decision making by the physician and consultant(s);
- medical, technical or other limitations in obtaining, processing, presenting and/or understanding patient data may result in inappropriate decisions);
- delayed evaluation of patient's condition due to failures or deficiencies of equipment may influence the quality of telemedical service;
- prearranged consultants' time schedules and availability may influence time-to-response and decision making;
- patient's condition may vary in time necessary for teleconsultation and relevant (tele)medical procedures;
- in rare instances, telemedical practice algorithms, security protocols and integrity of medical data could be affected or damaged by changes in services,
- in rare cases, lack of access to complete medical records.

Table 3.3 *Complexity of Telerehabilitation Technologies (adapted, with permission, from Pramuka & Van Roosmalen, 2009)*

Complexity Levels	Data type	Functional features	Telerehabilitation Technology
Level 1	Textual	Messages Feedback	Pen and paper Text to phone Email
Level 1	Audio	Voice Speech Language communication Memory	Voice recorder Phone POTS
Level 2	Visual (2D)	Shape Stage Image Schematics Location	Mobile phone Camera
Level 2	Time and Textual	Planning Monitoring data History Improvement	Planner PDA
Level 3	Visual (3D)	Space Movement Motion (bodily) Fit Human-product interaction Gait Safety	Video Radar 3D camera Multiple cameras
Level 4	Audio and Visual (3D)	Interaction Expression Personality User opinion	Videoconferencing Digital video
Level 4	Touch - Haptics	Texture Resistance Temperature	Sensors Gauges
Level 5	Time and Visual (3D)	Location Speed Acceleration	GPS Accelerometer Video Wireless
Level 5	Time and Haptics	Resistance Force Moment	Accelerometer Sensors Robotics
Level 6	Haptics, Time, Audio and Visual (3D)	Behaviour in environment Prediction	Virtual reality Robotics Sensors and cameras

Note: 2D = 2 dimensional; 3D = 3 dimensional

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Thank You for attention!

Q & A