НОВ БЪЛГАРСКИ УНИВЕРСИТЕТ
NEW BULGARIAN UNIVERSITY

Information systems, communication technologies and mobile applications, assisting development disorders

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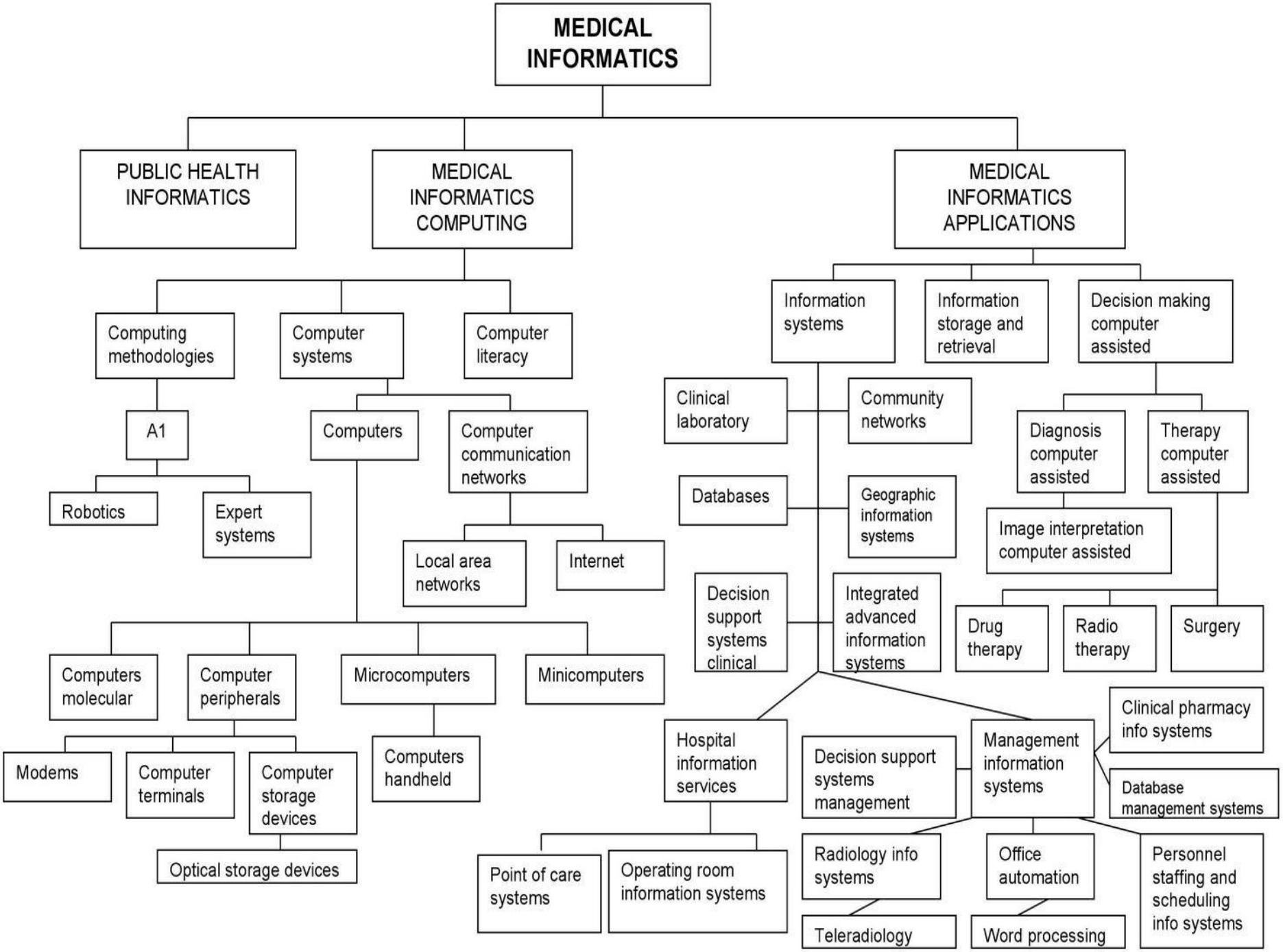
Definitions

"Information Technology is the use of hardware, software, services, and supporting infrastructure to manage and deliver information."

"*Information Technology* is the acquisition, processing, storage and dissemination of vocal, pictorial, textual and numerical information by a microelectronics-based combination of computing and telecommunications"

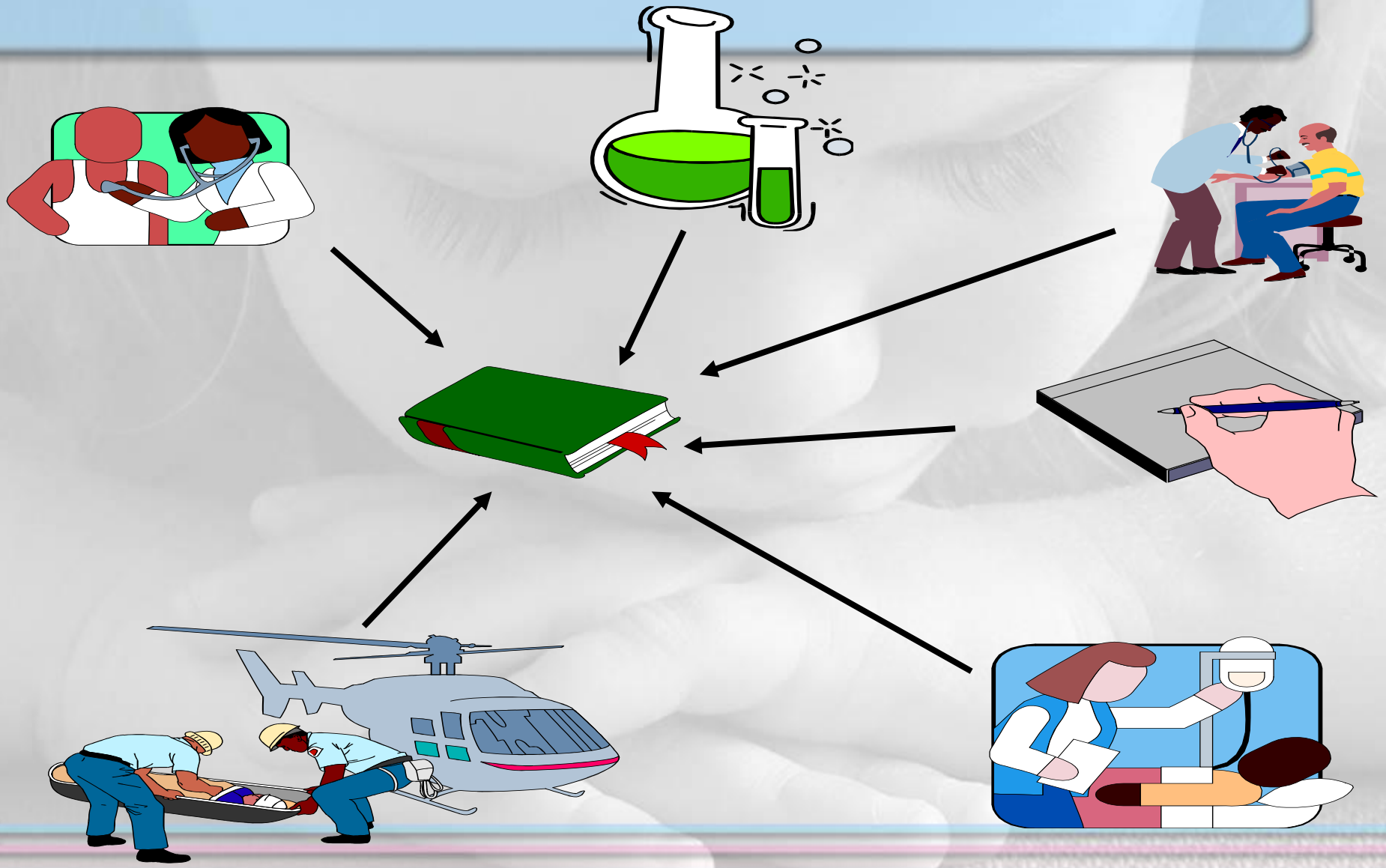
•What do we mean by the terms *medical computer scienc*e, *medical computin*g ,*medical informatics, clinical informatics, nursing informatics, bioinformatics,* and *health informatics*?

- Why should health professionals and students of the health professions learn about medical-informatics concepts and informatics applications?
- How has the development of mini-computers, microprocessors, and the Internet changed the nature of biomedical computing?
- How is medical informatics related to clinical practice, biomedical engineering, molecular biology, decision science, information science, and computer science?
- How can changes in computer technology and the way medical care is financed influence the integration of medical computing into clinical practice.

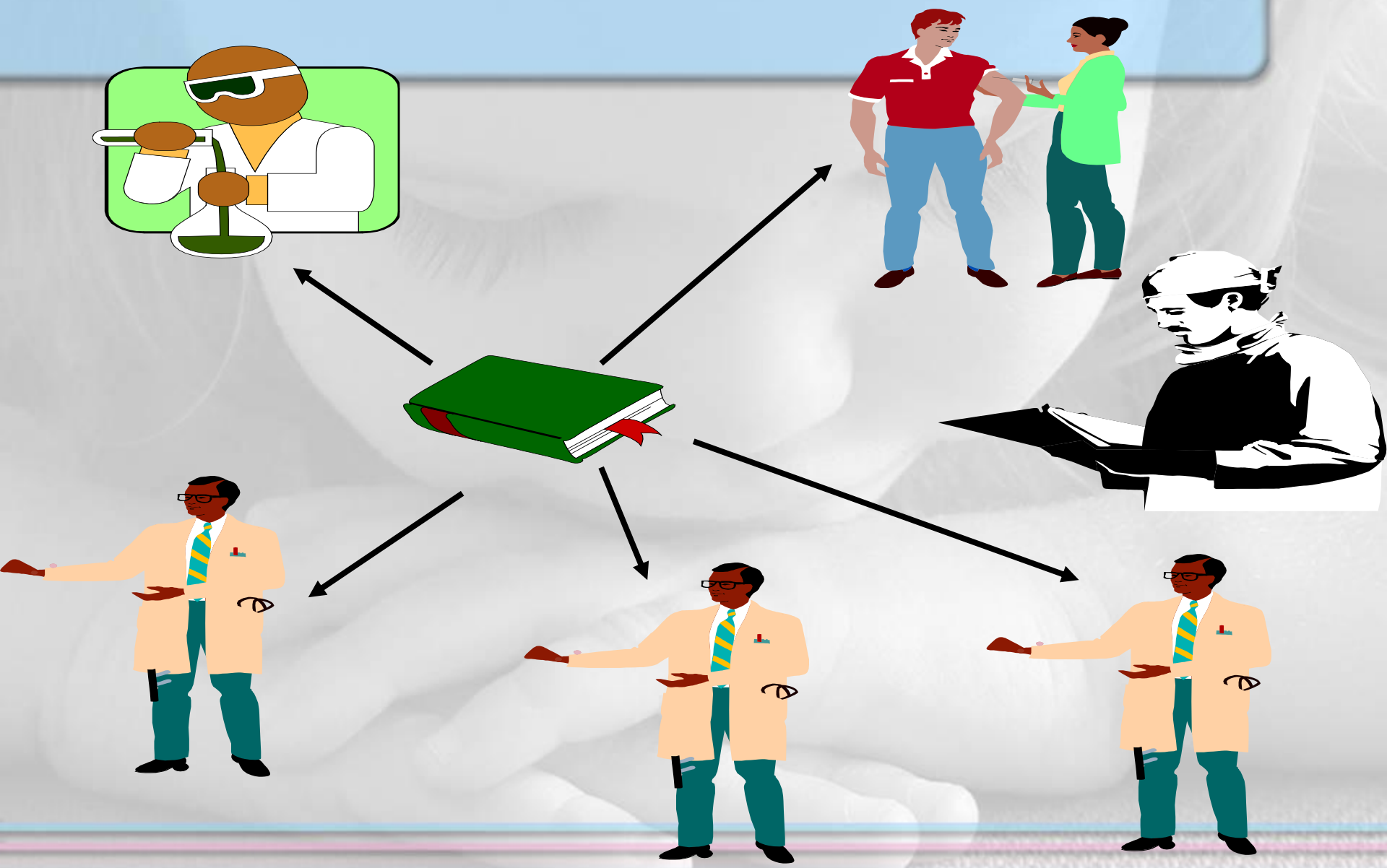

MEDICAL INFORMATICS
PUBLIC HEALTH INFORMATICS
MEDICAL INFORMATICS COMPUTING
MEDICAL INFORMATICS APPLICATIONS
Computing methodologies
Computer systems
Computer literacy
A1
Computers
Computer communication networks
Robotics
Expert systems
Local area networks
Internet
Computers molecular
Computer peripherals
Microcomputers
Minicomputers
Modems
Computer terminals
Computer storage devices
Computers handheld
Optical storage devices
Information systems
Information storage and retrieval
Decision making computer assisted
Clinical laboratory
Community networks
Databases
Geographic information systems
Decision support systems clinical
Integrated advanced information systems
Diagnosis computer assisted
Therapy computer assisted
Image interpretation computer assisted
Drug therapy
Radio therapy
Surgery
Hospital information services
Decision support systems management
Management information systems
Clinical pharmacy info systems
Database management systems
Point of care systems
Operating room information systems
Radiology info systems
Office automation
Personnel staffing and scheduling info systems
Teleradiology
Word processing

Inputs to the medical records

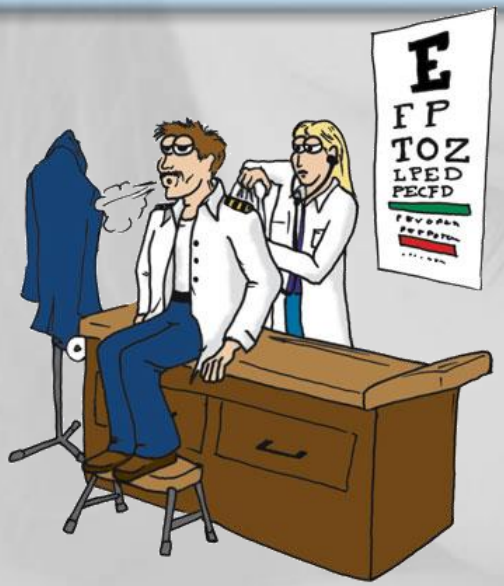
Traditional paper medical records



Outputs of the medical records



Conventional data collection…



Medical records

Data sheets

Hospital storage

Search storage(Long time)

Write Results

How it should be!

Medical records systems

Data sheets

PC Storage

Analyses

Quick and accurate search

Automatic result

Advantages of information technologies

- Stored and protected information.
- Automated processes.
- Accessible.
- Confidential.
- Secure.
- Work remotely.
- Statistics

Some applications of Information Technologies

- Distance learning.
- Speech recognition.
- Simulations.
- Tools for disabled.
- Smart sensors.
- Health and medicine-ct, MRI, patient monitoring devices, microprocessors, pacemakers, distance surgery, device to control surgeons shaking, computerized gene mapping, protein modeling, telemedicine.
- Reducing paper loss.

Applications of Medical Informatics by NASA

to provide:

- Telemonitoring
  - people
  - environment
  - systems
- Tele-education
- Telecare
- Telescience

Telerehabilitation = *e-rehabilitation*

- Method of using information technology to provide rehabilitation services at a distance.
- Telerehab is the delivery of rehabilitation services over telecommunication networks and the internet.

History

- 1998 – “Born”
- 2001 – The first Web based internet application
- 2006 – First science article about getting profit from Telerehab

Benefits of Telerehab

- Improved access
- Distance work
- Reduced travel
- Efficiency
- Cost-effectiveness
- Continuum of Care
- Extend Provider Access
- Improved outcomes

How is it working?

- Most telerehabilitation is highly visual.
- Rich web page application.
- Using mobile technologies
- Speech recognition
- and so on…

Current projects

- Cognitive and Vocational Rehabilitation
- Prevention and Management of Secondary Conditions
- Communication Technology Assessment anTraining
- Capacity Building

Focus area 1 : Cognitive and Vocational Rehabilitation

- R1 Reliability and validity of a remote neuropsychological assessment protocol
- D1 Developing mobile telerehabilitation applications for cognitive and vocational rehabilitation
- R2 Determining the efficacy of a mobile TR portal for delivery of cognitive and vocational rehabilitation

Focus area 2 : Prevention and Management of Secondary Conditions

- R3 A telerehabilitation enhanced wellness program in spina bifida

- R4 Telerehabilitation for self-management of chronic edema/lymphedema in individuals with mobility limitations

Focus Area 3: Communication Technology Assessment and Training

- D2 Development of TR tools for communications technology
- R5 Evaluation of remote AAC service delivery
- R6 Evaluation of remote computer access service delivery

Focus Area 4: Capacity Building

- D3 Technology implementation projects (TIPs)
- D4 Development of outcome measures and a uniform data set

Why using IT technologies in rehabilitation?

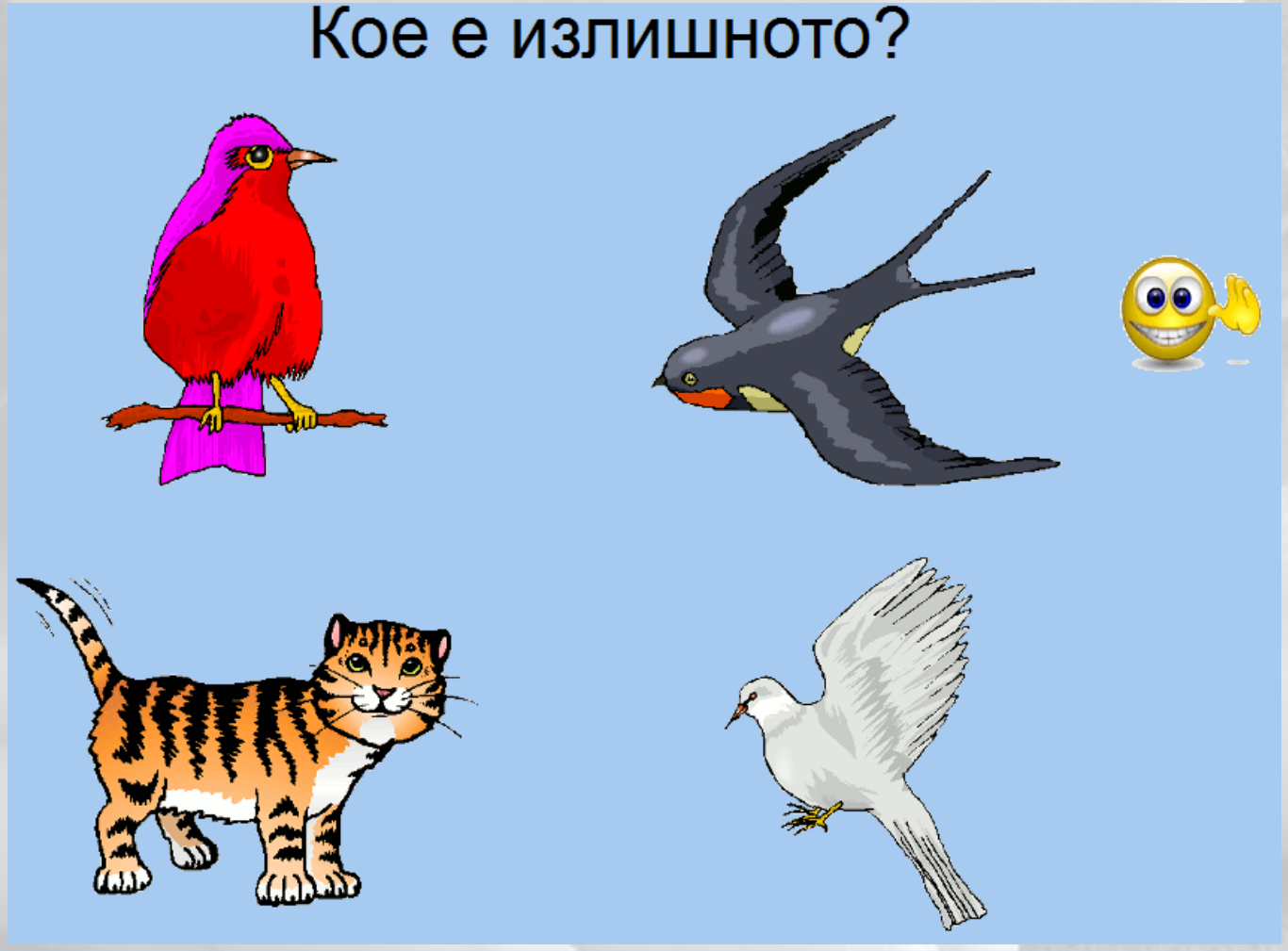
- At least six reasons
  - Safety
  - Effective, evidence based
  - Patient centered, patient values guide decisions
  - Timely, reduce waiting and delay
  - Efficient, avoid waste
  - Equitable, care doesn’t vary by gender, ethnicity, etc

Considerations

Information systems for telecare and telerehabilitattion must take into account three special considerations to meet this population's information needs effectively :

- 1) widely divergent pediatric subpopulations, as well as the unique physiology and diseases of children and special interventions for them;
- 2) connectivity and system integration at the community level, since it is imperative for pediatric practices and institutions to be connected closely to the public health authority and the schools; and
- 3) consumer health information that addresses the needs of the whole family.

Our projects (1) – Children`s assessment



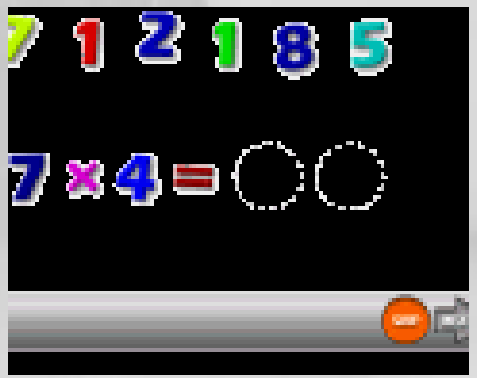
Our projects (2) - Creativity testing

Discalculia

- Сравняване на обекти на височина – колко пъти се нанася един обект върху друг
- Curious Geroge

- Повече, по-малко – липсващ оператор
- 1 or 2 more than

- [Times Tables target game]



- Връзка операция и конструиране на число с точните места на единиците и десетиците
- [Build the answer]

- Multiplication games
- [Multiplication to 25 e.g. 5 x 5]
- [Multiplication to 45 e.g. 5 x 9]
- [Multiplication to 81 e.g. 9 x 9]

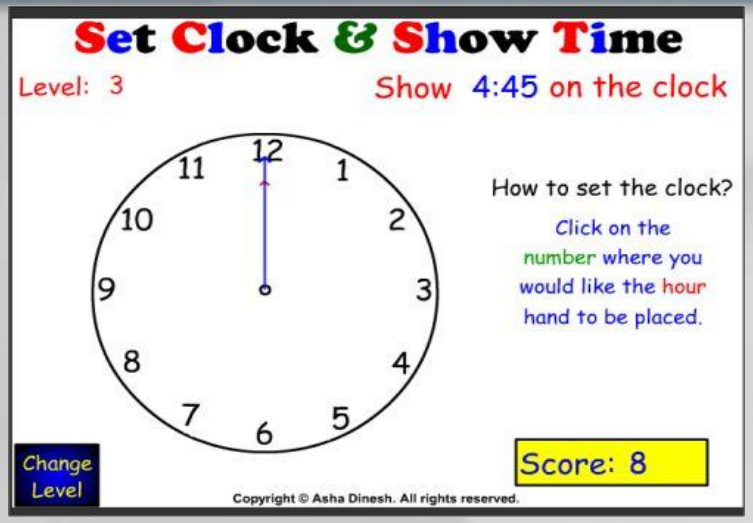
- Игра с карти
- [Drag and Drop]

- 2 times table
  - 1 x 2 = 2
  - 2 x 2 = 4
  - 3 x 2 = 6
  - 4 x 2 = 8
  - 5 x 2 = 10
  - 6 x 2 = 12
  - 7 x 2 = 14
  - 8 x 2 = 16

Calculating table-game

- Times tables practice
- tabs

Часовник



- Set a Clock and Show Time

- Time is…

integers	fractions	concepts	geometry
Arithmetic	Identify	Time	

ехнологични решения в елерехабилитацията

- Provide real-time biofeedback (feel, see, hear)
- Objective Measures - Monitor progress, tracking outcomes, evidence for third party payers, clear to patient
- Relevant to society
- Motivating, Engaging, Stimulating
- Marketing Tool: Screening, Research
- Real Life Simulation in Clinic
- Errorless learning

- 3 crucial elements for the acquisition of motor programs through rehab : **adequate feedback, variability of practice, and design of learning situation.**
- “Patients with motor dysfunction are totally dependent on the information concerning the outcomes of the attempts to perform motor tasks especially during the acute stage”. -Mulder

- “…allow precise recording of movements and application of forces…valuable tool for motor rehabilitation….visual cues conveyed on a computer screen to convert repetitive movement practice into an engaging task... information sent to the patient about exercise performance…address psychosomatic variables influencing therapy” (3).
- “Assistive technologies can open new worlds for individuals with physical, communication, and cognitive limitations.” “A new technology may also help someone with a chronic or progressive disabling condition maintain or improve his or her independence” (4).

Устройства за физическа телерехабилитация

- Myomo
- Neuromove
- Balancemaster
- Biodex Balance System SD
- Armeo
- Lokomat
- Restorative FES Cycles
- GAITRite
- Free Supported Ambulation System (SAS)
- Tibion
- CAREN

Biodex Balance System

- Description: Force platform for testing and training of static and dynamic standing balance.
- Capabilities: Fall-risk screening and training, Postural stability, Clinical Test of Sensory Integration of Balance (CTSIB), compare scores to age-dependent norms, charts progress over time, determine which of 3 balance systems pt is relying on.
- Screening: Concussions

- Evidence: Effective with CVA and Mild TBI (Concussion)
- Cost: ~ $12,000
- Very common in clinics
- Video

http://www.biodex.com/physical-medicine/products/balance/balance-system-sd

(3:08 total (to 1:40)

Biodex Balance System

- 6 interactive training modes in Static and Dynamic: Postural Stability, Maze Control, Weight Shift, random Control, Limits of Stability, Weight bearing. Large Color Touch Screen, Interactive, game-like balance. 4 Standardized tests: Static Measuring Capability, Increased Dynamic resistance, Standardized Fall Screening Test Protocol, Athlete Knee Injury Screening Test protocol.

NeuroMove

Cleared by FDA in 2001

- Stroke rehab by muscle re-education
- Relaxation of muscle spasms (spasticity)
- Prevention of retardation of disuse atrophy
- Increase local blood circulation
- Maintaining or increasing ROM

How it works

Video: http://www.neuromove.com/neuromove-therapy-video/

- Detects attempts below where trace movements are visible. Distinguishes between regular muscle activity, muscle tone, and real attempts.
- When a real attempt is detected, the unit rewards the patient with muscle contraction, *visual and sensory feedback serves as an important element in relearning the movement.*
- Very motivating, see they could make a difference, where previously, they had no indication of their attempts.

More Info

- Concentration and focus is the key to achieving better control of motor functions
  - Doesn’t work on confused or cognitively low patients
- Use 1 - 3 X/day for ~ 20 minutes; longer intervals not common
- Effective for spastic & flaccid extremities
- International Functional Electrical Stimulation Society

Clinical studies

- Classically backed by biofeedback principals
- Most of the studies included patients between 6 months and 14 years post-stroke, subjects were motivated and cognitively intact, and the findings were:
- Improvements were in form of improved strength, range-of-motion, reduced spasticity and tone, flexibility, and motor capability in general.

*** Regular therapy and electrical stimulation was less than half as effective!

Research resources

- Electrical Stimulation Driving Functional Improvements and Cortical Changes in Subjects With Stroke. (2003) Teresa J. Kimberley, Scott M. Lewis, Edward J. Auerbach, Lisa L. Dorsey, Jeanne M. Lojovich and James R. Carey, University of Minnesota. “Experimental Brain Research”.
  - These findings suggest that NMES may have an important role in stimulating cortical sensory areas allowing for improved motor function.
- Electromyographically triggered electric muscle stimulation for chronic hemiplegia. (1987) R.W. Fields, Arch. Phys. Med.Rehabil 68(7):407-14.
  - Progress often far exceeded that of previous conventional therapy. Regarding mechanisms, impaired proprioceptive feedback is considered central to stroke-disrupted sensorimotor control. EMG-triggered EMS is intended to improve brain relearning by reinstating proprioceptive feedback time-locked to each attempted movement. Clinical results were consistent with this theory.
- Mental Practice of Motor Skills used in poststroke Rehabilitation has Own Effects on Central Nervous Activation. (1994). T. Weiss, Ellen Hansen, R. Rost, L. Beyer, F. Merten, Christa Nichelmann, and C. Zippel. Intern J. Neuroscience, 1994, Vol. 78, pp 1 57-166.
  - It has been shown that the use of the EMG triggered electrical myostimulation (ETEM) brings good results in poststroke. The technique is most powerful if imagination of motor acts (the so called mental practice) is used as an initial part of ETEM.
- Home-based electromyography-triggered stimulation in chronic stroke. (2005). Clin Rehabil 19(7) 737-745.
  - ETMS use is feasible in the home environment. Neither participation in a traditional home exercise program nor ETMS use conveyed changes on the Fugl-Meyer or Action Research Arm Test. However, ETMS use increased active affected limb extension. This new movement may provide a potential pathway for subjects to participate in other interventions, such as modified constraint induced therapy.

How to purchase

- **Clinic Use:** MSRP $ 5,950, however there is a 20% discount for a total of **$4,670** if the amount is paid in full

- Patients can *lease* the Neuromove starting at **$99/ month** and other plans are available
  - Part time patients can feel confident they are not losing out on valuable Physical and Occupational Therapy, when their cognitive program is winding down or limited due to insurance

- Discharge preparation- given as a *resource* to continue therapy when appropriate.
  - Especially for those who are losing insurance or prematurely discharging

SMART Balance Master
by Neurocom

- Moving platform posturography,: also called computerized dynamic posturography (CDP): method of quantifying balance.
- Description: The PRO Balance Master® provides objective assessment and retraining of the sensory and voluntary motor control of balance with visual biofeedback on either a stable or unstable support surface. VESTIBULAR REHAB. Utility in malingering. Fall Risk Assessment and Balance conditioning.
- Useful for identifying pts who could benefit from vestibular rehab and which balance system is involved
- Moveable Forceplate and surround. EMG option.
- Availability for demo: TWU
- Other clinics (Shepherd, BIR, fairly common)
- Video: http://www.youtube.com/watch?v=L72Vx_F-b18 (1:51)

STANDARDIZED ASSESSMENT PROTOCOLS	VSR™	Basic Balance Master®	Balance Master®	PRO Balance Master®	SMART Balance Master®	SMART EquiTest®	EquiTest®
Sensory Organization Test (SOT)*					✓	✓	✓
Head Shake-Sensory Organization Test (HS-SOT)				Optional	Optional	Optional	Optional
modified Sensory Organization Test (mSOT)				✓			
modified Clinical Test of Sensory Interaction on Balance (mCTSIB)	✓	✓	✓				
Center of Gravity (COG) Alignment	✓	✓	✓	✓	✓	✓	✓
Dynamic Visual Acuity Test (DVA)	Optional	Optional	Optional	Optional	Optional	Optional	Optional
Gaze Stabilization Test (GST)	Optional	Optional	Optional	Optional	Optional	Optional	Optional
Adaptation Test (ADT)*				✓	✓	✓	✓
Motor Control Test (MCT)*						✓	✓
EMG / Postural Evoked Response (PER)				Optional	Optional	Optional	Optional
Balance Strategy Analysis				✓	✓	✓	✓
Limits of Stability (LOS)	✓	✓	✓	✓	✓	✓	
Rhythmic Weight Shift (RWS)		✓	✓	✓	✓	✓	
Weight Bearing Squat (WBS)		✓	✓	✓	✓	✓	✓
Unilateral Stance (US)		✓	✓	✓	✓	✓	✓
Sit-To-Stand (STS)			✓	REQUIRES THE LONG FORCEPLATE OPTION			
Walk Across (WA)			✓				
Tandem Walk (TW)			✓				
Step/Quick Turn (SQT)			✓				
Step Up/Over (SUO)			✓				
Forward Lunge (FL)			✓				
Training for habituation and compensation on a fixed or moving surface				✓	✓	✓	
Training for habituation and compensation in a fixed or moving visual environment					✓	✓	
Seated Balance Training		✓	✓	✓	✓	✓	
Weight Bearing and Mobility Training		✓	✓	✓	✓	✓	
Closed Chain Training		✓	✓	✓	✓	✓	
Custom Training	✓	✓	✓	✓	✓	✓	✓

Computerized Dynamic Posturography (CDP) includes SOT, MCT, and ADT, available on EquiTest® and SMART EquiTest only.

Armeo (Boom-Spring-Power)

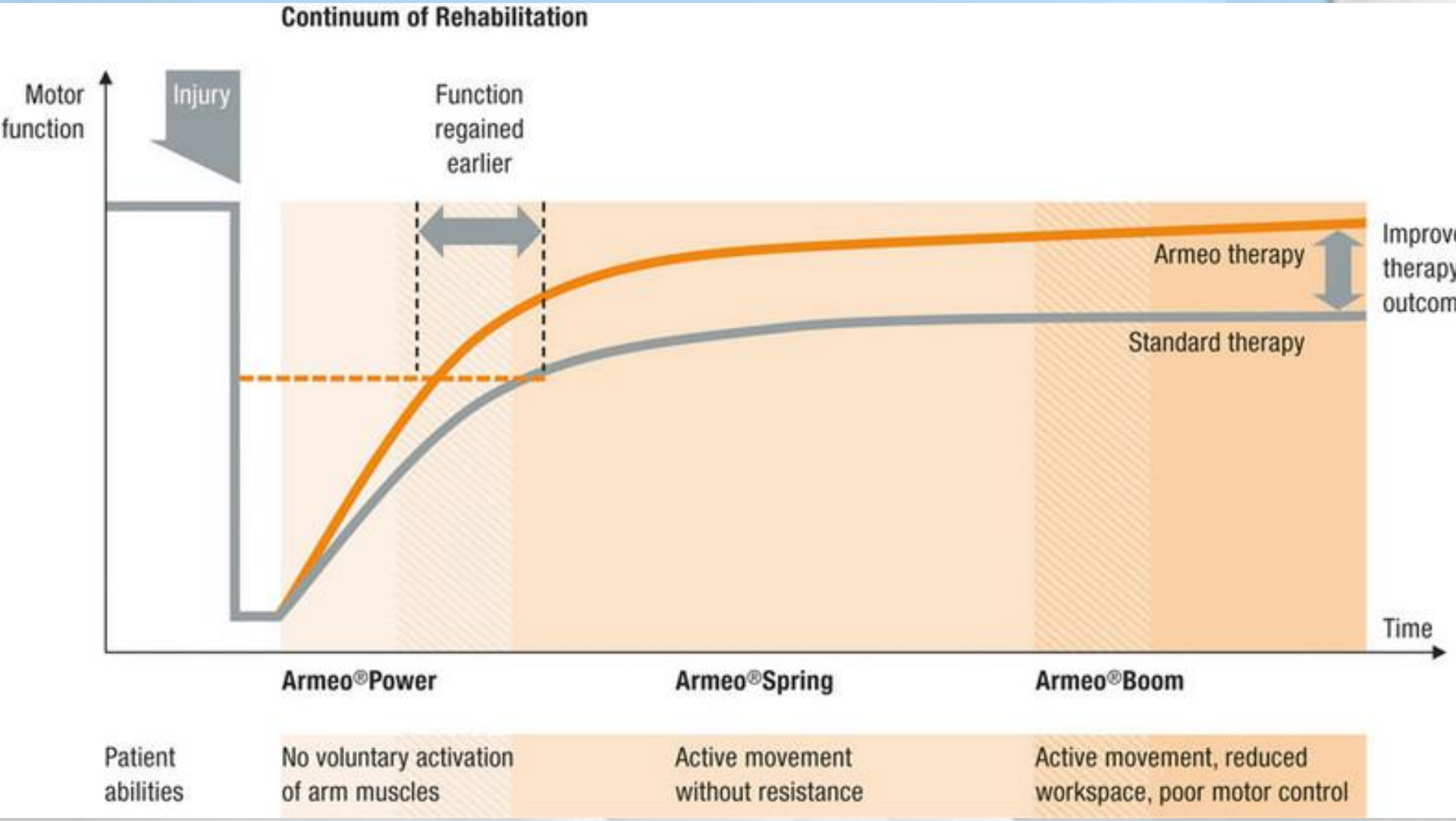
Suitable for individuals who have suffered strokes, traumatic brain injuries, or neurological disorders resulting in hand and arm impairment.

How does it work?

Video: http://www.hocoma.com/en/products/armeo/armeo-spring/

- Adjustable arm support with a highly sensitive hand grip and videogame-like exercises to simulate arm movements used in specific real-life tasks
- Exercises are carried out in the virtual environment on a computer screen, providing you with goal-oriented tasks and giving you immediate visual feedback.
- Because the weight of the arm is counterbalanced in the arm support, you can use residual neuromuscular control to perform the exercises and gradually build strength in your arm.
- Built-in sensors and software record arm movements at each joint, so you and your therapist can track your improvement, determine the appropriate difficulty level for you and customize your training program as you progress.

Other clinics: UT Southwestern, TWU Dallas, TIRR Houston, RIC, Ireland, & Germany



Clinical studies

- **87% of participants who received Armeo training demonstrated motor improvements in their arm compared to 69% of subjects who completed conventional arm exercise**
- **More than 80% of all participants preferred Armeo to conventional exercises and would recommend the Armeo exercises over conventional exercises.**
- **On the Fugl-Meyer clinical test; both groups had the same training time and therapist supervision. * (RIC study)**

The latest clinical findings show that therapeutic methods that are based on active, high-intensity, task-specific movement training are superior to traditional methods

How we can obtain

- **Cost: <u>$60, 500</u>**
- **Lease to own option: <u>$1,122 for 60 months</u>**

- "*.. very reasonably priced unit (called the ArmeoSpring) for patients who are able to self initiate movement. (I am scheduled to install 3 ArmeoSpring units and train the staff for each of the rehab hospitals in Houston/Austin, Texas next week!) Additionally, we have gotten 3 requests for quotes and information on this upper extremity technology from the Dallas area in the last 2 months! Right now the only units in Texas are at UT Southwestern and Texas Woman's University in Dallas and at TIRR in Houston*." April Philpot, DPT
  Southeast Account Manager

- Presenters will visit Dallas locations, if possible.

Lokomat by Hocoma

Nanos and Pro

- Robotic Gait Orthoses

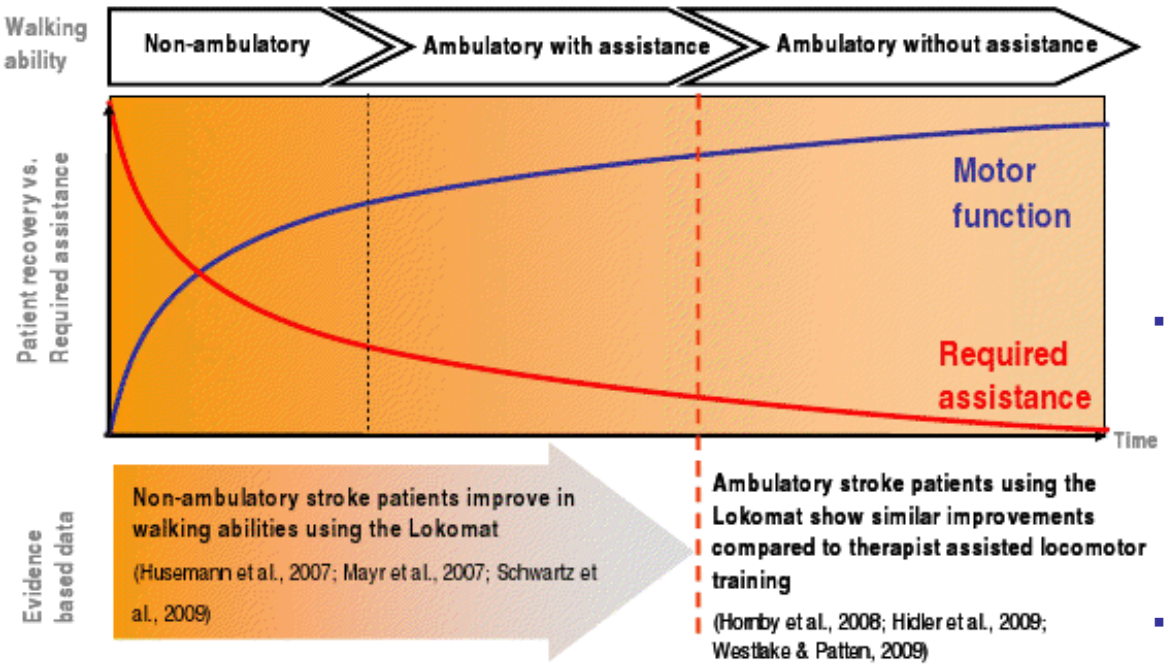
- Longer and more intensive training sessions compared to manual treadmill Training (principles of motor learning), real time feedback for a higher motivation and compliance, physiological gait pattern provided by individually adjustable orthoses, guidance force and body weight support, assessment and reporting functionality for an easy measurement of the patient's progress, task-specific, repeated practice of movement (errorless)

- Gait asymmetry may be associated with many potential negative issues (eg, challenges to balance control, increased energy expenditure, increased risk of musculoskeletal injury to the nonparetic LE, and decreased overall activity levels) (12).

Lokomat

- Evidence: “assumed”Reduced spasticity, Improved walking ability, Increased alertness, Strengthened leg muscles, Improved stamina, Increased motivation
- Cost: $150-300 K- available for lease for purchase
- Availability for demo: Inservice or demo at UTSW
- Other clinics- Craig, RIC, TIRR, Spaulding, Shepherd Center, Carolinas Rehab.
  - VA Houston, Dallas, San Antonio. UTSW Dallas. TIRR Houston. TIRR is only one used for tx. http://lifecenter.ric.org/index.php?tray=content&tid=top1&cid=5722
- Video http://www.hocoma.com/en/products/lokomat/lokomatpro/ (1 min)
- Severely impaired ambulating stroke patients benefit from the task-oriented and intensive training .
  - Ambulating stroke patients show improvements with the Lokomat system as well but require a challenging and variable training program either via therapist assisted or Lokomat assisted locomotor training.•
  - Locomotor improvements might depend on an early training onset as well as a high number of repetitions which can be applied with the Lokomat system.

Use of Lokomat ® in stroke patients



- Systematic review.
  414 CVA subjects. Electromechanical-assisted gait training combined with physiotherapy, improves recovery of independent walking and walking distance in patients who could initially not walk independently
  -(Mehrholz et al., 2007).

- Studies comparing efficacy of either robotic assisted locomotor training (LT) or therapist assisted
  - Review of 30 articles
    - (14 RCTs, 16 non-RCTs)
  - Limited evidence – beneficial for improving walking function in populations of patients with CVA, MS, TBI, or PD
    - Teffertiller, et al -2011

- **Significantly better effects of robotic** assisted treadmill training in comparison to therapist assisted treadmill training, though both groups improved in various locomotor tests. In these studies acute/subacute stroke patients with the **inability to ambulate** without assistance were trained within the first three months.

- Manually assisted treadmill training has proven to be rather difficult in these patients due to **their reduced body weight support, lack of distal control, and high demand on PTs**. -Schwartz et al. (2009)

Myomo

FDA approved

- **Brain injury rehabilitation by muscle re-educa**
- **Maintain or increase range of motion**

Video: http://www.youtube.com/watch?v=VvpFpZC4UZk&feature=player_embedded

- The arm brace has EMG sensors that sit on the skin's surface and detect even a very faint muscle signal.
- Person with weak or partially paralyzed arm tries to move their arm and a muscle signal fires, the robotics in the mPower 1000 engage to assist in completing the desired movement.
- In helping achieve desired movement, the device can be worn as a functional aid, used during exercise to maintain gains or applied as a rehabilitation device that re-teaches arm movement to the brain.

Research Resources

- Based on a completed clinical research study at University of Cincinnati, Myomo has developed the PERL Technique, a set of research-based treatment plans that integrate the mPower 1000 into therapy programs that aim to increase functional activity. (Push-Eat-Reach-Lift)
- The device has been clinically tested with scientific partners that are experts in stroke upper extremity rehabilitation. Their partnership along with the help of over 50 stroke subjects has allowed us to come up with clinical protocols and guidelines that work for both acute and chronic patients. These guidelines are given to our certified therapists during our CE accredited training for PTs and OTs.

- Electromyography-Controlled Exoskeletal Upper-Limb-Powered Orthosis for Exercise Training after Stroke. (2007). Stein J., et al. Am. J. Phys. Med. Rehabil. Vol. 86.
  - The Myomo device may serve as a therapy gateway for severe chronic patients who are so impaired that they currently are ineligible for other upper extremity stroke treatments

- (Title Unknown). (2000). Lipert J. et al. Stroke. 31:1210-6
  - Shows that task-based repetitive training may facilitate neural plasticity with concomitant improved motor abilities and enhanced functional performance

- InREACH Study In December 2010, a randomized control study of 30 subjects was completed. The goal of the study has been to compare therapy with Myomo to standard treatment. Currently, thirty chronic stroke survivors are receiving six weeks of therapy three times per week for one hour. The treatment sessions focus on three outcome measures that have been proven to be valid and reliable in the literature. The outcome measures include the Fugl Meyer (Impairment Measure), COPM (Functional Measure) and the SF36 (Quality of Life Measure). Additionally, kinematic data is being collected. The initial outcome measures have been very promising, with patient improvement seen in all areas. Publication of the first data set is pending.

How can we obtain

MSRP for **clinic use is $16, 500**- includes left and right device, android tablet and training and certification for 6 therapists. Rental options also available.

- Myomo for Clinical Organizations- has been used by therapists in community hospitals, rehabilitation hospitals and clinics, skilled nursing facilities and home healthcare agencies as part of neurological rehabilitation programs since 2007.

They can schedule an *in-service presentation* which takes about 30 minutes and can be presented via the Web.

- For individual use, insurance may cover all or part of the cost of the Myomo Mobility System for home use which would have similar benefits as the NeuroMove (hope after discharge; *resource* for recovery)

GAITRite

Simple observational gait analysis is subjective

- Description: Big screen for patients, Portable, Carpeted, pressure sensors, computer, 1/8" thick, 2-feet wide by 16-feet long(can be up to 26-feet long) and contains 18,482 sensors sandwiched between a thin vinyl top-cover and a rubber bottom. Have norms.
  - It rolls up to fit into a wheeled carrying case. The carpet is portable, can be laid over any flat surface, and requires minimal setup and test time. No markers or devices have to be placed on the patient. Patients can be tested with or without shoes, including those patients using assistive devices.

- Purpose: Objective measurement system, quantifiable evidence of change. Electronic footprints: Measures cadence, step length, Step-to-step symmetry and variability, velocity, and other gait parameters. Tracks, reports, graphs, prints-instantaneous data.
  - Validate impairments and progress to insurance/patient/family.
  - Determines dynamic balance and fall risk. Community Screening. Dual Task.
  - Prescribe assistive devices , FES devices, AFO, Neglect glasses.
  - Treatment-Weight Shifting.

Rite

- Evidence: high concurrent validity with various motion analysis systems(2). High test-retest reliability (2).
- Cost $34-58K
- Available for on-site demo.

- Other clinics
  - COPE- Center for Orthotics and Prosthetics in Chicago; San Antonio
- Video http://www.youtube.com/watch?v=DKdvEJDFRtE&feature=related (3:51)
- http://www.screencast.com/t/148Gf42mT password = gaitrite (1:50)

GAITRite

- Precise, objective gait analysis is necessary to quantify changes in gait and identify fall risk
- Dual task (7)
  - NP testing revealed mild deficits in attention and executive functioning so it was concluded that the cognitive impairment was responsible for gait disorder and recurrent falls while dual-tasking. She had normal gait with fast and slow speed as well as leisurely. As previously mentioned, walking is a complex motor task, yet generally performed automatically by healthy adults. The attentional demands are therefore minimal. In older adults, age-related neuromotor changes such as reduced motor strength or decreased sensory input (vision, hearing, proprioception) increase the attentional demands needed for walking. This increased demand is met at the cost of a reduction in the central processing capacity for attentional reserve
- High agreement between temporospatial gait parameters derived from an electronic walkway and a video-based motion capture system in healthy and chronic stroke subjects (8).
- Able to quantify variants in stroke gait compared to normal and with assistive device (9).
- Slower gait speed and worse performance on: swing time variability, double support phase, stride length variability: associated with higher risk of falls. Quantitative gait markers are independent predictors of falls in older adults. (597 adults followed up for incident fall rate) (10).
- Effect of AFO: Improved gait in CVA with AFO donned. Future study on types of AFO and timing in recovery (11).
- Temporal asymmetry can be found in many independently ambulating stroke patients. There is a need for a standard assessment of poststroke gait symmetry in light of the complex relationship with motor impairment and velocity (13).
- Quantitative gait measures predict future risk of cognitive decline and dementia in initially non-demented older adults (14).

Restorative Therapies RT300

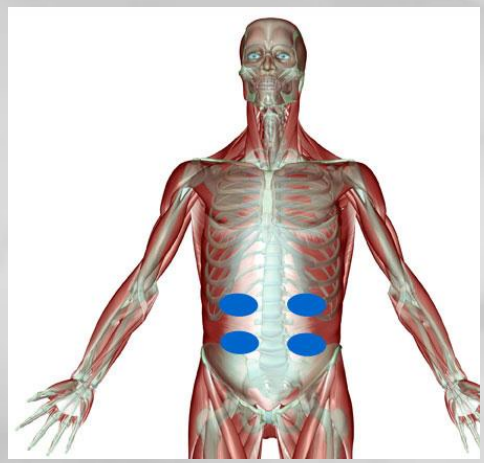
Cleared by FDA in 2007

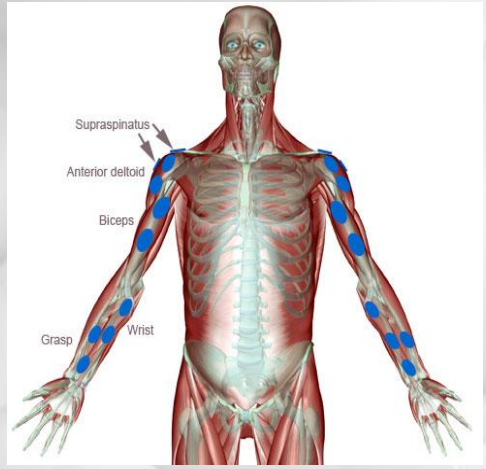
- **Relax muscle spasms**
- **Prevent or retard disuse atrophy**
- **Increase local blood circulation**
- **Maintain or increase range of motion**

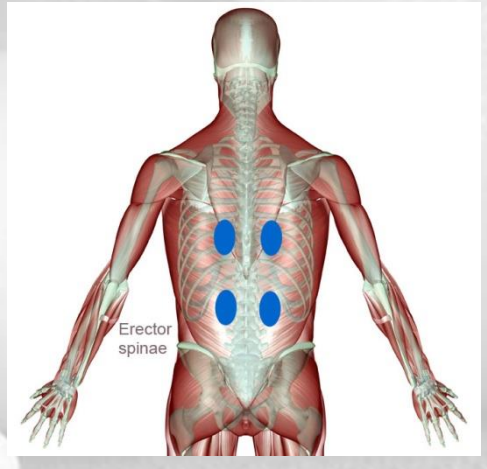
How it works

Video: http://www.youtube.com/watch?v=gcadj18Dsjc&feature=player_embedded#!

- *Activity based therapy*, promoting wellness, and aiding in preventing further disease
- Patients with dense hemiparesis or cognitive deficits of may still benefit from the effects FES has on both the cord and PNS components.
- Controlled stimulation patterns sent to arms, shoulder and trunk through electrodes, producing a smooth cycling motion
- 30 minute sessions at least 3 X/ week
- Stimulate up to 10 muscle groups in one or both legs or arms and the trunk







Special Features

- *Weekly email detailing the progress* of patients & make adjustments to therapy settings on the web
- Therapy settings are stored online for instant access
- Historical data for each patient & graphical progress and comparison charts available
- Every 5 seconds logs- Oxygen saturation·Pulse rate·Power -power generated by the patient's muscles·Stimulation level·Resistance·Control speed·Crank velocity·Drive torque·Motor velocity
- Every session graphs-·Distance Traveled ·Expended Energy ·Expended Energy per Hour ·Peak Pulse ·Average Pulse Rate ·Average Asymmetry · Average Stimulation ·Muscle tone measurements

More Info

Used in over 200 clinics in the USA including: **Courage Center**, MN; **Craig Hospital**, CO; **CORE**, Fl; **Total Rehab Care**, MD; **Shepard Center**, GA; **Sheltering Arms**,VA; **Woodrow Wilson Rehab Center**, VA

RT300 may facilitate improvements that help patients reach functional gains in a shorter time period. While it should not be used in place of a functional activity, it can certainly be used as an adjunctive therapy.

In a rehab setting, it is more typically used for shorter durations to impact a more *task specific goal*, such as *breaking up spasticity or neuro re-education*.

"There is almost no patient with upper motor neuron weakness that can't benefit from some type of FES cycling. It has benefits for cardiovascular conditioning, strength, reciprocal gait patterns and tone modulation."

Darryl Kaelin, M.D., Medical Director for the Acquired Brain Injury Program at Shepherd Center in Atlanta, GA.

Research Resources

- Cycling induced by electrical stimulation improves motor recovery in postacute hemiparetic patients: a randomized controlled trial. (2011). Ambrosini E, et al. Stroke. 42(4):1068-73.
  - The study demonstrated that 20 sessions of FES cycling training significantly improved lower extremity motor functions and accelerated the recovery of overground locomotion in postacute hemiparetic patients. Improvements were maintained at follow-up.
- Bilateral upper limb training with functional electric stimulation in patients with chronic stroke. (2009). Chan, M. K., Tong, R. K., Chung, K. Y. Neurorehabil Neural Repair. 23(4):357-65.
  - This study was a double-blinded randomized controlled trial. At baseline comparison, there was no significant difference in both groups. After 15 training sessions, the FES group had significant improvement on the Fugel-Meyer and Functional Test for the Hemiplegic Upper Extremity, and active range of motion of wrist extension when compared with the control group.

How we can obtain

- **$22,000 for device and cart**
- Trial period is available
- 4 hour web based course required before your new RT in-service

Free Step Supported Ambulation by Biodex

- Description: Body weight supported harness for gait. Uses an overhead track and harness.
- Purpose:
  - Therapist and pt safety and independence.
  - Decreases fear of falling
  - Requires less staff for balance activities
  - High fall risk pts 1:1
  - More assisting less supporting
- FITT
- Cost
- Other clinics: Shepherd Center
- Video: http://www.youtube.com/watch?v=lIfgyCy1TNg (3:11)

Tibion

PK100 Bionic Leg Orthosis

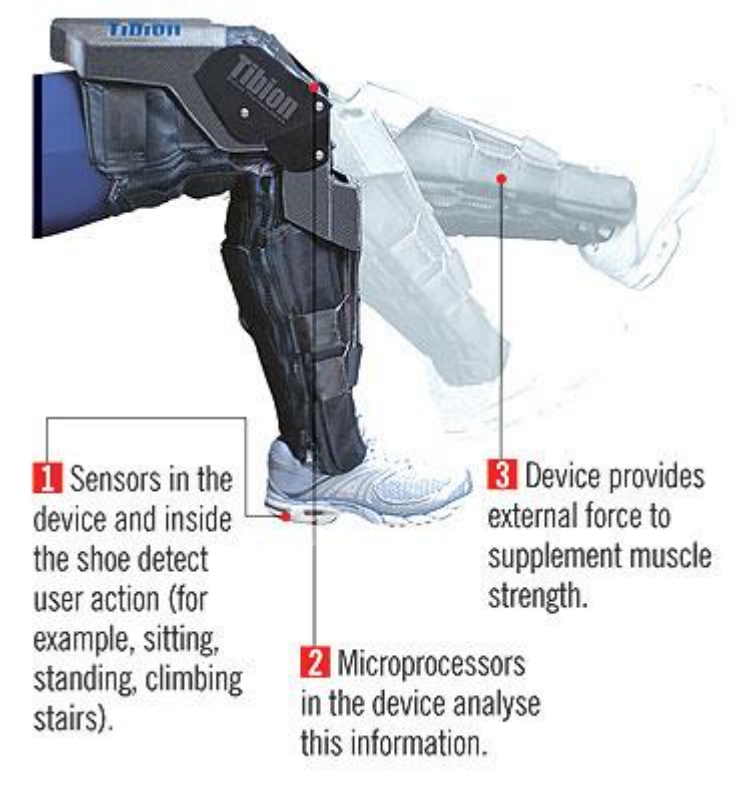
•Description: Robotic aid that aids the knee in flexion and extension. Activated by foot sensor, follows parameters set by PT. Worn during therapy sessions for strengthening and movement retraining.

•Benefits: More sit-to-stand exercises, More overground steps per session, More repetition of stair-climbing, Increased potential for "neuroplasticity". Compared to NMES, not affected by tone, spurs motor recovery via sensors that allow the device to respond to patients intentions.

•Evidence: Improves gait speed, endurance, balance. Even in 10 years post CVA

•Video: Before and After http://www.tibion.com/patients (1 min)

Tibion



- Cost: $700-1,000/month to rent. $40,000.
- Evidence
  - Untethered mobility. 3 ambulatory s/p CVA
  - All subjects improved balance, gait and functional performances with mean individual improvements of 12.6% for BBS, 12.0% for 6MWT and 16.7% for EFAP post-treatment. No adverse events occurred.
  - May have benefited from the task-specific functional training program augmented by RKO use.
    - -Wong, 2011

Cyberdyne

MIT

Argo Medical Technologies

Berkeley Bionics

Berkeley Bionics

U Michigan

Exoskeletons

Raytheon

Tibion

Laval U

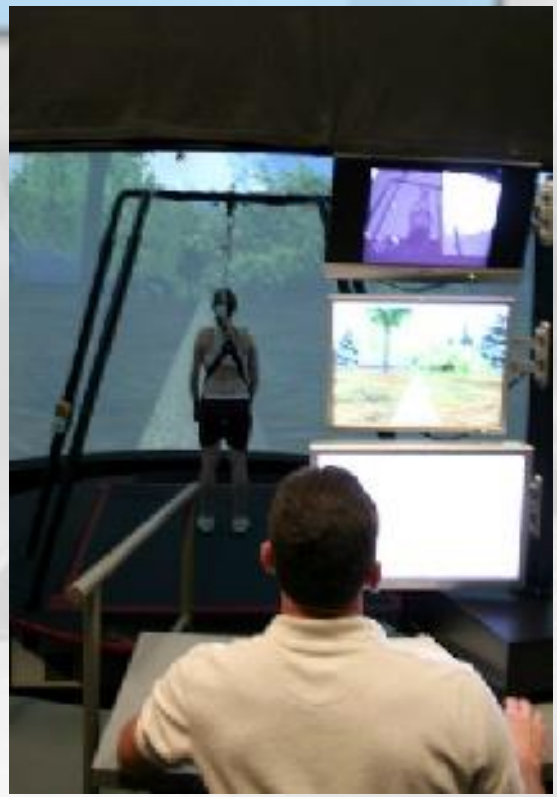
Honda

Honda

CAREN

- Computer Assisted Rehabilitation Environment
- The CAREN, a 21-foot dome, helps researchers analyze how patients react to different walking speeds, inclines and environments. (5)
- “Walking down a busy street? See other pedestrians around you. See the buildings. Hear and see traffic. A walk in the woods? See the trees, hear the wind and the birds, feel the trail twist and turn under your feet. Computers linked to sensors on the body move a treadmill to match the ground you’d be walking over and adjust video images all around to what you’d see and hear as you walk.” (5)
- Can be used with wheelchair.
- 7 in the world. Mild TBI and Amputee.
- Center for the Intrepid
- http://www.youtube.com/watch?v=ZCiGOWUPYZY&feature=related
- http://www.youtube.com/watch?v=LfkkPsPaEF8&feature=related

CAREN




Speed
91

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Thank You for attention!

Q & A