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Stroke Treatment Across The Care Continuum Virtual Conference

Guest Editor:
Salvador Bondoc, OTD, OTR/L, BCPR, CHT, FAOTA

Stroke Treatment Across The Care Continuum Virtual Conference CEU Series

Virtual Conference CEU Series

For OT Practitioners

PART 1

STROKE RECOVERY AND IMPLICATIONS IN THE CONTINUUM OF CARE

Objectives

After the course, participants will be able to

1. describe the natural and functional recovery process following stroke
2. describe the rehabilitative implications from the early stages of recovery to greater than 2 years (chronic period) post stroke that considers neuroprotection and neuroplasticity as key mechanisms to functional outcomes.
3. reconsider traditional approaches to rehabilitation during for chronic onset stroke.

5 – Day Program

Part 2: Taking the Mystery Out of Mastery in Stroke Rehabilitation Practice

Part 3: Neural Priming for Post-Stroke Upper Limb Hemiparesis

Part 4: OT's Role in Managing Visual and Cognitive Impairments

Part 5: Facilitating Return to Work after Stroke across the Continuum

OUTLINE

- Stroke epidemiology
- Natural recovery and rehab implications
  - Physiologic healing vs. Early rehabilitation
- Functional recovery and neuroplasticity
  - Development of compensatory strategies
  - Development of learned non-use
  - Motor relearning
- Beyond the plateau
  - Rethinking rehabilitation in the chronic stages
- Q and A

Stroke Epidemiology

- Leading cause long-term disability
- Top 5 leading cause of death
- Approx. 5 M stroke survivors are alive today
- Nearly 800,000 new strokes every year

American Heart Association
Centers for Disease Control & Prevention

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Stroke Outcomes

- Mortality = 130,000/year or 1 of 20 deaths
- Recurrence = 1 of 4 (185,000/ 795,000)

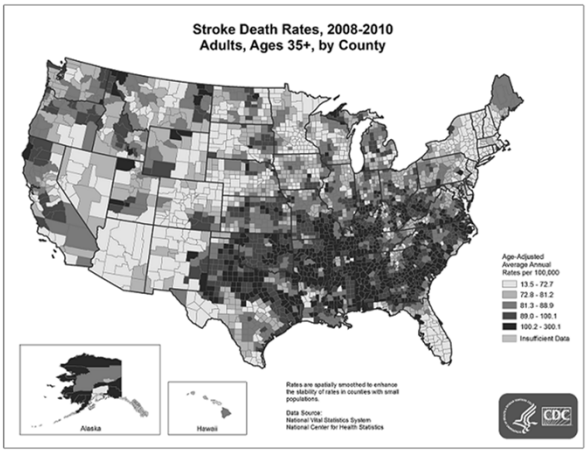

Table. Number and characteristics of hospitalizations for stroke: United States, 1989, 1999, and 2009

Characteristic	1989	1999	2009
Total stroke hospitalizations	795,000	961,000	971,000
Average age of hospital inpatients (years)	71	71	70
		Percent	
Proportion by sex			
Male	43	45	48
Female	57	55	52
Proportion by age group			
Under 65 years	24	27	34
65 years and over	76	73	66
Proportion with comorbidities			
Diabetes	18	23	23
Hypertension	37	55	58
Atrial fibrillation	10	12	12
At least one of the above comorbidities[1]	65	91	94

[1]Percentage of stroke inpatients with one or more of the above comorbidities in diagnostic fields 2 through 7 on the National Hospital Discharge Survey patient medical abstract form.
SOURCE: CDC/NCHS, National Hospital Discharge Survey, 1989, 1999, and 2009.

Wolf, T. J., Baum, C., & Connor, L. T. (2009). Changing face of stroke: Implications for occupational therapy practice. *American Journal of Occupational Therapy, 63*, 621–625.

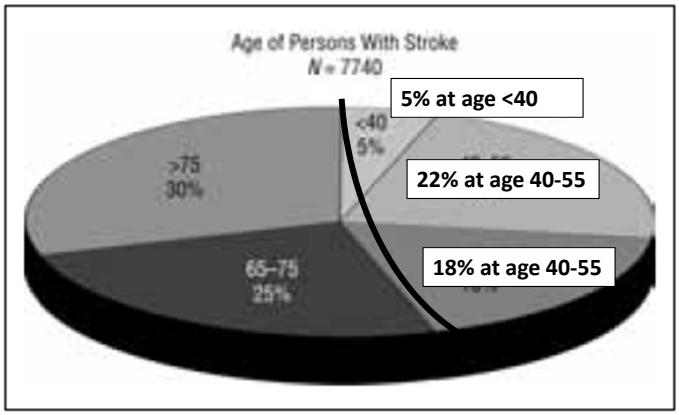

Figure 2. Decreasing age at first stroke.

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Prevalence of LTD

Contributing factors:

- Increased survivorship post-stroke
- Aging population with chronic conditions
- Advancements
  - Model stroke programs
  - Life-extending therapies and technology

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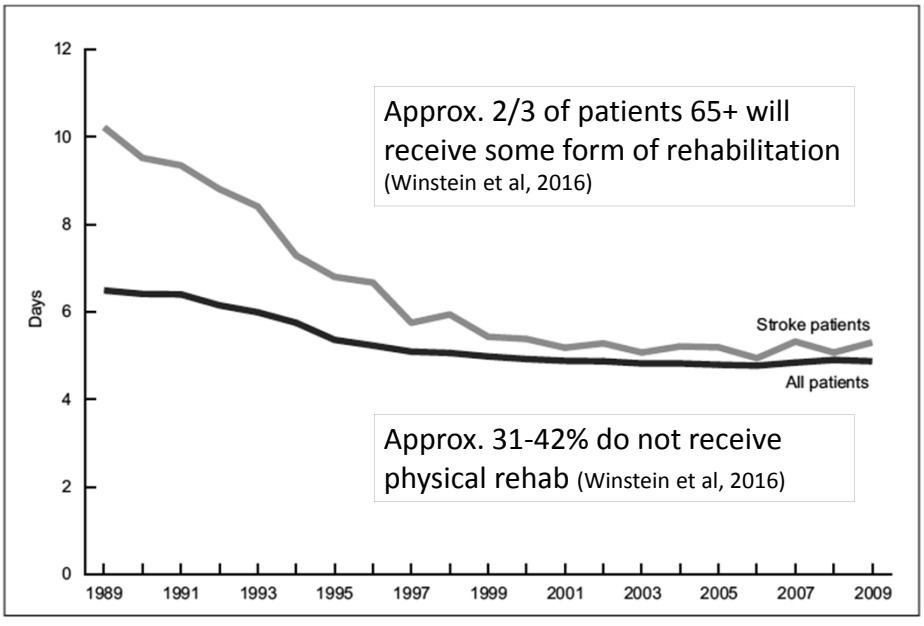
Figure 3. Average length of stay for hospitalizations for stroke: United States, 1989–2009

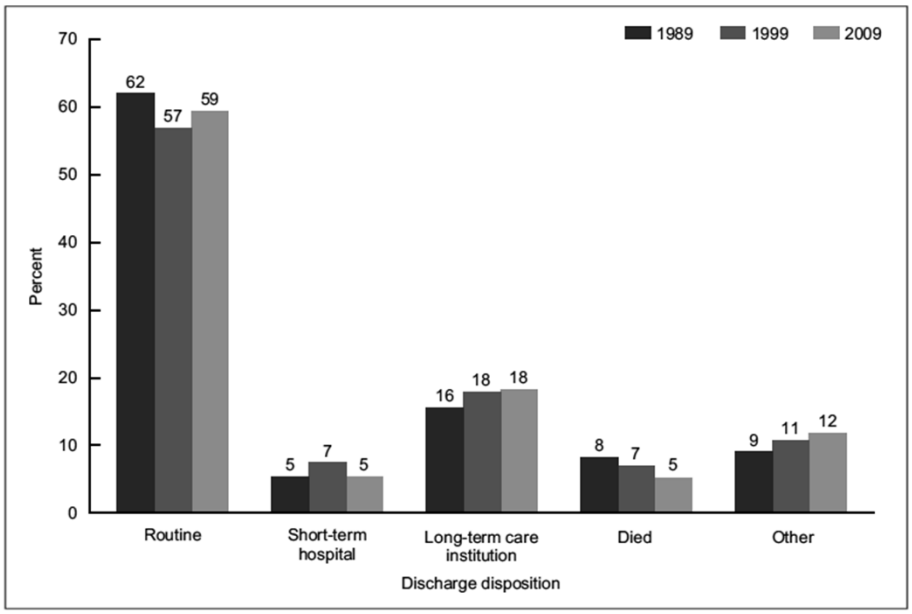


Approx. 2/3 of patients 65+ will receive some form of rehabilitation (Winstein et al, 2016)

Approx. 31-42% do not receive physical rehab (Winstein et al, 2016)

NOTE: A significant linear trend was observed from 1989 to 1999 for all and for stroke inpatients.
SOURCE: CDC/NCHS, National Hospital Discharge Survey, 1989–2009.

Figure 4. Discharge disposition of stroke patients: United States, 1989, 1999, and 2009



SOURCE: CDC/NCHS, National Hospital Discharge Survey, 1989, 1999, and 2009.

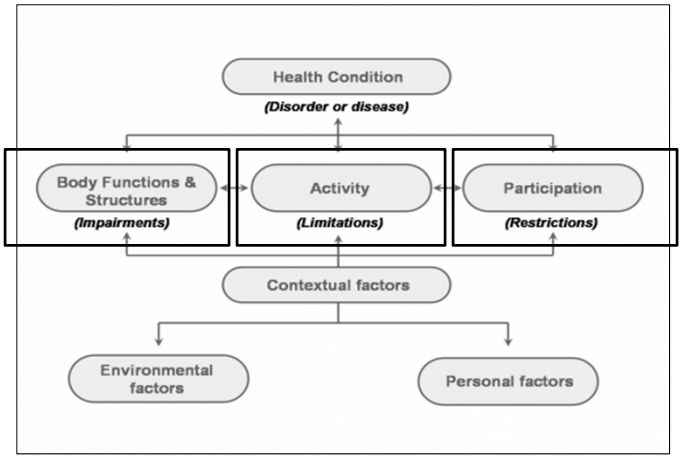
Impact of Stroke

Discharge – Disability Status

- 66% of patients discharged home require some level of assistance (Mayo et al., 1999).*
- 48%–58% regain independence with self-care (Gresham et al., 1995)*

*As cited in Teasell et al. (2006).

The ICF Model: Health, Functioning and Participation



Impact of Stroke - Impairments

- Two common areas of impairments associated with disability or reduced participation
  - Mild **cognitive deficits** goes undetected yet are significant predictors of disability (Baum, et al, 2009)
  - **Motor sequelae** is the primary reason for disability (Page et al., 2004).

Impact of Stroke: Participation

- Recent study suggest that 71% have mild to moderate impairments (Wolf, Baum & Connor, 2009)
  - Discharged usually as "modified independent" in ***activities*** in the home setting
  - Limited or no services are provided despite significant decrease in ***participation***

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Impact of Stroke: Participation

- Approx. 37% of mild strokes do not return to work (O'Brien & Wolf, 2010)
  - 53% of the ones who return report < ¾ of their capacity
  - **Majority report residual *IMPAIRMENTS***
- Perceived sense of disability and handicap (participation restriction) is associated with presence of ***residual impairments***

Points to Ponder

- Clients have lasting impairments that may require intervention
- Clients overcome their impairments through compensatory methods (good or bad) to enable activity independence, but…
- **Participation and Quality of Life** and not "independence"
  - should be the ultimate aim of rehabilitation
  - may still be linked to impairments

STROKE RECOVERY

Recovery After Stroke

(Teasell & Hussein, 2013)

Neurological Recovery	Functional Recovery
• Spontaneous biological response; predictable • Localized processes in the brain occurring within 3 – 6 months • Influenced by lesion size and medical factors	• Adaptive response to impairments or changes (improvements) in function • Occurs variably from within 6 months and beyond • Influenced by rehabilitation, social support, personal motivation and ability to learn

Local Processes = Neural Tissue Repair

- Ischemic penumbra
  - area of ischemia and surrounding cells that are vulnerable to damage
- Diaschisis or cerebral shock and its resolution
  - reversible depression of neural functions that are both anatomically or functionally linked to the damaged area
- Post stroke edema and its resolution
- Reperfusion of "salvageable" neural tissues (ischemic penumbra)

(Teasell et al., 2006)

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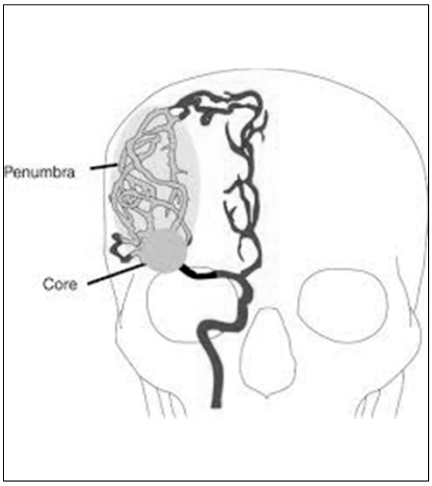
Ischemic Penumbra



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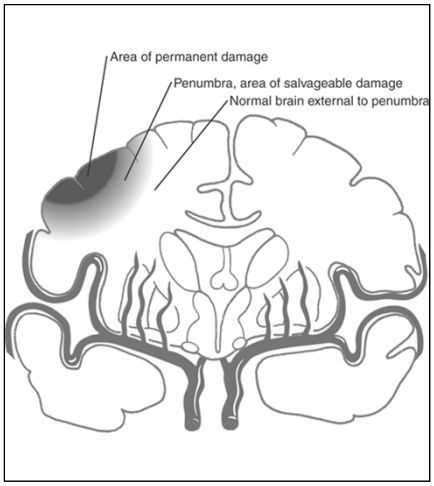


http://clinicalgate.com/wp-content/uploads/2015/06/f08-03-9781437702941.jpg

Ischemic Penumbra

- In animal models, this acute event occurs approximately from 4 hours through 7 days post lesion
- But damage to penumbral tissue may exceed the period of acute tissue repair (up to 2 months)

Recovery Timeline

Day 1-7	Weeks 2-8	Months 3-6	Months 7- 12	Year 1 - 3	Year 4 +

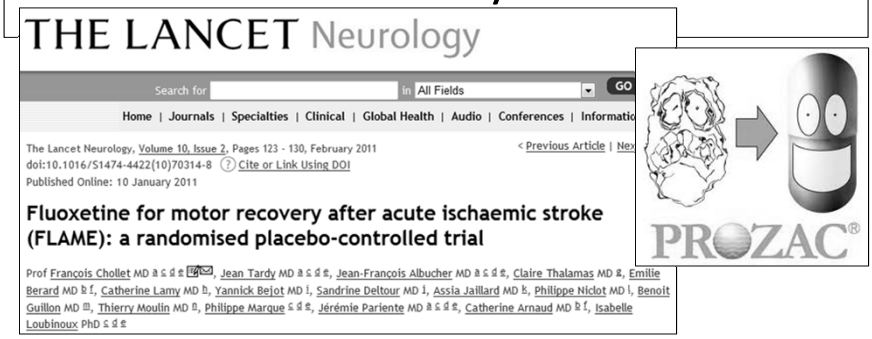
Penumbra Edema

Diaschisis

EARLY MOBILIZATION

Studies on use of neuroprotective medications in humans suggest promising effects

Can Natural Recovery be Enhanced?


THE LANCET Neurology

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The Lancet Neurology, Volume 10, Issue 2, Pages 123 - 130, February 2011
doi:10.1016/S1474-4422(10)70314-8 Cite or Link Using DOI
Published Online: 10 January 2011

< Previous Article | Nex

Fluoxetine for motor recovery after acute ischaemic stroke (FLAME): a randomised placebo-controlled trial

Prof François Chollet MD, Jean Tardy MD, Jean-François Albucher MD, Claire Thalamas MD, Emilie Berard MD, Catherine Lamy MD, Yannick Bejot MD, Sandrine Deltour MD, Assia Jaillard MD, Philippe Niclot MD, Benoit Guillon MD, Thierry Moulin MD, Philippe Marque, Jérémie Pariente MD, Catherine Arnaud MD, Isabelle Loubinoux PhD

Findings

- N= 118 patients with ischemic stroke
- FMA improvement at day 90 was significantly greater in the fluoxetine group
- Main adverse events: hyponatraemia, transient GI problems, insomnia and partial seizure

Interpretation

- In patients with ischemic stroke and moderate to severe motor deficit, the early prescription of fluoxetine with rehab therapy enhanced motor recovery after 3 months.

EARLY STAGES OF RECOVERY

REHAB IMPLICATIONS

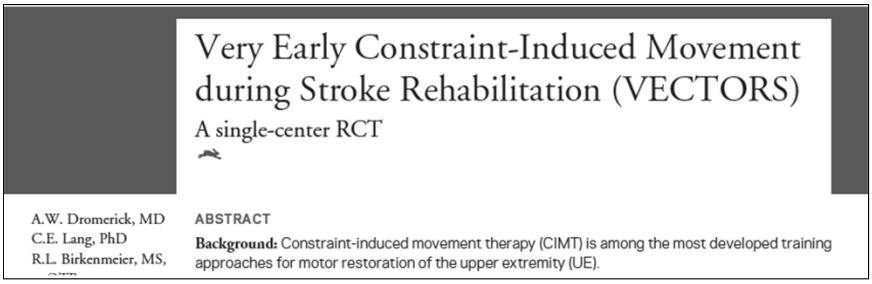
How Early, How Intense?

NeuroRehabilitation 17 (2002) 215–224
IOS Press

When should upper limb function be trained after stroke? Evidence for and against early intervention

Ailie Turton[a,*] and Valerie Pomeroy[b]
[a]*Burden Neurological Institute, Bristol, UK*
[b]*The Stroke Associations Therapy Research Unit, Hope Hospital, Manchester, UK*

How Early, How Intense?



Very Early Constraint-Induced Movement during Stroke Rehabilitation (VECTORS)

A single-center RCT

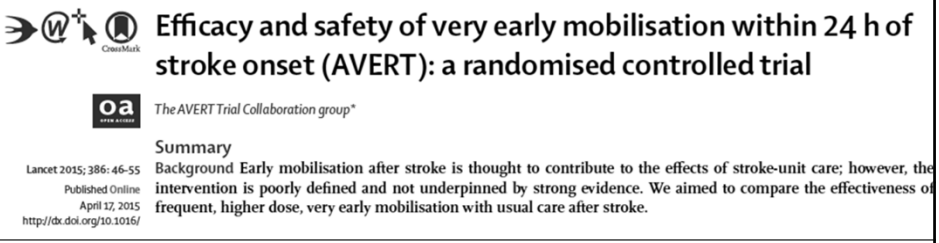
A.W. Dromerick, MD
C.E. Lang, PhD
R.L. Birkenmeier, MS,

ABSTRACT

Background: Constraint-induced movement therapy (CIMT) is among the most developed training approaches for motor restoration of the upper extremity (UE).

N=52 ischemic stroke
RCT = High Intensity CIT vs. Low Intensity CIT vs. Traditional Tx
Results:

- CIT was as effective as same dose traditional
- Higher intensity meant less improvement at 90 days (inverse dose-response)



Efficacy and safety of very early mobilisation within 24 h of stroke onset (AVERT): a randomised controlled trial

*The AVERT Trial Collaboration group**

Lancet 2015; 386: 46–55
Published Online
April 17, 2015
http://dx.doi.org/10.1016/

Summary

Background Early mobilisation after stroke is thought to contribute to the effects of stroke-unit care; however, the intervention is poorly defined and not underpinned by strong evidence. We aimed to compare the effectiveness of frequent, higher dose, very early mobilisation with usual care after stroke.

- N=2104, from 56 stroke units → 5 countries
- Single-blind RCT:
  - 24h very early mobilization (n=1054) vs. usual care (n=1050)
- Findings
  - Favorable outcomes in 3 months: 46% vs. 50% UC
  - Deaths: 8% vs. 7% UC
  - Adverse Events: 19% vs. 20% UC

Neurology®

Prespecified dose-response analysis for A Very Early Rehabilitation Trial (AVERT)
Julie Bernhardt, Leonid Churilov, Fiona Ellery, et al.
Neurology published online February 17, 2016
DOI 10.1212/WNL.0000000000002459

This information is current as of February 17, 2016

Lessons Learned:

- Early mobilization can change the outcome
- More practice is not always better; but
- More frequent but short sessions of out-of-bed improved odds of better outcome by 12%

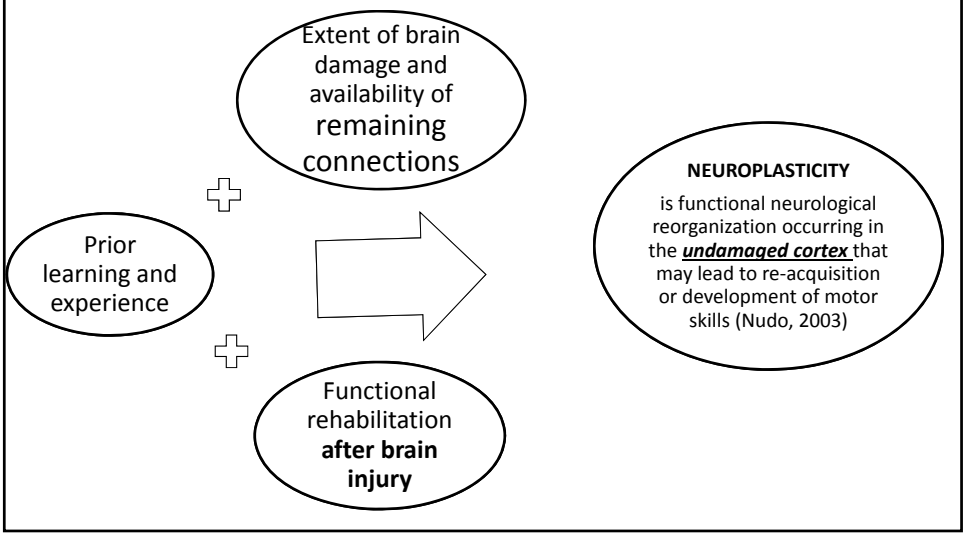
STROKE RECOVERY

Recovery After Stroke

(Teasell & Hussein, 2013)

Neurological Recovery	Functional Recovery
• Spontaneous biological response; predictable • Localized processes in the brain occurring within 3 – 6 months • Influenced by lesion size and medical factors	• Adaptive response to impairments or changes (improvements) in function • Occurs variably from within 6 months and beyond • Influenced by rehabilitation, social support, personal motivation and ability to learn

Determinants of Functional Recovery



TIMELINES

- Most recovery of movement occurs in the **first three months** after stroke
- However, functional motor recovery **continues at a slower rate** from 6 months to 3 years (Teasell, et al, 2013)

CNS Reorganization = Neurological-Functional Recovery

- Changes similar to motor learning (Nudo, 2003)
  - Synaptogenesis and long term potentiation
- Changes in cortical maps
  - Re-organization of remaining cortical areas around the infarct rim and the secondary areas
  - Recruitment of the contra-lesional hemisphere

(Teasell & Hussein, 2013)

Rehabilitation CAN influence this process!

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Mechanisms of Functional Recovery

- Spared areas of the cortex can be retrained to take on the role of the area corresponding with limb function
- Forced use of the impaired limb may lead to **use-dependent** changes

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LATTER STAGES OF RECOVERY

REHAB IMPLICATIONS

Reasons for Slower Progress

(Barreca et al, 2001)*

- *Limited rehabilitation resources**
- *Time constraints**
- *Distributed focus of therapy on other motor impairments and disability**
- *Lack of knowledge translation from research*

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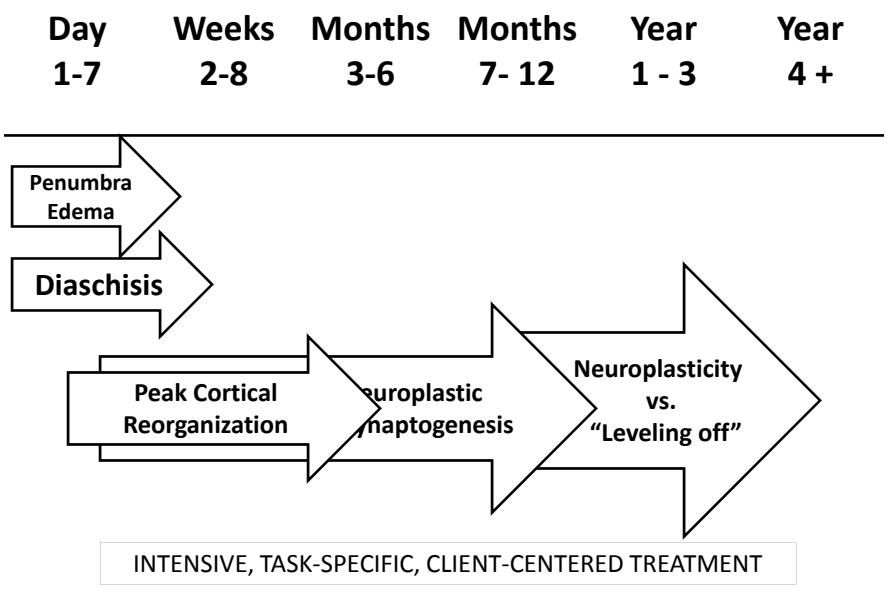
Key Ingredients: Motor Learning Principles

1. Task-specificity
   - Results in long-lasting cortical reorganization
2. Contextual interference
   - Enriched environments promote functional re-organization vs. rote
3. Intense practice and variable practice schedules
   - Intensity of practice induces cortical changes
   - Repetition alone is insufficient to change the brain

Motor Learning Principles

- Use of proper feedback
  - KR and KP
- Practice conditions
  - must be task-specific
  - High repetition
- Client-centered
  - Meaningful
  - Fits in client's lifestyle and interests

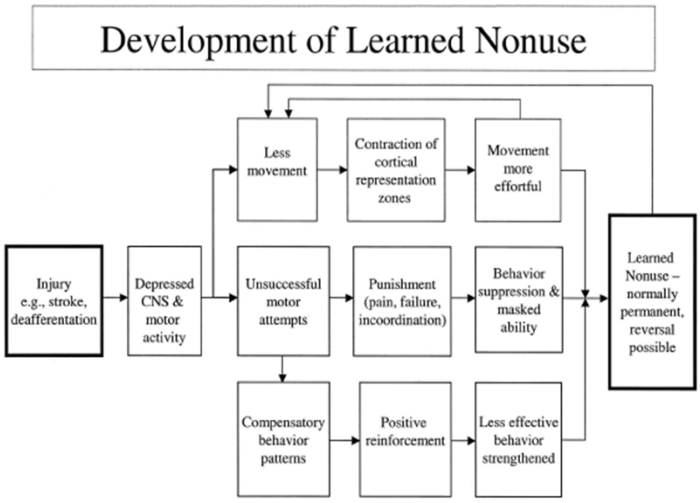
Recovery Timeline



CNS Reorganization = Neurological-Functional Recovery

- Recruitment of ipsilateral (contralesional) pathways/nonaffected hemisphere
  - Proportional to the infarct size
  - Compensation and heightened function of the nonaffected M1 and M2 (Schallert et al, 2003)
- However…
  - Increased frequency of contralesional activity is associated with poor recovery (Schaecter, 2004)

Figure 1
Schematic Model for the Development of Learned Nonuse



Note. CNS = central nervous system.

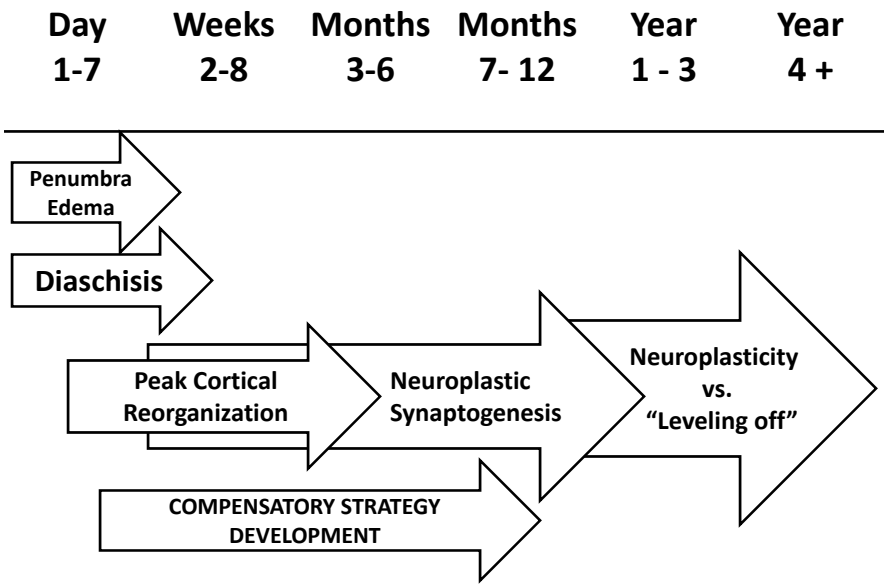
Taub, E. (2004) Harnessing Brain Plasticity Through Behavioral Techniques to Produce New Treatments in Neurorehabilitation. *American Psychologist,* 692-704

Functional Recovery and Compensatory Strategy

Use of compensatory strategy is well-documented in stroke:

1. Trunk flexion for inadequate reach (Cirstea & Levin, 2000)
2. Arm circumduction
3. Increased MCP flexion for poor PIP control (Raghavan, et al, 2010)
4. Tenodesis powered grasp and release

Windows of Opportunity

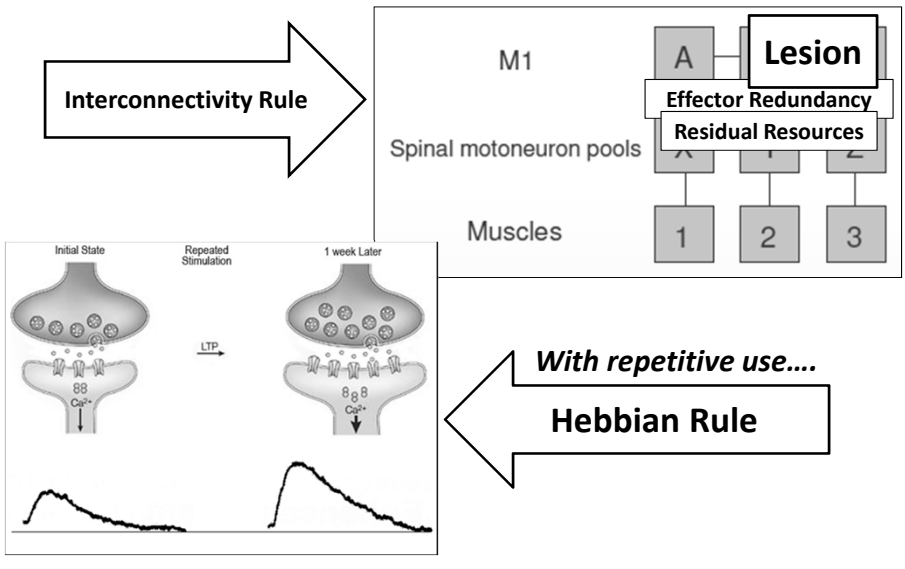


Functional Recovery and Compensatory Strategy

What is a compensatory strategy?

- Defined as "…the partial recovery of a goal-directed *coordinated movement* with the affected limb using residual neural resources to control alternative muscles or joints." (Raghavan, et al, 2010)

Basic Rules of Neuroplasticity



Thus…

- In post-stroke, compensatory strategies may represent **new function** that emerge based on
  - **Goooooal!**
  - Number of functional connections available
  - Strength of these connections
  - **Practice and Practice Conditions**
- Neural system exploits the "**effector redundancy**" to achieve task using an alternative path

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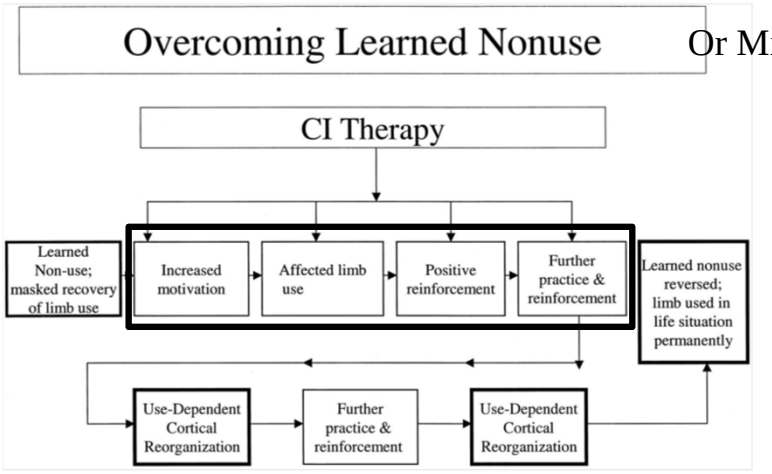
Figure 2
Schematic Model of Mechanism for Overcoming Learned Nonuse



Note. CI = Constraint-Induced Movement.

AHA/ASA Guideline

Guidelines for Adult Stroke Rehabilitation and Recovery

A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association

Endorsed by the American Academy of Physical Medicine and Rehabilitation and the American Society of Neurorehabilitation

The American Academy of Neurology affirms the value of this guideline as an educational tool for neurologists and the American Congress of Rehabilitation Medicine also affirms the educational value of these guidelines for its members

Carolee J. Winstein, PhD, PT, Chair; Joel Stein, MD, Vice Chair; Ross Arena, PhD, PT, FAHA; Barbara Bates, MD, MBA; Leora R. Cherney, PhD; Steven C. Cramer, MD; Frank Deruyter, PhD; Janice J. Eng, PhD, BSc; Beth Fisher, PhD, PT; Richard L. Harvey, MD; Catherine E. Lang, PhD, PT; Marilyn MacKay-Lyons, BSc, MScPT, PhD; Kenneth J. Ottenbacher, PhD, OTR; Sue Pugh, MSN, RN, CNS-BC, CRRN, CNRN, FAHA; Mathew J. Reeves, PhD, DVM, FAHA; Lorie G. Richards, PhD, OTR/L; William Stiers, PhD, ABPP (RP); Richard D. Zorowitz, MD; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Quality of Care and Outcomes Research

Closing Remarks

RETHINKING STROKE RECOVERY

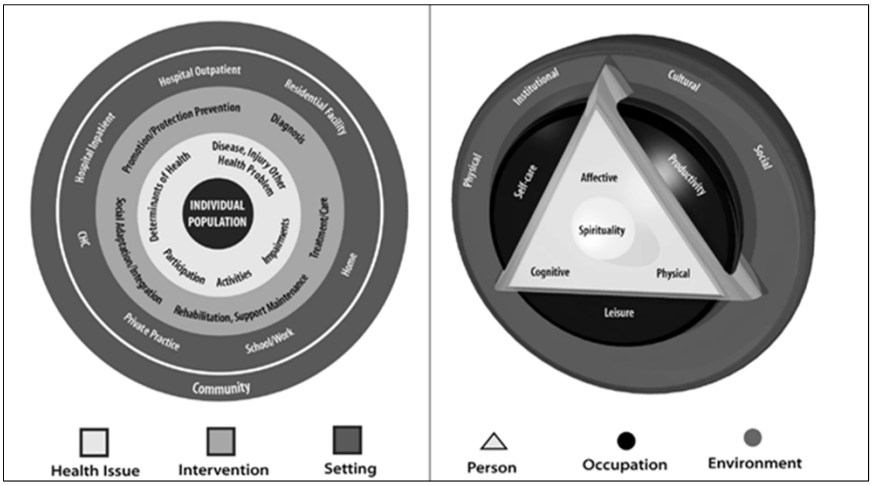
Stroke as a Chronic Disease

- End of formal rehabilitation _ 3 to 6 months
- Unmet needs:
  - Health maintenance
  - Lifestyle management
  - Social and community reintegration/participation
  - Apathy, depression, loss of activity interests
  - Fatigue
  - Return to work
  - Secondary prevention

Consider These

- Spasticity increases the cost of care 4x, present in 33-45% of SS
- Contractures and musculoskeletal pain are preventable
- Hip fractures due to falls occurs in 27% of SS
- Post-stroke depression has negative effects on functional recovery
- Visual field loss occurs in 30% of SS
- Recurrence of stroke is 20-30%
- Cardiovascular state in SS is at 53% of age-matched normative values

Primary Care OT Model (www.caot.ca)



Key Roles

Early identification, secondary prevention and surveillance

- Identify risks for secondary impairments/sequelae
- Manage, monitor/follow-up

Health literacy and disease management

- Educate and Identify resources
- Self-monitoring

Relational continuity and Interprofessional collaboration

- Refer, collaborate
- Set expectations with patient for follow-up

Take Home Points

1. Early rehab works, but doesn't need to be too intense!
   - Encourage active engagement in meaningful tasks
   - Discourage learned non-use
2. In post-acute patients,
   - Intensity of practice alone will not change the brain
   - Practice has to be task-specific and meaningful
3. Effective interventions don't require fancy equipment
   - Your brain is the most sophisticated instrument ever
4. Stroke survivors will have protracted needs
   - Recovery is ongoing through functional adaptation
   - Health and wellness, and secondary prevention are key

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Questions?

- Email: Salvador.Bondoc@quinnipiac.edu

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Stroke Treatment Across The Care Continuum

http://www.occupationaltherapy.com/general/stroke-awareness-month-virtual-conference

Mon 5/16	**Stroke Recovery and OT Implications within the Continuum** Salvador Bondoc, OTD, OTR/L, FAOTA
Tues 5/17	**Taking the Mystery Out of Mastery in Stroke Rehabilitation Practice** Robert Ferguson, MHS, OTR/L
Wed 5/18	**Neural Priming for Post-Stroke Upper Limb Hemiparesis** Mary Stoykov, PhD, OTR/L
Thur 5/19	**Occupational Therapy's Role in Managing Functional Implications of Visual and Cognitive Impairments** Lisa Rivera, MS, OTR/L
Fri 5/20	**Facilitating Return to Work after Stroke across the Continuum of Care** Shannon Scott, OTD, OTR/L