EXERCISE DOSING IN APHASIA THERAPY
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Learning Objectives

1. Define dosage as a principle of experience-dependent neuroplasticity
2. Outline literature on intensity of aphasia therapy to date
3. Explain dosage parameters as they apply to aphasia therapy

Intensity of Treatment

We provided “intensive” therapy.

The aphasia treatment was delivered on an “intensive” schedule.

What do we mean by intensive treatment?
• What is the first thing that comes to mind?
• What does it imply to you?
• What don’t you know based on this description?
Dosage - Definition

1. Administration of a therapeutic agent in prescribed amounts.
   a. Determination of the amount to be so administered.
   c. The amount so administered.

2. Addition of an ingredient to a substance in a specific amount, especially to wine.

Experience Dependent Neuroplasticity

Every experience, conscious or unconscious, makes tiny changes in the strengths of synaptic connections between some of the neurons.

Plasticity - the brain keeps changing with experience as synaptic connections change strength.

Hebbian Theory

Hebbian Theory (Donald Hebb, 1949):
"Neurons that fire together wire together."
• How we use our brains affects structure.

• Learning occurs as neurons and neural connections change → Brain structure is therefore described as plastic.

• Connections between areas of the brain are critical for speech and language processing.

• The Aphasia Laboratory

• Dosage - Neurorehab Definition

• Principles of Experience-Dependent plasticity (Kleim & Jones, 2008)

• Use It or Lose It
• Use It and Improve It
• Specificity
• Repetition Matters
• Intensity matters
• Time Matters
• Salience Matters
• Age Matters
• Transference
• Interference
**Animal Studies**

**Sufficient repetition** [Kleim & Jones, 2008]

- Kleim et al., (2003) - 400 repetitions/day of a skilled reaching task increased # of synapses in motor cortex.
- Luke, Allred & Jones (2004) - 60 repetitions/day of the same task did not elicit these changes.

**Animal v Human Studies**

- Nudo, (2011): human rehab therapies may be significantly under-dosed.

  - Animal studies tend to require many more repetitions than human studies
    - Animal - e.g. 100 times, twice daily [Nudo, Wise, Sierra & Miliken, 1996]
    - Human - e.g. 12 times, once daily [Lang et al., 2009]

**Our Question...**

- How many repetitions are necessary to instantiate lasting change in individuals with aphasia participating in therapy?
• Interaction between Timing and Dosage

• Is there a difference in treatment effects between manipulations in dosage in the acute versus chronic stages of recovery?

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Literature Review on Intensity of Aphasia Therapy

Studies using an intensive treatment paradigm

- Semantic treatments
  - Kurland & Falcon, 2011
  - Kurland et al., 2012
  - Marcotte et al., 2012
  - Marcotte, Perlbarg, Marrelec, Benali, & Ansaldo, 2013

- Phonological treatment
  - Vitali et al., 2007

- Other treatments
  - Wilson et al., 2012

• CILT/CIAT
  • Principles—massed practice, constraint of language output to speech, shaping of responses (CITE)
  • How important is massed practice?
• Is CILT equivalent to other treatment techniques delivered with an intensive treatment schedule?
  - Barthel et al. (2008)
  - Kurland et al. (2010)
  - Sickert et al. (2003)

• Are intensive and non-intensive schedules of various aphasia treatment techniques equivalent?
  - Sage, Snell & Lambon Ralph (2011)
  - Harnish et al. (2008)
  - Ramsberger & Marie (2007)
  - Raymer et al. (2006)
• Literature Review on Intensity of Aphasia Therapy

• Is intensive therapy always better?
• What are the problems with providing all aphasia therapy on an intensive schedule?
• BTW: what do we mean by intensive?

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• Defining Intensity

• More intense treatment could mean
  a) greater number of therapeutic events in a shorter amount of time,
  b) greater number of hours spent in therapy in a shorter amount of time (massed practice), as opposed to fewer hours of therapy in a longer total amount of time (distributed practice), or
  c) greater number of total hours spent in therapy.
**Defining Dosage Parameters**

- Precise documentation of dosage parameters
- Treatment fidelity
- Ability to replicate
- Comparison of different treatment techniques with same dosage
- Comparison of same treatment technique with different dosages
- Identification of most salient features of a treatment

**Dosage Parameters Applied to Aphasia Therapy**

- For review articles on intensity of aphasia treatment/intervention intensity: Cherney et al. (2008), Cherney (2012) and Baker (2012)
- Warren, Fey & Yoder (2007)
- Dose form
- Dose
- Dose frequency
- Total intervention duration
- Cumulative intervention intensity

**Dosage Parameters - Dose Form**

- The therapeutic task or activity that delivers the teaching episodes
- Teaching episodes include the active ingredients of the intervention (e.g. semantic cueing)
### Dosage Parameters - Dose

- The number of times a teaching episode or active ingredient occurs per session. (e.g. 40 pictures X 1 phonemic cue/picture = 40 teaching episodes)

- Dosage rate specifies the number of teaching episodes per unit of time. (40 teaching episodes per 50 minutes = 0.8 teaching episodes per minute)

### Dosage Parameters - Dose Frequency

- The number of intervention sessions per unit of time (e.g. 2 times per week)

### Dosage Parameters - Total Intervention Duration

- The total period of time in which a particular intervention is provided (e.g. 20 weeks)
• The product of dose x dose frequency x total intervention duration (e.g. 40 teaching episodes x 2 times/week x 20 weeks = 1600 teaching episodes)

• This gives us a precise measurement of how many teaching episodes occur over the course of therapy.

• Feasibility
  • Type of therapy
  • Maintaining consistent dosage across participants or sessions

• How do I determine appropriate dosage parameters for an established treatment? An informal treatment?
  • Literature
  • Practical considerations - time limit of session, reimbursement rates

• Can we create an "intensive" therapy session, without extending the amount of daily time a person spends in treatment?
Documenting Dosage Parameters- An Example

Harnish, SM; Morgan, J; Lundine, JP; Bauer, A; Singletary, F; Benjamin, ML; Gonzalez Rothi, LJ; Crosson, B (in press). Dosing of a cued picture naming treatment for anomia. *American Journal of Speech-Language Pathology*. 

**Aim:** to determine the feasibility of creating an intensive therapy session without extending the amount of daily time a person spends in treatment.

Methods

- Eight individuals who presented with chronic anomia post-stroke participated in two weeks of a computerized, therapist-delivered, cued picture naming treatment.

Harnish et al., 2014

Dose Form: picture naming

- Active ingredients: cueing in the form of semantic cues, phonemic cues, orthographic cues, repetition, naming after a delay, etc...
**Cued Picture Naming Treatment**

- Show same picture 8 times
  1. Independently name
  2. Orthographic cue
  3. Repetition
  4. Name after 3 sec delay
  5. Semantic cue
  6. Phonemic cue
  7. Repetition
  8. Name after 3 second delay

**Documenting Dosage Parameters - An Example**

- **Dose** = 50 pictures x 8 cues/presentations = 400 teaching episodes
- **Dosage rate** = 400 teaching episodes per 60 minutes = **6.67 episodes per minute**

Harnish et al., 2014

**Documenting Dosage Parameters - An Example**

- **Dose Frequency**: 4 times per week
• Documenting Dosage Parameters - An Example

  • Total intervention duration = 2 weeks

Harnish et al., 2014

• Documenting Dosage Parameters - An Example

  • Cumulative intervention intensity = 400 teaching episodes x 4 times per week x 2 weeks = 3200 teaching episodes

Harnish et al., 2014

• Documenting Dosage Parameters - An Example

  Results

  • Six of eight participants achieved significant increases from baseline on trained items after 400 teaching episodes (i.e. one treatment hour)

  • The remaining two participants achieved significant increases from baseline after 1200 teaching episodes (i.e. three treatment hours).

Harnish et al., 2014
• Maintenance data from seven of the participants indicated that six participants maintained significant improvement from baseline on trained items.

Discussion
• We found that most individuals with anomia were able to show significant gains in reacquiring problematic words after only approximately one hour of a cued picture naming treatment.
• 8 teaching episodes per word, or a total of 400 teaching episodes for all 50 trained words.
• This saturated context of training may be useful in a clinical setting when the amount of time a patient spends in therapy is limited.

Conclusions
• Given an intensive and saturated context, individuals with anomia were surprisingly quick at relearning to produce words successfully.
• Many of the participants retained the gains.
What do we know? What don’t we know? Which studies need to be done?

• comparing treatments with high and low dosage rate
• “overlearning”

How do we apply what we know to clinical practice?

• What do we know?
  • Application

How do we find out about new research in this area?

• Literature searches
• Continuing education
  • Conferences
  • Journal groups
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**References**


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References


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