UPSTATE
Comprehensive
Stroke Center

OVERVIEW OF STROKE REHABILITATION

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- No financial relationships with device or pharmaceutical company
- Past Research: PI on INSTRIDE Project, industry supported study
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- Off-label use of botulinum toxin injections for spasticity in lower limb (approved in upper limb)

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Learning Objectives

- Discuss interplay between neural plasticity and rehabilitation.
- Review site options for rehabilitation following a stroke.
- Identify key aspects of rehabilitation.
- List promising new rehabilitation interventions to improve the function of people who have survived stroke.

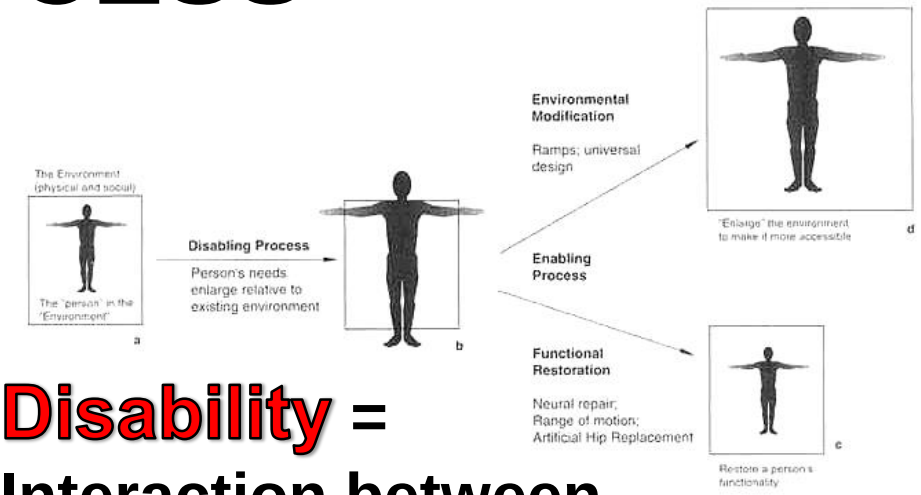
REHABILITATION

. . . is a **comprehensive process**, that **facilitates optimal status within the existing capacity** allowed by the impairment, personal desires and life plans, and environmental disadvantages. Consumers/patients, families, and professionals **work together as a team**, **identify realistic goals**, develop strategies to **achieve highest possible functional outcome**.

(Turk & Mudrick, 2012)

ENABLING/DISABLING PROCESS

PATHOLOGY	Stroke: injury brain
IMPAIRMENT	Paralysis: ↓motor control, weakness, hypertonia
FUNCTIONAL LIMITATION	Unable to walk or dress
SOCIAL PARTICIPATION	Unable to work, resume role in family



Disability = Interaction between Person and Environment

Changes (health and function) over time may be anticipated or modified. Critical factors in the physical, social, and psychological environments can affect transitions over the life course.

STROKE COURSE & REHABILITATION

- Typical history of recovery (in general)
  - – Most rapid improvement months 1-3
  - – Functional change slower after 3rd month, decreasing disability over 6 mos
  - – Improvements > 1yr: environmental changes and practice
  - – Participation in inpatient rehab: 60% vs. 39% independent walking at 3 mos Preston et al, 2011
- Maintain function - ongoing exercise, focused home and OP program

OUTCOME PREDICTORS

Predictors Hand Fnc
Flaccid UL at onset
No measurable grasp 4 wks
Severe proximal spasticity
Prolonged flaccidity period
>2wks no SFF/SAdd

Increased Risk for Long-Term Disability	
Minimal recovery 4 wks	Bilateral lesions
Low LOC	Previous stroke
Diabetes Mellitus	Previous disability
Cardiac Disease	Poor sitting balance
EKG abnormalities	Global aphasia
Older age	Severe neglect
Delay in medical care	Sensory/visual deficits
Delay in rehabilitation	Impaired cognition
	Incontinence > 1-2 wks

PLASTICITY & REHABILITATION

- Injury and changes in brain circuitry:
  - Behavioral activity patterns
  - Alterations in environmental experience
  - Direct brain injury
- Common pathways interact to enhance or impede
- Activity – may facilitate rewiring, prevent maladaptive patterns
- Based on animal studies

Overman&Carmichael 2013

PROMOTING REHABILITATION

- Very Early: shorter, frequent mobilization associated with > odds favorable 3 mos outcomes, especially less impaired Bernhardt J et al 2017
- ≤ 3 mos: ↑ dosing therapy results in better outcomes; varies based on clinical presentation Lang CE et al 2014
- ≤ 3 mos: time-limited plasticity mediates spontaneous recovery, with augmentation by task-specific or exploration Zeiler SR et al 2013

REHABILITATION CONTINUUM

- Benefits noted with rehabilitation interventions >6mos post stroke

Categories	RCTs
Motor function	256
Cognition	39
Medical interventions	17
Psychology & Community Integration	19
General outpatient therapy	8

- Unclear specifics of interventions related to method and dosing; repetitive practice most promising

Teasell RW et al 2012

REHABILITATION SETTINGS

Program	Site	Services	Med-Nsing	Therapy
Acute Hospital	Neurology service	Mobilization; assess and determine post-acute needs	Primary acute services;PMR consultation	Daily as needed; goal oriented
Post-Acute Care Continuum				
IRF/Acute	Separate unit/rules; Freestanding	Coordinated, interdisciplinary; serves high need, high acuity	Daily physician; 24hr nsing	3hrs/d, 6d/wk; require at least 2
SNF/ Subacute	Unit within SNF; LTC rules	Multidisciplinary; at least 2 on-site services	Physician available; few staff on-site	1-2hrs/d, 5d/wk; require at least 1
Home health	In home	RN/Therapies	Nsing as needed	1-2hrs/d, 1-3d/wk
Outpatient	Facility based	Single service or multiple; ± coordinated	None	1-3hrs/d, 1-3d/wk
SNF LTC	SNF	Various	LTC regs	1-3d/wk

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

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ACUTE HOSPITAL REHABILITATION*

Recommendations: Rehabilitation Interventions in the Inpatient Hospital Setting	Class	Level of Evidence
It is recommended that early rehabilitation for hospitalized stroke patients be provided in environments with organized, interprofessional stroke care.	I	A
It is recommended that stroke survivors receive rehabilitation at an intensity commensurate with anticipated benefit and tolerance.	I	B
High-dose, very early mobilization within 24 hours of stroke onset can reduce the odds of a favorable outcome at 3 months and is not recommended.	III	A

*AHA/ASA Guidelines for Adult Stroke Rehabilitation

ACUTE HOSPITAL REHABILITATION

- AVERT Trial – 3 countries (not USA); difficult recruitment; early OOB
  - Caution re: BP stability, hemorrhagic component, level of impairment
  - Shorter, frequent OOB early improves outcome, control for age, severity and compare onset to first OOB (range 14.7 – 23.8 hrs); scheduling important
  - Therapy in bed also valuable

Bernhardt J et al 2016;
Ward & Kitago 2016;
Bernhardt J et al 2017

IRF Regulation

- Qualify for rehab services:
  - Acute: dx appropriate and stable; medical needs; will benefit; need at least 2 therapies; tolerate 3hrs/day; D/C plan to home; typical LOS 2-3 wks
  - SNF: at least 1 therapy need; will benefit; medically stable; can tolerate; D/C plan; typical LOS 2wks - mos
- 3 hours/day rule - proxy, based on consensus, old paradigm
- Required Pre-admission and Plan of Care/Admission paperwork – WU complete
- Insurance – policy defines post-acute care, industry guidelines, concurrent reviews, documentation; recent carrier interpretations
- Measurement tools required

POST-ACUTE REHABILITATION*

Recommendations: Organization of Poststroke Rehabilitation Care (Levels of Care)	Class	Level of Evidence
It is recommended that stroke patients who are candidates for postacute rehabilitation receive organized, coordinated, interprofessional care.	I	A
It is recommended that stroke survivors who qualify for and have access to IRF care receive treatment in an IRF in preference to a SNF.	I	B
Organized community-based and coordinated interprofessional rehabilitation care is recommended in the outpatient or home-based settings.	I	C

*AHA/ASA Guidelines for Adult Stroke Rehabilitation

Acute Stroke Rehabilitation

- Shorter acute hospital LOS – shorter rehab admissions and higher FIM score, controlling for severity of co-morbidities
- Moderately and severely impaired – fewer days from onset sx and IRF admission, better FIM and outcome
- Moderately impaired – fewer days from onset sx and IRF admission, shorter rehab LOS

Maulden SA et al, *Archives PM&*R, 2005

REHABILITATION

- **GOALS:**

  Promote health and prevent additional disabilities

  Maximize mobility and self care

  Maximize communication and safety

  Reintegrate back to home, family, community

  Reestablish meaningful life

- **REHABILITATION PLAN:**

  Prevention secondary conditions and complications

  Focused therapy to improve limitations, impairments

  Functional training for compensation, use of devices

  Engage patient and family in education and training

  Resolution psychosocial and environmental barriers

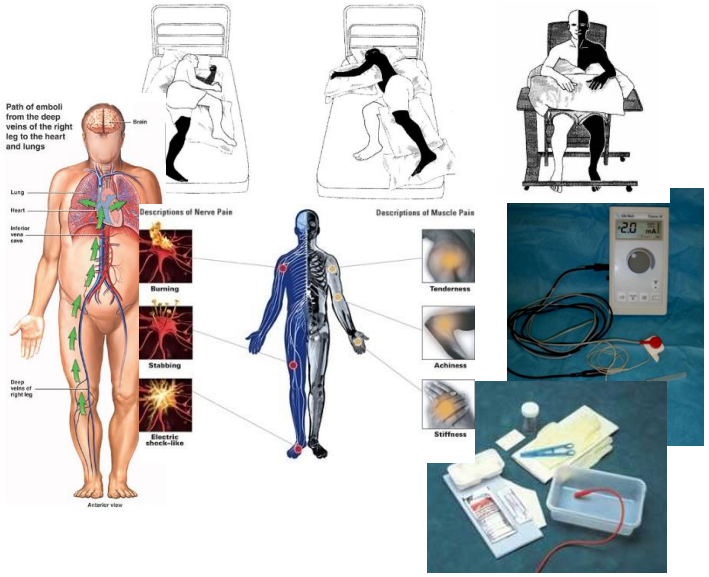
  Function maintenance over a lifetime

MEDICAL REHABILITATION=IRF

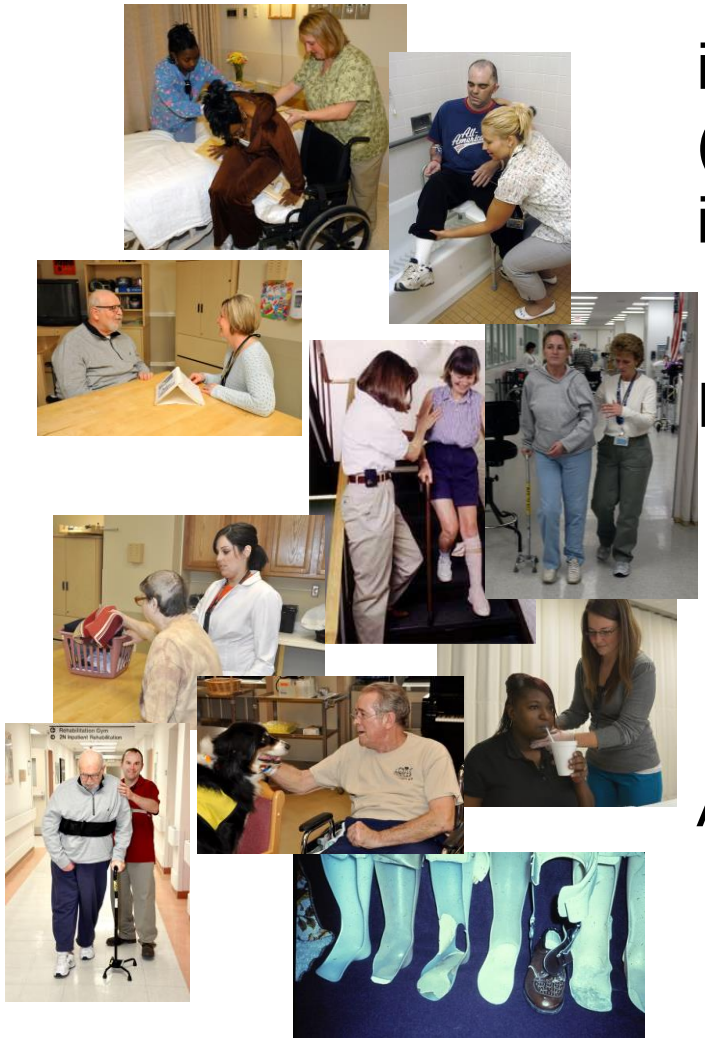
- Comprehensive, goal directed, plan of care
  - Teams: physiatrist directed, inter- (or trans-) disciplinary; perspectives
  - Single service = therapy, not rehabilitation
- Formal communication - meetings, problem solving not reporting, barriers
- Regulation: Weekly, documentation, intensity/progress, outcome measures
- Family participation: meeting, education

IRF

- **Prevent &/or manage medical conditions and complications:**
  - Safety and fall prevention
  - Manage neurogenic bladder/bowel, DVT risk, co-morbidities, risk factors, associated conditions
  - Higher acuity
  - Spasticity and contractures
  - Pain syndromes (shoulder)
  - Emotional disorders
  - Education family/patient
  - Prevention recurrence or known secondary conditions



IRF PROGRAM



- **Task-specific training** (repeated, in context) **+ Enriched environment** (↑physical activity, scheduled, interdisciplinary) **= Better outcome**

Takeuchi & Izumi 2013

Functional program (motor skills, self care, retraining, articulation or swallow, practice, challenges, compensatory skills, in context [Therapeutic Recreation])

Additions: Exercises; Modalities; System; DME; Cognitive; Counseling; Animal-assisted therapy; Education

IRF PROGRAM

- **Nontraditional noninvasive therapies:**
  - -NMES/sEMG
  - -Kinesiotape
  - -Robotics, assist
  - -Constraint induced movement therapy (CIMT)
  - -Vision therapies








STROKE REHABILITATION

Effectiveness

- Repetitive task training improves U&LL fnc, remaining up to 6 mos French et al, Cochrane 2016
- No treatment recommended over others for recovery postural control, LL function Pollock et al, Cochrane, 2014
- Robotics-assisted gait training + PT associated with walking Mehrholz et al, Cochrane 2010 & 2015
- Conditioning improves walking speed/tolerance, but not resistance training Saunders et al, Cochrane 2016

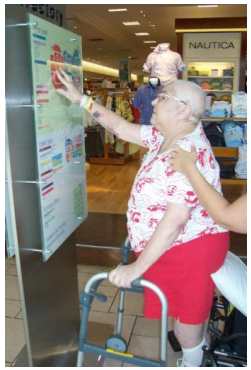
IRF

- **Return to community**:
  -Home care
  -PCP, Specialty care
  -Environment adaptation
  -Recreation therapy
  -Equipment
  -Community activities
  -Vocational rehab plan
  -Education program for patient and family









REHABILITATION (Post IP)

- General integration
  - Safety and health promotion; physical activity, leisure, recreation
  - Return to school, work, driving
  - Education reinfored
- Goal focused therapy: traditional (outcome relates to amount of therapy time, unrelated to time from stroke
- Non-traditional therapies: aquatics, pilates, robotics (virtual reality), walk-aide
- More aggressive tone management

STROKE REHABILITATION

Effectiveness

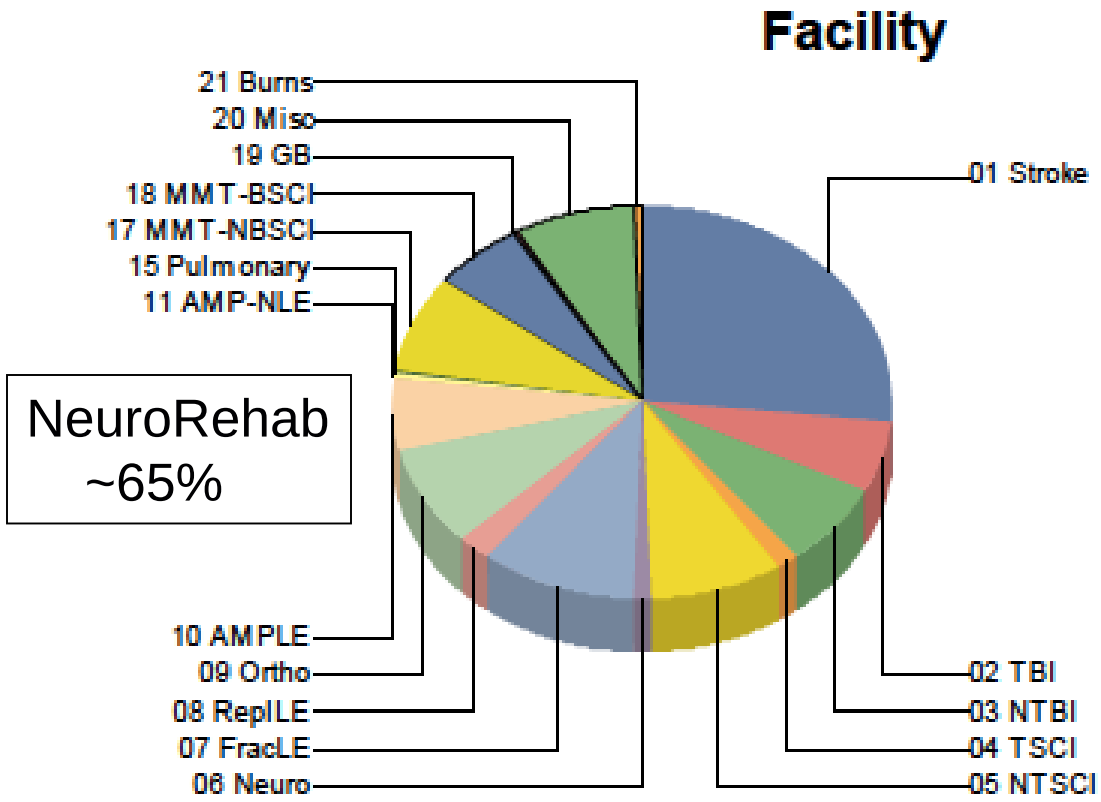
Longer Term Post Stroke

- While there are many studies, the details of method and dosing are not clear
- Moderate-low evidence for therapy-based self-care improvements Legg et al, Cochrane 2003
- Insufficient evidence for community walking → independence Barclay et al, Cochrane 2015
- Low evidence for cognitive remediation without reinforcement Das Nair et al, Cochrane 2016
  Bowen et al, Cochrane 2013

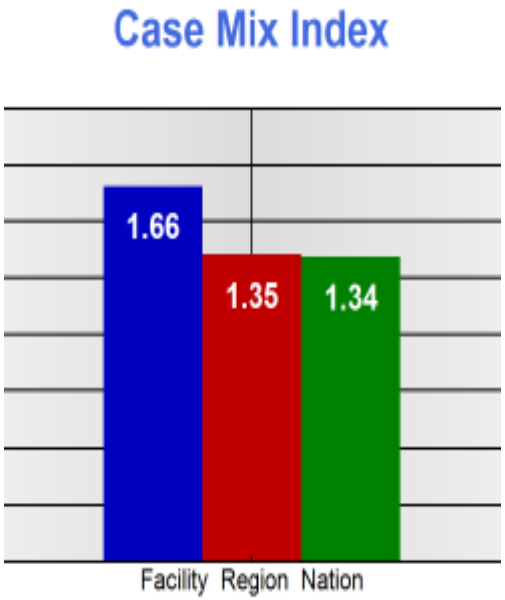
Upstate Stroke Rehabilitation

- Inpatient/outpatient programs
- Traditional/nontraditional therapies
- Stroke Survivors Support Group
- Spasticity and tone management
  - Botulinum toxin, ITB
  - NMES, serial casting, taping
- WalkAide (INSTRIDE)
- Robotics: Lokomat, Armeo
- CIMT
- DME
- Pain management

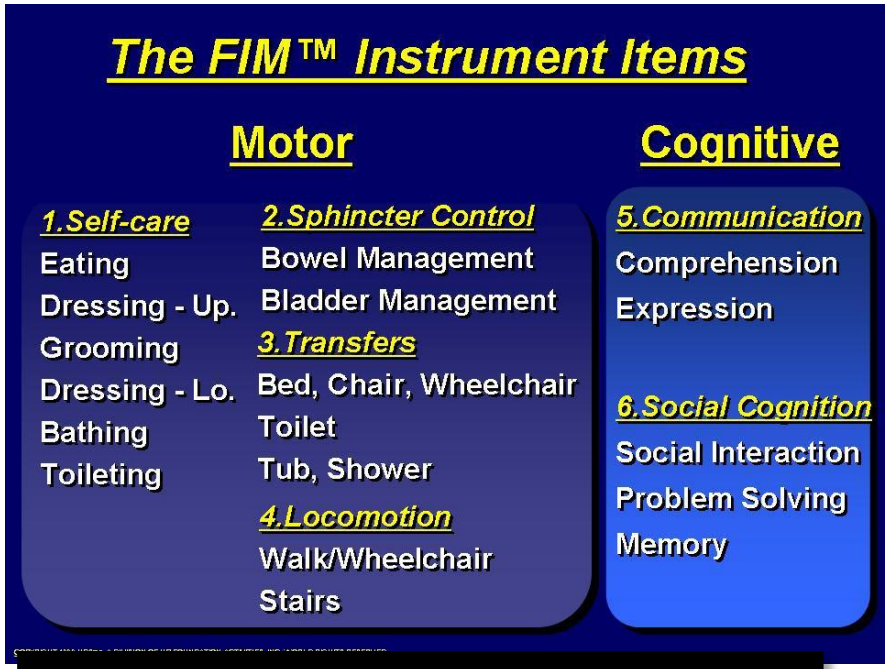
Upstate Inpatient Rehabilitation

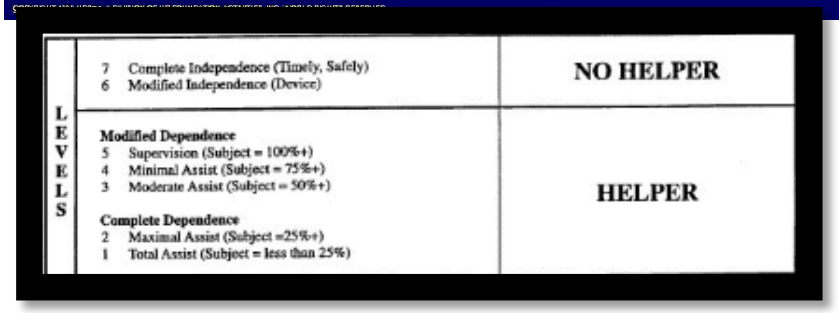


NeuroRehab
~65%



REHABILITATION
Outcomes Measurement

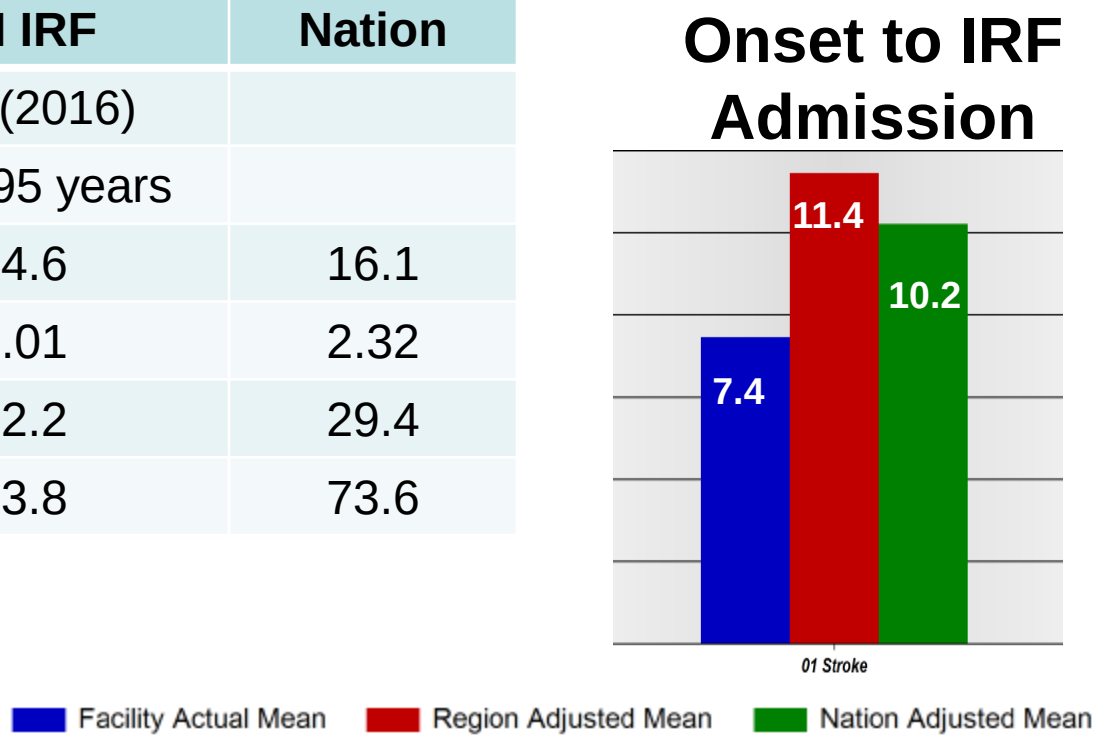




- UDS - National Registry
- Burden of care (social participation)
- LOS
- Efficiency
- Modified for CMS use (CARE Tool)

REHABILITATION
Outcome Measurement

Description	2N IRF	Nation
Total cases stroke	149 (2016)	
Age range stroke	12 to 95 years	
LOS average	14.6	16.1
LOS efficiency	3.01	2.32
FIM gain	32.2	29.4
%D/C to home	73.8	73.6



STROKE REHABILITATION

SUMMARY

- Stroke rehabilitation crosses a continuum.
- Early stroke rehabilitation is important.
- IRF is preferable to SNF for post-acute care, per AHA/ASA recommendation.
- Expertise is important for appropriate prescription and smooth progression of interventions.

STROKE REHABILITATION

SUMMARY

- Continued practice and exercise are important for long term functioning.
- Traditional and nontraditional therapies are available in the region.
- Reintegration to home and community are priorities, and requires family participation and education.