TBI Across the Lifespan: The Challenge of Change

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MORE SURVIVORS

• 30 years ago, 50% of individuals with TBI died, the number today is 22%

• Improved medical technology and automotive safety features, e.g. seatbelts, child safety seats and airbags

• Average Lifespan shortened about 8 years; to about 70, correlated to physical impairments.
Distribution of TBI Severity: 2.5 million ER Visits

- Mild (Concussion) = 80%
  (LOC < 30 min, PTA 1 hour)

- Moderate = 10 - 13%
  (LOC 30 min-24 hours, PTA 1-24 hours)

- Severe = 7 - 10%
  (LOC >24 hours, PTA >24 hours)
<table>
<thead>
<tr>
<th>Age Group</th>
<th>MVA</th>
<th>Falls</th>
<th>Assault</th>
<th>Struck</th>
<th>All Other</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–4</td>
<td>14,655</td>
<td>250,413</td>
<td>1,513</td>
<td>53,761</td>
<td>13,222</td>
<td>10,225</td>
</tr>
<tr>
<td>5–14</td>
<td>18,110</td>
<td>101,790</td>
<td>16,612</td>
<td>101,112</td>
<td>31,355</td>
<td>20,763</td>
</tr>
<tr>
<td>15–24</td>
<td>76,602</td>
<td>77,951</td>
<td>81,822</td>
<td>71,031</td>
<td>34,486</td>
<td>22,722</td>
</tr>
<tr>
<td>25–44</td>
<td>75,122</td>
<td>80,867</td>
<td>75,527</td>
<td>49,505</td>
<td>36,933</td>
<td>22,855</td>
</tr>
<tr>
<td>45–64</td>
<td>46,923</td>
<td>95,824</td>
<td>28,206</td>
<td>36,925</td>
<td>15,843</td>
<td>18,804</td>
</tr>
<tr>
<td>≥ 65</td>
<td>10,359</td>
<td>174,544</td>
<td>4,068</td>
<td>12,815</td>
<td>6,285</td>
<td>5,216</td>
</tr>
</tbody>
</table>

Percent Distributions of TBI-related Emergency Department Visits by Age Group and Injury Mechanism — United States, 2006–2010

- Motor Vehicle Traffic
- Falls
- Struck by/Against
- Assault
- All Other Causes
- Unknown
### Erikson's Stages of Psychosocial Development

<table>
<thead>
<tr>
<th>Approximate Age</th>
<th>Psycho Social Crisis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant - 18 months</td>
<td>Trust vs. Mistrust</td>
</tr>
<tr>
<td>18 months - 3 years</td>
<td>Autonomy vs. Shame &amp; Doubt</td>
</tr>
<tr>
<td>3 - 5 years</td>
<td>Initiative vs. Guilt</td>
</tr>
<tr>
<td>5 - 13 years</td>
<td>Industry vs. Inferiority</td>
</tr>
<tr>
<td>13 - 21 years</td>
<td>Identity vs. Role Confusion</td>
</tr>
<tr>
<td>21 - 39 years</td>
<td>Intimacy vs. Isolation</td>
</tr>
<tr>
<td>40 - 65 years</td>
<td>Generativity vs. Stagnation</td>
</tr>
<tr>
<td>65 and older</td>
<td>Ego Integrity vs. Despair</td>
</tr>
</tbody>
</table>
Pediatric TBI
Challenges of Childhood

- Trust v Mistrust  
  **HOPE**: Fundamental -- safety, predictability.

- Autonomy v Shame  
  **WILL**: Freedom to explore and welcoming of failure

- Initiative v Guilt  
  **PURPOSE**: Peers, independent decisions, sense of burden

- Industry v inferiority  
  **COMPETENCE**: Peer comparison of self-worth, recognition of disparities
FACTORS AFFECTING OUTCOME IN PEDIATRIC TBI

Age 1  Age 10  Age 20

- Adult
- Child
- Toddler
Lower IQ – More ADHD More ODD
123 children, Avg 11.6 (ages 6 – 17)
Today's Parenting Tip: Treat a difficult child the way you would your boss at work. Praise his achievements, ignore his tantrums and resist the urge to sit him down and explain to him how his brain is not yet fully developed.

— Robert Breault —
Significant group by authoritarian parenting interaction ($F_{3,113} = 3.14; P = .03$). Children with traumatic brain injury (TBI) revealed greater functional
Significant group by home environment interaction ($F_{3,114} = 3.28; P = .02$)
Challenges of Adolescence

- **Identity v Role Confusion** (Identity Crisis)

- **Intimacy v Isolation** (continued)
  - Love: Dating, exploring capacity for intimacy.
Injuries to a child's developing brain may result in delayed consequences that may not be readily apparent at the time of injury or within the first year following the injury.
Initial recoveries may be followed by plateaus and apparent declines.

- Initial knowledge “reserves” no longer adequate
- Peers developing at a faster pace, pulling ahead
- Environmental Demands more complex
  - (Dating, work entry, expectations for responsibility)
- Social isolation, lack of dating success
- Experimentation with substances and alcohol
- Psychiatric Disorders, behavioral and emotional
A student with a TBI could be eligible as a “child with a disability” as that term is defined by ADA Rehabilitation Act of 1973 (Amended 1990; 2010) Section 504

The determination of eligibility under Section 504 requires an evaluation of whether the student has a physical or mental impairment that substantially limits a major life activity, without regard to mitigating measures, such as a health care plan, medication.

The list of major life activities includes the operation of major bodily functions, including neurological function and brain function.
Challenges of Adulthood

• Intimacy v Isolation

LOVE: Dating, marriage, family, parenting. Safety, care and commitment.
Marriage & Divorce
(2008, N=977, multicenter)

50% **ALL** Marriages end in divorce

- 85% still married (only two year follow)
- More serious injury, more likely divorce
- Older more likely to stay married
- Length of Marriage mattered
- TBI males more likely divorced than women
- TBI related to violence more divorced
- Minorities w/ Severe TBI more likely married

Limitations: short follow-up
Sexuality

- Poorly studied, especially in women
- Difficulties of both sexual functioning and desire
- Hypersexuality relatively rare but distressing

- Loss of intimacy and connection separate
- Partners described as childlike and self-oriented.

- Medication effects, distractibility, pain, impulsivity, spasticity
Reproductive Health

- 68% of women 5-10 years post TBI reported their cycles were irregular after injury
- 46% experienced amenorrhea
- No significant differences in conception but more post partum difficulties
- Significantly more mental health issues

- Colantonio et al., 2010
**Parenting Skills**: No differences Over Time

**SELF-PERCEPTION**
Less accepting, Less encouraging
Less positive, Less disciplined
*Non-injured spouse as well

Both Parents more Depressed
(20% Clinical Depression)

Children more Depressed and see parents as:
- Less involved
- Less caring
- Inconsistent
Challenges of Adulthood

Generativity v
Stagnation

CARE: Finding a sense
of purpose -- career,
life goals, provider

CONTRIBUTION

Failure leads to regret,
stagnation, remorse
for past decisions.
Oklahoma Vocational Rehabilitation Training
*(curriculum for State VR)*

- 35% to 71% of persons with TBI return to some level of employment
- The presence of neurobehavioral symptoms, memory deficits, and the severity of physical limitations are general predictors of work outcome
- Work outcome is otherwise difficult to predict as outcome depends on motivation to succeed and the ability to match job demands and employer understanding and compassion with residual skills.
Chronic Traumatic Encephalopathy
Dementia Pugilistica

First described in boxers by Martland in 1928
23 cases reported to him by a single boxing promoter
5 cases ‘personally examined’
1 case with clinical details


Harrison S. Martland
(1883-1954)
First full time paid pathologist
Newark city Hospital, 1909-1927
Chief Medical examiner Essex county
Corsellis, Bruton, and Freeman-Browne described 3 stages of clinical deterioration:

- The first stage is characterized by affective disturbances and psychotic symptoms. Social instability, erratic behavior, memory loss,

- Initial symptoms of Parkinson disease appear during the second stage.

- The third stage consists of cognitive dysfunction, dementia and is accompanied by full-blown Parkinsonism, as well as speech and gait abnormalities.
NFL and CONCUSSIONS

- 61% of the former players sustained at least one concussion in their career.
- 24% sustained 3 or more concussions.
- Retired players with 3 or more concussions had 5 times reported significant memory problems compared to players with no concussion.
- Researchers also observed an earlier onset of Alzheimer's disease in retirees than in general male population.
“Mild Traumatic Brain Injury in U.S. Soldiers Returning from Iraq”

- 1 in 6 returning troops have had at least one concussion
- 4.9% reported injuries with LOC
- 10.3% reported altered mental status, of those, 27.3% met criteria for PTSD
- TBI with LOC also associated with major depression
Normal 65 y/o  
NFL Linebacker (45 y/o, 8 Concuss)  
73 y/o boxer extreme dement
TBI Challenges of Old Age

- Ego Integrity v Despair
- **Wisdom**: accepting victories, defeats, accomplishments and shortfalls. Guilt or regret leads to despair.
The older you get, the more quiet you become. Life humbles you so deeply as you age. You realize how much nonsense you've wasted time on.
Physical Decline with Aging

- Heart capacity
- Resting energy expenditure
- Maximum energy expenditure
- Lung volume

Percentage of function remaining

Age in years
30 40 50 60 70 80 90
Cognitive Changes With Age

The graph illustrates the change in various cognitive abilities with age. The x-axis represents chronological age (in years), and the y-axis represents Z-score. The lines denote different types of cognitive tests:
- Tests of vocabulary
- Tests requiring speeded performance
- Test of reasoning ability
- Tests of memory

The terms 'Crystallized' and 'Fluid' likely refer to different types of cognitive abilities: Crystallized abilities are those that are acquired and do not change much with age, while Fluid abilities are those that are more quickly learned and tend to decline with age.
AGE & TREACHERY
will always triumph over
YOUTH & SKILL
Other Factors Affecting Health

• Economic and Social Status
• Limited Resources/Insurance
• Reduced Health Literacy
• Poor Health Practices due to Cognitive Problems

Increased Rates of Obesity, Hypertension, Depression and Diabetes
TBI Elevates Risk of Neurodegenerative Disease In General

Alzheimer’s – Elevates risk in Dose Dependent Fashion and lowers age of onset.

Parkinson’s – Increased risk, lower age of onset

Frontotemporal Dementia – increased risk

Multiple Sclerosis – Risk Factor

ALS – Possible risk factor, more likely with CTE
In non-progressive neurological disability (mainly traumatic brain injury, spinal cord injury and cerebral palsy) it is the disability itself that determines life expectancy rather than the underlying cause.

1. Mobility
2. Continence
3. Swallowing
4. Epilepsy
5. Severity of Cognitive Deficits
**TBI reduces life expectancy by about 8 years -- to age 70**

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>Increased Risk for Coloradans with TBI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seizures</td>
<td>15 times</td>
</tr>
<tr>
<td>Mental Conditions (includes unspecified dementia)</td>
<td>5 times</td>
</tr>
<tr>
<td>Pneumonias</td>
<td>3 times</td>
</tr>
<tr>
<td>Nervous System Conditions (includes Alzheimer's)</td>
<td>3 times</td>
</tr>
<tr>
<td>Infections</td>
<td>3 times</td>
</tr>
<tr>
<td>Digestive Conditions</td>
<td>3 times</td>
</tr>
<tr>
<td>Assaults</td>
<td>3 times</td>
</tr>
<tr>
<td>Suicide</td>
<td>2 times</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>2 times</td>
</tr>
<tr>
<td>Injuries</td>
<td>2 times</td>
</tr>
</tbody>
</table>
FIGHT ME IF YOU WISH

BUT REMEMBER I AM OLD FOR A REASON
Hope is the most indispensable virtue in being alive...even where confidence is wounded, trust impaired.

Erik Erikson
Questions?

Thank You
Sue went back to work. But she had all sorts of problems.

She kept forgetting where she put things. When the phone rang, she couldn't remember what she was doing. And then she couldn't remember who was on the phone.
Sue began to lose her ability to be a "team player". She was often rude and irritable. It seemed that Sue was in a bad mood more and more.

The people in the office became more and more impatient. They didn't understand why Sue couldn't just "get with it" or "snap out of it".