Delirium: Critical New Tools to Predict Those at Risk & Provide Timely and Accurate Diagnosis

The Stanford Proxy Test for Delirium (S-PTD)
A New Tool for the Screening of Delirium Based on DSM-5 & ICD-10 Criteria

José R. Maldonado, M.D., FAPM, FACFE
Professor of Psychiatry, Internal Medicine, Surgery, Emergency Medicine & Law
President, Stanford SoM Academic Senate
Medical Director, Psychosomatic Medicine Service
Medical Director, Emergency Psychiatry Service
Psychosomatic Medicine Training Program Director
Stanford University School of Medicine
jrm@stanford.edu

President Elect – AMERICAN DELIRIUM SOCIETY
jrm@stanford.edu
Updates on Dementia Annual Meeting - 2017
Disclosure: Jose R. Maldonado, MD

• With respect to the following presentation, there has been no relevant (direct or indirect) financial relationship between Dr. Maldonado (and/or spouse) and any for-profit company in the past 96 months which could be considered a conflict of interest.

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• President, Senate SoM

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Delirium Core Diagnostic Characteristics

- Global Disturbance of Cognition
  - Perceptual distortions, impairment of abstract thinking and comprehension, memory impairment, disorientation

- Impairment of Consciousness and Attention
  - Reduced ability to direct, focus, sustain, and shift attention

- Circadian Rhythm
  - Disturbance of Sleep-Wake Cycle

- Emotional Dysregulation
  - Irritability, anger, fear, anxiety, perplexity

- Psychomotor Disturbance
  - Delirium phenotype

[by Jose Maldonado, Professor, Stanford]
Delirium Phenotypes & Clinical Outcomes

Delirium Precipitant Factors
(“End Acute Brain Failure”)

Baseline Cognitive & Physical Functioning

Subsyndromal Type

Hypoactive Type

Mixed Type

Hyperactive Type

“Catatonic” Type (catatonic Retardation)

Restoration of Baseline Impaired Cognitive Functioning

Impaired Cognitive &/or Physical Recovery

Persistent Delirium Type

“Excited” Type (catatonic Excitement)

[by Jose Maldonado, Professor, Stanford]
The System Integration Hypothesis of Delirium

Precipitants of Delirium

"Acute Brain Failure"

- Electrolyte and fluid imbalances
- Neurologic disorders and injuries
- Nutritional deficiencies
- Age, baseline cognitive functioning
- Substance intoxication & withdrawal states
- Bodily trauma & surgery
- Endocrinopathies
- Baseline psychiatric disorders
- Medications and various toxidromes
- Decreased oxygenation states
- Infections, e.g., sepsis
- Organ failure, severity of medical illness process
- Infrachannel processes
- Isolation & sensory deprivation
- Sleep disturbances & alterations of the circadian rhythm
- Metabolic disorders, physiologic stress and immobility, and emergent delirium

Delirium Substrates

- Neuronal Aging (NAM)
- Neurotransmission (NIM)
- Oxidative Stress (OSM)
- Neuroendocrine Dysregulation (RED)
- Circadian Dysregulation (CDH)

Delirium Subsystems

- Neuronal Transmission
- Oxidative Stress
- Neuroendocrine Dysregulation
- Circadian Dysregulation

Delirium Subsystems

- Clinical Delirium Phenotype
  - Hypothalamic-Hypophyseal (Hypothalamic-Hypophysal Syndrome)

Delirium Outcomes

- Full Functional (cognitive & physical) Recovery
- Variable Degree of Cognitive & Functional Deficits (Physical & Neuropsychiatric Morbidity)
- Persistent (or Chronic) Delirium
- Morbidity & Mortality

[by Jose Maldonado, Professor, Stanford]
1. Delirium is the most common psychiatric syndrome found in the general hospital setting.

2. One of the six leading causes of preventable conditions in hospitalized elderly patients.

3. After controlling for demographics, apparent illness severity, age, and medical comorbidities, patients who develop delirium fare much worse than their non-delirious counterparts.
Delirium – why should we care?

4. ↑ Morbidity

<table>
<thead>
<tr>
<th></th>
<th>3-month follow-up (n=448)</th>
<th>12-month follow-up (n=382)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ADL disability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>32%</td>
<td>27%</td>
</tr>
<tr>
<td>No prior disability</td>
<td>27%</td>
<td>22%</td>
</tr>
<tr>
<td>Prior disability</td>
<td>69%</td>
<td>55%</td>
</tr>
<tr>
<td><strong>IADL disability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>26%</td>
<td>23%</td>
</tr>
<tr>
<td>No prior disability</td>
<td>23%</td>
<td>20%</td>
</tr>
<tr>
<td>Prior disability</td>
<td>56%</td>
<td>62%</td>
</tr>
</tbody>
</table>
5. Baseline Cognitive Impairment \(\uparrow\) risk for Delirium

- Older age to be an independent risk factor for delirium among medically-ill hospitalized patients.
- Among critically-ill elderly patients the probability of developing delirium increases by 2% per year of age for each year after age 65 \([\text{Pandharipande, Anesthesia 2006}]\)

\[
\text{Probability of Transitioning to Delirium}
\]

- Among medically-ill, hospitalized elderly (\(\geq 65\)) subjects the delirium risk increased from 3% at \(< 65\) years, to 14% for those 65-74 years, and 36% for patients \(\geq 75\) years \((p<0.0001)\) \([\text{Pendlebury et al, BMJ 2015}]\)
5. Baseline Cognitive Impairment \( \uparrow \) risk for Delirium

- Among elderly subjects undergoing orthopedic surgery the incidence of postoperative delirium (POD) increases from 32% among elderly non-demented to 100% among patients with dementia [Wacker et al, Dement Geriatr Cogn Disord, 2006]

- A study of non-demented elderly patients undergoing elective orthopedic surgery demonstrated that subtle pre-operative attention deficits (e.g., digit vigilance and reaction time testing), were closely associated with POD. In this population, subtle changes predicted a 4- to 5-fold increased risk of POD for subjects >1 standard deviation above the sample means on these variables. Lowery et al, Dement Geriatr Cogn Disord, 2007
Delirium – why should we care?

6. ↑ Adverse Long Term Sequelae – Cognitive Impairment

- After adjusting for age, education, preexisting cognitive function, severity of illness, severe sepsis, and exposure to sedative medications in the intensive care unit:
- Increasing delirium duration was an independent predictor of worse cognitive performance on neuropsychological testing at 3 and 12 months follow up ($p=0.02$ and $p=0.03$, respectively).
- An increase from 1 day of delirium to 5 days was independently associated with a 7 point decline in the cognitive battery mean score at 12 months f/u ($p=0.03$)
- Duration of mechanical ventilation was not associated with long-term cognitive impairment ($p=0.20$)

Girard et al. Cric Care Med 2010
Delirium – why should we care?

6. ↑ Adverse Long Term Sequelae – Cognitive Impairment

*Delirium accelerates cognitive decline in Alzheimer Disease*

- Prospective data from hospitalized patients with AD (n=263) (median follow-up duration, 3.2 years).
- Cognitive deterioration following delirium proceeded at twice the rate in the year after hospitalization compared with patients who did not develop delirium.
- Patients who had developed delirium maintained a more rapid rate of cognitive deterioration throughout a 5-year period following hospitalization.

*Fong et al, Neurology 2009;72:1570–1575*
Delirium & Long-term Cognitive Trajectory Among Persons With Dementia

- After adjusting for dementia severity, comorbidity, and demographic characteristics:
  - Patients who had developed delirium experienced greater cognitive deterioration in the year following hospitalization (3.1 IMC points per year) relative to patients who had not developed delirium (1.4 IMC ppy).
  - Cognitive deterioration after delirium proceeded at twice the rate in the year after hospitalization compared with patients who did not develop delirium.
  - Patients who developed delirium maintained a more rapid rate of cognitive deterioration throughout a 5-yr f/u.

IMC = information-memory-concentration (IMC) section of the Blessed Dementia Rating Scale

(by Jose Maldonado, Professor, Stanford) Gross et al, 2012, Arch Intern Med 172;17)
Delirium is a strong risk factor for dementia in the oldest-old

- The Vantaa 85+ study (population based cohort) examined 553 individuals (92% of those eligible) aged ≥85 years at baseline, 3, 5, 8 and 10 years.

- Delirium increased the risk of incident dementia (odds ratio 8.7, 95% confidence interval 2.1–35).

- In the whole study population, delirium was associated with loss of 1.0 more Mini-Mental State Examination points per year (95% confidence interval 0.11–1.89) than those with no history of delirium.

[by Jose Maldonado, Professor, Stanford]
Delirium Superimposed on Dementia

A. Morandi et al. / JAMDA xxx (2016) 1e7
The association between delirium duration, and cognitive outcomes in intensive care unit survivors: The VISIONS cohort magnetic resonance imaging study

• Method: A **prospective cohort** of medical and surgical ICU survivors with respiratory failure or shock. Quantitative high resolution 3-Tesla brain MRI was used to calculate **brain volumes at discharge and 3-month follow-up**.

• Results:
  – Patients with *longer delirium duration* displayed **greater brain atrophy** as measured by a larger ventricle- to-brain ratio at hospital discharge ($p = .03$) and at 3-month follow-up ($p = .05$).
  – **Longer duration of delirium** was associated with **smaller superior frontal lobe** (executive functioning) ($p = .03$) and **hippocampal volumes** (memory) at discharge ($p < .001$).
  – **Greater brain atrophy** at 3 months was associated with **worse cognitive performances** (executive functioning and visual attention) at 12 months ($p = .04$).
The association between delirium duration, white matter integrity, and cognitive impairment in ICU survivors: The VISIONS cohort magnetic resonance imaging study

- After ICU stay, **fractional anisotropy** (measure of white matter integrity), was calculated using diffusion tensor imaging with a 3-T MRI @ hospital D/H & 3-mo f/u.

- **Greater duration of delirium** (3 vs. 0 days) was associated with **lower fractional** anisotropy (i.e., higher white matter disruption) in the genu \((p=.04)\) and splenium \((p=.02)\) of the **corpus callosum** and anterior limb of the internal capsule \((p=.01)\) at hospital discharge.

- These associations **persisted at 3 months** for the genu \((p=.02)\) and splenium of the corpus callosum \((p=.004)\).

- White matter disruption was associated with worse cognitive scores up to 12 months later.
Long-Term Cognitive Impairment Following Critical Illness

• Critical illness in the absence of full-blown delirium has also been found to result in long-term cognitive dysfunction (subsyndromal delirium?) 2 months to 6 years following critical illness.

  o At 1 year: 46-70% of patients,

  o At 6 years: 25% of patients showed signs of cognitive dysfunction.

Cole et al. JAGS 2003;
# Subsyndromal Delirium and Clinical Outcomes

<table>
<thead>
<tr>
<th></th>
<th>No delirium (ND)</th>
<th>Subsyndromal (SD)</th>
<th>Clinical (CD)</th>
<th>(P) value*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ICU Mortality</strong></td>
<td>2.4%</td>
<td>10.6%</td>
<td>15.9%</td>
<td>(P &lt; 0.001)</td>
</tr>
<tr>
<td><strong>ICU LOS</strong></td>
<td>2.5 d</td>
<td>5.2 d</td>
<td>10.8 d</td>
<td>(P &lt; 0.001)</td>
</tr>
<tr>
<td><strong>Hospital LOS</strong></td>
<td>31.7 d</td>
<td>40.9 d</td>
<td>36.4 d</td>
<td>ND vs. SD, (P = 0.002)\nSD vs. CD, (P = 0.137)</td>
</tr>
<tr>
<td><strong>Severity of illness</strong></td>
<td>12.9</td>
<td>16.7</td>
<td>18.6</td>
<td>ND vs. SD, (P &lt; 0.001)\nSD vs. CD, (P &lt; 0.016)</td>
</tr>
</tbody>
</table>

*Pairwise comparison

[by Jose Maldonado, Professor, Stanford]  

7. Adverse Long Term Problems – Emotional Sequelae

Systematic review of studies in general ICU settings revealed that:

- up to 27% of ICU survivors suffer from PTSD
- Risk factors included:
  - use of benzodiazepines
  - duration of sedation
  - fear, stress and delirium in the ICU


Nature and content of post-intensive care memories:

- 70% of patients had hallucinatory/delusional intrusive memories, while 12% had factual but no hallucinatory/delusional memories; 18% were uncertain
- The content of intrusive memories commonly merged realistic events with delusions and frightening hallucinations.
Delirium – why should we care?

8. ↑ Mortality

- > 49% of all US hospital days are spent caring for patients with delirium.¹
- Death: 1 vs. 8%²
- 90 day mortality 3% vs. 11%³
- 6-month mortality 15% vs. 34%⁴
- Increased 1-yr mortality post-ICU admission⁵

➢ Kaplan-Meier survival curve for 1-year mortality post–ICU admission $P < 0.001$
➢ Each day of delirium in the ICU increases the hazard of mortality by 10%

² Francis J et al. JAMA 1990;263:1097
³ Pompei et al. JAGS 1994; 42: 809
⁴ Ely et al 2004
⁵ Pisani, Am J Resp Crit Care 2009
Delirium – why should we care?

9. ↑ Health Care Costs

- The overall cost is of about 2.5X higher than non-delirious counterparts. 1,2
- Estimated to occur in >2.3M inpatients/yr = 17.5M inpatients days. 3
  - Delirium results in increased nursing time per patient, higher per-day hospital costs, and an increased length of hospital stay. 4
  - A recent study estimated that delirium is responsible an additional cost of $60,000 - $64,000/patient/yr.
    - Thus, total direct 1-year health-care costs attributable to delirium is up to $164 B (USA) and $182 B (Europe). 5,6,7
- Costs accrue after hospital discharge due to greater need for long-term care or additional home health care, rehabilitation services, and informal caregiving.
  - Lengthened hospital stay: 7 vs. 12 days 6,7,8
  - ↑ nursing home placement: 3 vs. 16% 6,8
  - The functional decline persisted at 6 months after hospital discharge 10

1. Milbrandt et al, CCM 2004
2. Leslie et al, Arch Int Med 2008
3. Rizzo et al, Medical care 2001
7. Ely et al. Int Care Med 2001; 1892-1900

[by Jose Maldonado, Professor, Stanford]
Delirium’s Diagnostic Dilemma

[by Jose Maldonado, Professor, Stanford]
Delirium Phenotype

Insult

Baseline Cognitive Functioning

Hyperactive Delirium
- Insult
- Hyperactive
- Delirium
- Confused
- Psychomotorically
  agitated
- Intrusive
- Cognitively
  Impaired
- Perceptually
  Disturbed

Hypoactive Delirium
- Insult
- Hypoactive
- Delirium
- Confused
- Psychomotorically
  retarded
- Withdrawn
- Cognitively
  Impaired
- Perceptually
  Disturbed

Mixed-type Delirium
- Insult
- Mixed-type
  Delirium
- Confused
- Psychomotorically
  agitated
- Intrusive
- Cognitively
  Impaired
- Perceptually
  Disturbed

“Excited” Delirium
- Insult
- “Excited”
  Delirium
- Combative
- Agitated
- Irritable
- Uncooperative
- Cognitively
  Impaired
- Perceptually
  Disturbed
- “Depressed”
- Subdued
- Apathetic
- Lethargic
- Obtunded

“Catatonic” Delirium
- Insult
- “Catatonic”
  Delirium
- Combative
- Agitated
- Irritable
- Uncooperative
- Cognitively
  Impaired
- Perceptually
  Disturbed
- “Depressed”
- Subdued
- Apathetic
- Lethargic
- Obtunded

<table>
<thead>
<tr>
<th>Patient Factors</th>
<th>Clinician/Practitioner Factors</th>
<th>Systems Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Older subjects</td>
<td>• Lack of knowledge and training</td>
<td>• Lack of consensus over the optimal assessment of delirium</td>
</tr>
<tr>
<td>• Patients experiencing co-morbid dementia</td>
<td>• Lack of confidence</td>
<td>• Location of care [worse in surgical rather than medical settings]</td>
</tr>
<tr>
<td>• Fluctuating course of presentation</td>
<td>• Lack of suspicion</td>
<td>• Busy clinical settings [especially low nurse to patient ration]</td>
</tr>
<tr>
<td>• Presence of hypoactive features</td>
<td>• Lack of time of the clinical staff</td>
<td>• Inadequate application of sedation holidays in sedated-ventilated patients</td>
</tr>
<tr>
<td></td>
<td>• Expectation that altered mental status or delirium are a “normal occurrence” in certain medical settings, such as the ICU</td>
<td>• The rapid transfer of patients from one unit to another which may decrease the proper documentation and diagnosis</td>
</tr>
</tbody>
</table>

[by Jose Maldonado, Professor, Stanford]
Objective Measures for the Diagnosis of Delirium

  - Confusion Assessment Method (CAM) (Inouye et al 1990)(Inouye, Balkin et al. 1990)

  - Delirium Assessment Scale (DAS) (O’Keeffe 1994)(O'keeffe 1994)
  - Neelon and Champagne (NEECHAM) Confusion Scale (Neelon, Champagne et al. 1996)
  - Memorial Delirium Assessment Scale (MDAS) (Breitbart et al 1997)
  - Delirium Severity Scale (DSS) (Bettin et al 1997) (Bettin 1998)
  - Delirium Index (DI) (McCusker et al 1998)(McCusker, Bellavance et al. 1998)

- Intensive Care Delirium Screening Checklist (ICDSC) (Bergeron et al. 2001)
  - Delirium Detection Tool-provisional (DDT-pro) (Kean, Trzepacz et al. 2010)
  - bCAM (Han et al, 2013)
  - 4AT (McLullich, et al 2013)

  - Stanford Proxy Test for Delirium (PTD)(Maldonado, Sher, et al 2014)

[by Jose Maldonado, Professor, Stanford]
Confusion Assessment Method (CAM-ICU)

1. Acute onset of mental status changes or a fluctuating course

and

2. Inattention

and

3. Disorganized Thinking

or

4. Altered level of consciousness

= Delirium

Ely et al, Crit Care Med 2001;29:1370-79
Ely et al, JAMA 2001;286:2703-2710
A study of “real-life” conditions (as opposed to a research setting) suggested that “the CAM-ICU in daily practice showed not quite as good test characteristics as presented in the original validation studies”.

“after stratification according to type of delirium, sensitivity of the CAM-ICU was lowest in the hypoactive subgroup (31%; 95% CI, 17%–48%); highest in the hyperactive delirious patients (100%; 95% CI, 56%–100%); and intermediate in the mixed-type patients (53%; 95% CI, 35%–74%); exhibiting particularly poor test characteristics in neurocritical care patients (sensitivity 17%; 95% CI, 1%–64%).

van Eijk et al., 2011
The 4AT

- **Alertness**
- **AMT4 (Abbreviated Mental Test – 4)**[Age, date of birth, place (building), year]
- **Attention**
- **Acute change or fluctuating course**

**Scoring**

≥4: possible delirium +/- cognitive impairment
1-3: possible cognitive impairment
0: delirium or severe cognitive impairment unlikely

**Sensitivity and Specificity**

<table>
<thead>
<tr>
<th>Score</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Score 4 or above</td>
<td>89.7%</td>
<td>84.1%</td>
</tr>
<tr>
<td>Alertness 4</td>
<td>53.2%</td>
<td>96.1%</td>
</tr>
<tr>
<td>AMT4 1</td>
<td>96.6%</td>
<td>54.6%</td>
</tr>
<tr>
<td>2</td>
<td>89.7%</td>
<td>80.2%</td>
</tr>
<tr>
<td>Attention 1</td>
<td>93.1%</td>
<td>49.8%</td>
</tr>
<tr>
<td>2</td>
<td>86.2%</td>
<td>82.6%</td>
</tr>
<tr>
<td>Acute change/Fluctuation 4</td>
<td>69.0%</td>
<td>94.2%</td>
</tr>
</tbody>
</table>

N=234 consecutive older patients in acute geriatrics and rehabilitation settings: the 4AT is **90% sensitive and 84% specific** for delirium when performed by a geriatrician.

[by Jose Maldonado, Professor, Stanford]
Patient Ability to Participate in cognitive tests or interviews

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**Excited delirium**
- Not cognitively testable (too agitated)
- Hyperactive
  - Cognitively testable
- Hypoactive
  - Cognitively testable
- Catatonia/Coma
  - Not cognitively testable (too drowsy/unresponsive)

**Normal function**
- Cognitively testable

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Range of level of increased arousal

-range of level of reduced arousal

[by Jose Maldonado, Professor, Stanford]
Stanford Proxy Test for Delirium (S-PTD)

Rationale

• This may partly be due to the reliance of these validated tools on the patient's report of symptoms and their (in)ability to engage in active participation on the delirium screening tool itself.

• Instead, a screening tool relying on the observations of nursing staff could potentially provide a more accurate assessment of patient symptoms.

• “the low sensitivity of the CAM-ICU in routine, daily practice may limit its use as a screening test” (Neto et al., 2012).
Delirium
Diagnostic Criteria

**DSM V**

A. Disturbance in attention (i.e., reduced ability to direct, focus, sustain, and shift attention) and awareness (reduced orientation to the environment).

B. The disturbance develops over a short period of time (usually hours to a few days), represents a change from baseline attention and awareness, and tends to fluctuate in severity during the course of a day.

C. An additional disturbance in cognition (e.g., memory deficit, disorientation), language, visuospatial ability, or perception that is not better explained by a preexisting, established, or other evolving neurocognitive disorder.

D. The disturbances in Criteria A and C are not better explained by another preexisting, established, or evolving neurocognitive disorder and do not occur in the context of a severely reduced level of arousal, such as coma.

E. There is evidence from the history, physical examination, or laboratory findings that the disturbance is caused by the physiological consequence of another medical condition, substance intoxication or withdrawal (i.e., due to a drug of abuse or to a medication), or a toxin exposure, or is due to multiple etiologies.

**ICD–10**

Symptoms, mild or severe, should be present in each one of the following areas:

A. Impairment of consciousness and attention, on a continuum from clouding to coma (e.g., reduced ability to direct, focus, sustain, and shift attention);

B. Global disturbance of cognition (e.g., perceptual distortions, illusions and hallucinations - most often visual; impairment of abstract thinking and comprehension, with or without transient delusions, but typically with some degree of incoherence; impairment of immediate recall and of recent memory but with relatively intact remote memory; disorientation for time as well as, in more severe cases, for place and person);

C. Psychomotor disturbances (e.g., hypo- or hyperactivity and unpredictable shifts from one to the other; increased reaction time; increased or decreased flow of speech; enhanced startle reaction);

D. Disturbance of the sleep-wake cycle (e.g., insomnia or, in severe cases, total sleep loss or reversal of the sleep-wake cycle; daytime drowsiness; nocturnal worsening of symptoms; disturbing dreams or nightmares, which may continue as hallucinations after awakening);

E. Emotional disturbance (e.g. depression, anxiety or fear, irritability, euphoria, apathy, or wondering perplexity).

The onset is usually rapid, the course diurnally fluctuating, and the total duration of the condition less than 6 months.
Stanford Proxy Test for Delirium (S-PTD)

Development

• Our team combined DSM-V & ICD-10 criteria and developed highly technical choice items to address every aspect of the diagnostic criteria

• Conducted focused groups and cognitive testing sessions to obtain nurses’ feedback, allowing the nurses to re-write the descriptive items using language that is more akin to how nurses would describe a given patient’s behavior

• Thus, the final version of S-PTD was written by nurses, for nurses.

[by Jose Maldonado, Professor, Stanford]
## Proxy Test for Delirium (PTD)

*Maldonado, et al. 2013 Psychosomatic Medicine Service, Stanford University School of Medicine*

### Instructions – Using the provided scoring card, please grade as “0” = “not at all”, “1”=sometimes, “2”=most of the time”, based on observations made during the preceding nursing shift and information provided by previous nursing staff & family DURING THE PRECEDING 24 HRS.

<table>
<thead>
<tr>
<th>Question</th>
<th>Not at ALL</th>
<th>SOME TIMES</th>
<th>MOST of the time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. During your shift, has your patient experienced difficulties with <strong>attention:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For example:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Trouble maintaining focus when you ask questions or provide directions?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Easily distracted during conversations?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Easily distracted from tasks requiring attention (e.g., filling out the menu)</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3. During your shift, has your patient experienced difficulties with <strong>memory:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For example:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Forgetting why he/she was admitted to the hospital?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Forgetting daily events such as visitors, meals, procedures, etc.?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Forgetting the identities/roles of primary team and staff members?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. During your shift, has your patient experienced difficulties with <strong>perceptions:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For example:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. ILLUSIONS, (e.g. believing that objects in the room are something else, or misinterpreting sounds/spoken language that he/she hears)?</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>b. Auditory and/or visual HALLUCINATIONS (e.g., picking at “stuff” in his skin or sheets, grabbing/poiting at imaginary objects; having conversations with people not present in the room)?</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>11. During your shift, has your patient had changes in <strong>sleep pattern</strong>?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For example:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Experienced insomnia?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Demonstrated excessive daytime somnolence which is clinically significant and impairing daily function?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Has your patient experienced extremely vivid and disturbing dreams during the daytime?</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>d. Talking about events from sleep/dreams as if they had actually occurred?</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
The S-PTD incorporates DSM-5 and ICD-10 diagnostic criteria.

The instrument was developed in collaboration with members of the nursing staff who assisted in the development of test items prompts.

The PTD eliminates the need of direct patient participation in the assessment:

- instead, nurses complete the tool at the end of their shift; thus using the full shift patient interaction to gather the information needed to accurately diagnose delirium.
Methods

• In this our study, the PTD is evaluated as compared to a validated tool (i.e., CAM) and clinical assessment (i.e., DSM-5 criteria).

• We hypothesize that the PTD will have equal or better predictive value as standard measures, but easier to use in all clinical environments.

• Methods:
  – Conducted at SHC on units housing Neurology, Neurosurgery & General Medicine patients from 4/24/2014 through 7/24/2014.
  – All patients admitted to these units were approached.
  – Exclusion criteria included:
    • unwillingness to participate
    • inability to communicate effectively in English or Spanish
    • designation of “too sick to participate” by the primary team.

Methods:

- Enrolled patients were separately and blindly screened for symptoms of delirium utilizing the:
  - PTD (primary nurse) at the end of their shift (end 10-12 hrs shift)
  - Confusion Assessment Method (CAM) (research assistant)
  - a clinical neuropsychiatric evaluation based on DSM_5/ICD_10 criteria (performed by Psychosomatic Medicine specialist - gold standard)
    - All exams administered within 60 min from each other.

- The study was approved by the Stanford’s IRB Committee

• Results:

- Average age: 59.9 years (standard deviation 19.5)
  - range of 18 – 98 yrs of age
- 54.5% were male.
- Indications for admission included brain surgery, spinal surgery, cerebral vascular accidents, cardiovascular diseases, seizures, gastrointestinal dysfunction, fever, infection, and pulmonary diseases.
- A total of 37 patients (17.3% of the sample) developed delirium, as captured by the gold standard, a neuropsych assessment based on DSM-5/ICD-10 criteria.


[by Jose Maldonado, Professor, Stanford]
Stanford Proxy Test for Delirium (S-PTD)

- Results:
  - using a cut-off score of ≥4

Psychometric Qualities:
- Sensitivity: 79.0%
- Specificity: 90.8%
- positive predictive value: 70.0%
- negative predictive value: 94.1%

Stanford Proxy Test for Delirium (S-PTD)

Results:

<table>
<thead>
<tr>
<th>Cut off 3</th>
<th>Disease +</th>
<th>Disease -</th>
<th>Total</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>PPV</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTD +</td>
<td>45</td>
<td>21</td>
<td>66</td>
<td>0.775862</td>
<td>0.90411</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTD -</td>
<td>13</td>
<td>198</td>
<td>211</td>
<td>0.681818</td>
<td>0.938389</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>58</td>
<td>219</td>
<td>277</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAM</td>
<td></td>
<td></td>
<td></td>
<td>0.758621</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAM+</td>
<td>44</td>
<td>5</td>
<td>49</td>
<td></td>
<td>0.977169</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAM-</td>
<td>14</td>
<td>214</td>
<td>228</td>
<td>0.897959</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>58</td>
<td>219</td>
<td>277</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Delirium</th>
<th>CAM +</th>
<th>CAM-</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTD+</td>
<td>40</td>
<td>5</td>
<td>45</td>
</tr>
<tr>
<td>PTD-</td>
<td>4</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>14</td>
<td>58</td>
</tr>
</tbody>
</table>

McNemar's Test P-Value 0.739

- PTD performed just as well as CAM in identifying delirium, with a McNemar's Test P-Value of 0.739.
- However, PTD took less time to administer:
  - After an initial training period of 2 weeks, it took the average nurse < 1 min to complete the questionnaire (vs 5 min for CAM or 3–5 min for 3D-CAM).
  - Nurses reported that PTD was “easier to use” than CAM, "liking" the PTD better than CAM, and being “more willing to complete” the PTD than CAM.
The System Integration Hypothesis of Delirium

Precipitants of Delirium
“End Acute Brain Failure”
(i.e., electrolyte and fluid imbalances, neurological disorders and injuries, nutritional deficiencies, age, baseline cognitive functioning, acute substance intoxication & withdrawal states, body trauma & surgery, endocrinopathies, baseline psychiatric disorders, medications and various toxidromes, decreased oxygenation states, infections, sepsis, delirium, organ failure, severity of medical illness process, intracranial processes, isolation & sensory deprivation, sleep disturbances & alterations of the circadian rhythm, metabolic disorders, physiologic stress and immobility, and emergence delirium)

Systems Integration Failure Hypothesis (SIFH)

Acute Brain Failure
Clinical Delirium Phenotype
(Variable or Complete: Hypersensitive, Hyporesponsive)

Outcomes

Mortality & Morbidity

Full Functional (cognitive & physical) Recovery
Variable Degree of Cognitive & Functional Deficits (↑ Physical & Neuropsychiatric Morbidity)
Persistent (or Chronic) Delirium

Maldonado, Int J Ger Psych, 2017: 32 (6)
Upcoming deadlines:

- Dec 15, 2016: Oral Presentations
- Jan 20, 2017: Poster Presentations
- March 31st, 2017: Early Registration

American Delirium Society
June 4-6, 2017 | Nashville, TN

http://www.americandeliriumsociety.org/

American Delirium Society
San Francisco, California  June 9-11, 2018