Assessing Competence in Procedural Skills

UTSW Effective Teacher Series
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Learning Objectives

At the end of this ETS Session, learners attending will be able to:

- Describe Miller's Pyramid as it applies to procedural competence.
- List common approaches used for assessment of outcomes for procedure training at the resident level.
- Differentiate features of procedure skill assessment methods which produce data that is valid from other forms of assessment methods.
- Identify key features of a Hierarchical Task Analysis tool required to measure outcomes in procedural skills

Competence in the Performance of Medical Procedures

- Patient safety relies on physician competence in the performance of medical procedures
- Training programs are charged with providing instruction in performance of procedures *and* with learner assessment of competence

Jolly, 2001

Southgate, 2001

Competence in the Performance of Medical Procedures

- Since 1989, after the Libby Zion case, NY State required that all residents be credentialed in the procedures they are performing independently
- In a 1992 survey of graduates, many reported learning procedures without supervision – often after they entered practice.

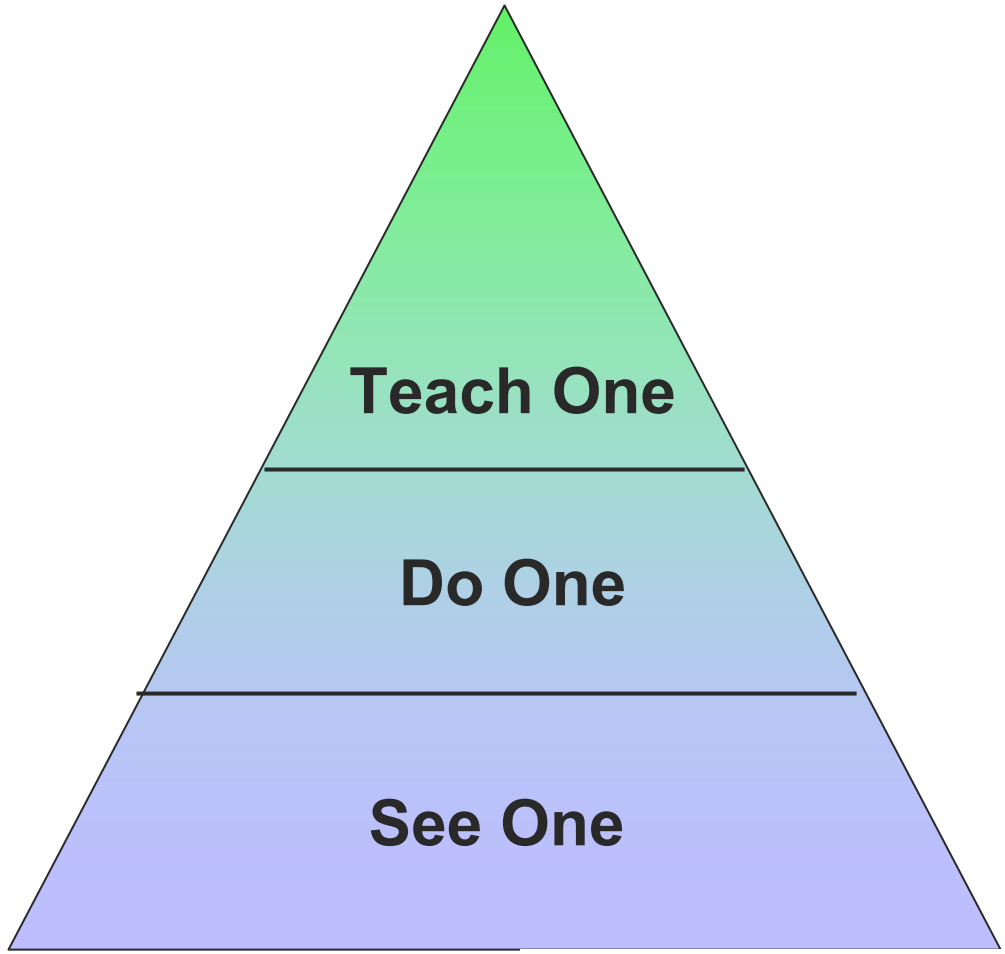
Wigton, 1992

Programs recognize need to provide instruction in and assessment of procedures

- 2500 practicing general internists surveyed reported they were doing more and more procedures
- PD's surveyed at the same time:
  - 53% had developed list of procedural skills
  - 21% had developed specific criteria for competence; 56% of the 389 PD's surveyed planned to develop such criteria
  - 82% stated "uniform system to be used by all programs to document procedures would be helpful"
  - Patricia Hicks, MD

Wigton, 1989.

“See One, Do One, Teach One”



Thomas, 1994.

Assessment: Miller's pyramid of competence

Performance assessment in vivo

Logs, assumed experiential, observation

Performance assessment in vitro

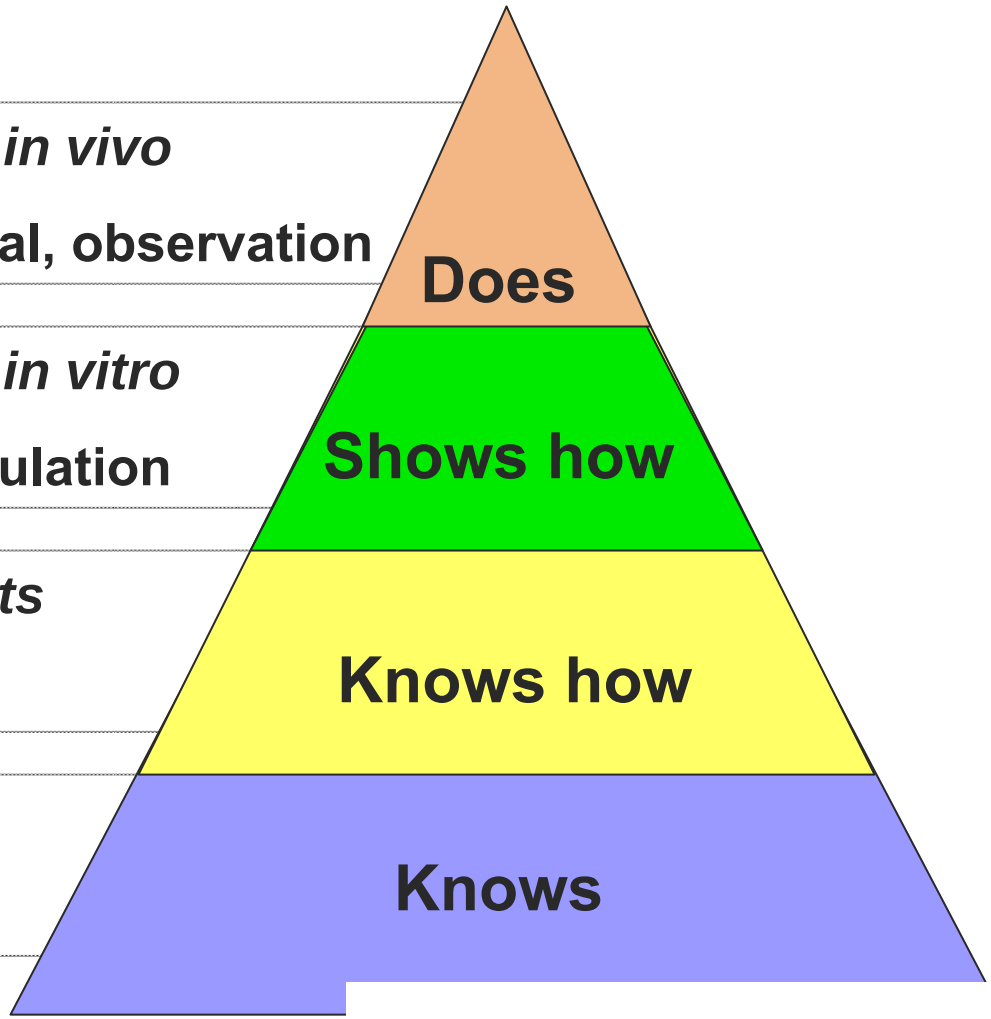
OSCE, SP-based test, simulation

Clinical context based tests

MCQ, essay, oral

Factual tests

MCQ, essay, oral



Wass, 2001

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Assessment of competence in the performance of procedures

- *Counting* procedures
- Surveying physician *confidence* in the performance of procedures
- Surveying physician *perception of comfort* when performing procedures

Assessment of competence in the performance of procedures

- *Counting* procedures
  - ABIM established a *number* of procedures experienced as a required pre-requisite for readiness for the ABIM certifying examination
  - Residents report that few of them achieved the number of procedures required by the ABIM

Wickstrom, 2000.

Assessment of competence in the performance of procedures

***Procedure experience** (number performed) **as it relates to performance mastery** (gold standard)*

1. **Gold standard** established for thoracotomy with both computer-based simulation and animal performance testing (construct validity study)

Chapman, 1994

Assessment of competence in the performance of procedures

***Procedure experience** (number performed) **as it relates to performance mastery** (gold standard)*

2. Study groups chosen: students, residents and faculty
3. Study subjects were assessed for mastery by performance on both computer-based simulation and animal performance (for which the gold standard had already been established)
4. Masters and non-masters grouped separately and sorted by sub-groups of number of procedures experienced

Chapman, 1994 and 1996

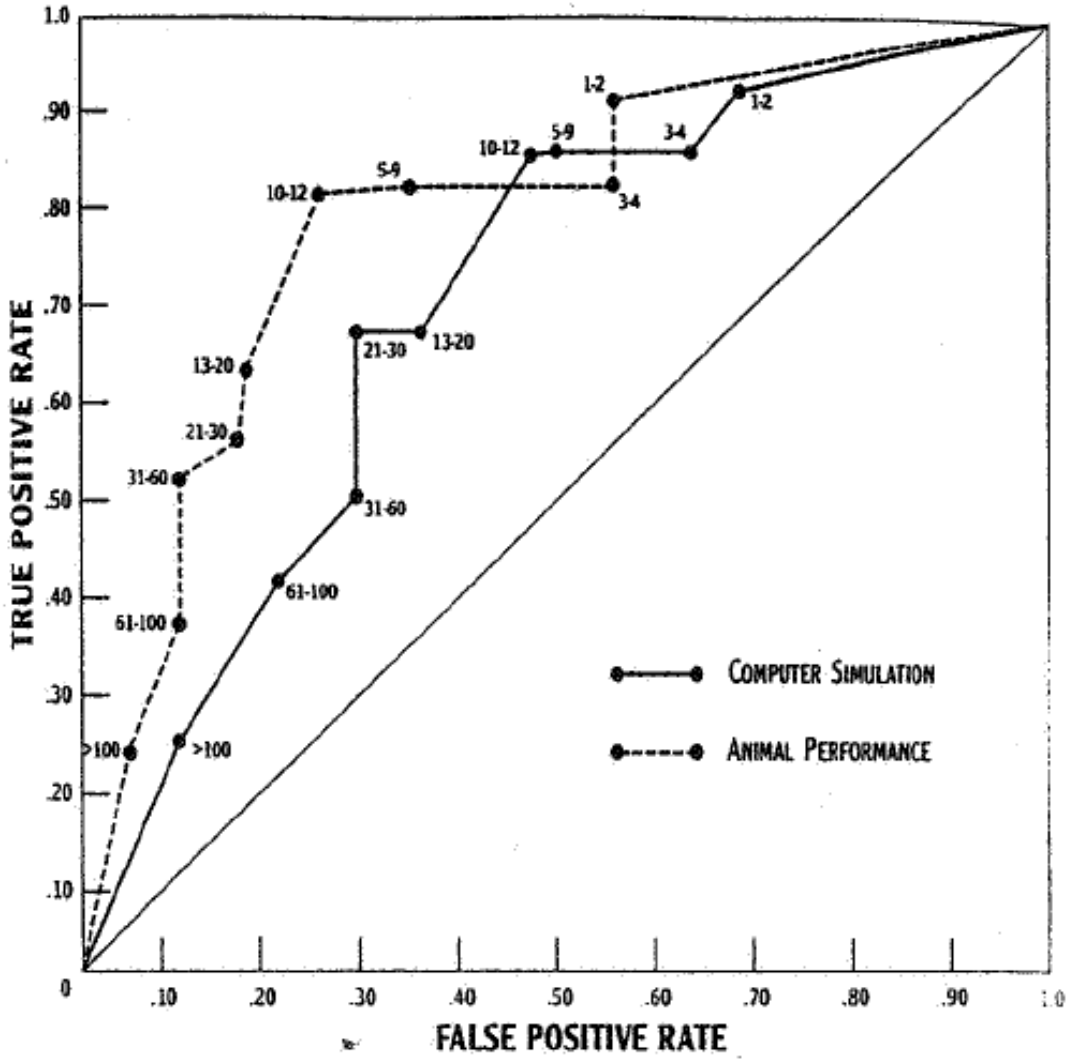
Assessment of competence in the performance of procedures

Receiver operator characteristic curve requires the graphing of the true positive rate and the true negative rate

# of procedures (cut-off value)	Master	Non-master
≥ x	True positive	False positive
< x	False negative	True negative

Colliver, 1994

ROC for reported experience in number of procedures performed as it relates to gold standard performance assessment



Colliver, 1992

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Assessment of competence in the performance of procedures

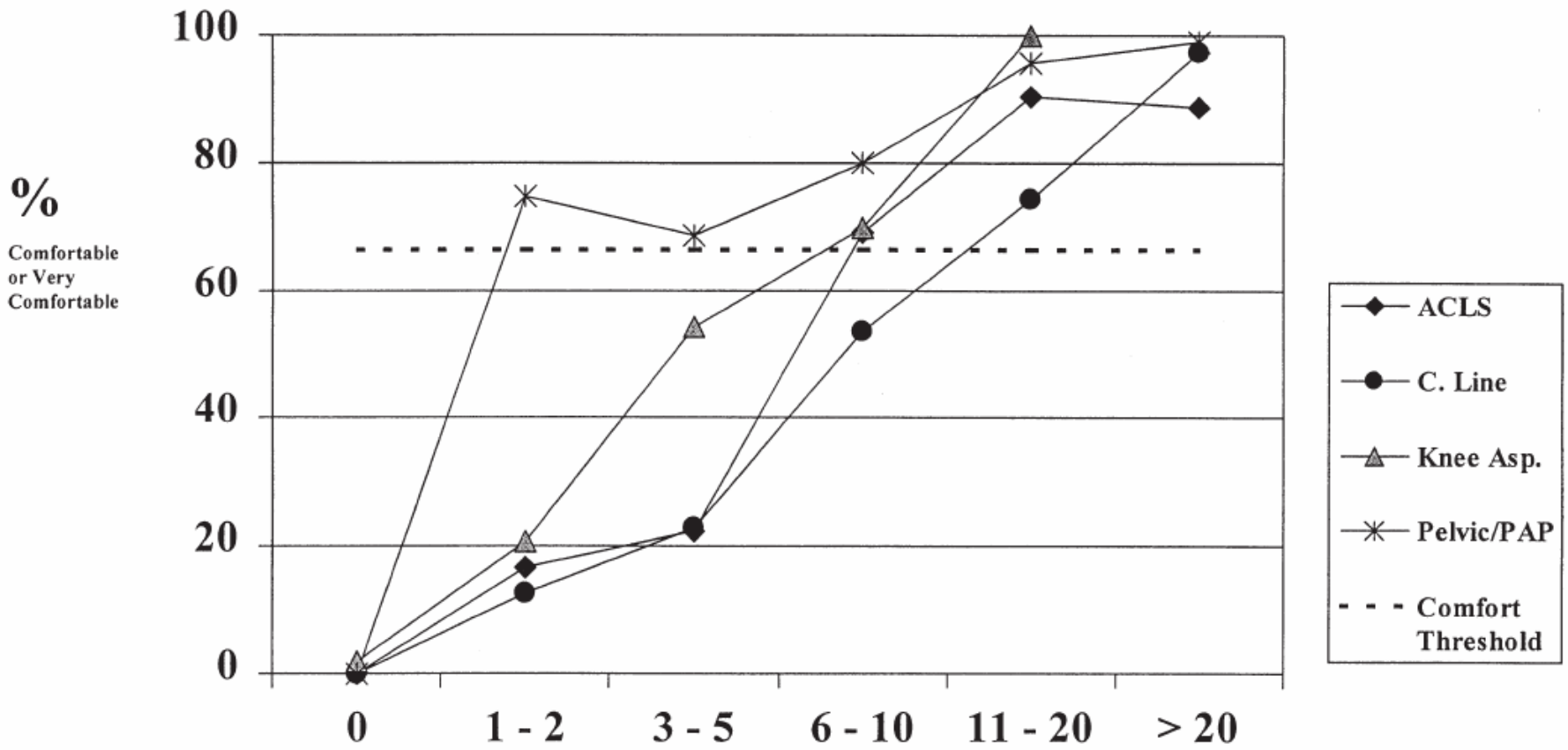
- ***Confidence* in the performance of procedures as a measure of competence**
  - 87% of pediatric residents reported *confidence* in their ability to intubate neonates after neonatal resuscitation training and megacode check-off
    - 35% of the attempts were never successful
    - Post-graduation, 71% of this group stated that they were practicing general pediatrics and 36% of them were attending deliveries

Falck, 2003

Assessment of competence in the performance of procedures

- **Physician *perception of comfort* when performing procedures**
  - Residents at two university, one military base and two community hospitals were asked to report their level of comfort when performing specified procedures
  - A comfort threshold was determined to be the number of procedures where 2/3 or more of the housestaff were comfortable or very comfortable in performing that procedure
  - This comfort threshold was studied against the ABIM suggested number of procedures

Physician *perception of comfort* when performing procedures



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Hicks C, 2000; Davis 2006

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Current ABIM Requirements

- ABIM does not specify a minimum number of procedures to demonstrate competency; however, to assure adequate knowledge and understanding of the common procedures in internal medicine, each resident should be an active participant for each procedure five or more times.

Current ABIM Requirements for Procedure Competency

	Know, Understand and Explain				Perform Safely and Competently
	Indications; Contraindications; Recognition & Management of Complications; Pain Management; Sterile Techniques	Specimen Handling	Interpretation of Results	Requirements & Knowledge to Obtain Informed Consent	
Abdominal paracentesis	X	X	X	X	
Advanced cardiac life support	X	N/A	N/A	N/A	X
Arterial line placement	X	N/A	X	X	
Arthrocentesis	X	X	X	X	
Central venous line placement	X	X	N/A	X	
Drawing venous blood	X	X	X	N/A	X
Drawing arterial blood	X	X	X	X	X
Incision and drainage of an abscess	X	X	X	X	
Lumbar puncture	X	X	X	X	
Nasogastric intubation	X	X	X	X	
Pap smear and endocervical culture	X	X	X	X	X
Placing a peripheral venous line	X	N/A	N/A	N/A	X
Pulmonary artery catheter placement	X	N/A	X	X	
Thoracentesis	X	X	X	X	

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http://www.abim.org/certification/policies/imss/im.asp

Assessment approaches used to determine physician competence in the performance of procedures

- *Counting* procedures
- Surveying physician *confidence* in the performance of procedures
- Surveying physician *perception of comfort* when performing procedures

Assessment: Miller's pyramid of competence

Performance assessment in vivo

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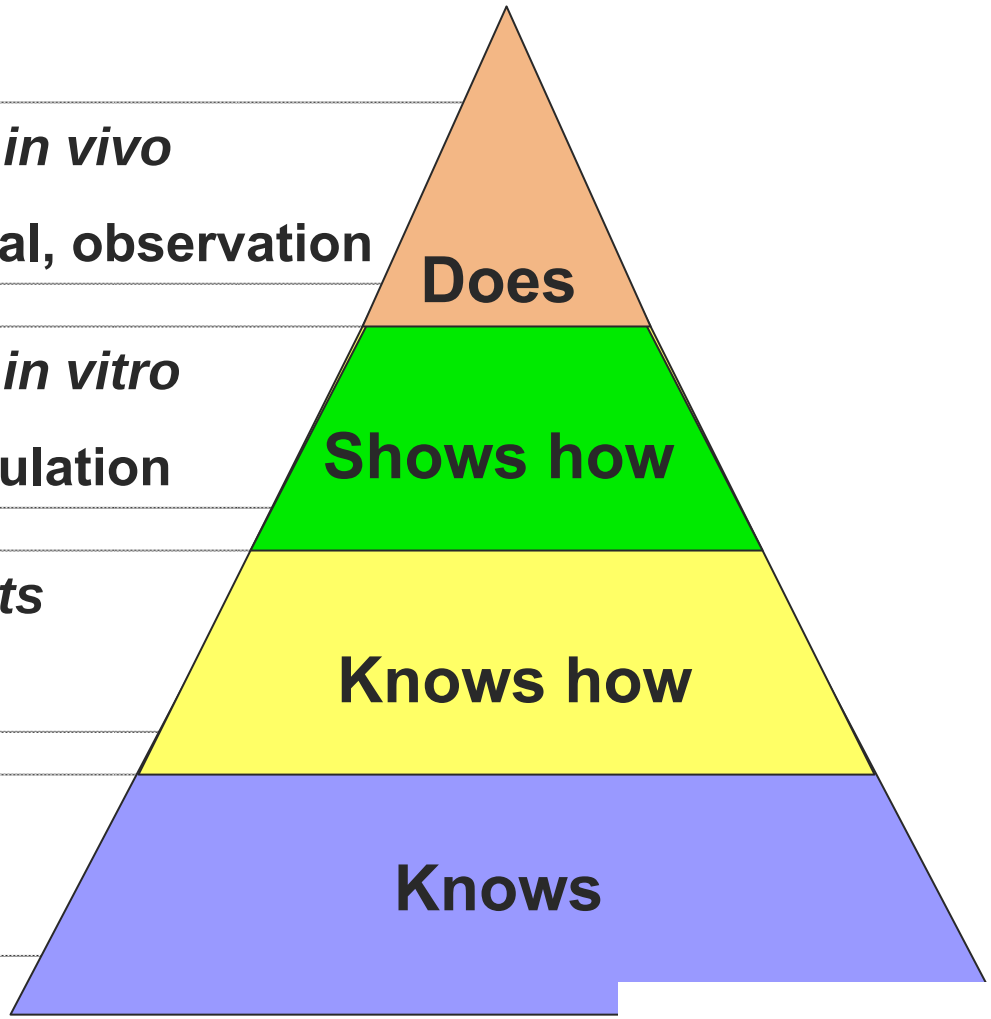

Wass, 2001

Assessment by direct observation of procedure performance

- Checklist development and checklist completion issues:
  - Checklist completion training
  - Checklist length
  - Clarity of checklist items
- When judgments are recorded on structured forms, clinician examiners' inter-rater reliability is usually high

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Huber, 2005; Vu, 1992; Tamblyn, 1991; Wilkinson, 1993 Heins, 1993,

Assessment by direct observation of procedure performance

- Direct observation requires a checklist to produce reliable and valid data
  - Reduce variability by:
    - Standardizing training of raters
    - Calibrating scoring of observations
    - Maintaining high inter-rater reliability within and between institutions

Content validity and construct validity of checklists - NRP and other checklist issues

- EMTs training on intubation techniques on manikins were only 53% successful in the field
- NPR certified physicians were videotaped performing neonatal resuscitation – 30% of NRP steps were not performed or were performed incorrectly
- NRP trained residents were less successful at intubation on first attempt than respiratory therapists on a transport team

Sayre, 2998; Carbine 2000;

Video recording as an instructional tool and as an assessment method

- Video recording has been an effective tool for instructional debriefing
  - Learner feedback
  - Learner identification of key elements of the procedure
  - Debriefing video, when used as a form of assessment, can drive learning

Finer, 2002

Video recording checklist construction

- Focus the checklist task (content to be assessed)
- Make, classify and sort checkpoints
- Define and order categories of checkpoints
- Pilot checklist to refine
- Video record procedure and send recording to experts to score performance using checklist

Stufflebeam, 2000

Training, calibration and re-calibration of checklist raters

- Raters involved in the creation and piloting of the checklist have higher inter-rater reliability
- Video-recording of rater and subject along with scored checklist should be used for calibration and re-calibration
- National or regional or inter-institutional standards for calibration are best

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Stufflebeam, 2000; Wilkinson, 2003; Van Der Vleuten, 1990

Hierarchical Task Analysis (HTA)

- Reliable and valid method of assessing technical skills
  - Complex procedures are broken down into a hierarchical and patterned sequence of steps used in the performance
    - Includes cognitive and psychomotor skills as well as team interactions

Shepherd, 1998; Baxter, 2005

Hierarchical Task Analysis (HTA)

- Obtain an expert's video recording
- List discrete fundamental step or task
  - Divide into subtasks and recovery steps (those steps to be anticipated; those steps which occur with some predictable frequency and thus performance assessment should include acknowledgement and adjustment to these steps)
  - Subtasks can be in parallel; subtasks may be repeated

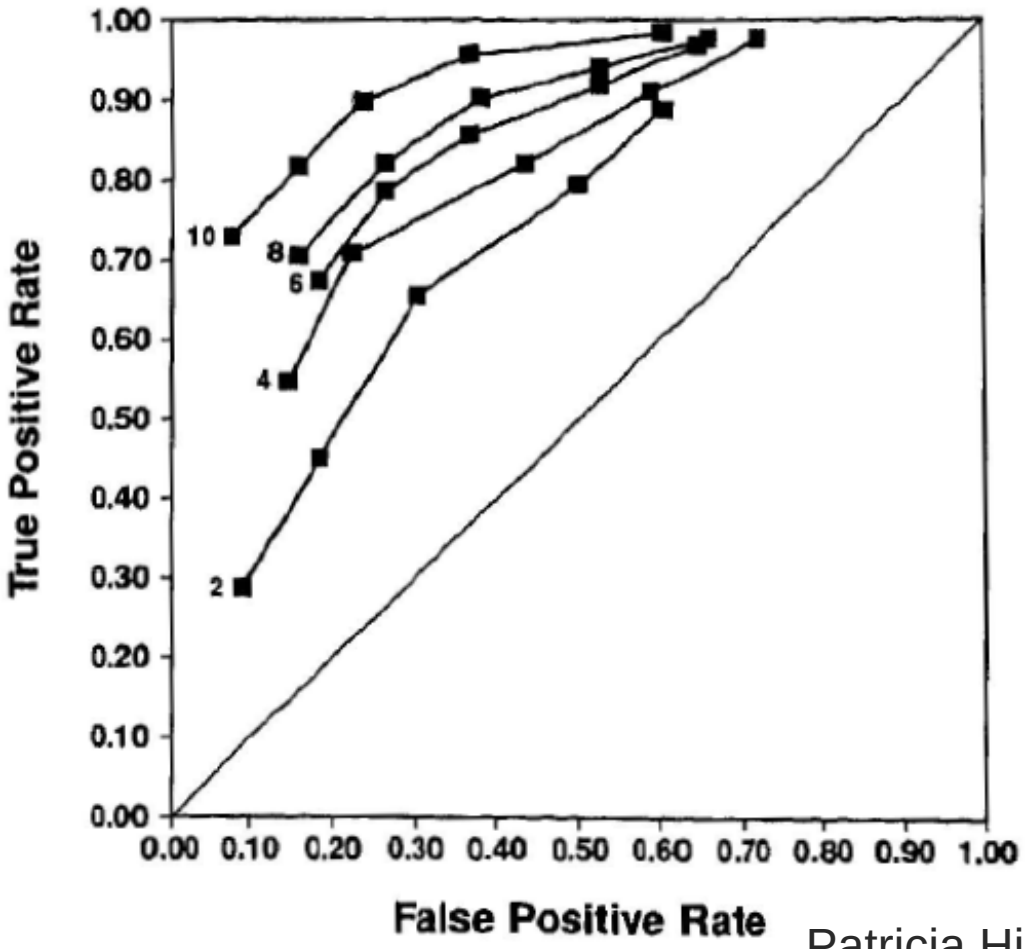
Shepherd, 1998; Baxter, 2005

Hierarchical Task Analysis (HTA)

- Assessing competence with HTA gives the learner and rater detailed information about both psychomotor performance and integration of cognitive components

Shepherd, 1998; Baxter, 2005

Sequential Testing – Alternative to full high fidelity assessment or video recording of entire procedure



Number on each curve is the length of the screening segment used

Colliver, 1992

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Attenuation of knowledge & skills

- Competence in the performance of procedures is important to maintain
  - Attenuation is rapid for both the cognitive and psychomotor aspects of procedures
  - Evidence reveals that physicians do not assess themselves accurately
  - Oversight or directed assignment of re-assessment of competence is required

Kaczorowski, 1998; Curran , 2004; Levitt 1996; Davis 2006