

The Jimmy A Young Memorial Lecture

July 15, 2015
8:00 to 9:30 AM
Phoenix, AZ



Jimmy Albert Young, MS, RRT
1935 –1975

The NBRC has honored Jimmy's memory and the contributions he made to respiratory care through this program since 1978 .

**Jimmy Albert Young, MS, RRT
was one of the profession's
most outstanding and
dedicated leaders**

In a 15-year career,

- achieved the RRT
- directed an education program
- directed a hospital department
- served as AARC President
- served as an NBRC trustee

- 1935 – born in South Carolina
- 1960 – 1966 – served as Chief Inhalation Therapist at the Peter Bent Brigham Hospital in Boston
- 1965 – earned the RRT credential, Registry #263
- 1966 – 1970 – served in several roles including director of the education program at Northeastern University in Boston
- 1970 – became director of the Respiratory Therapy Department at Massachusetts General Hospital
- 1973 – became the 22nd President of the American Association of Respiratory Care
- 1975 – was serving as an NBRC Trustee and member of the Executive Committee when he passed away unexpectedly

Criterion Validation Studies for the Therapist Multiple-Choice Examination and the Clinical Simulation Examination

**Results of studies done in 2013;
accepted by the Board in 2014**

Presenter

- Robert C Shaw Jr PhD RRT FAARC
 - NBRC Assistant Executive Director and Psychometrician

Conflict of Interest

I have no real or perceived conflicts of interest that relate to this presentation. Any use of brand names is not meant to endorse a specific product, but to merely illustrate a point of emphasis.

Learning Objectives

- Describe the intent behind these studies
 - TMC
 - CSE
 - TMC + CSE
- Explain how volunteers were recruited and how study data were collected
- Link results from these studies to policies for achieving the RRT

Describe the intent behind these studies

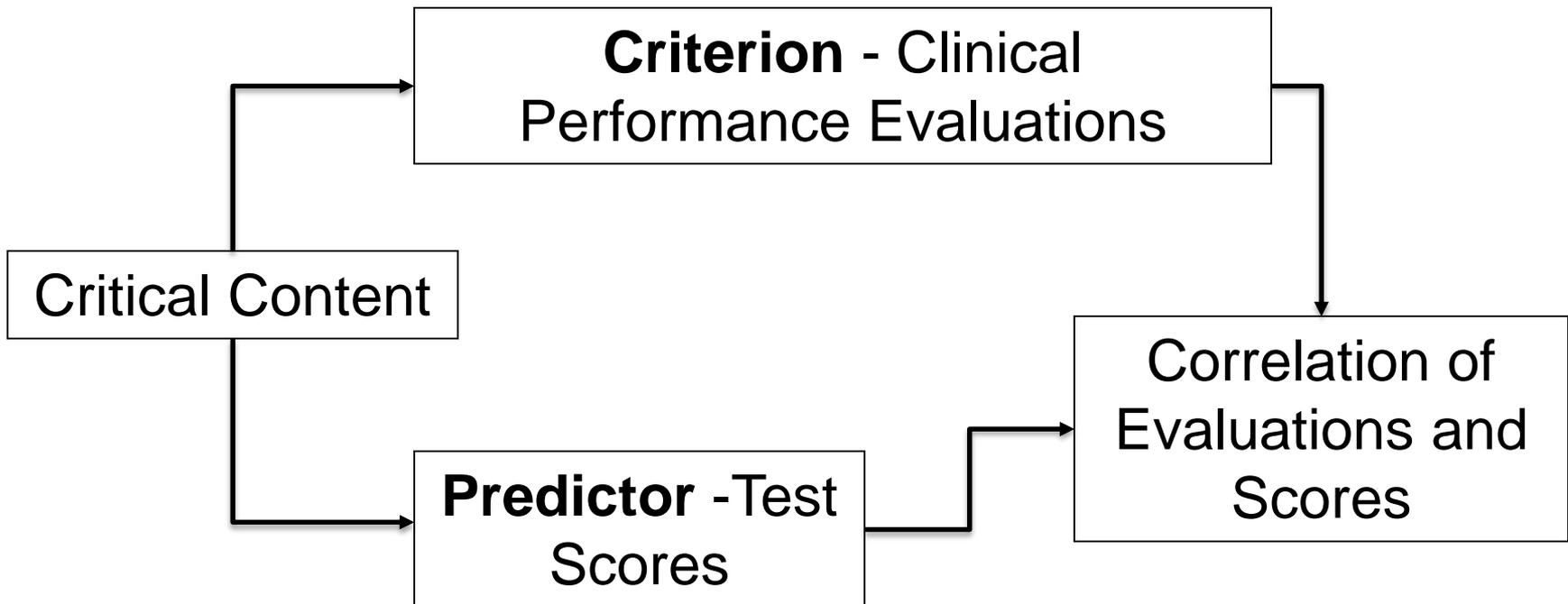
TMC

CSE

TMC + CSE

OBJECTIVE 1

Criterion-Referenced Evidence



Separate Studies for TMC and CSE

- Are scores from the examination related to job performances?
- Is the credential status of test takers linked to
 - mean scores from the examination?
 - pass rates from the examination?

Why should TMC + CSE = RRT?

Why not TMC = RRT? Why not CSE = RRT?



A Study of TMC + CSE = RRT

- Is more information made available from two examinations as compared to one of those examinations when predicting performances?
- Do CSE results add to the prediction of the group who would achieve the RRT?
- Do scores from TMC and CSE share one component that dominates variability?

Explain how volunteers were recruited and how study data were collected

OBJECTIVE 2

Sampling Plan

- Goal
 - Represent therapists across the spectrum of clinical experiences
- Incentive
 - \$100 to each volunteer for each completed data set
 - Volunteers knew there was no pass or fail at stake

Sampling Plan

- Cohorts of therapists
 - Any years of experience
 - Postcard to the population (N = 5,011) of technical directors in hospitals likely to have a respiratory therapy department
 - 4 years of experience or less
 - Email to the population (N = 35,168) within 4 years of making a first attempt at CRT
 - In training
 - Email to the population (N=423) of accredited education programs

Data Collection

- Potential volunteers directed to www.nbrc.org
 - A document explained the study, the role of volunteers, and the incentive
 - Linked to an Internet-based study application
- Application responses from volunteers provided
 - identity of supervisor with email address
 - demographic information about the volunteer
 - For example, experience, degrees, credentials

Data Collection

- Supervisors
 - Received a link to a training video; password given at the end
 - Password authenticated access to an online performance evaluation survey
- Volunteers
 - Authorized to take a test after verification of a completed
 - study application
 - clinical performance evaluation

Development of Predictor Tool

- Therapist Multiple-Choice Examination Committee of 2013
 - 10 trustees + 3 consultants; therapists and physicians in both subsets
- TMC detailed content outline
- Standard approval procedure for items and the test form
 - 140 scored and 20 unscored

Development of Predictor Tool

- Clinical Simulation Examination Committee of 2013
 - 6 trustees + 4 consultants; therapists and physicians in both subsets
- CSE detailed content outline
- Standard approval procedure for problems and the test form
 - 20 scored and 2 unscored

Development of Criterion Tool

- NBRC President - George
- TMC Chair - Barnhart
- TMC Vice-Chair - Bocklage
- CSE Chair - Plummer
- CSE Vice-Chair - Haas
- psychometrician - Shaw
- Translate task statements from content outline into competency statements

Criterion Tool Detail

- Rating scale used by evaluators

Clinical Activities of Respiratory Therapists There are 96 activities to evaluate	Activity number	How does the clinical performance of this therapist compare to your expectations for a competent respiratory therapist who works in your region?			or	The activity is NOT done by this therapist.
		falls below	is equal	falls above		
I. PATIENT DATA EVALUATION						
A. Evaluate Data in the Patient Record						
1. Reports of history, physical examination, and monitoring trends	1					

Link results from these studies to policies for achieving the RRT

OBJECTIVE 3

Descriptions of Samples

RESULTS

Sample Descriptions

The NBRC made nearly \$100,000 in payments to volunteers as a result of the incentive.

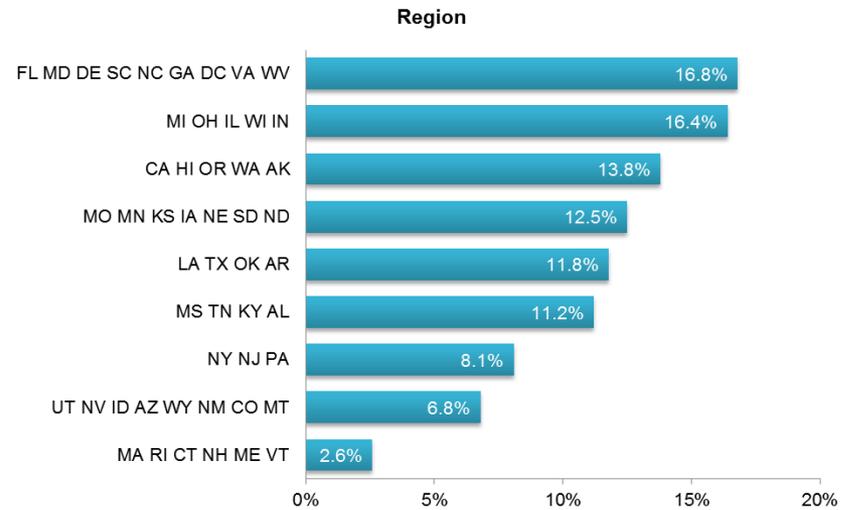
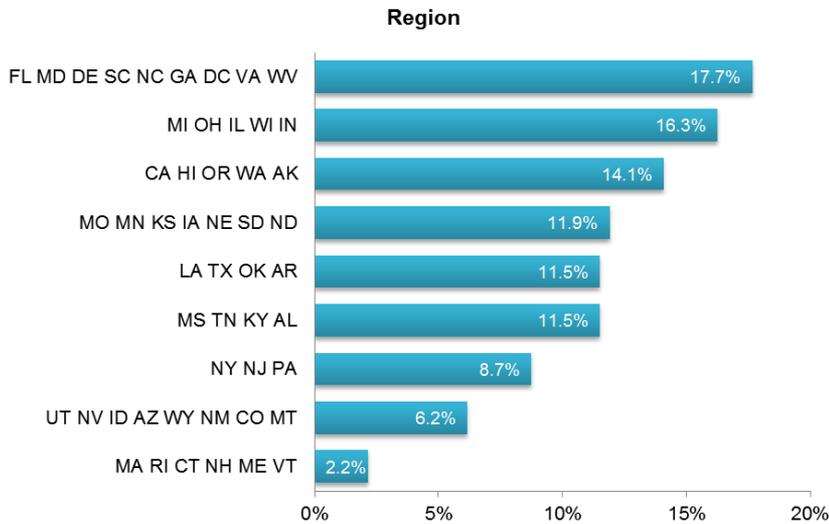
Sample sizes were approximately twice the sizes of samples from previous studies.

	TMC	CSE
N	504	457

Sample Descriptions

TMC

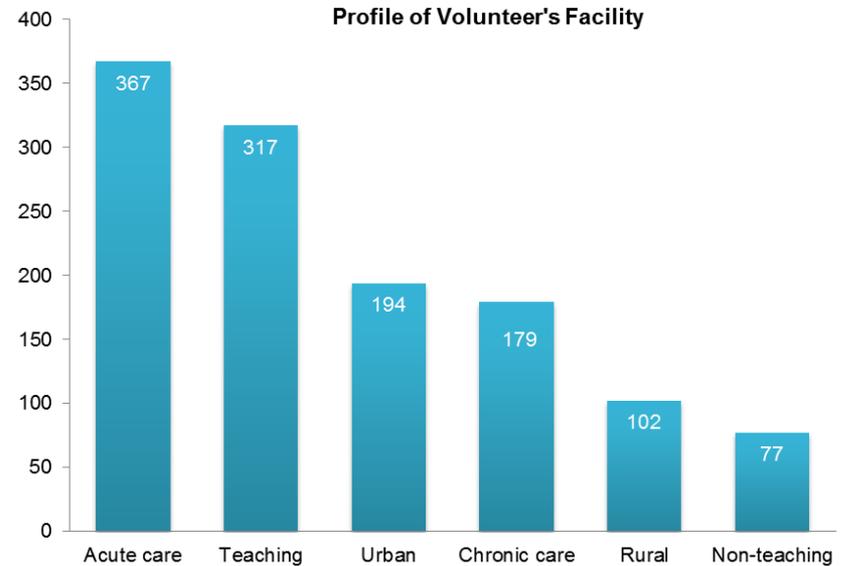
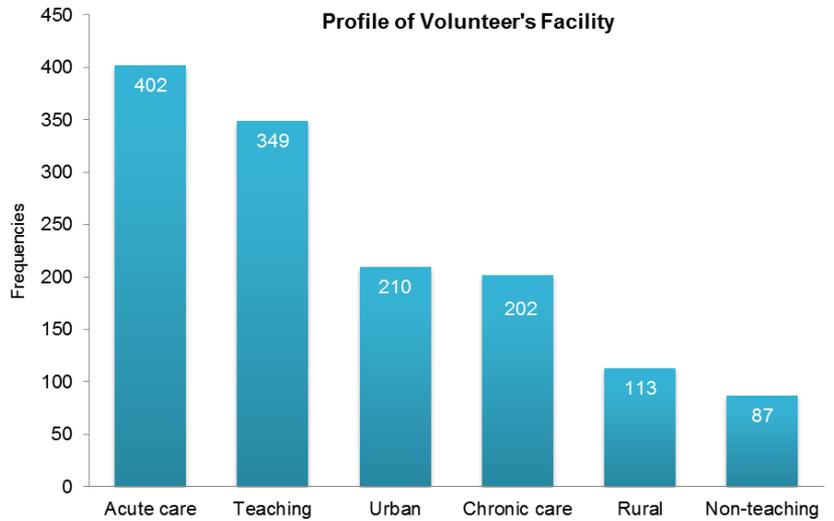
CSE



Sample Descriptions

TMC

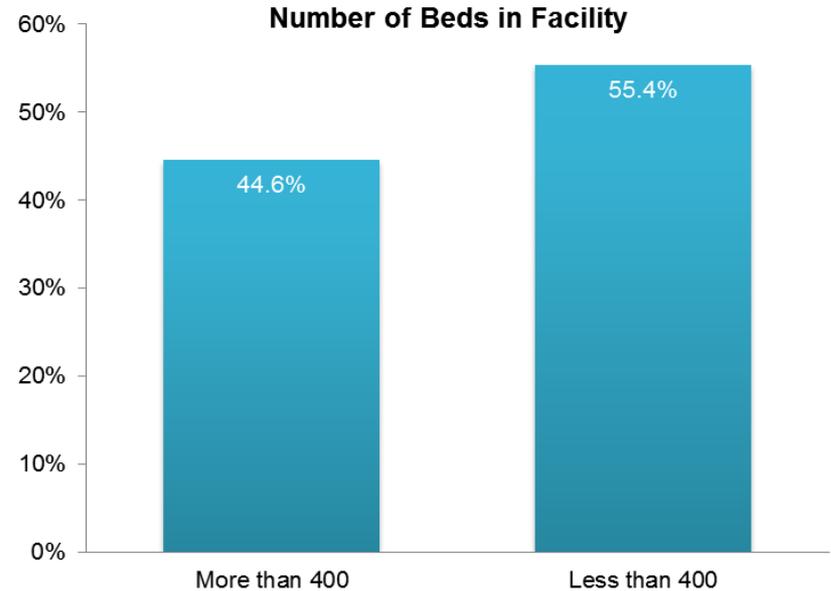
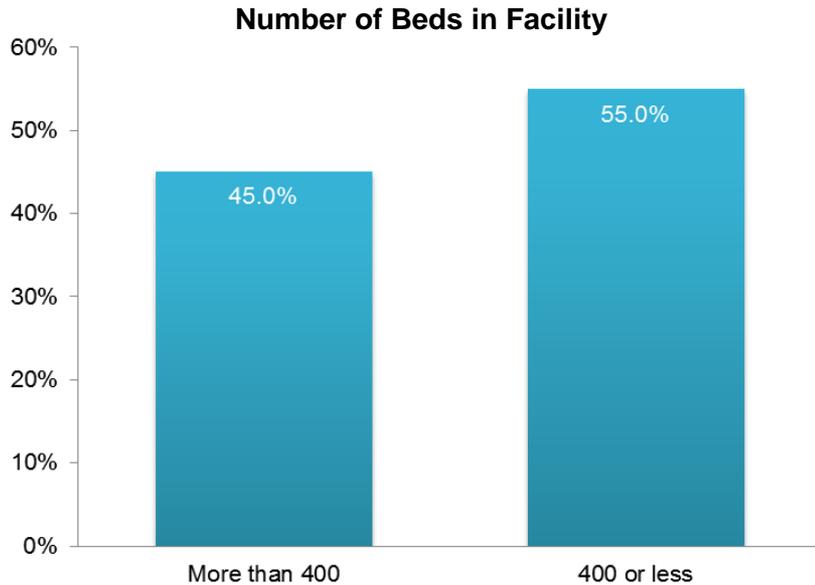
CSE



Sample Descriptions

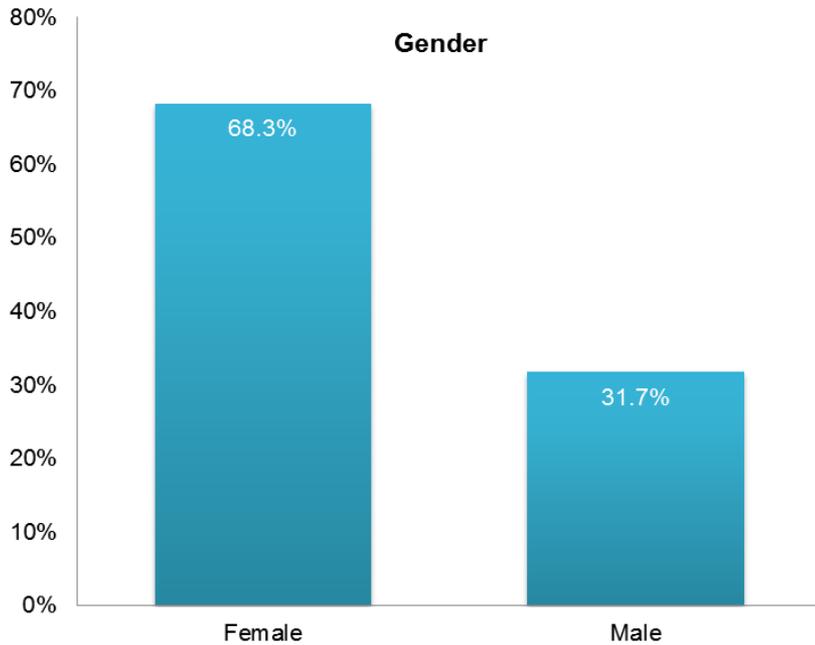
TMC

CSE

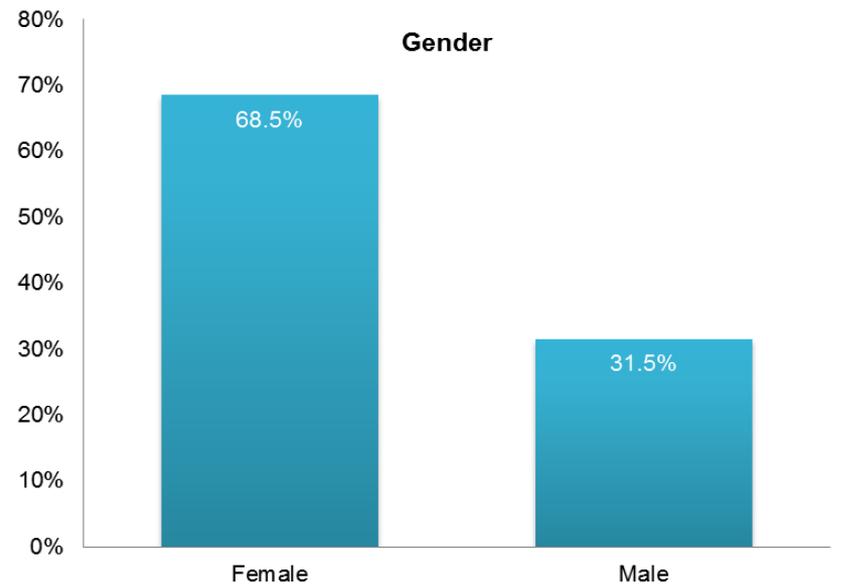


Sample Descriptions

TMC



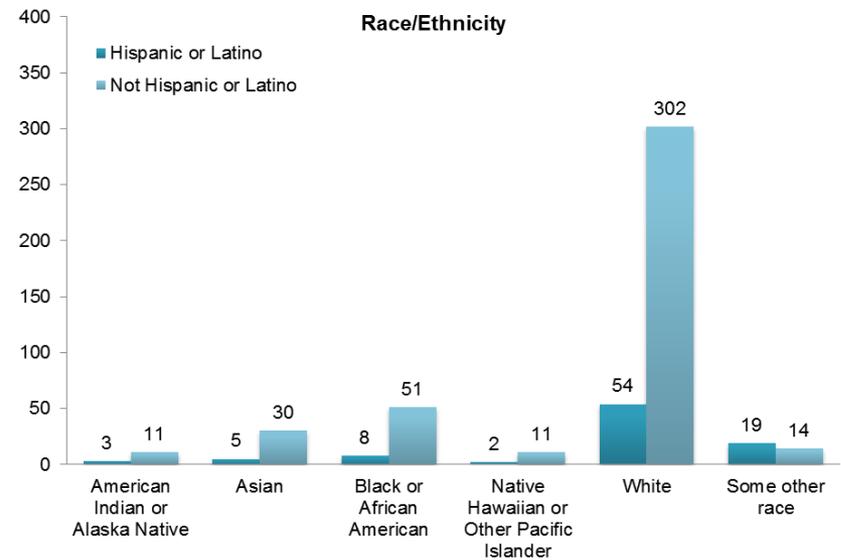
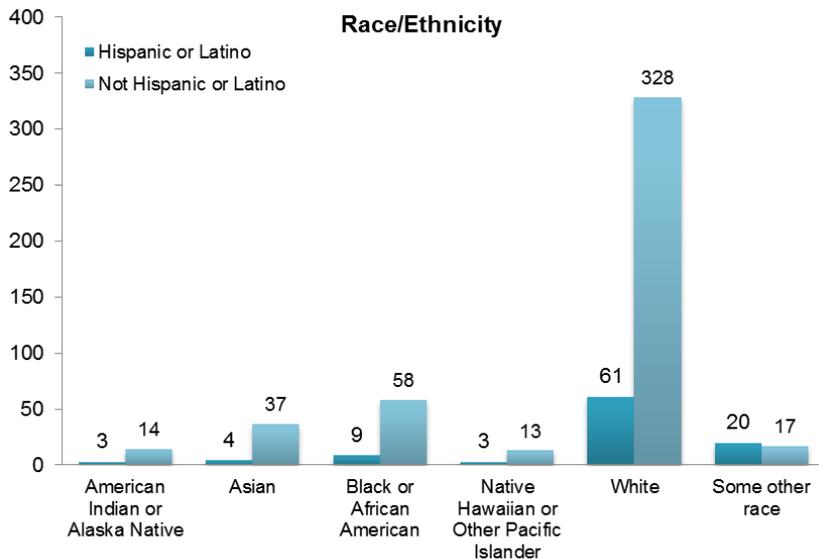
CSE



Sample Descriptions

TMC

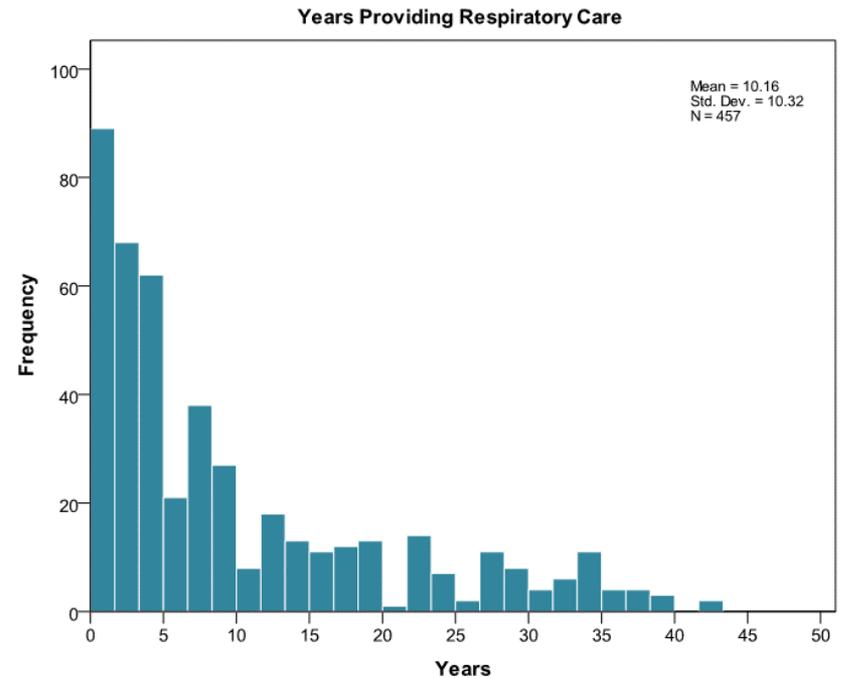
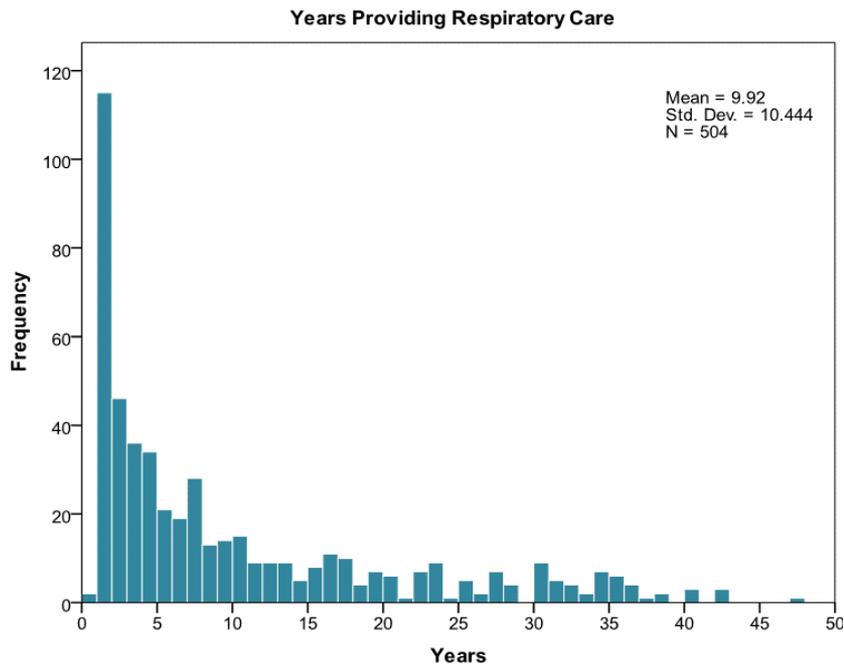
CSE



Sample Descriptions

TMC

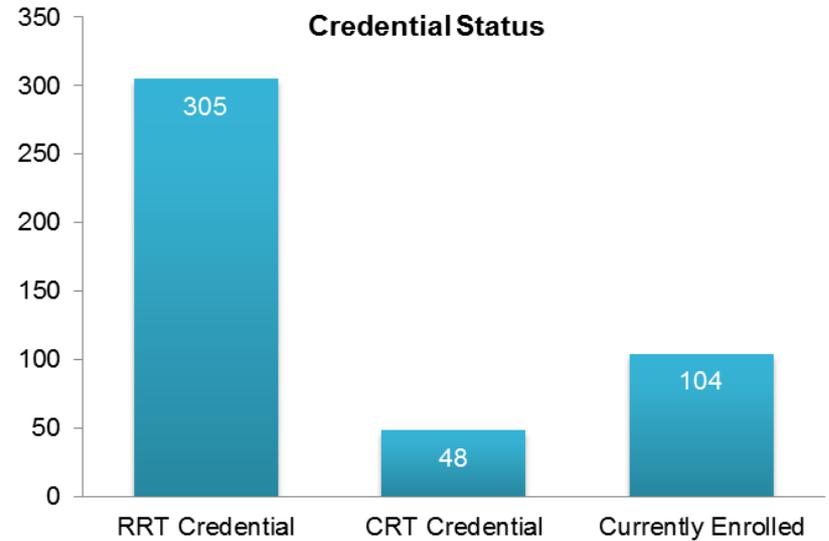
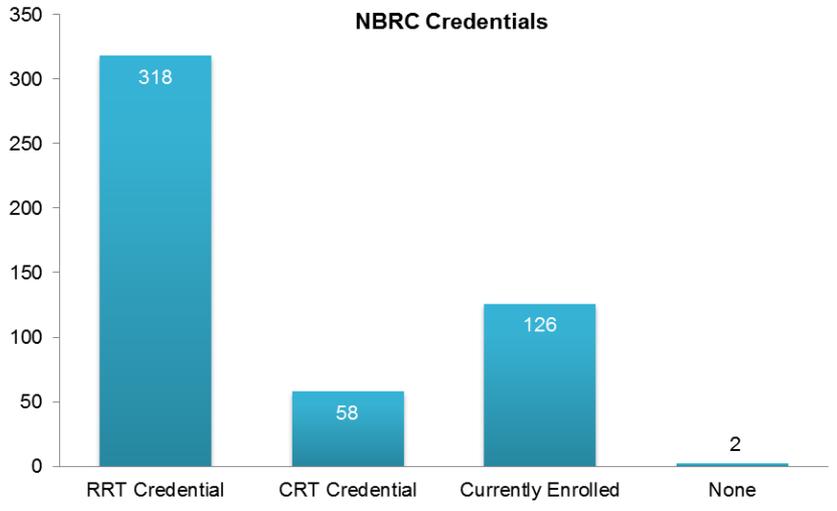
CSE



Sample Descriptions

TMC

CSE

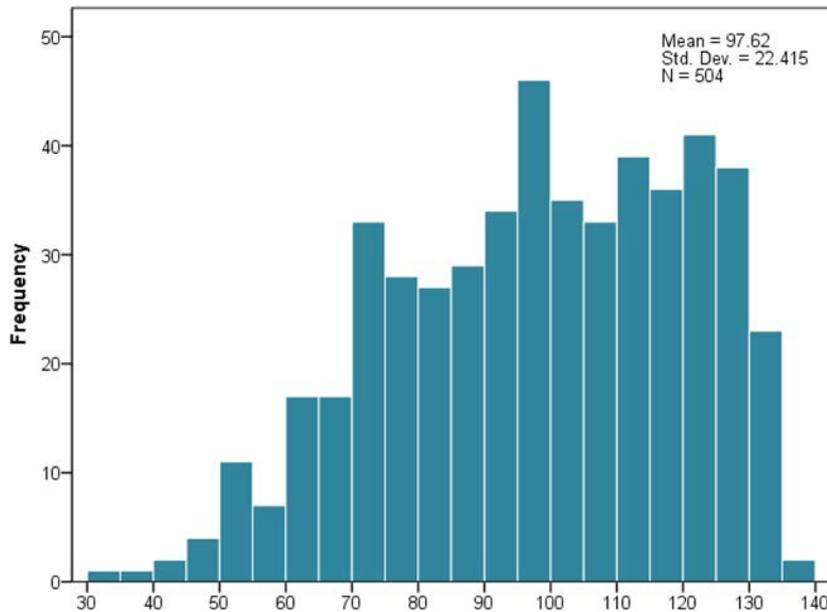


Predictor Distributions

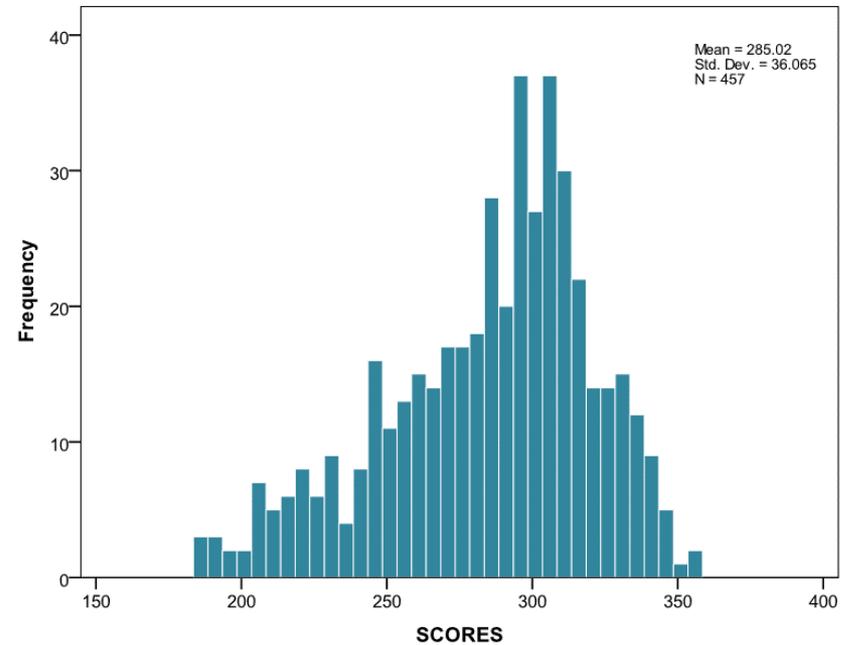
TMC

CSE

SCORES Distribution



SCORES Distribution

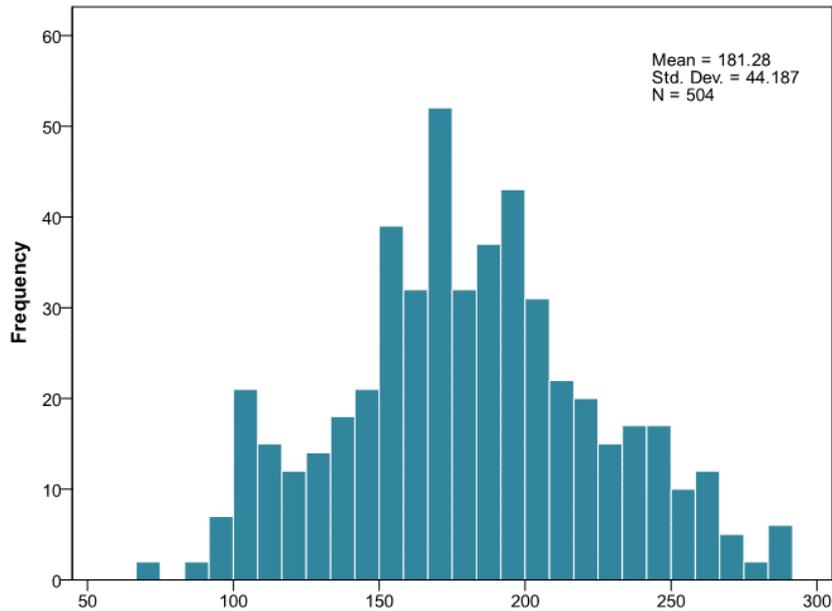


Criterion Distributions

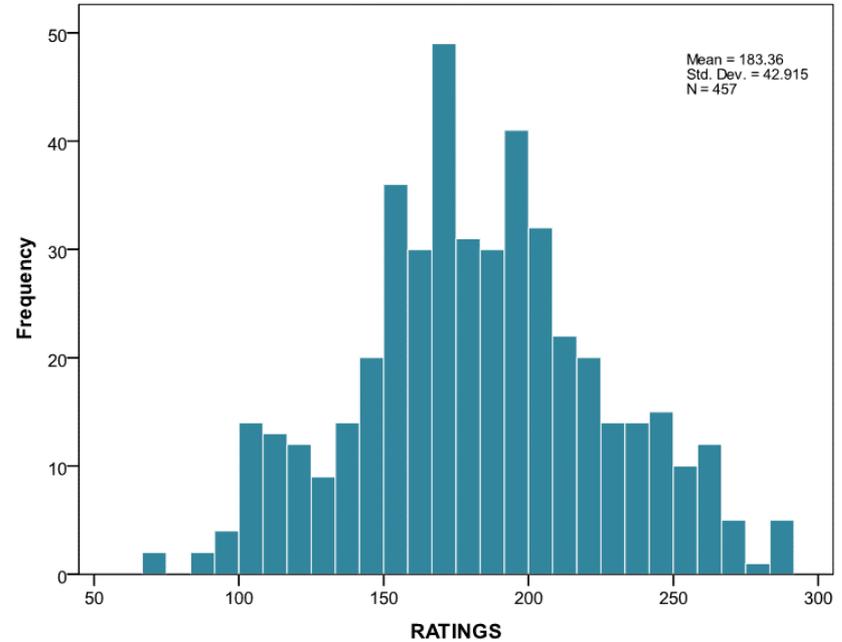
TMC

CSE

RATINGS Distribution



RATINGS Distribution



Validity Coefficients - Correlations of Predictors and Criterion

Group	Performance Evaluation Reliability	Scores Reliability	Uncorrected R	p <	Corrected R
TMC	.977	.953	.456	.001	.473
CSE	.975	.873	.461	.001	.481

Corrected values show the result of the procedure to mitigate against attenuation, which occurs when some error resides within the criterion or predictor.

$$p_{TxTy} = p_{xy} / \sqrt{(R_{xx})(R_{yy})}$$

Where:

- P_{TxTy} = estimated correlation between true scores (x=SCORES, y=RATINGS)
- P_{xy} = correlation between observed scores
- R_{xx} = reliability of SCORES
- R_{yy} = reliability of RATINGS

History of Validity Coefficients with the Criterion

TMC (CRT)

Year	Coefficient
2013	.47
2009	.41
2004	.63
1999	.63
1994	.51

CSE

Year	Coefficient
2013	.48
2004	IG .37 - DM .60
1996	IG .35 - DM .59

TMC Study Comparisons by Credential

Dependent Variable	Credential Status	N	Mean	SD	SE _{Mean}	95% Confidence Interval	Effect Size Estimate (R ²) ²
SCORES	Credentialed	376	101.11	20.203	1.042	99.06 – 103.16	.14
	Not Credentialed	128	87.35	25.345	2.240	82.92 – 91.78	
	<i>t</i> = 5.568, <i>df</i> =184.95, <i>p</i> < .001						
RATINGS	Credentialed	376	192.38	41.473	2.139	188.17 – 196.58	.19
	Not Credentialed	128	148.67	34.90	3.085	142.57 – 154.78	
	<i>t</i> = 10.701, <i>df</i> =502, <i>p</i> < .001						

Max SCORES = 140

Max RATINGS = 288

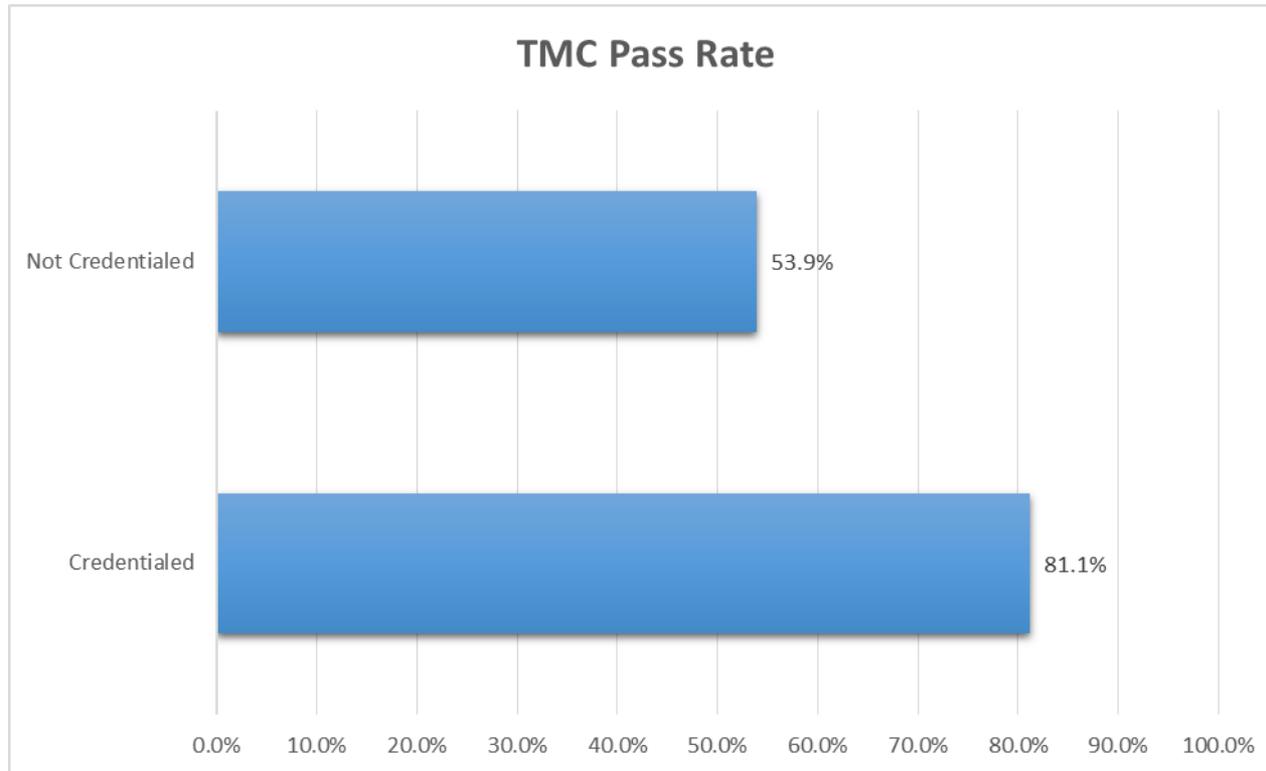
CSE Study Comparisons by Credential

Dependent Variable	Credential Status	N	Mean	SD	SE _{Mean}	95% Confidence Interval	Effect Size Estimate (R ²) ²
SCORES	Credentialed	353	282.39	31.586	1.681	279.08 – 285.69	.29
	Not Credentialed	104	260.01	39.135	3.837	252.40 – 267.62	
	$t = 7.728, df=144.768, p < .001$						
RATINGS	Credentialed	353	192.69	40.594	2.161	188.44 – 196.94	.16
	Not Credentialed	104	151.67	34.781	3.411	144.91 – 158.44	
	$t = 9.342, df=455, p < .001$						

Max SCORES = 401

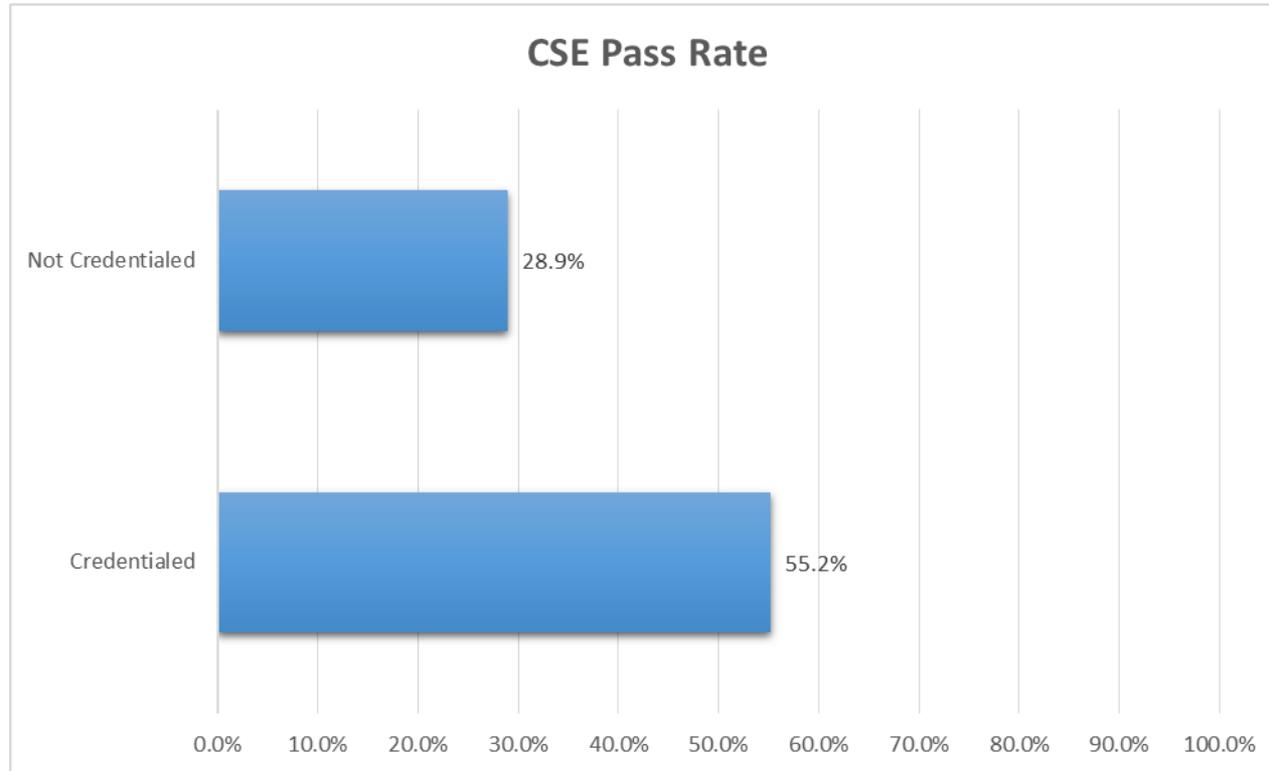
Max RATINGS = 288

Outcome Comparison



Chi Square = 35.532, df=1, $p < .01$

Outcome Comparison



Chi Square = 21.348, df=1, $p < .01$

Criterion Validation Study Summary

- Incentive was effective in attracting the largest samples ever
- Samples were diverse
 - geography
 - practice settings
 - facility size
 - experience

Criterion Validation Study Summary

- Samples emphasized volunteers
 - with only a few years of experience
 - who were woman
 - who had achieved a credential
- Training of supervisors was effective in encouraging normal variability and high consistency in performance evaluations
- Validity coefficients were statistically significant and in line with past coefficients

Criterion Validation Study Summary

- The volunteer group with a credential
 - had significantly higher scores and performance evaluations
 - passed the new examinations at significantly higher rates

Most volunteers participated in both studies,
which opened new lines of research

TRIANGULATION STUDY

Performance Evaluation

449 volunteers

TMC Score

CSE Score

Hypothesis 1

- No more variability in clinical performances will be explained after simulation examination scores are added to a model already containing multiple-choice examination scores
 - Deployed stepwise multiple regression

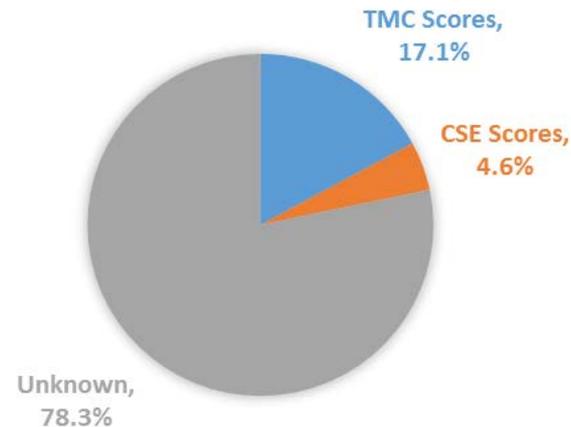
Preliminary Results

Variable	Clinical Performance Assessment	Multiple-Choice Examination Score	Multiple-Choice Examination Score
Clinical Performance Assessment	1.00		
Multiple-Choice Examination Score	.414	1.00	
Simulation Examination Score	.456	.779	1.00
Each correlation was significant at the .0001 level (2-tailed).			

Multiple Regression Results

- Unlikely to have occurred by chance
 - 1. TMC ($p < .0001$)
 - 2. CSE ($p < .0001$)
- Strongest prediction occurred when both scores were available

PERCENTAGES OF EXPLAINED VARIABILITY
IN PERFORMANCES



***Predicted clinical performance rating =
(.307)(multiple-choice score) + (.409)(simulation score) + 36.32***

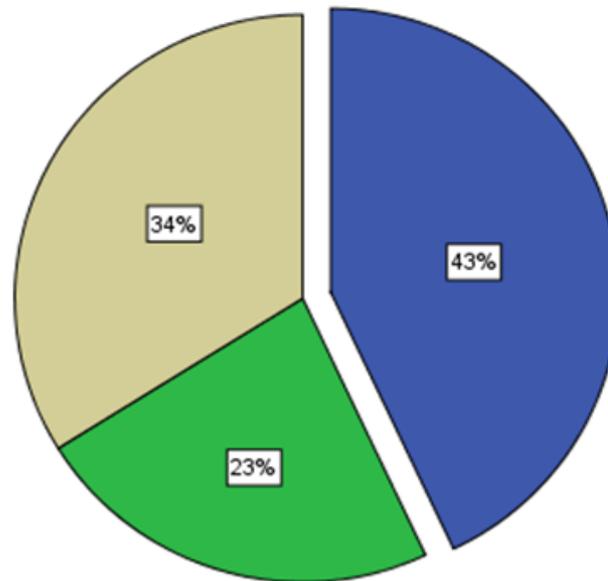
Hypothesis 2

- No further information regarding variability in RRT progress group membership will be explained by a combination of multiple-choice examination and simulation examination scores than can be explained by multiple-choice examination scores alone

Methods

Progress Through the Examinations

- Passed Both - RRT
- Passed One
- Failed Both



Methods

- z-score transformations of raw test scores
 - General Formula
 - $z\text{-score} = (\text{test score} - \text{mean score}) / \text{standard deviation}$
 - Specific Formulas
 - multiple-choice z-score = $(\text{multiple-choice score} - 99.9) / 20.7$
 - simulation z-score = $(\text{simulation score} - 285.3) / 35.8$
- Discriminant analysis predicting group membership from test scores

Discriminant Analysis Results

		Wilk's Lambda	F Test for Entry	
Step	Examination Scores	Proportion of unexplained variance	Value	p<
1	multiple-choice	.299	522.201	.0001
2	multiple-choice + simulation	.232	239.423	.0001

Hypothesis 3

- Scores from multiple-choice and simulation examinations will fail to coalesce around one component that expresses performance while providing respiratory care

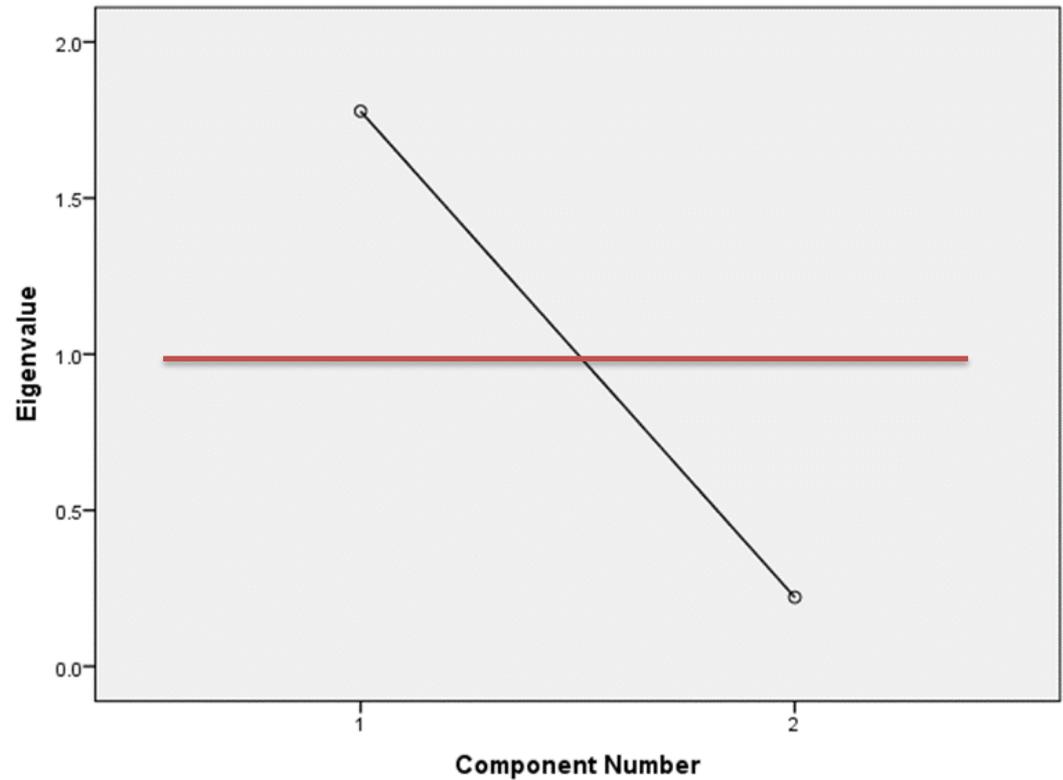
Methods

- Multiple-choice and simulation examinations have different characteristics
 - Cut score setting methods
 - Response scoring: [0 or 1] vs. [-3, -2, -1, 0, 1, 2, 3]
 - Independence or dependence among response stimuli
- Deployed principal components analysis with split-sample validation

Principal Components Analysis Results

88.9% of variability
explained by
component 1

Cronbach's alpha
reliability = .876



Triangulation Study Summary

- The addition of simulation examination scores to multiple-choice examination scores added to the explanation of variability in clinical performances among respiratory therapists
- Membership in three RRT progress groups was explained by the addition of simulation scores beyond what was explained by multiple-choice scores alone

Triangulation Study Summary

- Scores from multiple-choice and simulation examinations coalesced around one component that expressed performance while providing respiratory care

Linking Study Results to Policy

- Scores from the multiple-choice and simulation examinations
 - expressed information about abilities within the same domain
 - each provided unique information about abilities
 - were more strongly predictive of clinical performances and credentialing outcomes when together than when apart
 - were higher for respiratory therapists who were already credentialed

Linking Study Results to Policy

- Dropping one set of test scores or the other would remove information from the credentialing system that would weaken confidence in pass and fail decisions

Limitations of Studies

- Samples of volunteers rather than examination candidates could have introduced a systematic bias
 - Could be differences in
 - preparation
 - confidence
 - professional engagement
 - motivation
 - resources

QUESTIONS