

Measurement in Elderly Populations

Instructor: Rebecca E. Graff, ScD
Friday, February 1, 2019, 8:45am – 10:15am
Mission Hall 1105

Discussion:

**WHY IS ACCURATE MEASUREMENT
IMPORTANT?**

Outline

- General Issues of Measurement
- Specific Issues of Measurement
 - Your Discoveries
 - Death
 - Functional Status and Disability
 - Cognitive Impairment
 - Multimorbidity
 - Social Factors

GENERAL ISSUES OF MEASUREMENT

Methods of Measurement

- Self-report
 - Limited understanding of health
 - Physical, cognitive, and/or sensory impairment
- Proxy report
 - Lack of availability
 - Lack of knowledge
- Objective Measures
 - Expense / Convenience
 - Unnatural environment

Measurement Considerations

- Periodicity
- Mode of questionnaire administration
- Instrument and item selection
- Formulation of questions
- Question ordering
- Visual aids

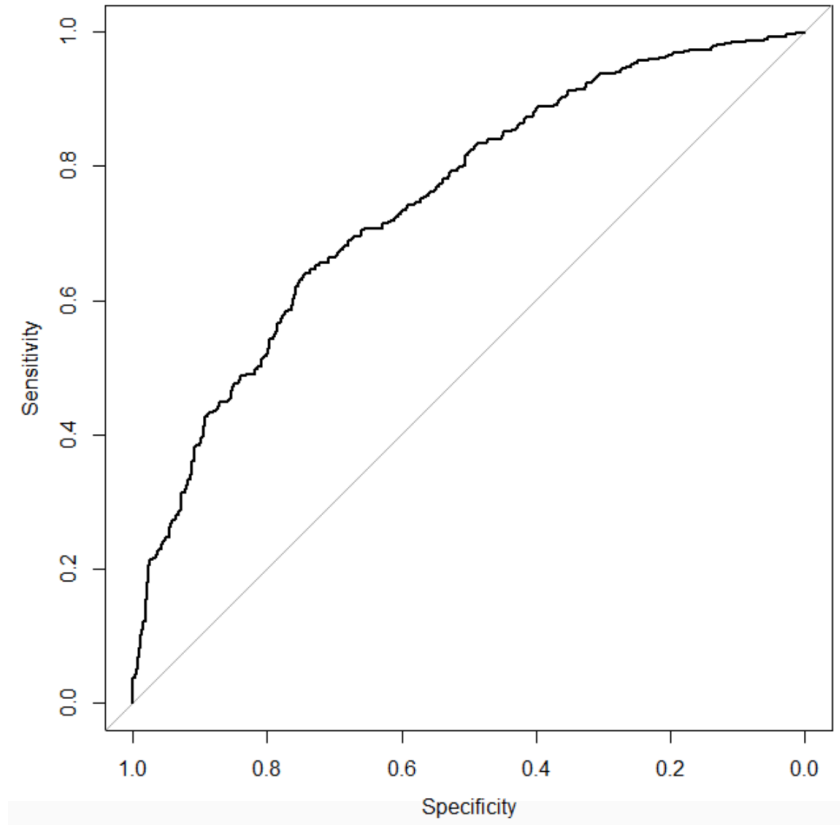
Discussion:

**HOW WOULD YOU ASSESS HOW
“GOOD” A MEASUREMENT IS?**

Sensitivity and Specificity

- Sensitivity: $\Pr(\text{Test Positive} \mid \text{Condition})$
 - Probability of a true positive
 - $1 - \text{sensitivity} = \text{probability of a false negative}$
- Specificity: $\Pr(\text{Test Negative} \mid \text{No Condition})$
 - Probability of a true negative
 - $1 - \text{specificity} = \text{probability of a false positive}$

ROC Curves



Validity and Reliability

- Validity: the ability of a measurement to distinguish between who has the condition and who do
- Reliability: the extent to which a measurement is replicated if repeated
 - E.g., inter-rater
 - E.g., test-retest

Information Bias

- E.g., Nondifferential misclassification: the degree of misclassification of exposure is independent of outcome (or vice versa)
- E.g., Differential misclassification: the degree of misclassification differs between the groups being compared

Discussion:

**WHAT RESPONDENT
CHARACTERISTICS MIGHT AFFECT
MEASUREMENT ACCURACY?**

Factors Associated with Accuracy

- Age
- Race / ethnicity
- Respondent type
- Education
- Living Arrangement
- Income
- Health Status

Subjective Diagnoses

- Some diagnoses are inherently based on subjective measures
- Example based on self-report: many mood disorders
- Example based on clinical features: Parkinson's disease

Mixed Phenotypes

- Some conditions encapsulate a broad range of symptoms and disease courses
- Example: breast cancer

SPECIFIC ISSUES OF MEASUREMENT

Discussion:

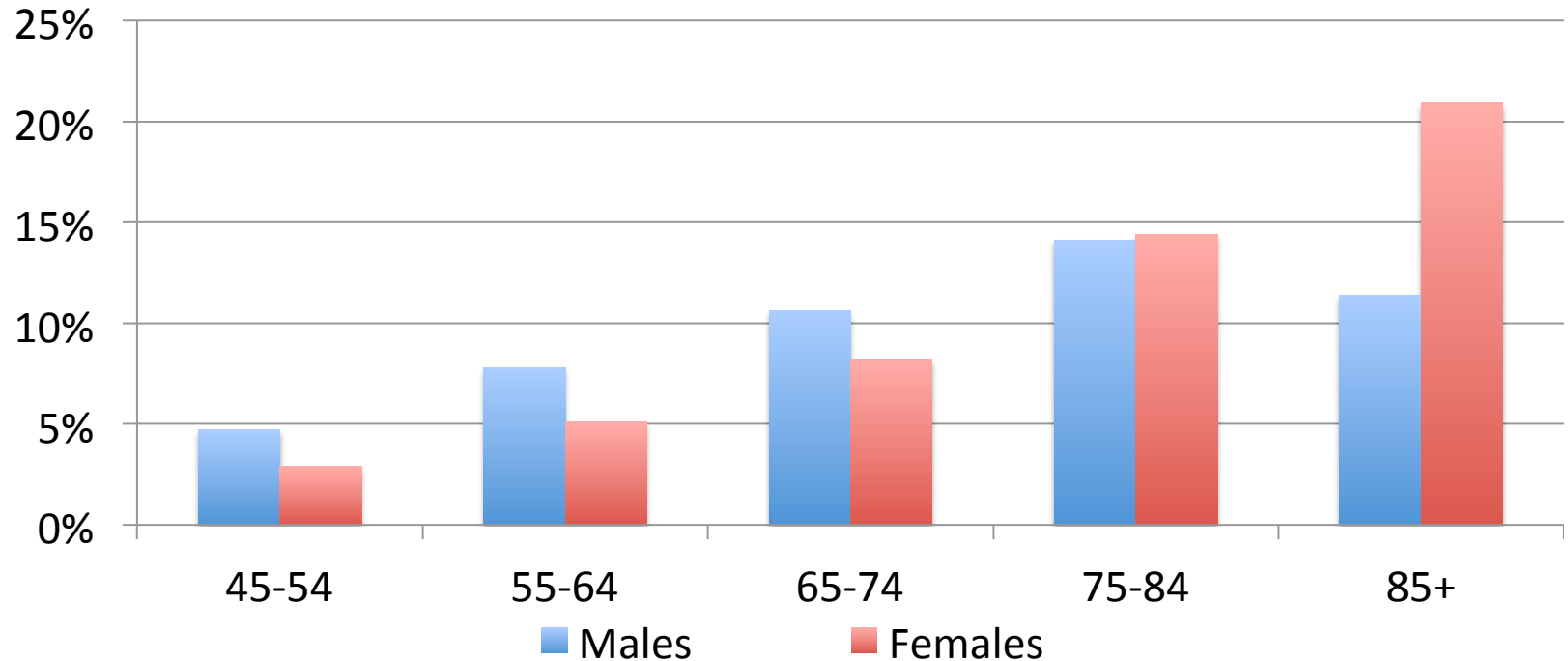
**WHAT ISSUES OF MEASUREMENT
DID YOU DISCOVER FOR THE
CONDITIONS YOU CONSIDERED?**

Specific Issues of Measurement:

DEATH

Death Due to Multiple Causes

Percent of Total Deaths Attributed to Multiple Causes



Death Due to Ill-Defined Causes

Country	Year	%
Lithuania	2016	3%
United States	2016	7%
Argentina	2015	17%
Albania	2010	24%
Egypt	2015	32%
Georgia	2015	38%
Saudi Arabia	2012	46%

Specific Issues of Measurement:

FUNCTIONAL STATUS AND DISABILITY

Review of Disability

“Disability is best conceptualized as the gap between an individual’s physical / cognitive capabilities and the demands of the environment, which leads to an inability or difficulty in fulfilling one’s social or role functions.”

Discussion:

**WHAT METHODS FOR MEASURING
DISABILITY DID THE JETTE ARTICLE
OUTLINE?**

Discussion:

**WHAT OTHER METHODS FOR
MEASURING FUNCTIONAL STATUS
AND DISABILITY MIGHT THERE BE?**

Domains of Function

- Physical
 - Personal roles
 - Social roles
 - Physical capacity
- Psychological
- Social
- Cognitive
- Sensory

Personal Roles

- Measurement of ADLs and IADLs
- Difficulty
- Dependency
- Performance

Social Roles

- Late Life Disability Instrument

- Visit friends
- Travel out of town
- Go out to public places
- Work at a volunteer job
- Keep in touch with others
- Participating in social activities
- Invite family and friends into home
- Participate in active recreation
- Provide assistance to others

Physical Capacity

- Self-report
 - Nagi Questions
 - Physical Functioning Subscale (PF-10) of the Short Form 36 Health Survey (SF-36)
 - LLDI
- Objective performance tests
 - Gait speed
 - Stair climb

Summarizing Multiple Measures

- Difficulty / inability in 1+ items
- Summated scale
- Hierarchical scale
- Computer-adaptive testing

Specific Issues of Measurement:

COGNITIVE IMPAIRMENT

Clinical Tests

- Neuropsychological tests
 - Global cognitive function
 - Specific cognitive abilities
- Physician Interview (or administration of questionnaire instruments)

Algorithmic Assessment

- Cohort-specific!
- In the Health and Retirement Study:
 - Herzog & Wallace
 - Langa-Kabeto-Weir
 - Crimmins
 - Hurd
 - Wu

Specific Issues of Measurement:

MULTIMORBIDITY

Comorbidity / Multimorbidity Indices

- Tally
- Charlson index
- Cumulative Illness Rating Scale
- Functional Comorbidity Index
- Duke Severity of Illness Scale
- Index of Coexistent Diseases
- Physiologic index of comorbidity

Charlson Comorbidity Index

Charlson score (X)	$X = A + B$
Comorbidity component (A)	Sum of points for each morbidity (Table 1)
Age component (B)	Age <40 years – 0; age 41–50 years – 1 Age 51–60 years – 2; age 61–70 years – 3 Age 71–80 years – 4.
Charlson probability (Z)	formula: $e^{0.9X} = Y$, $0.983^Y = Z$ (10-year survival)

Weight	Clinical condition
1	Myocardial infarct Congestive cardiac insufficiency Peripheral vascular disease Dementia Cerebrovascular disease Chronic pulmonary disease Conjunctive tissue disease Slight diabetes, without complications Ulcers Chronic diseases of the liver or cirrhosis
2	Hemiplegia Moderate or severe kidney disease Diabetes with complications Tumors Leukemia Lymphoma
3	Moderate or severe liver disease
6	Malignant tumor, metastasis Aids

Distribution of Indices

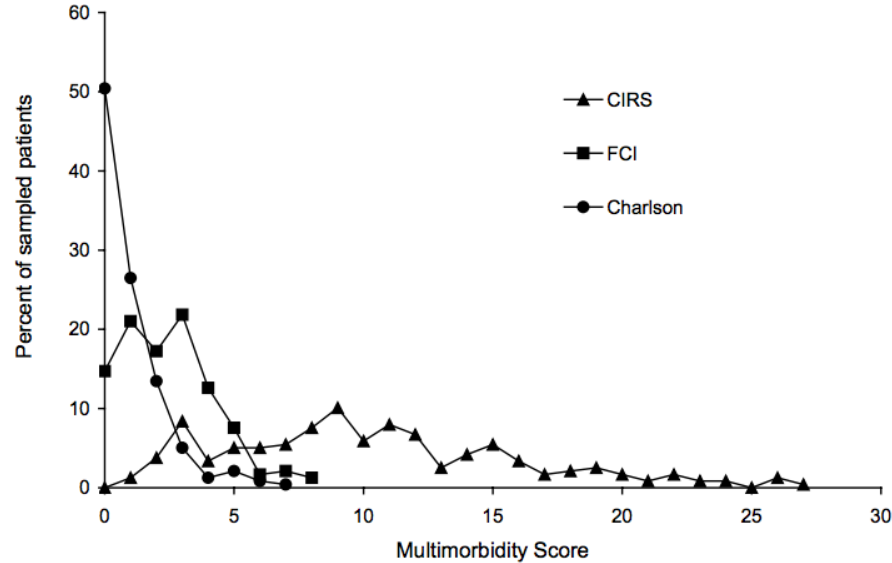


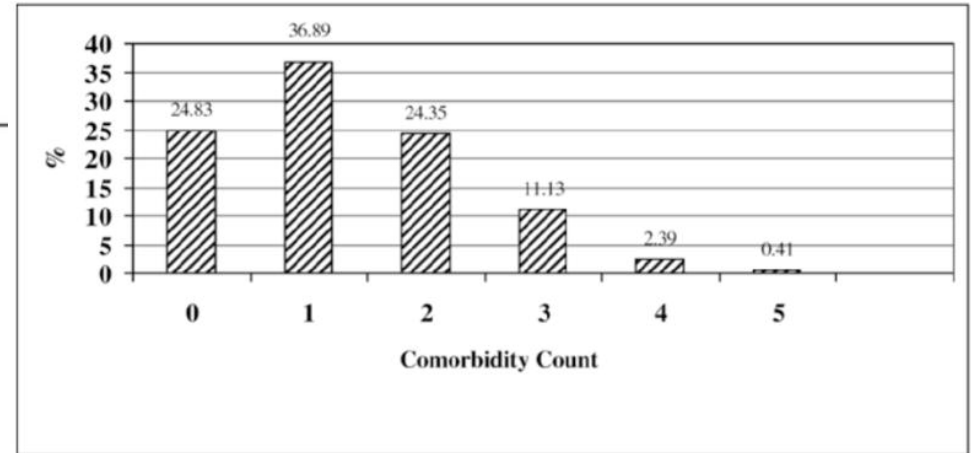
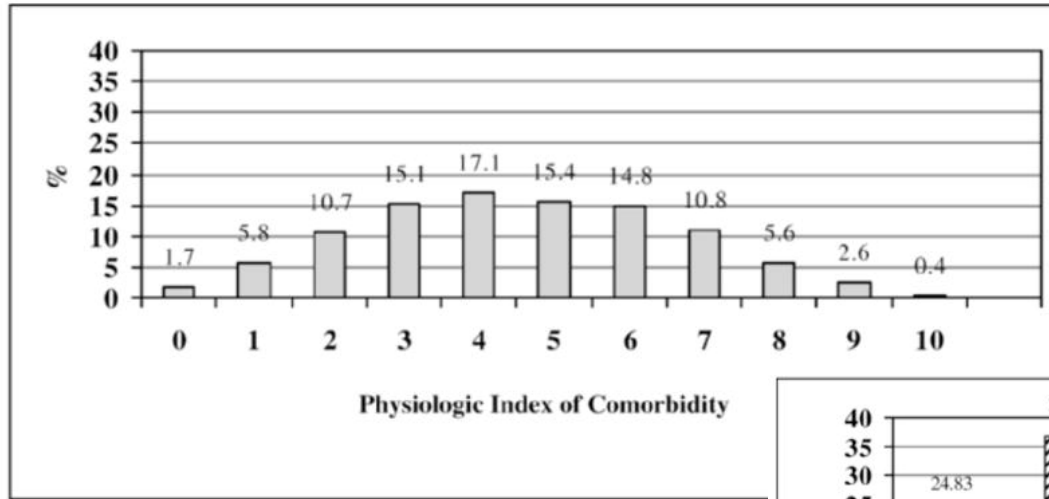
Figure 1

Distribution of scores on multimorbidity measures. CIRS = Cumulative Illness Rating Scale; FCI = Functional Comorbidity Index; Charlson = Charlson index.

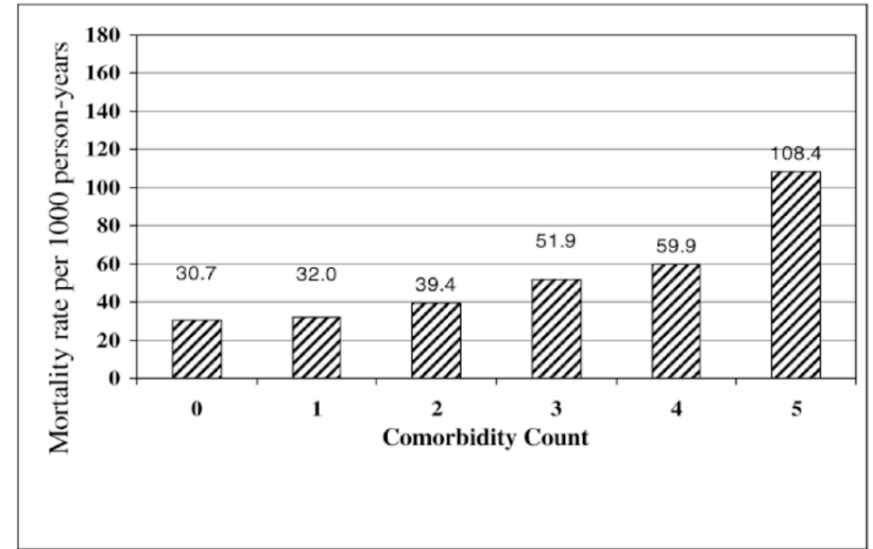
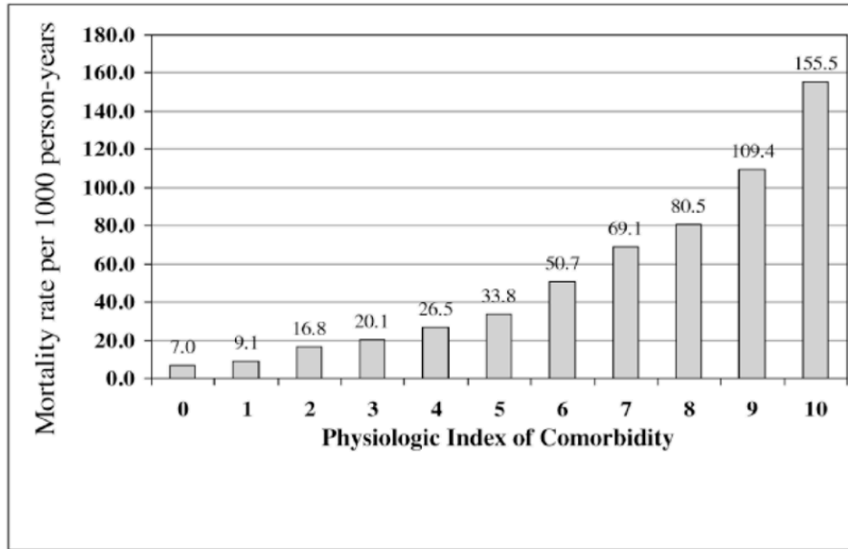
Physiologic Index of Comorbidity

- Elements:
 - Atherosclerotic vascular disease (carotid ultrasound)
 - Pulmonary function (spirometry)
 - Glucose tolerance (fasting glucose)
 - Kidney function (serum cystatin-C)
 - Vascular disease in the brain (brain MRI)
- Calculation: sum of tertiles (0 = best, 2 = worst)

Physiologic Index Distribution



Physiologic Index and Mortality



Specific Issues of Measurement:

SOCIAL FACTORS

Factor	Source	Measurement considerations		Methodological strengths of measurement method		Potential methodological and pragmatic limitations of measurement method regarding associations with health outcomes				
		Measure of SES	Time-varying	Reliability	Validity	Non-response bias	Misclassification	Recall bias	Ecologic fallacy	Difficult to obtain
Income	Self-report, current status	*	*			*	*			
	Self-report, past status	*	*			*	*	*		
	Tax records	*	*	*	*					*
	Census-tract level data	*	*	*	*		*		*	
Education	Self-report	*		*	*					
	Census-tract level data	*		*	*		*		*	
Occupation	Self-report, current status	*	*	*	*		*			
	Self-report, past status	*	*	*			*	*		
	Union records	*	*	*	*					*
Living arrangement	Self-report, current status		*	*	*					
	Self-report, past status		*					*		
	Self-report, change in status		*	*	*					
	Census-tract level data		*	*	*		*		*	
Caregiving Status	Self-report, current status		*	*	*		*			
	Self-report, change in status		*				*	*		
Widowhood	Self-report, current status		*	*	*					
	Self-report, change in status		*	*			*	*		

Next Week:

**LECTURE: CLINICAL PERSPECTIVES ON
AGING**

**HOMEWORK: READING, POSSIBLE
DEBATE TOPIC**