



Assessing PA with self-report: A methodological overview

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Overview of talk

- Utility of self-report
- Type of studies PA self-report are used in
- Type evidence needed in these studies
- How we are currently assessing the validity of PA self-report
- Discuss potential issues to consider in the validation process



Utility of Self-Report?

- Advantages
 - Most practical & economical
 - Only feasible method in large scale studies
 - Best at measuring context & type of PA performed
 - Limitations
 - Utility in some context debated
 - Validity & reliability less than objective methods
- [Sallis & Saelens (2000); Shephard (2003); Westerterp (2009)]



**TYPE OF STUDIES PA
SELF-REPORT ARE USED IN**



Type of Studies

Epidemiological
studies

Surveillance
studies

Intervention
studies



Type of Studies

Epidemiological
studies

- Assess relations between PA and health

Surveillance
studies

Intervention
studies



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Epidemiological studies

- Assess relations between PA and health

Surveillance studies

- Monitor levels of PA and patterns of change at the population level

Intervention studies



Type of Studies

Epidemiological studies

- Assess relations between PA and health

Surveillance studies

- Monitor levels of PA and patterns of change at the population level

Intervention studies

- Generally aim to detect small changes in PA



Methodological Consideration

- Validation sample
- Study design
- Validation criterion
- Statistical procedures



Methodological Consideration

- Validation sample
- Study design
- Validation criterion
- **Statistical procedures**

Content validation process - completed

- Qualitative interviews
- Cognitive interviews
- Pilot testing....



Statistical Procedures

Level of evidence

Association

Agreement

Sensitivity to
change



Criterion



Level of evidence & interpretation

- **Association**
 - Indicate whether different people who responded to the questions did more or less PA (Ranking of the scores on the PA self-report).



Level of evidence & interpretation

- **Association**

- Indicate whether different people who responded to the questions did more or less PA (Ranking of the scores on the PA self-report).

- **Agreement**

- Allow the scores on the PA self-report to be interpreted in terms of actual amount of PA the person does. Actual min would correspond to the behavior.



Level of evidence & interpretation

- **Association**

- Indicate whether different people who responded to the questions did more or less PA (Ranking of the scores on the PA self-report).

Relative
interpretation

- **Agreement**

- Allow the scores on the PA questionnaire to be interpreted in terms of actual amount of PA the person does. Actual min would correspond to behavior

Absolute
interpretation



Type of studies & Level of evidence

Type of studies		Level of evidence
Epidemiological		Association
Surveillance	Relative change over time	Association
	Actual amount of PA - % meet recommendations	Agreement
Intervention		Sensitivity to change



Type of studies & Level of evidence

Type of studies		Level of evidence
Epidemiological		Association
Surveillance	Relative change over time	Association
	Actual amount of PA - % meet recommendations	Agreement
Intervention		Sensitivity to change

Group level validity

Individual level validity



WHAT ARE WE CURRENTLY DOING?

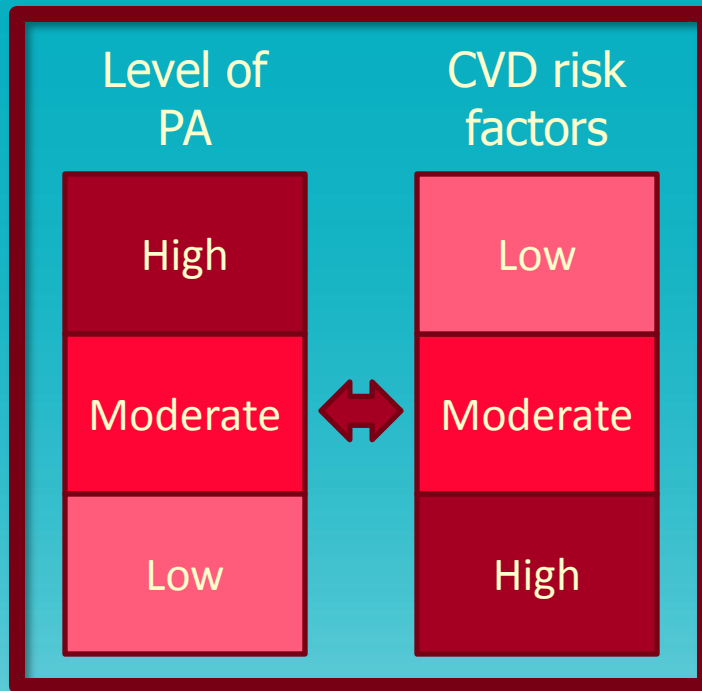


ASSOCIATION



Associations — Epidemiological studies

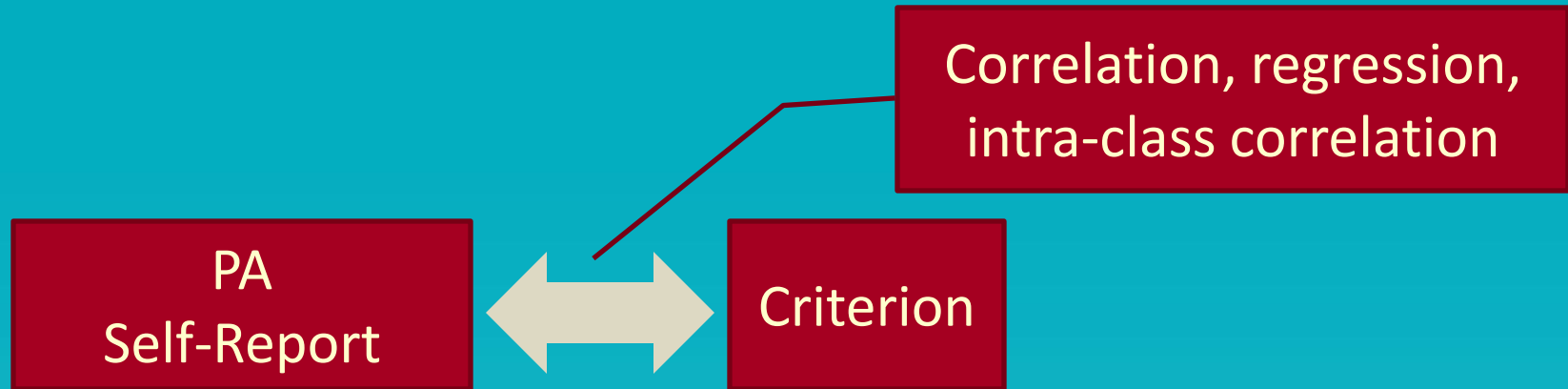
- Relationship between PA and health exist



Requires valid relative ranking for PA self-report



Associations — Epidemiological studies



- Appropriate methods to assess ranking?
- Limited in their ability to account for measurement errors in the validation process



Associations — Epidemiological studies

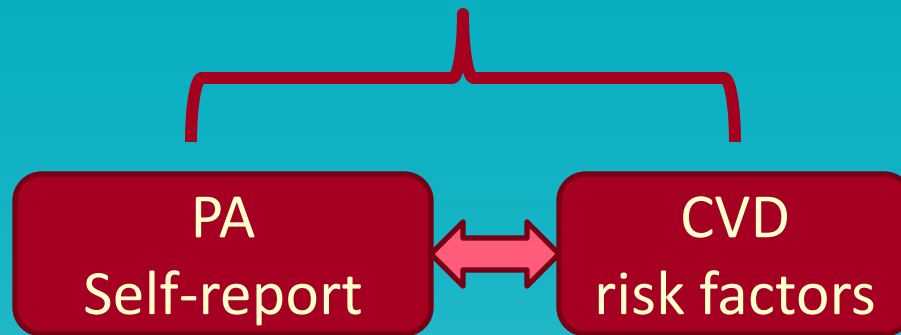
- Statistical models that account for both measurement errors (Buonaccorsi, 2000) and correct for attenuations in epidemiological studies are not new but deserve more attention.

Mixed models
Family of statistical procedures



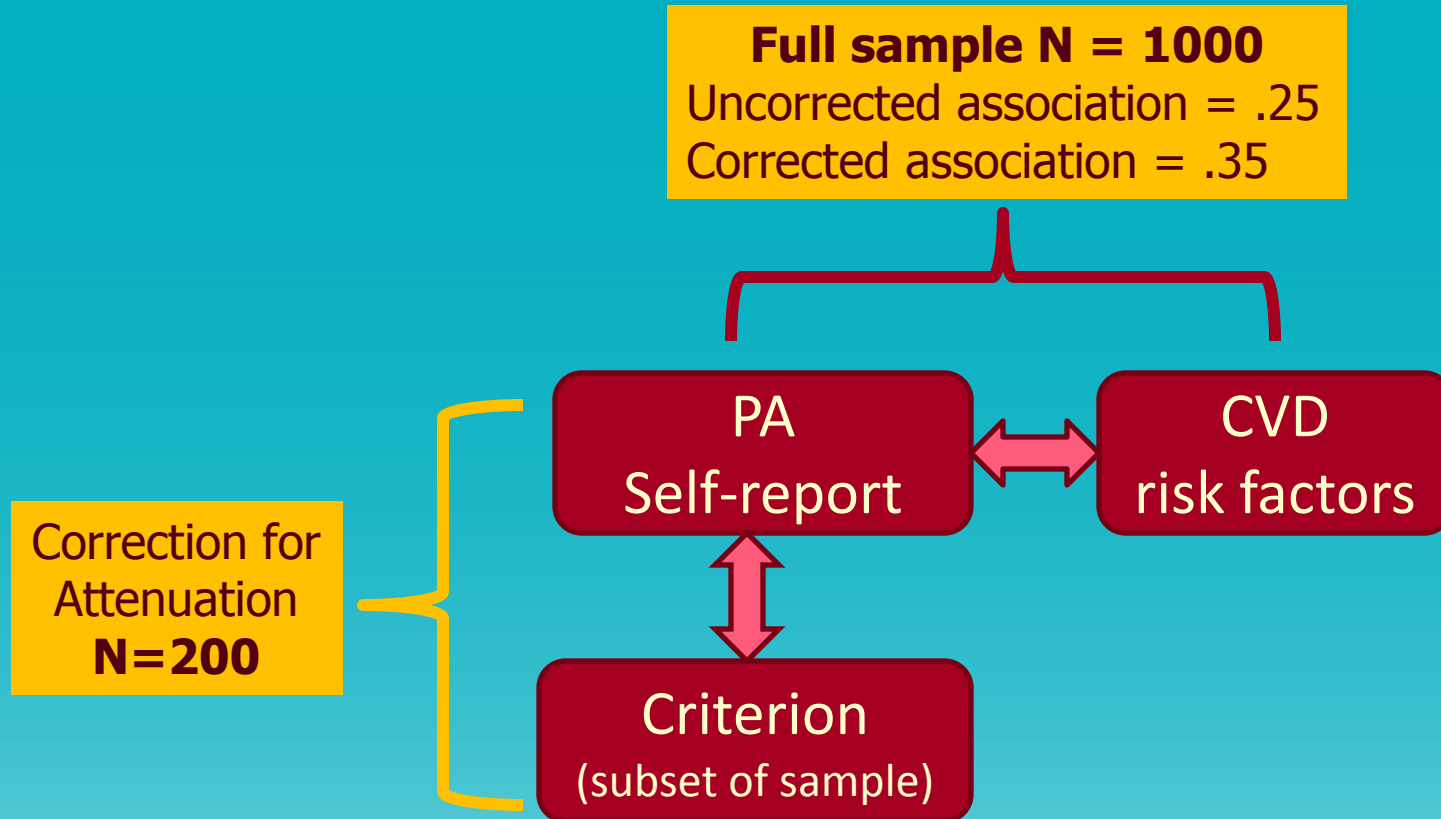
Associations — Epidemiological studies

Full sample N = 1000
Uncorrected association = .25





Associations — Epidemiological studies





AGREEMENT



Surveillance Studies

- Relative ranking – Association
 - If reliability is acceptable then it can be used to assess group level change from year to year
 - Assume no secular trend affecting patterns and that the questions remain the same

Can detect group level change
Cannot assess % meeting recommendation



Surveillance Studies

- Absolute interpretation – Agreement
 - % meeting PA recommendation need actual min
- Issue to consider
 - Do we have a valid criterion?



Possible Criterion

- Accelerometers
- VO2 max
- Doubly Labeled water
- Pedometers
- 6 min walk test
- Run test
- Heart rate
- Body fat
- FEV....



Useful Criterion

- Accelerometers
- VO2 max
- Doubly Labeled water
- Pedometers
- 6 min walk test
- Run test
- Heart rate
- Body fat
- FEV....



Criterion

- Accelerometry
 - Min above a certain count can be compared
 - Does not capture all activities (walking based)



Criterion

- Doubly Labeled water
 - $TEE = RMR + TEF + AEE$ (Kcal metric)
 - Self-report $PAEE = \text{min} * \text{MET value} * \text{BW}/60$
 - High intensity activities account for 25% of AEE
need to assess moderate and inactivity (Westerterp, 2009)



Criterion

Low
Moderate
High
Intensity activities

- Doubly Labeled water
 - $TEE = RMR + TEF + AEE$ (Kcal metric)
 - Self-report $PAEE = \text{min} * MET \text{ value} * BW/60$
 - High intensity activities account for 25% of AEE
need to assess moderate and inactivity



Criterion

- Transforming the instruments on the same metric does not mean that both instruments (self-report and criterion) are capturing the same thing.



VERSUS





Agreement – Surveillance studies

Bland & Altman, group comparison (t-test – Anova – MANOVA), kappa, Kendall tau-b

PA
Self-report



Criterion

- Appropriate methods to assess agreement?
- Other methods to quantify agreement?



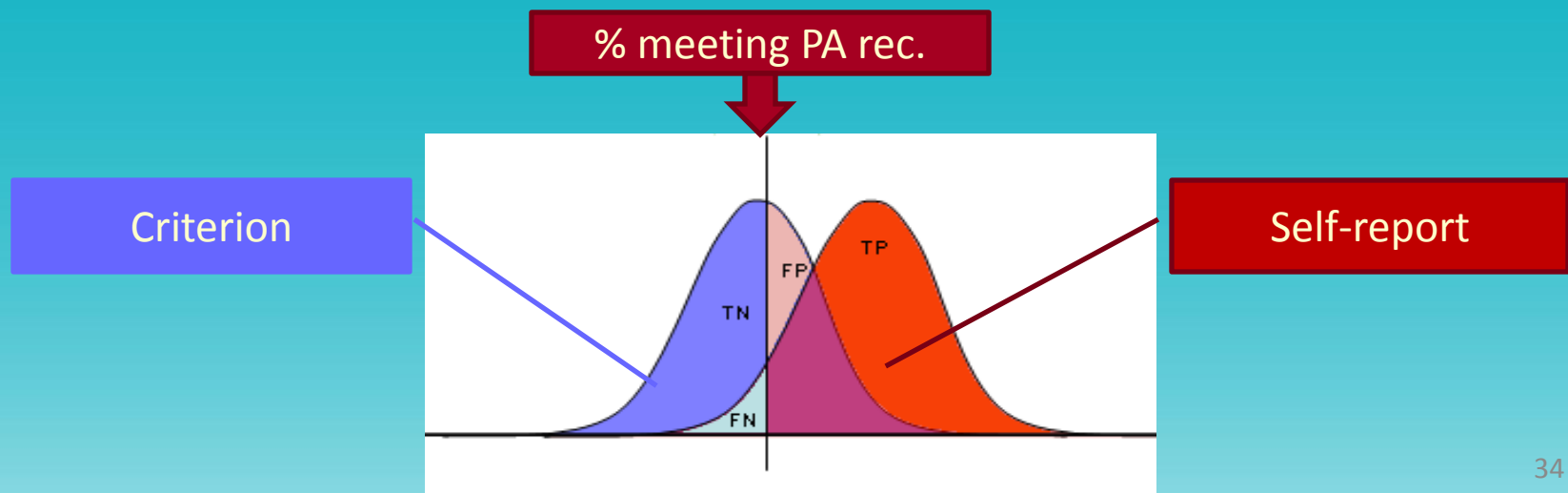
Quantifying Agreement

- Intra-class correlation

$$ICC - consistency = \frac{\sigma_s^2}{\sigma_s^2 + \sigma_e^2}$$

$$ICC - agreement = \frac{\sigma_s^2}{\sigma_s^2 + \sigma_m^2 + \sigma_e^2}$$

- Receiver Operating Characteristic (ROC) –
(application Trost et al, 2006)





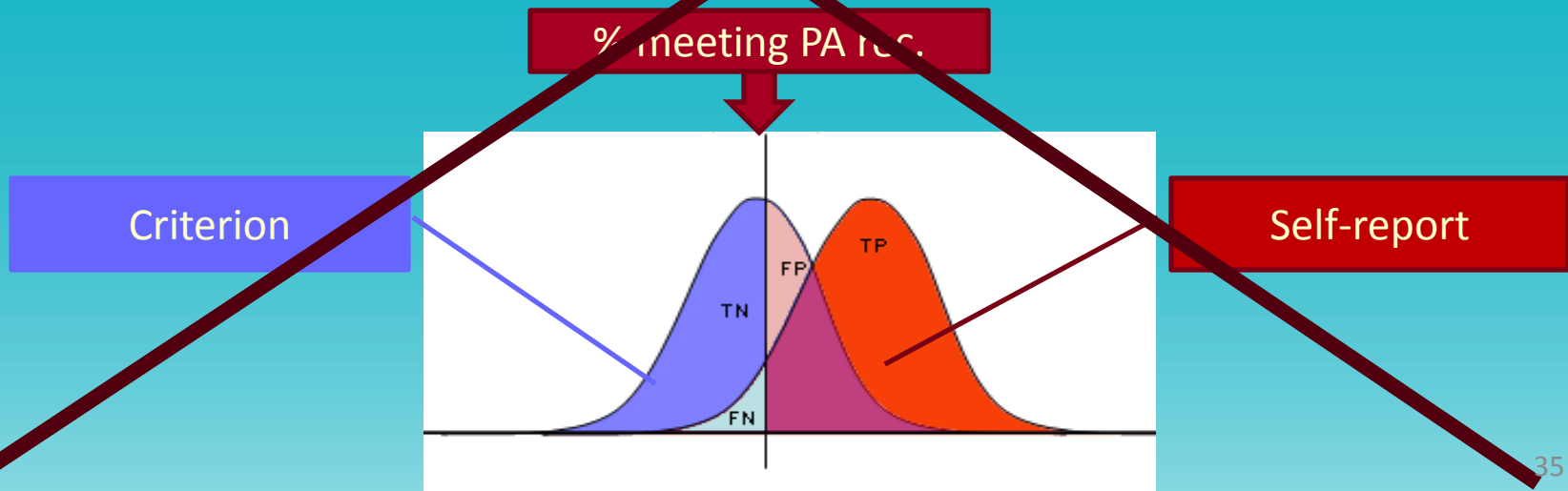
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SHOULD WE FOCUS ON QUANTIFYING BIAS (OVER REPORTING) AS A WAY OF IMPROVING AGREEMENT?



Correcting for bias — systematic error

- Developing prediction equations
 - PA min from criterion
 - PA categories from criterion (Meeting / not meeting rec.)
- Challenges
 - Modeling the type of errors we have (Plankey 1995 BMI)
 - Drift phenomenon - verifying that bias is consistent over time or sample (Gorber 2010 BMI)
- Learning from the educational field
- Measurement error models



SENSITIVITY TO CHANGE (INDIVIDUAL LEVEL VALIDITY)



Intervention studies

- Is the measure able to detect differences pre / post interventions?

Anova, t-test, Wilcoxon test

Change in PA
Self-report

=

Change
Criterion

- Appropriate methods to assess change?
- Other methods to quantify change?



Quantifying change

Pre	Post	Comparing Pre and Post scores	Issues with this approach
		Criterion (VO ₂ max) p<.05	Those who changed on the criterion might not be the same who changed on the PA self-report.
		PA self-report p<.05	



Quantifying change

Pre	Post	Comparing Pre and Post scores	Issues with this approach
		Criterion (VO ₂ max) p<.05	Those who changed on the criterion might not be the same who changed on the PA questionnaire.
		PA self-report p<.05	

Pre	Post	Pre and Post change scores	Alternative methods
		Criterion (VO ₂ max)	Change score can be compared statistically using either “correlational methods or agreement methods.” Agreement only possible if the metrics are comparable .
		PA self-report	



Quantifying change

- Validating change scores with “correlational methods” (regression methods)
 - Accurately rank the change with PA self-report
- Validating change scores with “agreement methods”
 - Change score can be meaningfully quantified (in min for example)



UTILITY OF ADVANCED PSYCHOMETRIC METHODS



Item Response Theory

Rasch Models

- Two key assumptions are problematic
 - Local independence
 - Essential unidimensionality



Assumptions

PA domains

Household

Yard work

Family

Volunteer

Transportation

Exercise / Sports

Employment

Miscellaneous

- 1-dominant dimension that explains about 40% of the variance. This assumes high correlations among domains.
- Errors are not correlated after you account for dominant dimension.



Assumptions

PA domains

- Household
- Yard
- Family
- Community
- Transportation
- Exercise / Sports
- Employment / unpaid work
- Miscellaneous

Correlation likely to be moderate

Correlation likely to be low or non-existent



Assumption test – real data

- Minority women (N=250)
- Essential unidimensionality test
 - Factor analysis forcing a 1-factor solution



Assumption test – real data

- Correlations among domains
 - Highest correlation = 0.207
 - Next highest correlation = 0.137
- 1-factor explain 16% of total variance
 - A 2nd factor would explain 14% of total variance
 - Not all items load on 1st dimension

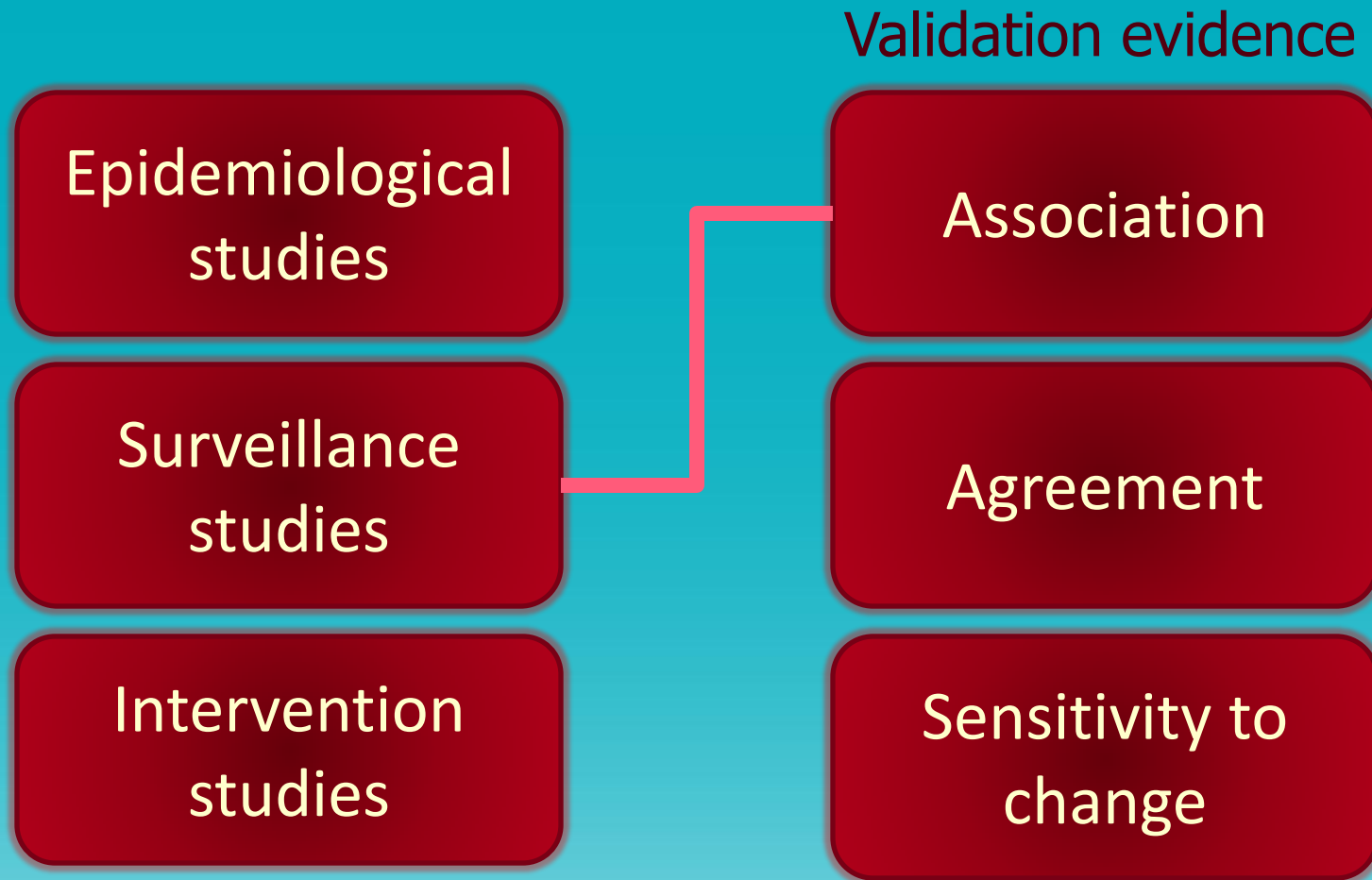
Clear violation of the assumptions



CAN ADVANCED PSYCHOMETRIC METHODS BE USED TO VALIDATE PA MEASURES?



Take home message



Can we estimate the % meet who PA recommendation?



Take home

- Before you select a PA instrument for your study – make sure it has been validated for how you intend to interpret the data.



What evidence do we have?

Associations

- Lots at this level

Agreement

- None

**Sensitivity to
change**

- Some but weaker design



WILL BETTER STATISTICAL METHODS IMPROVE OUR SELF- REPORT INSTRUMENTS?