Small-area estimation of prevalence of serious emotional disturbance (SED) in schools

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Overview

- Detailed domain data from short scale
- Limited amount of data from calibration survey with longer instrument
- Models relating the instruments at individual and school levels
- Predictions based on data from short scale
  - School level (prevalence)
  - Individual level (screening)

Outline

- Measures
  - CIDI
  - K6 and enhancement for adolescents
- Sample design
- Models
- Predictions
- Future directions

Measures: CIDI

- Composite International Diagnostic Interview
  - Trained lay interviewers
- Adolescent version: CIDI-A
  - Adolescent interview
  - Parent questionnaire (SAQ) focused on dx more noticed by parents (ADHD,)
- Contains most information required for SED dx
  - P(Clinical GAS) imputed from CIDI dx & other items (data from 347 clinical validation interviews)
- Numerous other covariates

Measures: K6 scale

- 6 items on 0-4 severity scale (never−always)
  - "So depressed nothing could cheer you up"
  - Nervous
  - Restless/fidgety
  - Hopeless
  - Everything an effort
  - Worthless
- Internalizing disorders: depression, anxiety
  - Developed for adult population

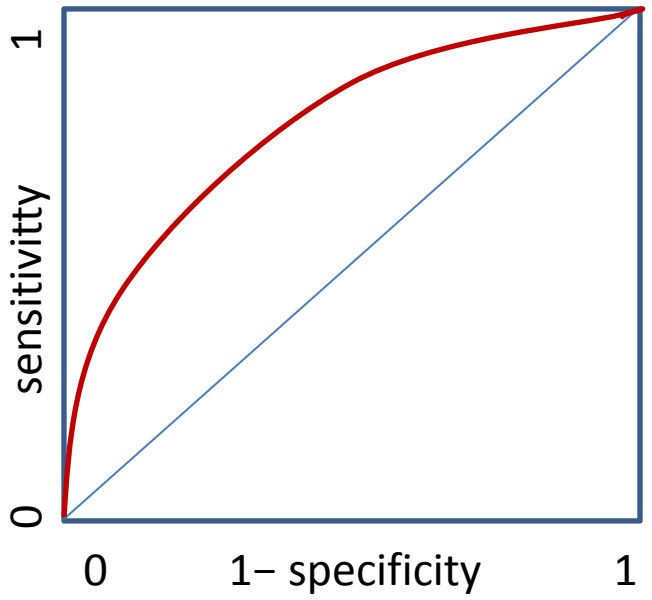
K6: adolescent enhancements

- Considered 18 items: screeners,behavioral symptoms of personality disorder
- Elicit externalizing disorders (ODD, CD, ADHD)
  - Earlier onset, more common in adolescents
- Selected 5 items
  - Screeners for ADHD, IED, ODD
  - 2 personality items: “can stay out of trouble”, “have strong temper”

K6: predictive power at individual level

- Compare by AUC (area under ROC curve) for prediction of disorders and SED
  - 0.5=chance agreement, 1.0=perfect agreement

Diagnosis	K6	K6+5
Any mood disorder	.77	.81
Any anxiety disorder	.73	.75
Any behavior disorder	.67	.82
Any SED	.74	.83
SED with behavioral disorder	.53	.78



Sample design of NCS-A

- National Comorbidity Survey – Adolescent Supplement
- School-based component
  - Highly stratified national PPS sample
  - 320 schools (after replacement of refusing schools)
- Final sample 282 schools (≥10 students/school)
- 9244 adolescents (74.7% participation rate)
  - 83.7% parent response (conditional on child)

Models

- Bivariate multilevel mixed model, continuous outcomes Y_1, Y_2:

$$Y_{ijm} = \mathbf{X}_{ijm}\beta_m + v_{im} + e_{ijm}$$

i = cluster (school, neighborhood, etc.)
j = individual
$m = 1, 2$ = measure
$\mathbf{X}$ = covariates
v = cluster-level random effect
e = individual-level random effect

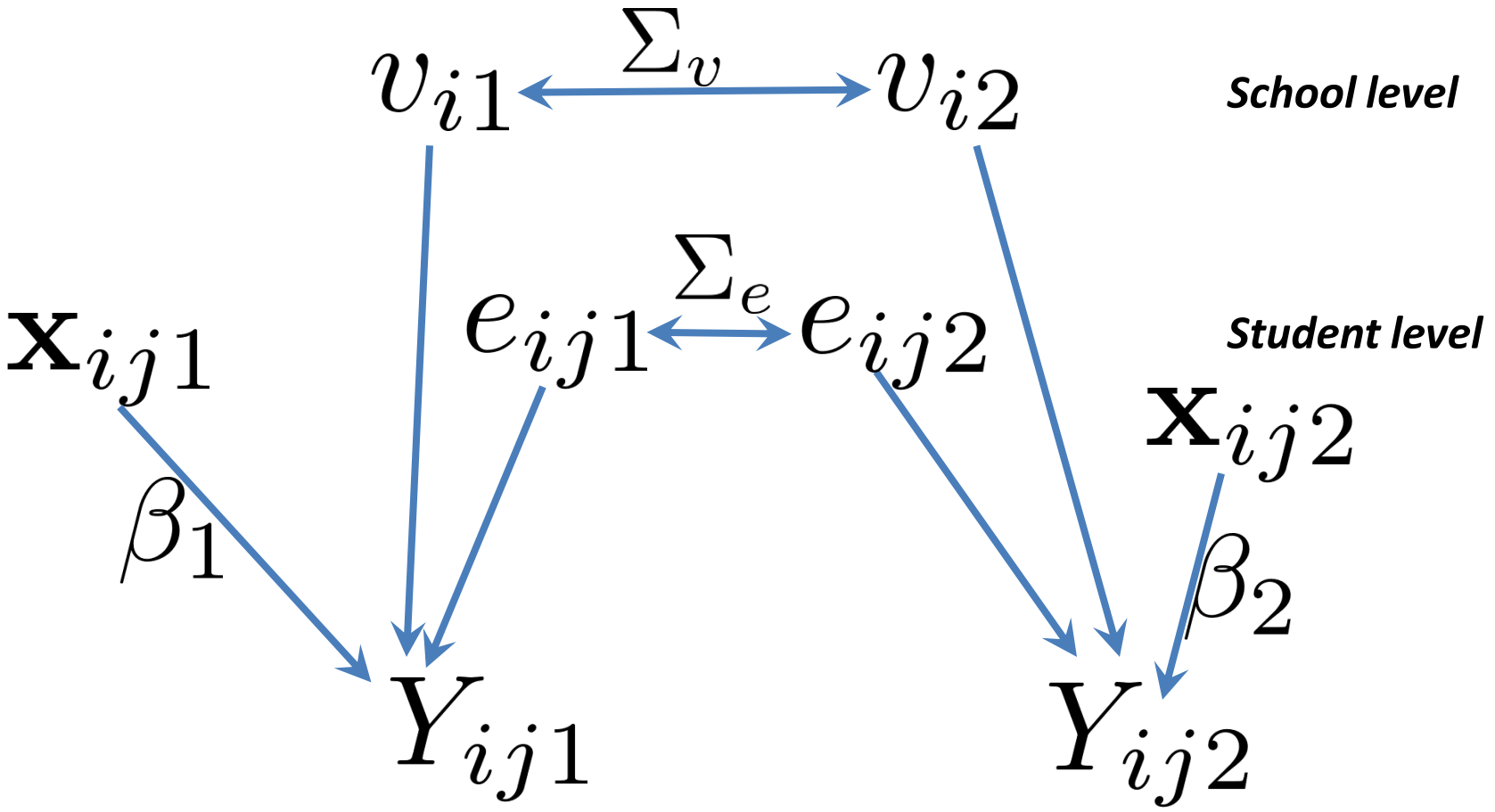
Models

- Version with dichotomized SED outcome:

$$Y_{ij3} = I\{Y_{ij2} > 0\}$$

  - Equivalent to probit model for binary outcome
  - E.g. Y_1=screener score, Y_2=Φ(P(SED)), Y_3=SED
- Covariates
  - Age, sex, race/ethnicity, age at school entrance
  - Public/private, size (<50 teachers vs >50)

Model diagram



Estimates from NCS-A

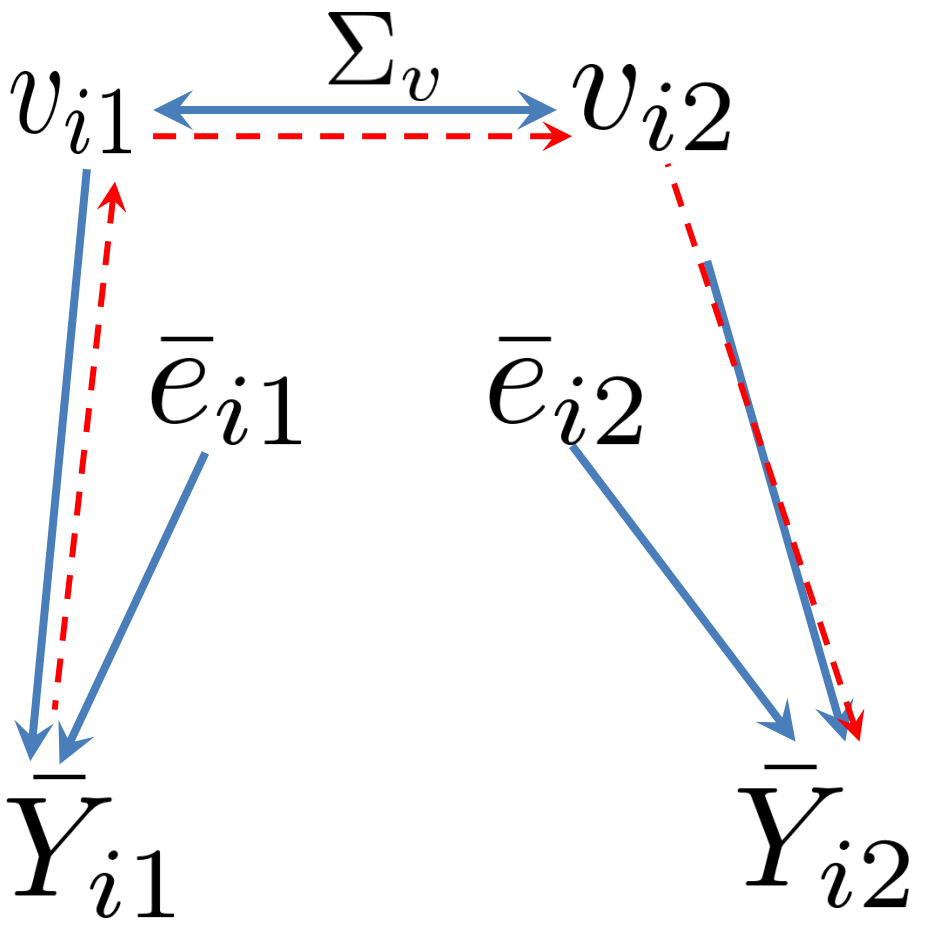
- With continuous outcomes

	v (school level)	e (individual level)
σ^2_1 (K6+5 variance)	0.019	0.371
σ^2_2 (SED variance)	0.037	0.597
P (correlation)	0.845	0.544

Covariates

- Age, sex, race-ethnicity
- Age starting school
- Public/private

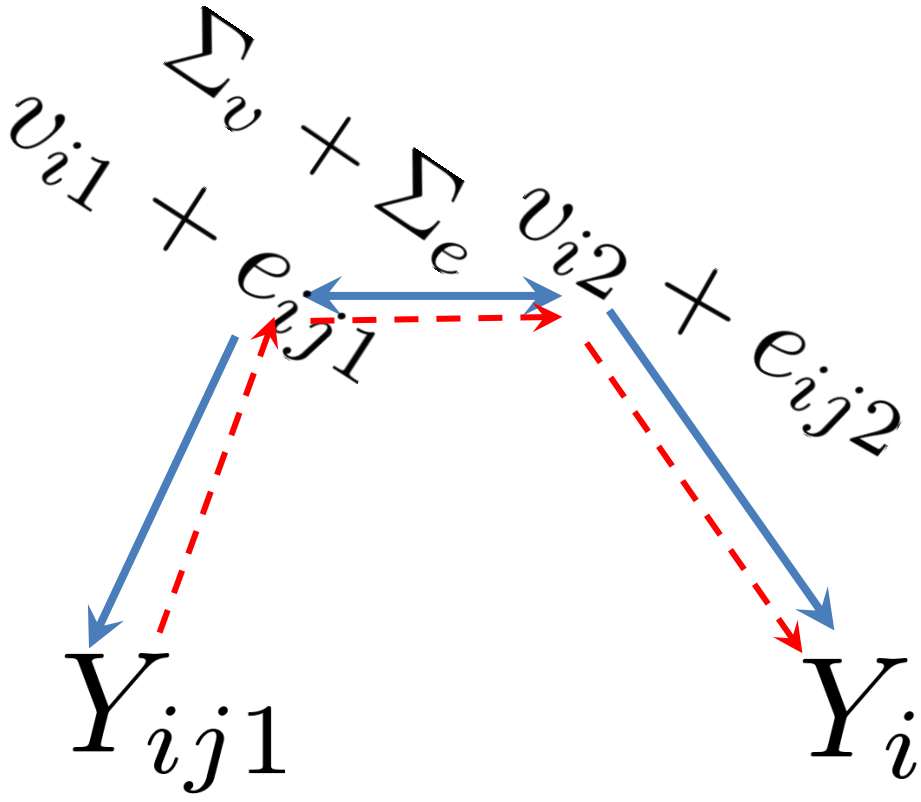
Out-of-sample prediction



Scenario:

- Collect K6+5 measures in school subsample.
- Predict for remainder of school

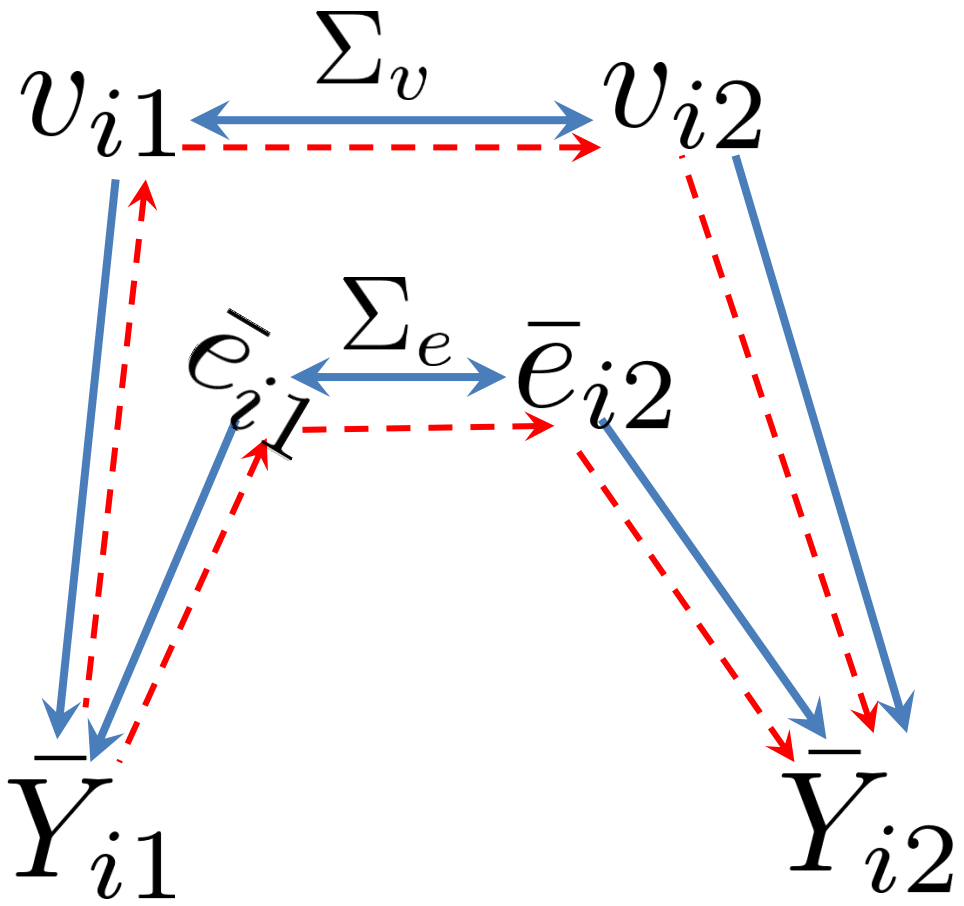
Individual-level prediction (naïve)



Scenario:

- Collect K6+5 measures for individuals.
- Predict SED score for same individuals
- Ignore clustering

In-sample prediction



Scenario:

- Collect K6+5 measures for a sample.
- Predict SED score for same sample.
- Design with sampling within school combines in- and out-of-sample prediction

Prediction for individuals

- Special case of in-sample prediction
- Estimate of school-level random effect has substantial effect on prediction for individual.
  - Implies prevalence.
  - E.g. same screening score at schools at ±1 SD from median random effect → P(SED)=12.7%, 6.3% respectively

Limitations and open questions

- Short scale development
  - Only items from current CIDI questionnaire
  - Might function differently out of context
  - Investigate other short scales
- Validation sample design
  - Optimize for estimation of variance/covariance
  - Test school-level covariates
- Model fit imperfect at high end
  - Perhaps better for ranking than exact prevalence

More covariates

- School level: Principal questionnaire
  - Frequency of depression reports, attacks/fights, etc
- Neighborhood characteristics
  - Families in poverty, homeless, racial/ethnic composition, stability, region, urbanicity
- School-level (ecological) models – weaker than K6
  - R^2=.45 with both sets of variables
  - R^2=.40 with only Census
- Need data on school characteristics related to assignment policies/patterns

Conclusion

- Combination of short screening scale with calibration survey is technically possible
- Large improvements relative to synthetic model based on demographics
- Best estimates use multilevel model instead of single-level regression.

References

- NCS-A description
  - Kessler RC, Avenevoli S, Costello EJ, Green JG, Gruber MJ, Heeringa S, Merikangas KR, Pennell BE, Sampson NA, Zaslavsky AM. National Comorbidity Survey Replication Adolescent Supplement: II. Overview and design. J Am Acad Child Adolesc Psychiatry 2009;48(4):380-385.
- K6+ development
  - Green JG, Gruber MJ, Sampson NA, Zaslavsky AM, Kessler RC. Improving the K6 short scale to predict serious emotional distress in adolescents in the USA. Int J Meth Psych Res 2010;19(Supp 1):23-35.
- Modeling
  - Li F, Green JG, Kessler RC, Zaslavsky AM. Estimating prevalence of serious emotional disturbance in schools using a brief screening scale. Int J Meth Psych Res 2010;19(Supp 1):88-98.
  - Li F, Zaslavsky AM. Using a short screening scale for small-area estimation of mental illness prevalence for schools. J Am Stat Assoc 2010;105(492):1323-1332.