Causal modeling approaches to answer research questions about health disparities

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Study description and research questions

Research Question examples:
1. "What is the size of HD between specific ethnic groups?"
2. "What are the key drivers of HD in a specific health outcome?"
3. "How much of existing HD is due to ethnic differences, or how much can/cannot be explained by other mechanisms?"
4. Is ethnicity the major reason for heterogeneity on data/effects?

We employ a sequence of simple Structural Models starting with: 1. Simple mean comparisons, which can be equivalently specified as 2. Regressions of the outcome on the grouping variable; 3. adjusted mean difference models; 4. Mediation models of HD; 5. Mixture models to gauge the "size of the HD effect".

Causal modeling approaches to answer research questions about health disparities (HD) research questions. HDs are considered avoidable differences in health outcomes between groups like ethnicities. Understanding HD and their causes requires flexible modeling aimed at separating out causal factors and mechanism responsible for observable HDs.

Modeling HD can be achieved using flexible structural models; the specific HD can 'occur' at many points in time/dimensions. Comparing Racial/Ethnic (R/E) groups requires prior substantive knowledge about the causal reasons behind the HDs. Asking: Why are there differences in the outcomes between groups like ethnicities. Understanding HD and their causes requires flexible modeling aimed at separating out causal factors and mechanism responsible for observable HDs.

HD can 'occur' at many points on a continuum (1). We are asking: Why are there more of these arrows pushing these trajectories up/down in one vs. the other racial/ethnic group? One modeling translation of this conceptual model is into TTO 1-group regressions:

1. Health Outcomes, Protective Factors
2. HD background modeling
3. Health Disparities (HD) Modeling options
4. How to prove / disprove discrimination:
5. Some Health Disparities (HD) Modeling options
6. Study description and research questions

Some Health Disparities (HD) Modeling options

We first illustrate health outcomes HD assessed through a mere comparison between independent means. A brief study description: diabetics participated in a quality improvement study using peer supporters (2). DBP was centered at 50.

1. Compare raw means, as 2-group 1-outcome model, with:

- Mean, Variance, NH DBP: H DBP:
- There is a 3.90 mean difference; the 'means equal' (27.06) constraint worsens the fit, so it's not supported by data. An ANOVA yields F (1,197) = 1.705, p = .031.

2. Test HD effect as 1-group 1-outcome model:

- There is an effect of Hispanic/Non on DBP: \( \beta = 3.95, p = .028 \) (p-value in subscript).

3. Test HD effect as 1-group 1-outcome with Auto Regressive model (AR1):

- There is an effect of Hispanic/Non on DBP: \( \beta = 5.55 \), and this model explains more DBP\(^2\) variability (111%).

4. Test HD effect as 2-group 1-outcome difference in outcome intercepts:

- 2-group models are more flexible, can incorporate theory and sample data expectations: one has now 2 sets of model estimates, for each ethnic group. Predictors do not correlate within ethnic groups. Fit of 2-group model is adequate: \( \chi^2 (5) = 2.90 \) (1; \( p \chi^2 < .05 \)), so one can compare models nest ed in it. Forcing intercepts to become equal (to 12.58) does not alter fit significantly: \( \Delta \chi^2 (1) = .73 \) (1; \( p \chi^2 < .05 \)), so DBP appears similar across groups.

5. Test residual HD effect after indirect effects are specified, e.g. BMI:

- Total effect is 3.676, so 5.4% is the indirect effect through BMI.

6. Test HD effect as 2-group 1-outcome difference in outcome intercepts:

- A 2-class DBP on DBP, BMI, 6 Age (with age and DBP, correlated) mixture solution vs. original Hispanic group (\( p \chi^2 < .02 \)). Class 2 leans towards Hispanics, although 56 of its 220 are mis-classified (25%); class 2 mis-classifies however all Non-Hispanics.

Conclusions and Proposed Extensions

1. Modeling Health Disparities (HD) can be achieved using flexible structural models: the specific question however informs which model to be fit to the data.
2. Comparing Racial/Ethnic (R/E) groups require prior substantive knowledge about the causal processes involved in the specific health area: poor models fit poorly, and will lead to inconsistent conclusions.
3. Mixture models are powerful tools for uncovering sources of heterogeneity, yet new nuanced models like change mixture models (4) may be more appropriate.

For more information contact: coman@cdsn.edu or google 'modeling latent change models'.