

Modeling health disparities with a unique combinations of 1-on-1 matching and latent difference and latent change scores

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*Both LCS/LDS and causal inference tools
learned via MMM in recent years: thanks!*

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Skewed cost analyses

Costs in healthcare are notoriously skewed: a small percentage of patients could account for half the costs, (the 5-50 rule of thumb, see AHRQ), so modeling such variables needs extra ... care!

While transformations (logX, etc.) may 'squeeze' the original distribution of costs to 'look' better (more normally distributed), there is a lot that's left unattended when doing so (references below).

As an example, costs seen in the eConsult intervention are quite skewed:

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The paired *t*-test as a simple latent change score model

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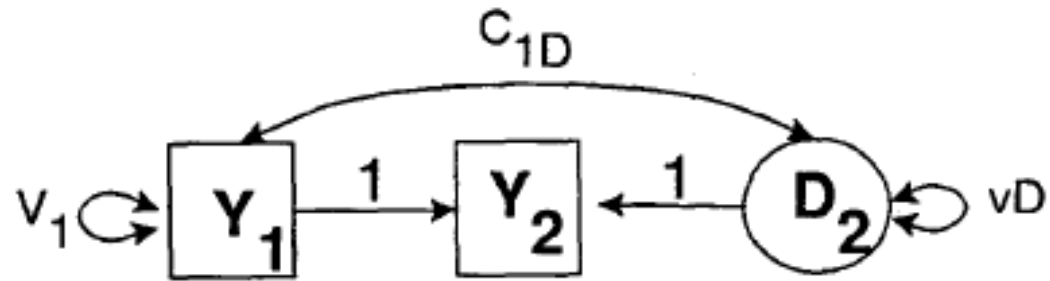
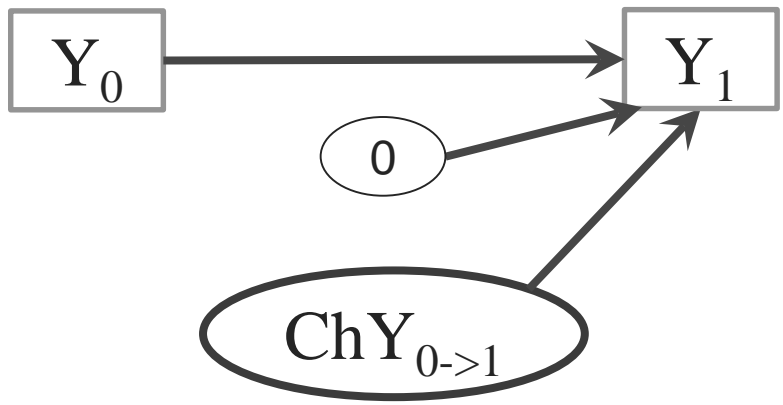
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[LCS



(b) A Different Score Model of Change

All paths shown are set @ 1

Example shown for Hispanics (H).

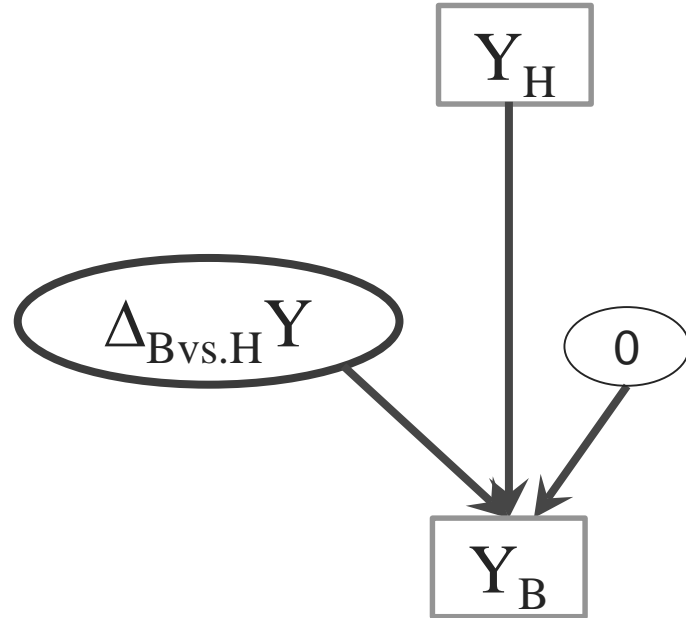
One backs graphically and structurally into the LCS model by force-specifying the *mathematical equation* as a statistical (directional) equality:

$Y_1 = Y_0 + ChY_{0 \rightarrow 1}$ becomes the *regression*
 $Y_1 \leq 0 + 1 \cdot Y_0 + 1 \cdot ChY_{0 \rightarrow 1} + 1 \cdot 0$ or $ChY_{0 \rightarrow 1}$ and Y_0 ‘fully explain’ Y_1

Key is forcing several parameters to **1 & 0**.

1. McArdle, J. J., & Nesselroade, J. R. (1994). Using multivariate data to structure developmental change. In S. H. Cohen & H. W. Reese (Eds.), *Life-span developmental psychology: Methodological contributions* (pp. 223–267). Mahwah, NJ: Lawrence Erlbaum Associates.
2. Coman, E. N., K. Picho, McArdle, J. J., et al. (2013). "The paired t-test as a simple latent change score model." *Frontiers in Quantitative Psychology and Measurement* 4, Article 738.

LDS

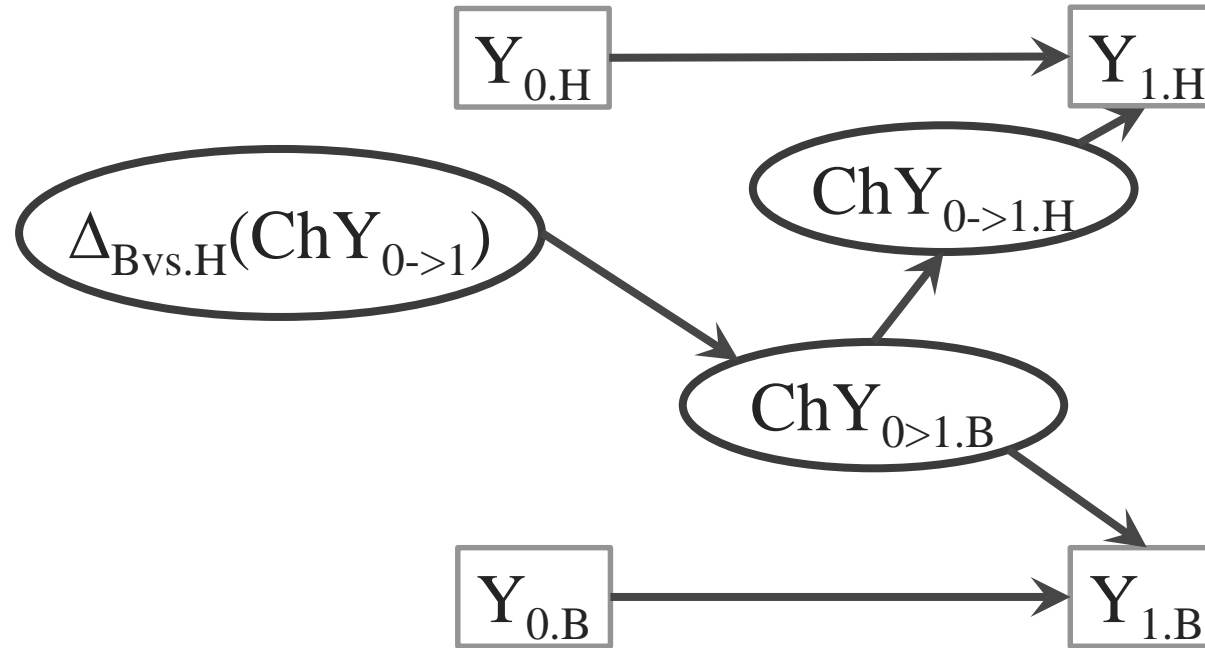


All paths shown are set @ 1

Example shown for Blacks
(B) - Hispanics (H)
differences.

The contemporaneous LDS is built the same way as a LCS: $\Delta_{Bvs.H} Y$ and Y_H 'fully explain' Y_B . LCS/LDS latents carry the same unit of measurement as its 'makers'.

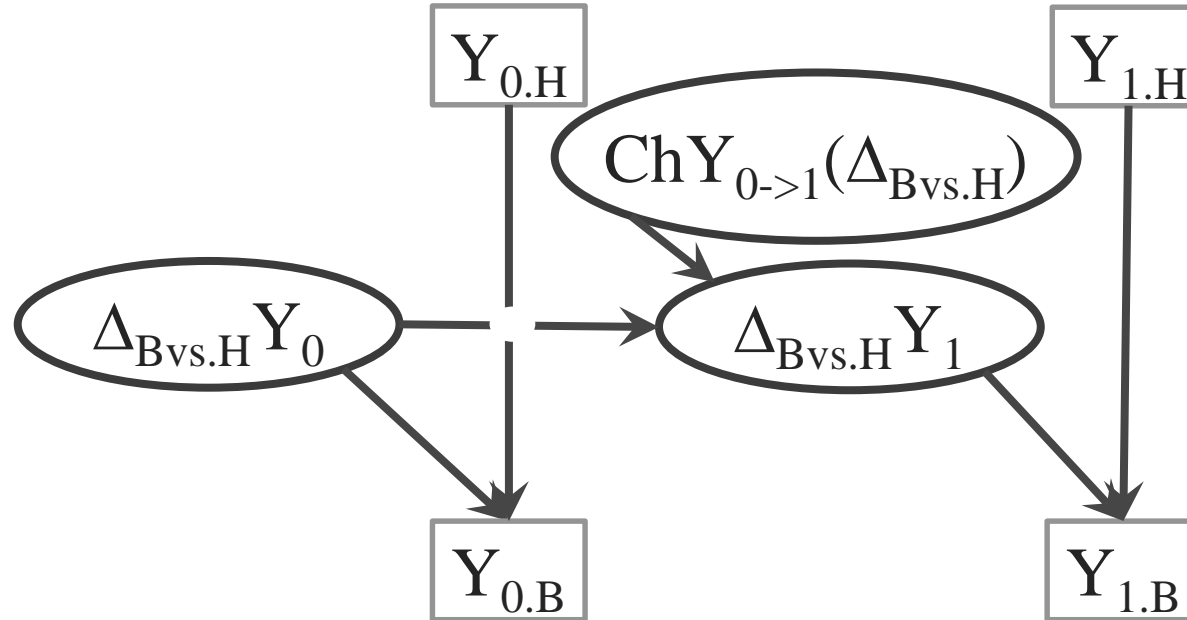
1-on-1 matching approach. Change in Differences: LCS after LDS



All paths shown are set @ 1

The 2 LCSs->1 LDS model estimates the Difference in Y Changes $\Delta_{Bvs.H}$ after 1-on-1 matching Blacks & Hispanics (79 dyads).

1-on-1 matching approach. Change in Differences: LCS after LDS



All paths shown are set @ 1

The 2 LDSs->1 LCS model estimates the Change in Y Differences $ChY_{0->1}(\Delta_{Bvs.H})$ after 1-on-1 matching Blacks & Hispanics (79 dyads).

The 2 LDSs->1 LCS model seems to be rather misspecified temporally and causally: paths for same group time 0 -> time 1 are not included in the raw setup.

If one includes them however, the meaning of the Δ LDSs starts shifting.

‘Fatherworks’ intervention in Hartford, CT

- ❖ *92 Hispanic and 145 Black young fathers*
- ❖ *ages 15 to 24 enrolled in a 15 week parenting education program*
- ❖ *met once a week for 120 minutes as well as case management*
- ❖ *Topics covered*
 - *communication with a co-parent*
 - *interactions with the court system*
 - *and relations with extended family*



Increasing condom usage for African-American and hispanic young fathers in a community based intervention

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ABSTRACT

Objectives: This paper investigates a community-based intervention for young fathers, *FatherWorks*, compared to care-as-usual, *24/7 Dads*. We hypothesized that utilizing the *FatherWorks* intervention (a 15 session parenting intervention, 13 session employment class, paid internship, case management, and access to behavioral health services) will assist in readiness to use condoms and increase condom usage, which may differ by race/ethnicity.

Methods: Eligible males ($n = 328$) were enrolled into a Randomized Control Trial. Participants were 15–24 years old and had fathered one or more children with a female under the age of 21. A survey was taken at baseline and at 15 weeks following the intervention.

Results: Analyses of changes indicated that intervention participants improved from the pre-contemplation stage of condom usage towards contemplation, and from preparation to action. The pattern of improvement in the condom use stage of change was different in African-American versus Hispanic participants. Changes in condom use during last intercourse were not significant.

Conclusions: Study findings indicate that *FatherWorks* is successful in increasing the intent to use condoms, with the effect manifesting differently in African-American and Hispanic young fathers. Future work with minority fathers indicates a need for cultural adaptation of the intervention.

ARTICLE HISTORY

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KEYWORDS

Fathers; latin@s; hispanics; condom usage; African American; intervention

‘Fatherworks’ intervention

Cristina Mogro-Wilson, Aubri Drake, Emil Coman, Toral Sanghavi, Melanie Martin-Peele & Judith Fifield (2018) Increasing condom usage for African-American and hispanic young fathers in a community based intervention, *Ethnicity & Health*, DOI: [10.1080/13557858.2018.1427704](https://doi.org/10.1080/13557858.2018.1427704).

‘Fatherworks’ intervention in Hartford, CT

The Caregiving perceived reflected-appraisals scale (Care)

- *the other parent’s views about one own’s parenting roles, and their partners’ roles, as parents,*
- *14 items*
- *Cronbach’s alpha of .700 at baseline*
- *sample item: ‘My child’s mother thinks I should be more involved in the day-to-day matters of physically caring for our child.’)*

The Breadwinning identity scale (Bread)

- parent’s attitudes about breadwinning
- 9 item
- Cronbach’s alpha at baseline was .775
- items like ‘I have a responsibility as a parent to be a financial provider for my child’

‘Fatherworks’ match on 2 SES indicators

	Hispanic Black	No Highschool	Highschool
No work	36%	70%	41%
Part-time	7%	9%	5%
Full-time	1%	2%	3%

❖ *Are they comparable?*

Matching and its utility

- *1:1 matching suggested long ago by Cochran [1], a 1:1 match, done in “the hope of securing a more accurate comparison”*
- $\Delta\bar{Y} = \bar{Y}_B - \bar{Y}_H$ represents true health disparities (HD) if the Black and Hispanic participants are ‘exchangeable’
- Potential $Y^{B/H}$ should be independent on how one is ‘assigned’ to a racial/ethnic (R/E) group $\{Y^B, Y^H\} \perp\!\!\!\perp A_{B/W}$
- Since R/E is not assigned randomly (like gender [2]), then this becomes a conditional independence assumption (on income, education, employment, e.g.). If one matched 1:1 however, we have ‘exchangeable’ paired cases, or dyadic data (repeated Y variable for B and H).
- So one can analyze Latent Difference Score (LDS) models +
- Latent Change Score (LCS) ones too, if time-repeated data is collected.

1. Cochran, W.G., *The comparison of percentages in matched samples*. Biometrika, 1950. **37**(3/4): p. 256-266..

VanderWeele TJ, & Hernán MA. (2012). Causal effects and natural laws: towards a conceptualization of causal counterfactuals for non-manipulable exposures with application to the effects of race and sex. In Berzuini C, Dawid P, & Bernardinelli L (Eds.), *Causality: statistical perspectives and applications* (pp. 101–113).

Matching and its benefits

Instead of

$$\Delta\bar{Y} = \bar{Y}_{Bi} - \bar{Y}_{Hk}$$

➤ After 1:1 matching we can analyze

$$Y_{Bj} - Y_{Hj}$$

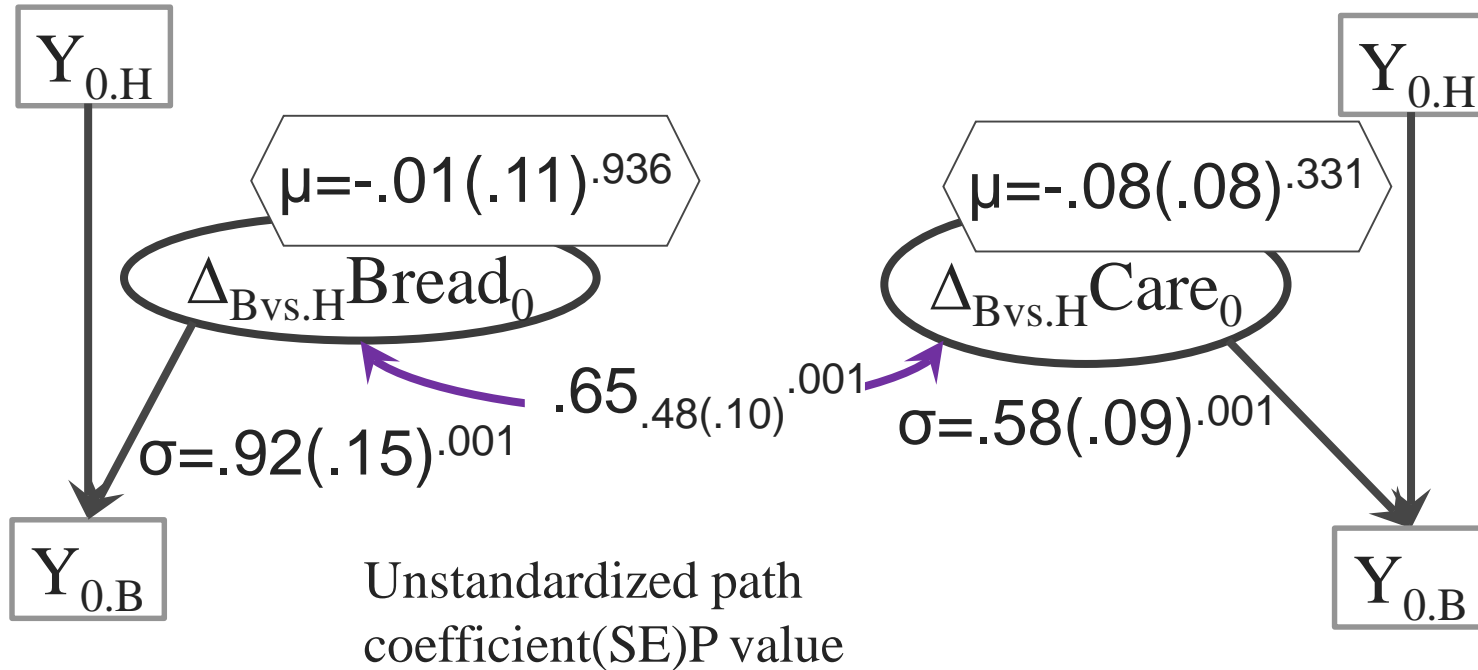
and then (notice Δ moved under the bar!):

$$\overline{\Delta Y} = \overline{Y_{Bj} - Y_{Hj}}$$

So: from unmatched $Y_{Bi} - Y_{Hk}$ -> to matched $Y_{Bj} - Y_{Hj}$

➤ 79 Blacks were matched to 79 Hispanics, on age, highschool, whether still in school, and a 4 level employment status within .003 of the probability of belonging to the focal (Black) vs. reference group (Hispanic).

LDS Breadwinning (Bread) & Caregiving (Care) measures



All paths shown are set @ 1

Example shown for Blacks (B) - Hispanics (H) differences.

Both Black-Hispanic difference scores vary substantially, and higher B/H difference in breadwinning makes a higher B/H difference in caregiving more likely. The averages were not distinct from 0.

LDS Mplus syntax X=Bread Y=Care

```
sem /// /* method(mlmv) */
(XLDS -> XB@1) (XH@1 _cons@0 -> XB) ///
(YLDS -> YB@1) (YH@1 _cons@0 -> YB), ///
means(XH XLDS YH YLDS) ///
var(e.XB@0 XLDS e.YB@0 YLDS) cov(XLDS*YLDS)

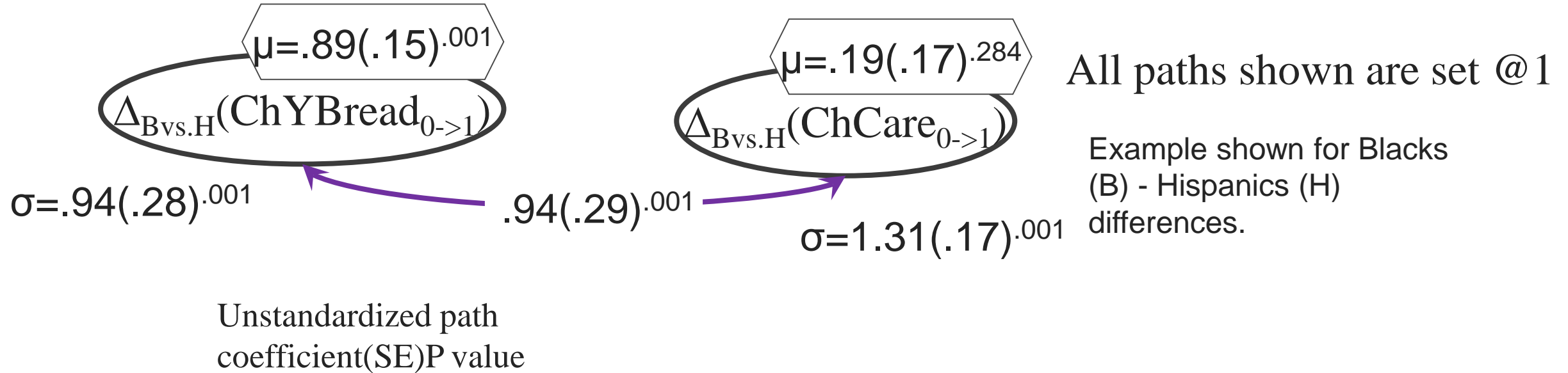

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XLDS by XB; XB@0; [XB@0]; XB on XH@1; [XLDS]; XLDS;
YLDS by YB; YB@0; [YB@0]; YB on YH@1; [YLDS]; YLDS;


---


XLDS <- 'XLDS =~1*XB          XB=~ 1*XH          XB~~0*XB
XLDS~1          XB~0*1          XLDS~1
YLDS <- `YLDS =~1*YB          YB=~ 1*YH          YB~~0*YB
YLDS~1          YB~0*1          YLDS~1
```

LDS Breadwinning (Bread) & Caregiving (Care) measures



Both difference-in-changes scores vary substantially, and higher difference in breadwinning makes high difference in caregiving more likely.

Black young fathers showed higher changes breadwinning responsibility attitudes than Hispanic young fathers.

Conclusion

1:1 matching (Cochran) allows us to analyze models with Latent Difference Scores (LDS), Latent Change Scores (LCS, McArdle), as well as combinations of them, to answer:

1. How variable R/E differences (health disparities, HD) are?
2. What predicts (causes?) larger HDs?
3. Racial/Ethnic (R/E) differences in changes (LCSs then LDS)
4. How HDs (synchronous differences) change over time (LDSs then LCS)?

1. Cochran, W.G., *The comparison of percentages in matched samples*. Biometrika, 1950. **37**(3/4): p. 256-266.

2. McArdle, J. J., & Nesselroade, J. R. (1994). Using multivariate data to structure developmental change. In S. H. Cohen & H. W. Reese (Eds.), *Life-span developmental psychology: Methodological contributions* (pp. 223–267). Mahwah, NJ: Lawrence Erlbaum Associates.

[Thanks]

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