How to Peel Oranges into Apples: Finding Causes and Effects of Health Disparities with Difference Scores Built by 1-on-1 Matching

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Emil N. Coman[1]
Helen Wu[2]
Wizdom A. Powell[1]

[1] UConn Health Disparities Institute, [2] UConn Health

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HDs with *1-on-1 Matching*

Goals

Introduce a new method to estimate HDs

Interpret results

Suggest uses/extensions

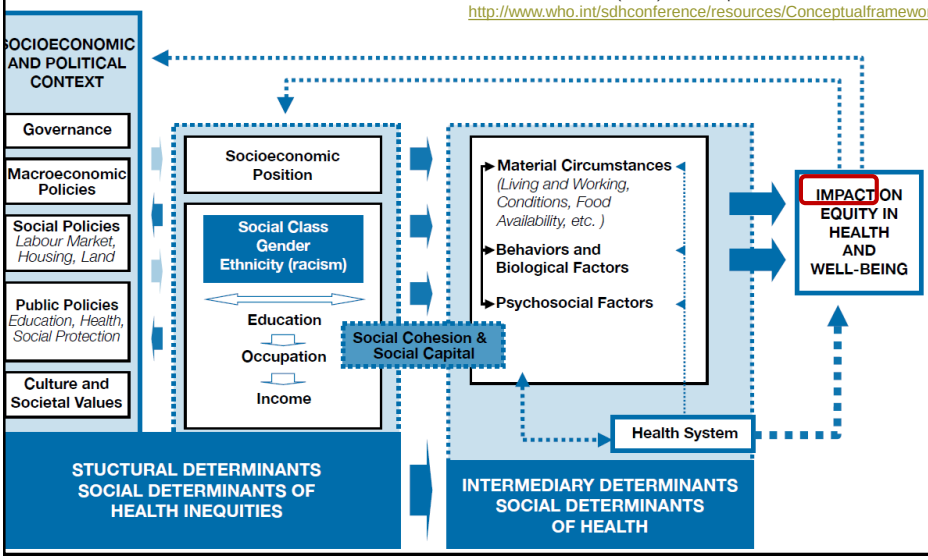
HDs with 1-*on-1 Matching*

- Understanding the underlying causes of health disparities (HD) is a major public health objective
- HDs are defined as differences in health resulting from avoidable 'social forces', not due to unavoidable biological (or genetic) differences
- Challenge: compare the comparable to confidently reach causal inference

HDs and causes - example

Figure 5. Final form of the CSDH conceptual framework

Solar, O., & Irwin, A. (2007). A conceptual framework for action on the social determinants of health. from http://www.who.int/sdhconference/resources/ConceptualframeworkforactiononSDH_eng.pdf



HDs with *1-on-1 Matching on what*

	White (%)	N	Black (%)	N	All (%)	N	
Total		92		145		237	
Employment							
Unemployed	38.64	34	45.83	66	43.1	100	0.165
Homemaker	13.64	12	7.64	11	9.91	23	
Part-time	20.45	18	13.19	19	15.95	37	
Fulltime	27.27	24	33.33	48	31.03	72	
Education							
0 < Grade < 12	33.79	30	33.33	49	33.33	79	0.523
Grade = 12	48.28	40	46.41	70	46.41	110	
Grade > 12	17.93	22	20.25	26	20.25	48	
Marital status							
Married	20.65	19	7.59	11	12.66	30	<.001
Co-habitating	32.61	30	16.55	24	22.78	54	
Not married w/ boyfriend	21.74	20	51.03	74	39.66	94	
Not married w/o boyfriend	25	23	24.83	36	24.89	59	
Means	White	SDs	Black	SDs	All	SDs	$p_{t\ test}$
Age	22.59	3.66	23.11	3.63	22.91	3.64	0.282

1-on-1 matching approach

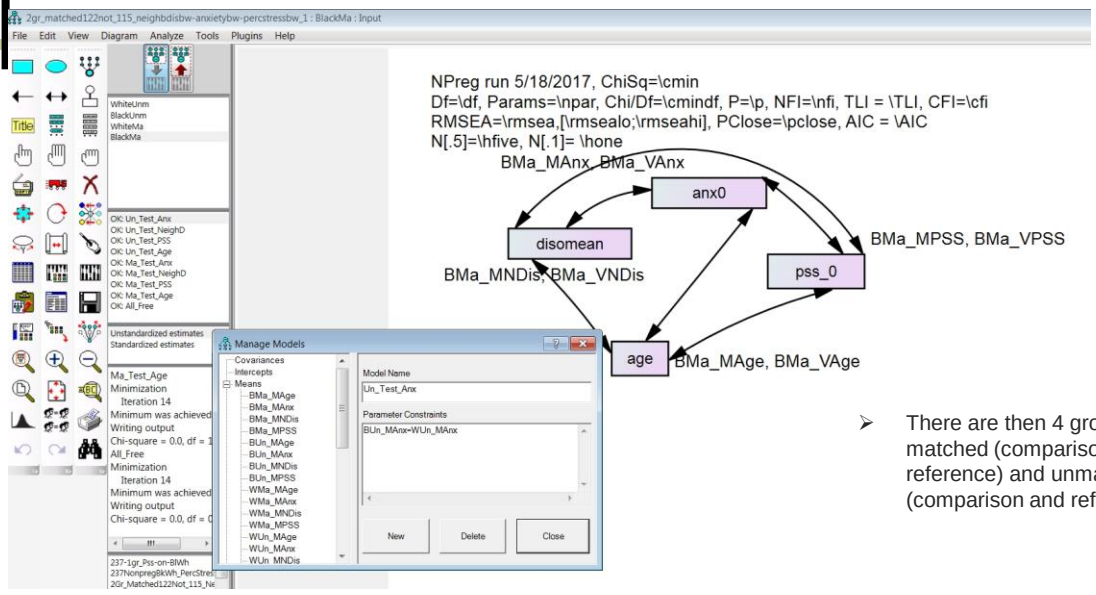
Deceptively simple:

1. Get probabilities/propensities for all in logistic e.g. model Black vs. white regressed on SES = Match on SES factors
2. Apply a rule for matching 1-on-1
3. Create dyads
    1. One has now 4 groups: B/W matched, and B/W unmatched
4. Analyze as 'repeated measures'
5. Build difference (latent, why not) scores, and find its predictors
6. Matching can be done in clusters/strata too.

1-on-1 matching approach

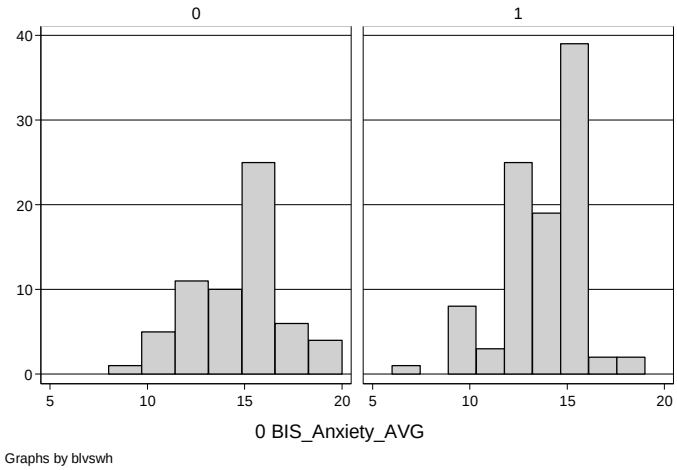
dyadMMM	match61	m2blwh2	dyads4c	yhat4v	blvswh	clust13
.	0	Unmatched white	1	.0987048671	0	1
2	1	Matched Black	1	.1613160819	1	1
.	0	Unmatched white	.	.228888303	0	1
3	1	Matched white	.	.228888303	0	1
.	0	Unmatched white	2	.2410351187	0	1
9	1	Matched Black	2	.2429085672	1	1
.	0	Unmatched white	.	.2457663268	0	1
7	1	Matched white	3	.2457663268	0	1
1	1	Matched Black	3	.2605578601	1	2
.	0	Unmatched white	.	.2678673267	0	2
.	0	Unmatched white	.	.2678673267	0	2
.	0	Unmatched white	.	.2678673267	0	2
.	0	Unmatched white	.	.2723173499	0	2
.	0	Unmatched white	4	.2880042493	0	2
.	0	Unmatched white	.	.2880042493	0	2
4	1	Matched Black	4	.2889622152	1	2
9	1	Matched white	.	.2958693802	0	2
8	1	Matched white	5	.2991040349	0	2
8	1	Matched Black	6	.2991040349	1	2
7	1	Matched Black	5	.2991040349	1	2
1	1	Matched white	6	.2999676168	0	2
2	1	Matched white	.	.3110224009	0	3
.	0	Unmatched white	.	.3170807958	0	3

1-on-1 matching approach – AMOS version



- There are then 4 groups: matched (comparison and reference) and unmatched (comparison and reference)

Anxiety scores



The distribution of Y scores in the 2 groups (initial, unmatched).

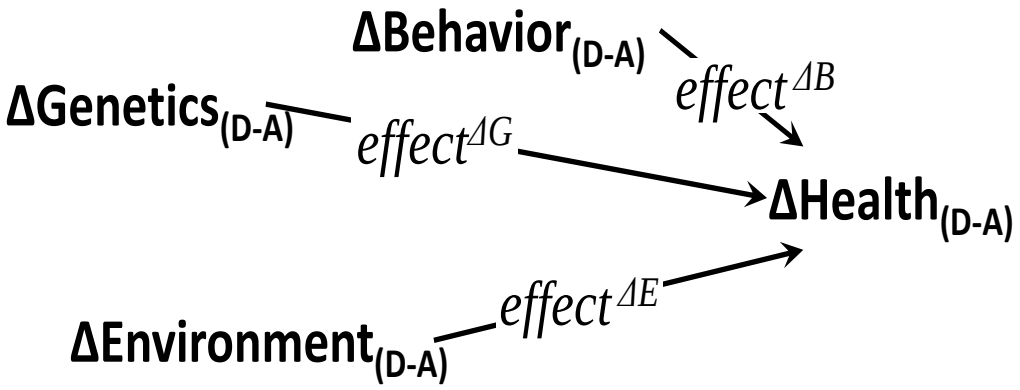
1-on-1 matching approach

	Mean	SE	p_{SEM} p_{LDS} B vs. W	'Dyadic' correlations
Anxiety - whites	14.269	0.345	0.213	0.128^{NS}
Anxiety - Blacks	13.692	0.323		
HD-Anxiety$_{LDS}$	-0.512	0.408	0.209	

We can compare 'before' matching (92 white, 145 Black women) and then 'after' matching – 61 dyads. Black women report lower BIS anxiety than white women, indicating a HD favoring Blacks, by about .40 standard deviation of the combined measure.

Unmatched matched sample (n = 115)	Mean	SE	p_{SEM} B vs. W
Anxiety - whites	15.066	0.414	0.019
Anxiety - Blacks	13.853	0.26	

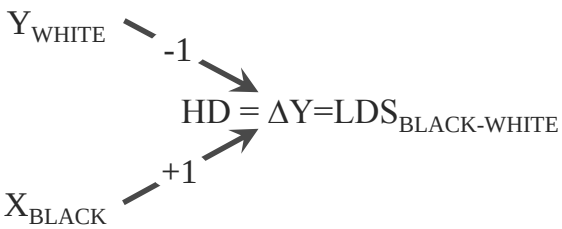
Simplified model of HD causes



D=Disadvantaged group; A= advantaged.
ΔG, ΔE, and ΔB are the effects of the *differences* in genetics, environment, and behavior on health disparities (HD, differences in health).

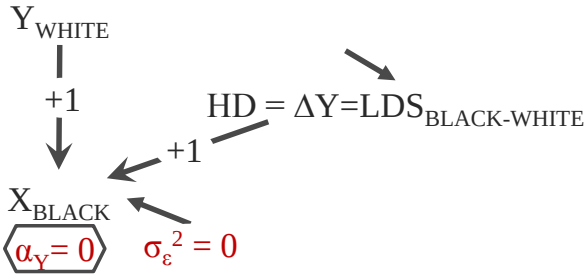
1-on-1 matching approach

- Intuitive model



Computing the difference: possible in the raw data

- LDS/LCS McArdle's



LDS is a DV now: we estimate intercepts, hence centering is crucial: the tests should be done at the predictors values set to 0.

Coman, E. N., K. Picho, et al. (2013). "The paired t-test as a simple latent change score model." Frontiers in Quantitative Psychology and Measurement 4, Article 738.

1-on-1 matching approach - intuition

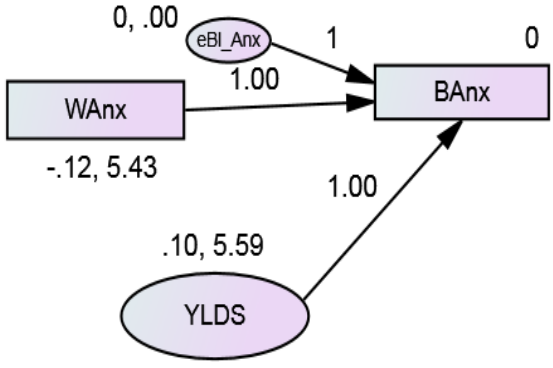
- One gets 2 variables out of any Y: $Y_{group\ 1}$ & $Y_{group\ 2}$
- It turns the data from 'independent groups' to 'repeated' tests one can run change in nature: t-test and others
- It changes the logic:

'Being in group 2 (vs reference group 1) leads to an difference between Y averages: $\overline{Y}_2 - \overline{Y}_1$'
to:
'There are varying differences between similar group 2 and group 1 *pairs* of cases.' (ΔY_j, j are dyads), hence we get $\overline{\Delta Y}$

1-on-1 matching HDs

AMOS [setup and] results

YLDS has a mean and a variance.
WAnx was centered (not needed unless It points to YLDS).



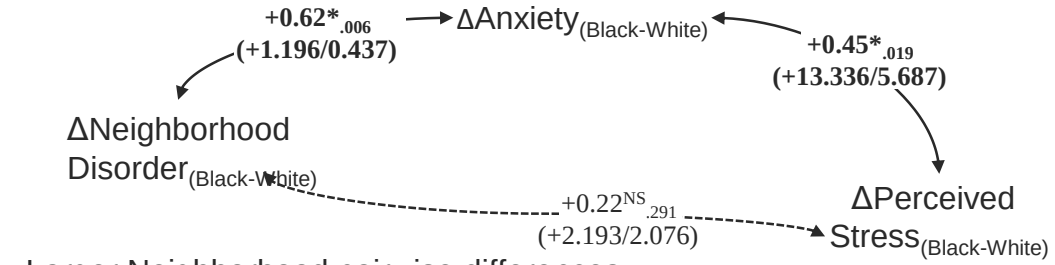
Cluster matching in HD

```
mixed y binary|| clust13:

           y |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      binary |  -.9425287   .3612864    -2.61   0.009    -1.650637   -.2344204
```

We can also compare the 2 groups (binary) in terms of the matched clusters Y averages in comparable Black and white clusters (13 here).

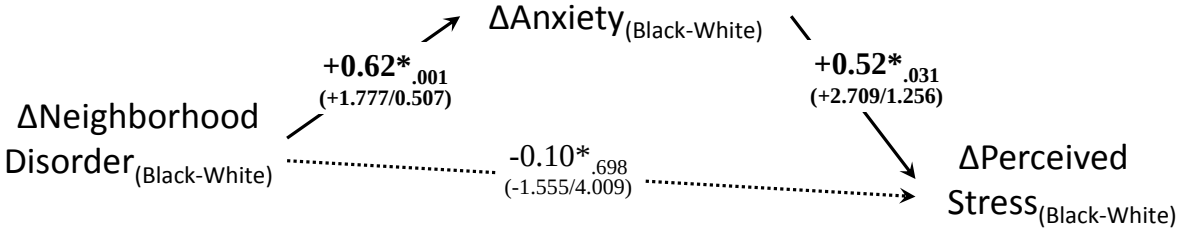
Correlations between three disparity measures



Larger Neighborhood pairwise differences translate into larger Anxiety pairwise differences.

Notes: Correlation$_{p\ value}$(covariance/standard error); * : p <.05; NS = non-significant (p > .05).

Effects among three disparity measures



Notes: Correlation$_{p\ value}$(covariance/standard error); * : p <.05; NS = non-significant (p > .05).

Conclusions – email for >: comanus@gmail.com

1. Capturing causal processes responsible for health disparities (by any groupings) may be served by models explaining actual such disparities.
2. The latent difference score (LCS) method of J. McArdle is uniquely qualified
3. Extensions can be envisioned: combinations of difference and change scores, partialling out group specific unreliabilities, etc.